IPVM – STRENGTHS AND CHALLENGES

3.1 General findings

Field visits by the mission team to IPVM Farmer Field School activities and discussions with IPVM-FFS alumni indicated that farmers have developed their skills to analyze their agro-ecosystems and are able to identify and monitor larval and adult populations of the major mosquito genera (*Anopheles, Culex, Aedes*), and to clearly distinguish between beneficial and harmful insects. These skills allow them to make ecologically sound decisions on the management of vectors, pests and crops (refer to Annex 1). IPVM-FFS graduates have cut down considerably on insecticide use in rice, were aware of the negative impacts of pesticide usage on the agro-ecosystem, and commonly started to incorporate rice straw into the soil to improve soil texture and organic matter content.

Various vector control methods involving environmental and biological control methods were adopted by the IPVM-FFS alumni, contributing to reducing risks of vector-borne disease at the community level. IPVM helped farmers to minimize insecticide inputs, improve productivity, and reduce the health risks associated with their ecosystem management practices. IPVM Farmer Field Schools generated a visible enthusiasm and self-confidence in the farming community. At one site visited, IPVM alumni reported that they proactively approached the anti-malaria staff operating in their area to learn about vector-borne disease issues. Follow-up activities after the IPVM-FFS have recently been started in the project locations but need to be given due attention in the remaining year of the project.

The project is relevant to a number of sectors, and is expected to have various health benefits (see Box 2).

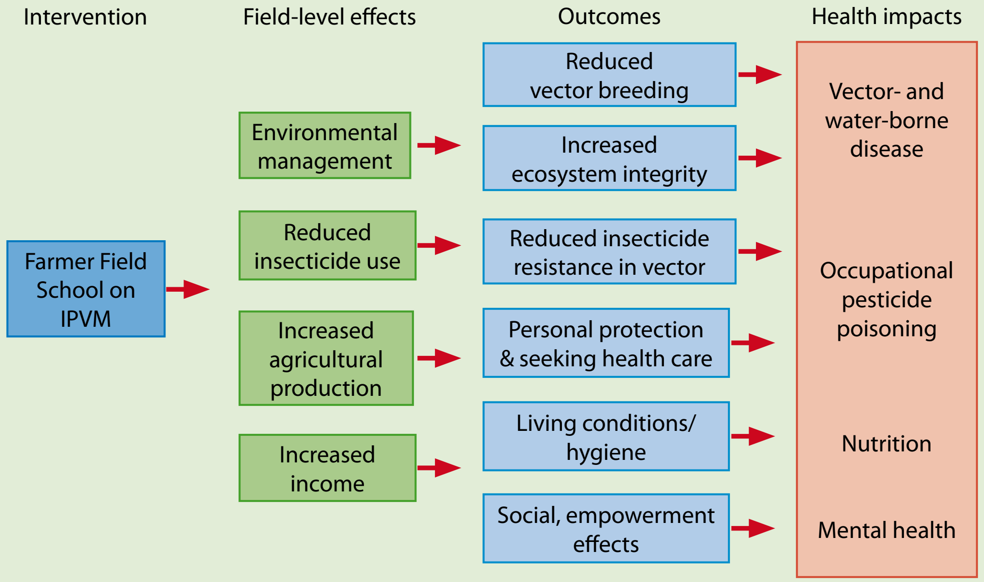
Annex 6 indicates the stakeholders of the project that have already been exposed to IPVM, mostly from the Department of Agriculture, Mahaweli Authority and the Anti Malaria Campaign, but various other potential stakeholders still need to be sensitized about IPVM, including policy makers and directors in sectors of health, agriculture, environment and education. Moreover, at the district level, there are several potential actors in the sectors of health, education and environment which need to be exposed to the project. For example, IPVM is a potential topic for project-based education in secondary schools. In fact, in the previous IPM project, field-based methodology on IPM has been successfully incorporated in the curricula of selected primary and secondary schools, mostly in the Central Province. IPM or IPVM education in schools is of particular significance as children are the most vulnerable to pesticide exposure.

3.2 Convergence between Agriculture and Health

A chronological overview of the activities by the agriculture and health sectors, and when convergence took place between their activities, is provided in Annex 3. During the past

Box 2 Health impacts of IPVM

The diagram below shows possible field-level effects, indirect outcomes and ultimate health effects of Farmer Field Schools on IPVM. IPVM Farmer Field Schools are expected to affect environmental management and crop management practices and thus, income from agriculture. The consequences of these effects are reduced vector breeding, increased ecosystem integrity, reduced risk of insecticide resistance, increased personal protection, living conditions and social and empowerment effects. These outcomes influence health with regard to vector-borne disease, pesticide poisoning, food safety, nutrition and mental health.



decade, IPM Farmer Field Schools have been implemented by the agricultural sector without direct linkages with the health sector. In parallel, the Anti Malaria Campaign has been conducting its own health-related activities. Its regular activities by the Regional Malaria Officers (RMO) and their entomological teams are: (i) routine entomological surveys for the main vector borne disease, (ii) community health activities to distribute bed nets and increase awareness about personal protection, and (iii) coordination of spray operations; the latter activity now being limited to areas with high transmission risk only. Monitoring of pesticide poisoning is the responsibility of the Pesticide Registrar, Department of Agriculture.

The project inception workshop brought together the stakeholders of AMC, DOA and Mahaweli Authority, to jointly discuss project objectives, and decide on the plan of action. In subsequent workshops on curriculum development there was effective cross-sectoral learning among the health and agriculture partners. This learning took place mostly in the field. Health-related exercises for possible inclusion in the IPVM-FFS curriculum were jointly developed and tested by these partners. Following these workshops, the agricultural trainers returned to their own locations for baseline surveys and experimental testing of the new curriculum in their ongoing Farmer Field Schools on IPM. The agricultural trainers were advised to involve Public Health Instructors (PHI) in field activities, but no specific guidance was provided on how to involve the PHI and for which mutual aims. Further fine-tuning of curriculum was always conducted jointly with the AMC partners in subsequent seasonal workshops. However, the actual IPVM-FFS activities in the project locations were implemented exclusively by the agricultural sector with some local involvement of the PHI. Likewise, the entomological surveys and their results were discussed at semi-annual workshops, but at the field level, no convergence of these activities with the IPVM-FFS activities by the agricultural sector took place.

Consequently, there were six-month gaps in convergence between the sectors. The AMC has so far been playing a supplementary role by way of providing advisory services to a largely agriculture-driven project, and by studying the impact of the interventions on mosquito populations in isolation from the agricultural activities. Possibly contributing to this situation, there has been lack of understanding among the agricultural actors about the objectives and strategy of the AMC.

Therefore, the AMC activities need to become better integrated with the project's field activities. This can be achieved by having interactions at common workshops at the field and district levels, and by having a larger AMC representation in central level workshops. In addition, the entomological surveys need to become better synchronized with the IPVM-FFS activities to allow for mutual interactions and mutual benefits. This can be achieved by conducting the entomological surveys only on FFS days, and staying on after the early morning surveys to participate in the FFS session. Also, increasing the intensity of surveys from 14-day intervals to weekly intervals coinciding with weekly agro-ecosystem analysis at the FFS should be considered, although such modification depends on the available funds.

IPVM-FFS sessions are occasionally attended by local Public Health Inspectors (PHI). These actors potentially play a more active role, for example in education on personal protection and pesticide-health risks.

3.3 Vector management through the FFS approach

Despite their different goals of raising agricultural productivity and reducing health risks due to vector borne diseases, the sectors of health and agriculture share the future objective of enhancing the role of rural communities in sound ecosystem management (Figure 2).

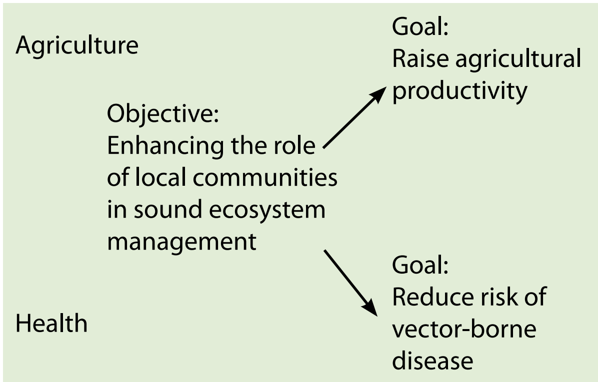


Figure 2: An example of how a shared objective contributes to sectorspecific goals in agriculture and health.

The main challenge for AMC is to internalize IPVM into its own vector-borne disease control strategy. In fact, the AMC has agreed to adopt the following strategy for malaria control: (i) In intensive transmission areas: Insecticide spraying (e.g. Trincomalee); (ii) In intermediate transmission areas: Insecticide-treated bed nets (ITN; mostly long-lasting bed nets); and (iii) In low transmission areas: IPVM Farmer Field Schools as method of risk reduction. There is a prospect to extend the IPVM strategy to intermediate transmission areas because of the demonstrated synergistic effect between IPVM and bed net use (see data on bed net use reported by Yasuoka et al., 2006b).

Furthermore, the current surveillance system of the AMC, aiming to detect early warning signals of disease outbreaks to initiate preventive action, is constrained by limited human and financial resources. The IPVM Farmer Field School approach provides an opportunity to test and/or establish a community-based surveillance system. Farmers have shown that they can identify and monitor larval and adult populations of the three major mosquito genera, *Anopheles*, *Culex* and *Aedes*.

Surveillance could benefit from the involvement of communities by the development of local capability on monitoring and evaluation. This would provide better coverage and intervals of data collection, allowing the AMC to target and evaluate their interventions (e.g., IPVM-FFS; bed nets) more accurately and more timely. Community-based surveillance would also enhance local project ownership and preventive actions taken by local people. Stronger, knowledge-based and sustained community participation in managing disease vectors could also be of utmost importance in the future, should ecosystem disruptions from climate change alter the geographic range (latitude and altitude) and seasonality of specific vector-borne diseases by boosting favourable conditions for mosquito vector populations (WHO, 2003).

3.4 Curriculum on IPVM

The current IPVM curriculum is based on IPM activities. Health-related activities have been added, strictly focusing on vector management. The agricultural operations in wetland rice and the constraints in crop management practices at different crop stages are presented in Annex 4. A comparison of the week-by-week curriculum of Farmer Field Schools on IPM versus those on IPVM is given in Annex 5. The duration of field schools was 16 weeks for IPM and 20 weeks for IPVM, to allow for more time at the beginning of the season which is the time when most mosquito breeding takes place. Modifications recommended by the mission team to improve the current IPVM curriculum are provided. Several modifications to the present IPVM curriculum are discussed in the paragraphs ahead.

The mission team recommended that IPVM-FFS participants are more involved in the tailoring of the curriculum according to their local needs or perceived problems, and that women's participation in the FFS is based on gender roles in activities related to agriculture AND health.

It was also recommended to include exercises on self-assessment of signs and symptoms of acute pesticide poisoning into the IPVM-FFS curriculum. Also, an exercise on household storage and disposal of pesticides was suggested for inclusion (see Murphy et al., 2002). The health risks associated with irrigated agriculture are not limited to vector-borne disease but include the potential harmful effects of agricultural pesticide use, in terms of occupational poisoning and food safety. Other health-related effects of pesticide use are the risk of insecticide-resistance in disease vectors and the destruction of natural enemies (refer to Box 1). Potential resource persons to assist in developing and incorporating these new exercises are the trainees of the 2001 workshop on pesticide exposure and poisoning held in Bandarawela. This participatory methodology has a demonstrated ability to capacitate farmers to monitor the health status in their community resulting in preventive action.

The mission also recommended a broadening of the IPVM-FFS activities to extend the rice-based training to other crops grown by the same rice farmers for which pesticides might also be used. For example, field walks during FFS sessions to observe other crops and utilize the knowledge and skills acquired in rice to these other commodities.

Hence, pesticide-related health risks of farmers are addressed in a more comprehensive way.

The mission team furthermore noted the opportunity for introducing income-generating activities to IPVM-FFS participants, such as vermi-composting, bio-composting, beekeeping, bio-control agent production, paddy-straw mushroom production and food processing. Consideration should be given to have a special topic in at least one FFS session on a selected income-generating activity, for example by inviting an expert farmer on the issue.

A final observation relates to practices of planting and weed management. Driven by a shortage of labour, Sri Lankan rice farmers are increasingly moving from transplanted rice and mechanical weeding towards broadcast-seeded rice and the use of herbicides. The study plots used in the IPVM-FFS are transplanted with rice seedlings and are mechanically weeded but the aspect of weed management is not specifically addressed in the curriculum. The aspect of herbicide application and their possible, but unknown effects of aquatic fauna need further consideration, but this is of lower priority than the above issues.

3.5 Farmer actions after the IPVM-FFS

At the field sites visited, farmers reported that they were practicing a number of non-chemical vector control methods as a consequence of the FFS. Rearing of fish in small water tanks for use in the community was being practiced by several farmers encountered, for release in some water bodies. Also, common vector-control activities in the residential area were the clearing of empty coconut shells and containers, keeping water containers upside down or closed with plastic bags. Concerted group action on sanitation was reported from the Udawalawe location. In the latter location, intermittent irrigation (4 days of watering alternated with 3 days of no water) was administered during the short rainy season by the Mahaweli irrigation authority for distribution of water. Therefore there was apparently no reason for farmers to control mosquito breeding in paddy fields through drainage.

All farmers reported a drastic reduction in their insecticide use as a consequence of their participation in the IPVM-FFS. This is consistent with an impact evaluation study of the IPM project conducted in 2002 which showed a reduction from 2.2 to 0.4 insecticide applications per season attributable to the IPM-FFS (refer to Box 3). Herbicide use was not affected by the IPM-FFS, and it appears that this is also the case for IPVM. Another impact of the FFS was the incorporation of rice straw in the soil practiced individually by alumni, resulting in higher organic matter content, retention of water in the soil and increasing biodiversity and production.

Mosquito nets for beds were present in all houses visited, but were not commonly used in the short rainy season because of high temperatures and because of the relatively low nuisance problem of mosquitoes during that season. Still, the study by Yasuoka et al. (2006b) conducted in the same area recorded that IPVM interventions resulted in a 60% increase in bed net use, indicating an effect on awareness about personal protection. Bed net use has so far not been part of the IPVM curriculum.

Apart from spontaneous activities after the IPVM-FFS, the project facilitated participatory planning exercises to assist the farming community in identifying their problems and causes of these problems, and to develop a strategy and practical work plan for addressing these problems. The project also facilitated farmer experimentation in their own fields by providing a small provision for materials and to cover possible yield loss.

3.6 Evaluating project implementation and impact

Monitoring and evaluation refers to an appraisal of a project's performance as well as its achievements towards reaching its objectives. Conversely, impact evaluation refers to an appraisal of the effects, and sustainability thereof, resulting directly or indirectly from the project activities, and is measured after a project or its local activities have come to an end and baselines are compared to achieved results.

Available data on impact

Initial research findings generated during the IPVM project to date indicate that anopheline mosquito densities were less in the short rainy season when vector breeding habitat is more or less restricted to irrigated fields, but not in the long rainy season when more alternative breeding habitat is available (Table 3). Despite the sketchiness of data (records from three seasons are missing), it is suggested that anopheline densities, and consequently malaria transmission, can most easily be interrupted in the short rainy season through ecosystem management (reduced spraying; improved agronomic and environmental practices).

Table 4 shows larval densities in dipper samples, based on the data by Yasuoka et al. (2006a). Paddy fields, because of their large surface area must have overwhelmingly contributed to adult densities of anophelines and culicines, whereas the *Aedes* species were restricted to residential areas. The agricultural use of insecticides in the early part of the season on aquatic fauna and mosquito population dynamics requires urgent study.

A study at two sites, Mahaweli H and Udawalawe with paired comparison villages, reported an increased knowledge about mosquito ecology and

Table 3 Average seasonal catches of adult Anopheles spp. in a cattle-baited net trap in each of one IPVM intervention village and one comparison village in Udawalawe during four recorded seasons of the IPVM project.

Season*	Intervention villages	Comparison villages	Source
Long rains, 2002/03	749	1,347	Yasuoka et al., 2006a
Short rains, 2003	279	1,232	Yasuoka et al., 2006a
Long rains, 2003/04	600	781	Yasuoka et al., 2006a
Long rains, 2005/06	691	1,016	AMC unpublished data, 2006

Table 4 Larval densities (no. per 144 dipper samples) of three major mosquito genera in five habitat types in two locations during the first 18 months of the IPVM project (Yasuoka et al., 2006a).

Habitat	Anopheles spp.	Culex spp.	Aedes spp.
Paddy fields	111	373	0
Irrigation canals	4	132	0
Seepage pools	125	210	0
Tank beds	67	97	0
Residential areas	11	132	493

disease prevention, changed agricultural practices and vector control actions attributable to the IPVM intervention (Yasuoka et al., 2006b). Also, a 60% increase in the use of mosquito nets in homes, was attributed to IPVM, even though the curriculum did not address bed net use. This indicates an increased awareness and behavioural change about personal protection and safety. Common vector control actions were elimination of breeding sites, applying oil, salt or fish to water bodies (storages/containers), and cleaning up surroundings.

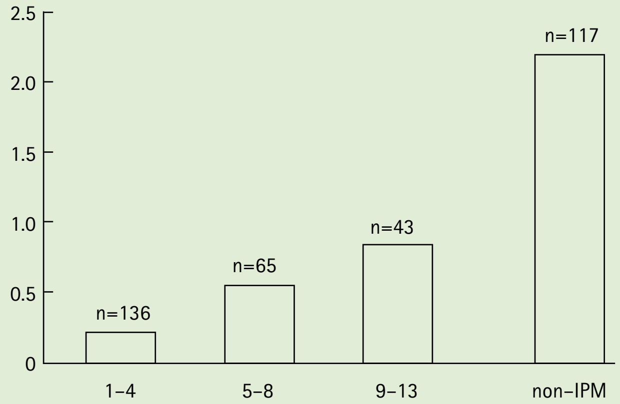
Impact studies of the previous IPM Farmer Field School project (without the vector component) have shown an average reduction from 2.2 to 0.4 seasonal insecticide applications in rice, and a 23% increase in yield (Box 3). The impacts were durable over a period of at least 5 years (van den Berg, Senerath & Amarasinghe, 2002; Tripp, Wijeratne & Piyadasa, 2005). This suggests that Farmer Field School training is a medium- to long-term investment. Outcomes of IPM were not restricted to reduced input costs and

Box 3 **Impacts of the IPM-FFS on pesticide use**

A large-scale nation-wide impact study of the IPM-FFS project in 2002, which covered 275 IPM sites and 117 comparison sites, found that a 23% yield increase was attributable to the IPM-FFS. Also, the IPM-FFS had a profound effect on the number of pesticide applications. Insecticides were reduced by 81%. The organochlorines chlorpiriphos and dimethoate, and the carbamates carbosulfan and fenobucarb jointly accounted for almost 70% of insecticides used in rice. These chemicals have been classified as hazardous (Class II). Fungicide use was low and was further reduced by FFS training. Herbicide use was not affected by the FFS, and weed-management requires more attention in the training curriculum.

Type of pesticide	Non-IPM	IPM	t test
Insecticides	2.21	0.42	<0.0001
Fungicides	0.24	0.12	0.01
Herbicides	1.21	1.10	not significant

The graph below shows that insecticide applications per season were lowest among the most recently trained farmers (n indicates the number of sites). Applications were slightly higher among farmers trained longer ago, but even among the group trained 9-13 seasons ago, the number of applications was still only 38% the level of non-IPM farmers. This result suggests that the training effect erodes only slowly, with a substantial effect even 4–6 years after the training.



Source: van den Berg, Senerath & Amarasinghe (2002) increased yields. IPM was shown to benefit all assets of rural livelihoods (natural, human, social, physical and financial) and thus helped in alleviating poverty. In particular, farmers developed critical thinking and creativity to start new initiatives. In addition , farmer associations were built in many locations.

As mentioned earlier in the text, Yasuoka et al. (2006a; 2006b) conducted external evaluations of the pilot project. The results refer to the overall impact of IPVM and can be supplemented by an earlier evaluation of the IPM programme in Sri Lanka (van den Berg, Senerath & Amarasinghe, 2002).

The IPVM curriculum as it is provides good guidance for field activities, data collection and analysis, and for decision-making, at the farmer level. But the project still lacks a complete monitoring and evaluation framework to measure its performance.

Need for more precise monitoring and evaluation tools

For these reasons, frameworks for monitoring and impact evaluation were developed and are proposed in Annex 7 and 8. Annex 7 presents the indicators and measurements for monitoring Farmer Field School activities on IPVM to assess the level of implementation of a quality control and monitoring system for ensuring standards in the application of the IPVM in Sri Lanka and in other countries where the approach could be replicated.

Annex 8 presents a proposed framework for impact evaluation, and distinguishes the impact levels of knowledge and skills, resulting in changed practices and effects at the field level, community level and institutional level. At each level of impact, different types of impact are identified, and indicators and methods for evaluating impact criteria are suggested. The framework demonstrates the complexity of a comprehensive evaluation of impact on IPVM. The purpose of the comprehensive framework is to assist in the preparation of an operational plan for an impact assessment study. In a plan, certain types and indicators of impact are prioritized, in accordance with the objectives and clients of the study, and taking into consideration the limitations of human and financial resources for carrying out the study. Some of the indicators and methods in Annex 7 are already being addressed by the IPVM project. Specifically, the AMC is conducting fortnightly entomological surveys on mosquito population densities and keeps records on disease incidence of public health importance, which has been low or nil over the past few years.

A small-scale baseline survey involving 28 farmers was conducted in the new project location in Matale at the end of 2005 to collect socio-demographic characteristics and information on agricultural practices and agrochemical inputs. The baseline was limited in scope. Nevertheless, it is recommended that this baseline is used to establish longitudinal change during clustered implementation of IPVM activities in the coming seasons by revisiting the same farmers again during several seasons after completion of the IPVM-FFS. It is also recommended that baseline studies are started for new project locations, both in the intervention villages and in the comparison villages.

In addition, however, there is need for latitudinal comparisons (IPVM versus comparison villages) to capture an impact on a broader range of issues and from more locations as the project activity expands. Owing to the small size of the present project, all project locations should be covered in a study. Site selection criteria are therefore not yet needed. Selection of individual farmers within an FFS group needs to be conducted randomly (e.g. by selecting every third person from the FFS participant list).

The above paragraphs refer to a centrally developed and operated impact assessment study. It will also be useful to conduct a participatory impact study by involving IPVM-FFS alumni in the evaluation of what they considered impact in their own situation. This type of activity not only strengthens farmer ownership over their local program but also provides new insights into areas of impact that might be missed in externally planned studies. Recommended methodology for participatory impact evaluation is the use of cameras by farmers to capture impact and explain the reason for taking each photograph. This methodology has been previously used in the IPM project in 2002 and could be considered for use to evaluate impact of IPVM (refer to van den Berg, Senerath & Amarasinghe, 2002; Pontius, 2003).

3.7 Expansion and replication

The mission team noted the importance of the clustered IPVM-FFS strategy whereby at least one member of every farmer household in a village participates in an FFS. This will create critical mass needed for disease management. It is further recommended that after government trainers initiate IPVM-FFS in a village, alumni farmers are trained to become FFS facilitators and carry on with further Farmer Field Schools in the village.

To expand the IPVM activities in Sri Lanka, the mission recommends a lateral spread from the present villages towards comparison villages, which should also benefit from the interventions after serving for three years, as comparison. New comparison villages could then be selected at the new frontier of the expanding IPVM area. In addition, but depending on new funding becoming available, new IPVM locations need to be initiated in intermediate and high transmission areas with a similarly clustered implementation of IPVM-FFS to achieve impact on disease transmission. The mission team moreover noted the importance of facilitating follow-up activities after the FFS (for example, participatory planning, action research) to strengthen local project ownership and local initiative.

Hence, more IPVM facilitators are needed. In accordance with the modifications suggested in the curriculum (refer to 3.4), there is scope for training public health staff on facilitation skills and on new educational exercises on reducing health risks related to pesticide use and vector-borne disease.

Besides its suitability under Sri Lankan conditions, IPVM is potentially replicatable in other countries and other regions, as an adaptive educational approach, initially focusing on situations where vector-borne diseases are associated with irrigated rice environments.

3.8 Next steps

Meetings were held in Colombo with (i) Director Anti Malaria Campaign and Director EOH & Food Safety (MOH); (ii) WHO-Sri Lanka staff (Dr Puri, Dr Verma and Dr Tissera) and Director EOH & Food Safety; (iii) FAO Representative. There was a strong overall consensus about the value of the IPVM-Farmer Field School approach to involve local people in evaluating and reducing their health-risks related to vector-borne diseases and agro-chemical pesticides. The need for further data on effects and impacts was emphasised upon.

It was also agreed that sensitization within the Ministry of Health and interaction with counterparts of Agriculture at top levels is a priority. WHO proposed the following plan: The Director EOH, who had joined the mission team's field visits, would introduce IPVM at a session of the Health Development Committee Meeting, and at the same time announce a brief seminar on IPVM. The seminar will bring together major players from the Health Ministry, and Provincial directors of Health, and representatives from the Ministry of Agriculture, Mahaweli Authority, FAO and alumni farmers to discuss the value of IPVM and to identify common objectives and possible synergistic effects to the different stakeholders. The WHO agreed to organize and sponsor the seminar, a timeframe for which would have to be agreed upon soon.

In parallel, WHO-SEARO will support the production of a short video film on IPVM in Sri Lanka targeted at policy makers. The mission findings and the video will serve as inputs to the regional IVM workshop, planned for October 2006, probably in Pondicherry, India, to discuss prospects for replication of IPVM in other countries.