PDF-XCHANGE Click to buy NOW! www.docu-track.com

Indicators of the level of adoption of IPM by smallholders

a CIRAD and Bayer CropScience joint project

D. Deybe, P. Prudent, B. Sallée, L. Temple and M. Vaissayre
In cooperation with CARBAP (Cameroon), INRAB-RCF (Benin) and CODOCAFE (Dominican Republic)

Final Report, September 2003

PDF-XCHANGE Click to buy NOW! www.docu-track.com

Indicators of the level of adoption of IPM by smallholders: a CIRAD and Bayer CropScience joint project

D. Deybe[1], P. Prudent, B. Sallée, L. Temple and M. Vaissayre[2]
CIRAD, Avenue Agropolis, Montpellier (France)
In cooperation with CARBAP (Cameroon), INRAB-RCF (Benin) and CODOCAFE (Dominican Republic)
[1] current address : European Commission DG-RDT ; Political aspects and strategy for sustainable development Division
[2] editor of the final report

Chapter 1

Problem statement

IPM definition and actors

The concept of IPM (Integrated Pest Management) is more complex than simple crop management to reduce the incidence of pests. It implies a new attitude on the part of farmers concerning their produce, their social integration, environmental concerns and the impact of their activities on society.

It relates to the concept of a “sound” product in a “sustainable” environment.

Implementing IPM is the consequence of several preliminary factors: the importance of integrating cultural practices and genetic resistance to pests and diseases, the need to preserve/enhance auxiliaries and rational use of pesticides. In some cases, these components imply substantial investment in research. In other cases, previous results can be used and field demonstrations can provide farmers with the required information.

Once these factors are identified, the following step consists in identifying the actors most concerned by IPM and analysing the best way of involving them in the process through precise and appropriate information or appropriate policy. Smallholders are stressed because of their cash flow problems, while IPM offers the prospect of a healthier and more stable outcome. This process produces results on a community but also on a more aggregate level, such as overall output, prices and the environment. The cost of implementing IPM has to be taken into account, as do the possible sources of funding.

In most cases, IPM means “learning” on two levels: local and national. On a local level, farmers have to learn to identify each crop problem, analyse alternative available control possibilities and coordinate the measures that can be taken. On a national level, citizens have to learn to appreciate products resulting from IPM as well as to recognize the positive effects associated with the consumption of these products.

One important aspect in the process of learning/training/teaching is the use of alternative transfer methods for the concepts and practices involved.

There are several possibilities: Farmer Field Schools, training of trainers, extension, media campaigns, etc. These extension techniques can be combined and should be adapted continuously in order to achieve the sustainable implementation of IPM.

Activities supported by the project

To better understand the process and adapt the extension practices to the target audience, four departments at CIRAD began to work, first with financial support from Aventis Foundation, and later Bayer CropScience, on a study in three countries with very different agro-ecological and socio-economic conditions.

The work was carried out in the field in close collaboration with local institutions (INRAB-RCF in Benin, CARBAP in Cameroon and CODOCAFE in the Dominican Republic). The project was launched at an initial workshop in October 2000, with a second workshop in February 2002 to evaluate mid-term progress on the project.

Survey

At the beginning of the project, an initial survey was conducted to obtain a precise view of the situation of the rural populations concerned by the work.

Training

Based on the FAO's Farmer Field Schools (FFS) concept, observations were made in the field on cotton, banana or coffee. Later on, farmers were invited by the facilitator to describe their impressions in front of the group, relating insect and plant damage observed. The key points resulting from these observations were identified by the farmers themselves and a discussion began on this basis. Farmers were subsequently encouraged to make their own decisions based on their observations. They now no longer have to apply pesticides based on technical advice given by extension people or the instructions on products provided by sales representatives, but they are invited to give their reasons for choosing one practice or another in response to the attack.

Sampling

Varying degrees of progress have been made on the surveys and transfer operations in the three participating countries. The three situations have given rise to various technology transfer methods:

- In Benin, villages in Zou Province have been selected for two consecutive growing seasons. One group follows the traditional method of technical package transmission. In the second group, the message in favour of rational insecticide use (TSC) is transferred through sessions organized by a development project (PADSE). The third group follows the FFS participatory method. In each of the villages, farmers have been selected with the help of the local farmers' association, with some modifications to ensure that they are willing volunteers. In spite of the difficult situation with the cotton crop during the project, 10 to 15 farmers participated in each of the planned sessions, once a week during the growing season.
- In Cameroon, two areas are concerned by the project. Farmer selection was based on a 20:80 ratio (20% of the farmers = 80% of production). An initial survey was conducted on 90 farms. A second one compared a sample of FFS farmers with a group following the training and visit process, and a third survey is in progress to evaluate the degree of appropriation of the technical message. Training was provided by researchers in different specialities, for two days in two villages, with a theoretical presentation before field observations. This approach then gave way to participatory identification of the technical aspects of crop protection, and the formulation of control strategies to be implemented in the experimental plot.
- In the Dominican Republic, three farmers' groups have been chosen, in the South of the country. Farmer Field Schools were organized weekly in the village of *La Cebolla* between February and March 2001. 12 *cafetaleros* attended the FFS, along with some extension people, who were not allowed to give advice or make technical recommendations. The first stage was an observation phase in the field, to observe pests and diseases, plant phenology and trapping results, followed by a debriefing session in the form of a group discussion in front of a paperboard. The results of the

FFS process are to be compared with the conventional approach adopted by 12 farmers in the village of *Mano Matuey Abajo*.

Difficulties and Preliminary Remarks

Some difficulties have been experienced during project implementation: external factors, such as drought in Benin and low coffee prices in the Dominican Republic, as well as internal ones: some technicians were reluctant to lose their position as "experts" in front of the farmers during the FFS.

Farmers showed strong interest in the project, as demonstrated by the number of participants throughout the sessions. Many of them asked to be involved in the future of the operation.

The Farmer Field Schools highlighted some farmers' knowledge that research has to take into account, but also some misunderstandings of natural processes, not only in the field of plant protection, but also in terms of plant physiology. Access to and cost of inputs are considered everywhere as a major constraint for farmers.

Questions arose beyond the scope of IPM, extending towards an ICM approach, including either the product quality elaboration process or organization of the production chain and price fixation mechanisms.

Chapter 2

Adoption and diffusion of technical innovations concerning Plantain

An impact analysis based on the surveys conducted in Centre and South province of Cameroon showed that plant material preparation (paring, dipping in slurry) and propagation (cuttings) techniques had been widely adopted. There was a positive link between the rate of adoption and the rate of extension, but extension rates were low (each farmer passed on his knowledge to a maximum of 14 people). This may partly be due to the complex way in which the existing farmers' organizations work. Leaf thinning techniques had also proved successful. It is worth noting that the farmers practice leaf thinning but do not associate it with black leaf streak disease control. In this case, the research proposals made had merely served to optimize existing practices. A distinction was thus made between:

- § techniques that had been significantly adopted (rate of over 70%) but not widely extended (leaf thinning, paring);
- § techniques that had been moderately adopted (rate of 50 to 80%) but widely extended (cuttings);
- § techniques that had not been significantly adopted (rate of less than 50%) or widely extended (intercropping, rotations, etc).

42% of producers continue to practice certain crop combinations that are not advised and 60% burn forest (which is not recommended) in over 70% of their new plantings.

- § Certain combinations that are not advised (plantain/maize) are intended to make use of the complementarity between these crops in order to optimize weeding operations. Producers accord more importance to the time saved as a result of this than to the potential yield gain that could be achieved through reducing nematode pressure.
- § Other combinations that are not recommended (plantain/cassava), in plots managed by women, are practised because of their complementary production cycles, to satisfy the household's food requirements.
- § The use of recommended combinations (pineapple, amaranth) is hindered by a lack of seeds (pineapple) or the difficulty of marketing perishable products (amaranths).
- § According to locals, forest is traditionally burnt to save time on clearing and weeding. It also prevents regrowth of certain weeds.

The economic factors determining the intercropping systems practised are linked to a search for «range effects». These effects are positive interactions or externalities between crops that are difficult to measure using conventional economic indicators. They differ from, and sometimes even counteract, the economies of scale generated by intensification and specialization. They sometimes hinder the agronomic optimization of cropping systems in terms of maximizing yields. This makes it difficult to reconcile the aims of researchers and producers. Researchers set out to increase productivity or protect natural resources. Producers, for their part, are more interested in ensuring food security, minimizing risks, reducing their workload or safeguarding social cohesion. The compatibility of these different objectives governs the implementation of research proposals.

Based on existing frames of reference obtained from trials and monitoring surveys:

- the adoption of new paring and slurry-dipping techniques increases yields by 10 to 30%, by reducing losses (fallen banana plants) and increasing average bunch weight and the life span of new plots, depending on the quality of the fallow in those plots.

- using material produced from cuttings means a major change in terms of the technical organization of production, which is difficult to quantify through precise indicators:

PDF-XCHANGE Click to buy NOW! www.docu-track.com

  - a reduction in pre-harvest losses.
  - uniform planting calendars and varietal structure, which changes the rules for technical management of production, since it makes it possible to organize work in a different way.
  - the removal of the sucker availability constraint, which frees up investment plans and enables suckering in existing plots.

- leaf thinning techniques increase yields as they reduce the recourse to inappropriate practices (removal of functional leaves) and black leaf streak disease pressure.

The monitoring survey enabled a representation of the way in which the knowledge and techniques proposed in the project are disseminated.

The representation comprises four links showing three interfaces of production/dissemination of knowledge and techniques. The first interface concerns the relations between researchers and producer representatives (CIG). The second concerns the relations between CIG representatives and producers (members). The third concerns the relations between producers belonging to CIG and those who are not members. As regards the second interface, reports on participative training courses concerned 50% of CIG members. As regards the third (members of CIG and their neighbours in the course of informal meetings), around 57% of farmers who did not belong to CIG were informed by members. This result does not show the intensity of the transfers of knowledge or techniques that took place—simple information, group demonstrations—but it does reveal that in terms of dissemination, knowledge transfer networks do not necessarily work through formal organizations (CIG), but also through other modes of coordination that need to be characterized.

Publications and Memoirs

Temple, L.; Kwa M.; Fogain R. & Mouliom Pefoura A. 2003 - Food Security in Central Africa and changes in production systems: the case of Plantain in Cameroon. *International Working Meetng: Food Africa*. NRI, IFS, IMPM/MINREST; 5-9 May 2003, Yaoundé, Cameroon.

Botto-Mbassa P. 2002 - Adoption des changements techniques sur les pratiques culturales du bananiers plantain. Mémoire de fin d’étude ; Faculté d’agronomie ; Université de Dschang, Cameroon.

An academic work on *the adoption and diffusion of technical innovation by the farmers of S’aa et Talba*. is in progress in 2003.

Chapter 3:

Adoption and dissemination of technical innovations concerning Cotton

During the first year of the Benin Project, operations centred on the preliminary survey aimed at determining the level of knowledge among producers and the state of their farms. Later on, the practice of FFS was implemented in the three selected villages, and the impact of the previous years' experience evaluated so as to better quantify parameters such as the work time required and the cost of the method, and gain additional, more comprehensive experience of how to implement this supervisory method. In addition to these estimates of the cost and time involved, the method has been extended to a principle of Integrated Crop Management (ICM) rather than being restricted to simple integrated pest management (IPM).

Field operations have been led under the supervision of a Cirad scientist, Dr Patrick Prudent, by Mr Symphorien Loko, helped for the second year by Mr Achille Djossin, a student at the Sékou Agricultural College, who defended his memoir entitled *"Contribution au transfert de compétences pour une gestion intégrée de la culture du coton par la méthode des Farmer Field Schools (FFS)"* (Contribution to a transfer of skills for integrated management of cotton crops through the Farmer Field Schools (FFS) method) in November 2002.

Farmer practices

There are certain divergences between the recommendations made for managing cotton crops and the practices actually adopted by farmers. The main points of divergence, some of which have a negative impact while others are neutral or positive, have been pinpointed, and some are described below:

- in most cases, recommendations on sowing dates are respected. In the event of late planting, they choice the most fertile soils.
- ridging is widely practised, but the tillage that should be done beforehand is never done for lack of time, since many farmers use a hoe. They recognise that cotton sown on land ploughed using draught animals emerge earlier and grow faster.
- density does not obey any precise rules. Overall, farmers prefer low densities as they appreciate plants with well-developed, widely spaced branches. This point is particularly important, as insufficient densities often result in poor yields. The recommended rate is four or five seeds per planting hole, but farmers throughout the zone sow around ten, if not more. There are two reasons for this: the poor germination quality of the seeds used and the formation of a crust on the soil surface, which means that it takes a large number of seedlings to break though.
- for thinning to two plants, farmers do it at the time of the first hoeing round or even later. The delay in doing this is combined with the large number of plants per planting hole due to the excessive number of seeds sown. The extended competition between the numerous plants in each hole results in weak, fragile, underdeveloped plants. The reason quoted by the farmers is the lack of available labour at the time when thinning should be done, as workers are involved in the maize and cowpea harvest.
- farmers base the fertilizer rate they apply on the appearance of the crop and the state of plant development, which they see as a good indicator of plot fertility. They often increase the recommended rate, after submitting a false declaration of the area they are planning to plant with cotton. Whereas researchers recommend split applications of NPKSB and urea, all farmers mix the two types of fertilizer and most practise just one application, between 30 and 50 days after sowing. They consider that if they respected the recommended dates, the cotton trees would not have enough fertilizer at the end of their cycle. Moreover, they say that they mix the two types of fertilizer and practise just one application for lack of time.

PDF-XCHANGE Click to buy NOW! www.docu-track.com

Demonstration plots and farmers' proposals

In these plots, any intervention is decided on and made following discussions held at each session.

Different levels of fertilization and sowing dates have been added to the initial design. Farmers generally claim that large amounts of fertilizer are crucial for high yields, and they therefore tend to exceed the recommended rate. In plots given the recommended rate, farmers find the foliage less green and less dense. They expect lower yields, but also consider that that less dense vegetation may reduce the risks of sticky cotton. On late planted plots, farmers observed substantial Pink and Red bollworm damage.

The FFS are in a zone in which rational chemical control (LEC) is being taught, hence all the "school" plots were protected using this method. Pests and the damage they cause are identified weekly. The results of these observations are then compared with the thresholds quoted in the decision-support chart. All the farmers who attended the FFS were given training in LEC, with regular refresher courses. Some still have a vague idea of the concept, while others have forgotten almost everything. Particular emphasis is placed on the "pest-damage" relationship, with which farmers appeared to be unfamiliar at the time of the initial survey. It was also surprising to note that the farmers knew nothing about jassids or the damage they cause. They were able to observe typical damage on a glabrous cultivar for the first time: discoloration and then reddening of the edge of the leaf blade. This led on to a discussion of plant-resistance characters.

The only beneficials frequently encountered and clearly visible are ladybirds and hover flies, associated with aphid colonies. With very few exceptions, the farmers see them as "relatives" of the aphids and thus as pests. An experiment was conducted with a matchbox containing leaf fragments carrying aphids, in one case with hover fly larvae and in the other with ladybird larvae. In both cases, the farmers subsequently understood that it was these auxiliaries that killed the aphids.

When it came to applying pesticides, the farmers were worried about measuring product doses, particularly in view of the fact that some products are supplied in containers that have to be split between several producers. They were worried about being "robbed" or tricked (eg by replacing some of the product in the bottle with petrol).

In this region, as in the rest of Benin, the cultivated plant most severely affected by pests, after cotton, is cowpea. The areas planted with cowpea are much greater than those under cotton. Farmers are therefore very keen to protect it, to the extent that most of the farmers attending the FFS said that they grew cotton so as to obtain sufficient insecticide to treat their cowpea plots. They all knew that this was forbidden, but said that they had no other choice.

These products are sometimes used in even more dangerous ways, for instance to treat food crop seeds, which is undoubtedly the practice that causes the most lethal accidents, according to the Crop Protection Service surveys.

Old cotton plants should be pulled up and buried after harvesting. The vast majority of farmers said they never did this, as the operation required extra labour and did not provide any clear benefits.

Rejection of some of the proposed methods

Some of the proposed innovations are of no real interest to growers, but others, whose merits are recognised, are nevertheless rejected for reasons that need to be identified. Several reasons have already been mentioned. They are combined with more general considerations:

- the archaic nature of the work tools used: in southern Benin, the farmers consider that tilling the soil with a simple hoe takes much too long, given the areas they want to prepare. They therefore prefer to build their planting ridges directly on untilled soils.

PDF-XCHANGE Click to buy NOW! www.docu-track.com

- some farmers consider themselves technically self-sufficient: older farmers often see training as a waste of time.
- farmers are attached to historic practices and wary of change: they often express a preference for traditional techniques and are reluctant to adopt new ones. Some are satisfied with what they produce and do not want to try new practices whose results may be uncertain.
- a lack of certain inputs or their high price: obtaining insecticides and fertilizers is already a problem for producers, and climatic incidents such as those experienced by the cotton commodity chain in recent years have made it difficult to repay the loans granted for such purchases.
- a lack of land for planting and of labour: cultivable land is in short supply in view of the growing population, while cotton does not guarantee such a high income as it used to, despite the complex, labour-intensive cultural practices involved. Farmers therefore prefer to abandon this speciality and use the available land for food crops, in order to ensure that they are self-sufficient in food terms.

Technical messages that seem to have been accepted

The adoption of certain recommendations can only be evaluated in the long term. However, farmers made certain comments during discussion sessions that suggested that some of the proposed practices stood a good chance of being adopted. They included:

- high planting density is the technique that most impressed farmers. The high-density demonstration plots all gave top yields, and despite the reservations expressed concerning the additional labour required, all the farmers eventually expressed and interest and their intent to implement the practice next season.
- the shortage of cultivable land in the region means that large numbers of farmers wait until they harvest the food crop before planting cotton. This results in a high proportion of late sowing. However, the climatic incidents of recent years have highlighted the importance of sowing earlier. On the whole, the farmers now agree that respecting early sowing dates is a major factor in the final yield.
- in view of the performance of the plot planted with treated seeds, the farmers are prepared to buy seeds given an effective treatment, rather than continuing to use the seeds with which they are usually supplied.
- the farmers are aware of the impact of weeds on their crops. They are all convinced that regular hoeing or herbicide use are crucial for good yields. They are all familiar with herbicides, but some are reluctant to use them because of the cost.
- beneficials: before the FFS, all the farmers considered that any insect found in a cotton plot was a pest. The self-paced training sessions enabled the farmers to distinguish between the main pest and auxiliary species, so as to conserve the latter.

The practices that are easiest to adopt are primarily those that do not require any additional input purchases and call for relatively little labour. Despite this, high planting density, which is labour-intensive, seems to be the most convincing, given the high yields obtained in the demonstration plots. The appeal of treated seeds will have to be confirmed once the farmers indeed have to purchase them and once their cost is known.

Creation of specific images to raise farmer awareness

The success of the component of the training programme in which the farmers are expected to produce drawings has varied from village to village. In the first year, all the participants were very enthusiastic and competed with each other to illustrate what they had seen in the field as effectively as possible. Since then, much fewer posters and drawings have been produced. Poster production has been the most severely affected, since producers are more willing to produce their own drawings on paper. Some have refused point blank to produce drawings. The operation needs to be handled carefully to ensure that the farmers do not develop a mental block about this.

However, it is an extremely useful operation, since it helps to generate a set of images that clearly show how farmers perceive the problems observed in their plots. This may lead research and extension services to describe certain pests or types of damage differently, and to produce documents more suited to the farmers' viewpoint.

Along the same lines, the FFS have confirmed that the farmers have entirely their own interpretation of the pictograms found on bottles of insecticide or other agricultural inputs. This problem has already been reported to the crop protection industry.

Conclusions and prospects

In the situation of Benin, the "Farmer Field Schools" method has been warmly welcomed by farmers, particularly as the lack of supervision during this stage of cotton commodity chain restructuring has been keenly felt. The fact that the method is open to practices that do not simply concern crop protection alone has helped to maintain farmers' curiosity throughout the season and to address many of their concerns, which explains the very satisfactory average participation rate (around 60%).

It is relatively easy to pinpoint the reasons for the rejection or adoption of technical messages, although it is sometimes difficult to obtain a clear picture of what farmers think. Greater efforts should be made in this respect when planning the sessions, and in identifying the demand and assessing knowledge at the end of the training cycle.

This method provides a clearer picture of the constraints linked to the adoption of any technical innovation and has proved much more effective than traditional demonstration plots.

Lastly, it has also helped in preparing training materials for use by large numbers of producers.

Chapter 4:

Adoption and diffusion of technical innovations concerning Coffee

The operations in the Dominican Republic have centred on integrated control of the coffee berry borer or CBB (*Hypothenemus hampei)*. The CBB is the main pest affecting coffee crops worldwide; it was first observed in the Dominican Republic in 1995. Its spread to the rest of the country's coffee growing zones (1997-2000) has coincided with the current world coffee price slump.

Since the CBB was first seen, the coffee department at the country's Ministry of Agriculture has launched a producer training programme based on the integrated control methods developed over many years in Central America.

Integrated control of the CBB centres on the following components:

- sanitary harvests: a) collection of residual cherries after harvesting (*pepena y repela* in Spanish), followed by a check on efficacy, and b) picking of premature, damaged cherries (from early flowering cycles) once a given damage threshold is exceeded.
- cultural practices: a) regulating shade, b) pruning the coffee trees, c) hoeing and d) fertilization.
- biological control using *Cephalonomia stephanoderis*.
- chemical control once a given threshold is exceeded.

The use of the Brocap® trap was added in 2001.

As in many similar situations, despite significant efforts in terms of training and information, it is clear that only a very small percentage of growers have adopted these practices. This issue therefore falls well within the framework of the current research on the degree of adoption of integrated control.

Identification of producer groups

In December 2000, three producer groups were identified in coffee production zones, at very similar altitudes so as to ensure equivalent CBB (*Hypothenemus hampei)* pressure.

Group no. 1, at "la Cebolla", is following the FFS method. A weekly meeting is held in a plot chosen by the producers. It lasts around two or three hours, and includes observations of pests and diseases, counts, plant phenology, insect trapping, etc, followed by a group discussion and the writing up of conclusions on a board. After the second meeting, a plot of around 2500 m^2 was chosen to carry out the work decided on during the discussion. The plot was then monitored from February to September, ie for the whole of the CBB control period (from the end of harvesting until the following crop ripened).

Group no. 2 (CG), at Mano Matuey Abajo, is following the conventional visits and training method. It is closely monitored at regular intervals, through training sessions in integrated control of the CBB and field visits with group members.

Group no. 3 (NES) was chosen at random, after the event, in Cumía, and is not receiving any particular follow-up but is part of a zone covered by an extension officer from the Dominican Coffee Council.

In all three cases, Codocafé extension officers are present, acting as observers in the case of group 1 and leaders in groups 2 and 3.

Operations completed

An initial meeting was held in December 2000 to present the approach to be taken with the first two groups, FFS and CG. As no interventions were planned for the NES group, this meeting was not held until the start of the evaluation operation (December 2001)

The socioeconomic surveys were more intensive in group FFS. The approach, which is somewhat cumbersome, was not clearly understood by those in group CG, in which there was much less of a climate of confidence. Problems with translation (French/Spanish) slowed down the surveys considerably.

In group FFS, weekly meetings have been held since January 2001, a plot has been chosen and managed jointly, Brocap® CBB traps are being tested, etc.

In group CG, the extension officer (CODOCAFE) visits roughly once a month, based on a calendar drawn up with the producers.

No interventions are planned for group NES, and those that may occur can be pinpointed after the event through producer surveys.

Initial results

§ *Farmer Field Schools: a successful participative method*

Group 1 has shown considerable interest in the FFS sessions. The group is now stronger and has been able to plan joint work in the members' plots. This "participative" extension operation has enabled farmers to express themselves, discuss issues and share their doubts and failings, apparently for the first time.

Two difficulties have arisen:

a) the operation has proved time-consuming, which jeopardizes its reproducibility. Between preparation, transport, the work session and the conclusions, the facilitator needs to spend a day with each group every week.
b) the social status of the facilitators is under threat. In conventional extension schemes, the extension officer "knows" and passes on his knowledge. Under the FFS method, he is expected to steer the work and observations to enable the group to make its own conclusions, without giving the answers himself or imposing his knowledge.

§ *The working plot*

The working plot and the observations and joint work carried out in it have proved to be excellent teaching tools. It is a working plot, not a demonstration plot. Based on traditional skills and observations, it is the group that decides jointly what is to be done. The chosen practices do not always tally with official policy, which sometimes warrants the establishment of small-scale comparative trials.

§ *The degree of knowledge of the plant and related insects, the key to integrated control*

The group quite quickly identified what needed to be done to control the CBB, particularly in terms of sanitary harvesting. Amongst other things, the observations of the insect, the study of its biology and the demonstration of its natural enemies have clearly shown the basic principles of and the reasons behind these practices, which are generally seen as an additional workload imposed by extension officers. Moreover, despite the farmers' very sound traditional knowledge of coffee and related cultural practices, the FFS sessions have revealed a number of misconceptions or misunderstandings concerning the biology and physiology of the plant, which sometimes prevent the farmers making appropriate crop management decisions.

§ *Epidemiology studies through trapping and counting*

Evaluating CBB population levels in coffee plantings has proved crucial. It is done by counting the number of insects at regular intervals and by using Brocap® traps, which, in addition to reducing population levels, also demonstrate the degree of infestation. The work to be carried out, particularly the sanitary harvests, is now much easier.

§ *IPM or ICM?*

Regular monitoring of the group for almost a whole production cycle prompted numerous questions that were beyond the scope of integrated control proper. Most concerned the factors that determine coffee quality, during cultivation and postharvest processing using the wet method, with a view to making maximum profits from what is produced and thus being able to fund CBB control. Similarly, it is clear that commodity chain and market efficiency is poor and hampers the profitability of the crop. This factor has to be improved if integrated control of the CBB is to become a reality.

Conclusion and operations still under way in 2003

The first two phases of the project revealed a certain number of constraints on the adoption of integrated control of the CBB, over and above the simple argument of world coffee prices, which were low throughout the test period.

An understanding of CBB biology and some form of epidemiological evaluation proved to be major factors in the adoption of IPM. This was only achieved in the group of producers involved in "participative" extension work.

In 2003, the aim is to validate the initial results through comparative surveys, which should be conducted between August and December. Losses caused by the CBB in the crops of the members of all three groups will also be counted.

The FFS approach has proved extremely successful. In just six months, the producers have been able to take on board the IPM techniques, and are almost self-sufficient; they are proud of the working plot, manage it together without any problems and are beginning to pass on their knowledge. The only major remaining obstacle to the transfer of IPM to their own plantings is economic. CBB infestation rates were between 2 and 5% of fruits in June 2001, compared to 20 to 30% in the previous cycle (2000). These initial results are very promising, and numerous NES officers have visited the group and the plot. Some disadvantages, quoted in the text presenting the research, have also been identified: the method is time-consuming and costly, and transmission rates are low.

Chapter 5

Conclusion

Overall, the project allowed to identify some interesting hints to promote the adoption of IPM by farmers as well as the problems that might be found when implementing such a promotion. Some of the lessons from the project are the following:

- Some of the IPM related practices can be adopted if they are understood by the farmers and enhance yields, even in the cases when they might imply more labour.
- IPM should be considered in a broader ICM context.
- The interaction between farmers, extensionists and researchers can provide useful hints for problem identification and solution findings.
- FFS is a good alternative for knowledge transfer.

Some of the drawbacks encountered are:

- Farmers are reluctant to evolve in their crop management. Changes require a persistent intervention.
- Technical solutions are not sufficient if the rest of the commodity chain aspects are not in accordance to provide for a beneficial context for the crop.
- The cost of FFS is too high and it requires changes in the extensionist's paradigm. More research is required to identify mechanisms to enhance communication between participating and non-participating farmers.

Even if more research is required, the results of the project advocates for modifications in the extension systems to enhance the adoption of environmentally concerned practices and provide for healthier conditions for farmers.