Farmer Participatory Training and Research Programme

IPM Reports and Reviews

Challenges for farmer participation in coffee research and extension:

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Stephanie Williamson

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CABI Bioscience

CABI Bioscience UK Centre (Ascot)
Silwood Park, Buckhurst Road
Ascot, Berkshire, SL5 7TA, UK
Tel: 01344 872999, Fax: 01491 829123
E-mail: a.little@CABI.org

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1. Introduction

The last decade has witnessed a major rethinking in the principles and organization of agricultural policy and rural development in general. Accumulated evidence from the field has made donors and policy-makers question the value of conventional approaches to research, development and extension in improving the welfare of farming communities, especially those in marginal, resource-poor and diverse agro-ecosystems (e.g. SDC 1999). In agricultural extension theory, the underlying concepts of the Technology of Transfer model are under increasing attack and the model's dominant application in practice via the Training & Visit system is widely discredited, even by its main funder, the World Bank (Roling and de Jong,1998). The new focus lies in active participation (as opposed to summary consultation) of farmers in problem diagnosis in their specific arable, agroforestry or livestock systems, followed by planning, testing and evaluation of farming practice options and strategies in collaboration with research and extension agencies in both public and private sectors. The "farmer first" ethos in rural development policy and practice called for in the 1980s (Chambers et al., 1989) is now becoming incorporated within agricultural institutions in many developing countries.

1.1 The farmer-first ethos in agricultural development

Farmer participatory approaches to training and research are employed increasingly by a range of agricultural development institutions, in order to empower farmers as active subjects in the process of making crop production more sustainable, rather than their conventional role as passive recipients of information and inputs. Learning, as a process of knowledge construction and interpretation by individuals interacting with their ecological and cultural environment, is replacing the earlier extension theory of pouring doses of relevant facts and messages into the "empty" vessels of "ignorant/backward" farmers (Pretty & Chambers, 1994). Ter Weel and van der Wulp (1999) provide an excellent (and free) review of these research and training issues in relation to integrated pest management (IPM) and outline the benefits of participatory IPM for food security, farmer wellbeing and rural development.

Encouraging experiences in crop and livestock management are building up through farmer-first programmes in Asia, Latin America and Africa using innovative approaches including Local Agricultural Research Committees (CIALs), Campesino a Campesino, Farmer Field Schools (FFS) and others, based on common principles of discovery-learning, group experimentation and community action. For instance, CIAL farmer members in Latin America are conducting location-specific research on agronomic and natural resource management problems in key food security crops of maize, beans and potato, with an emphasis on appropriate varieties and management practices (Braun et al, in press). In the area of soil fertility and conservation, discovery-learning and group study tools are used in Zimbabwe and Australia to help farmers understand soil bio-physics and the causes and effects of erosion (Hagmann et al 1997, and Campbell, 1994). Kenmore (1997) outlines the philosophy and potential of participatory IPM via FFS while a summary of FFS concepts and activities for improved decision-making by Asian vegetable farmers is given in Vos (1998) which emphasises the need for integrated crop management (ICM).

1.2 Field impact of farmer participatory methods

These programmes have achieved considerable impact in some cropping systems such as rice, vegetables and low-input cereals and in soil, water and varietal conservation. For example, a four year FFS programme in the Philippines trained over 1700 farmers in vegetable IPM at 65 FFS sites.. Before the FFS project, farmers in the region were applying an average of 14.6 litres of pesticide applications in the dry season, and they have now decreased insecticide use by 80% to 2.9 litres. Through discovery-learning exercises and comparative studies between IPM plots and current chemical practice, FFS farmers came to understand the negative effects of broad-spectrum products on beneficial insects. They also learnt how *Bacillus thuringiensis* works and the fact that it does not affect key natural enemies such as introduced *Diadegma* wasps. As a result of training and farmers raising awareness with their neighbours, the pesticide volume sold in the project provinces has decreased by 33% since 1991. At the same time, cabbage yields have increased by 21% and farmers' net income is up by 17%.FFS farmers now rely much less on information from pesticide company technicians and more on their own experiences shared during FFS sessions (Williamson, 1998).

In other systems, notably perennial tree crops (coffee, cacao, tea, fruits), farmer participatory approaches are unknown or only recently being tested. This paper analyzes the challenges to building farmer participation into current research and extension in tree crops, focusing on coffee production, with comparative studies from three continents. It looks at different factors, both local and global, in the business of growing coffee, which affect how farmers, particularly smallholders, interact with commodity research and development. Current constraints to farmer participation are described and their consequences for cost-effective, safe, environmentally-friendly and sustainable coffee growing, which is advocated increasingly by the donor community and coffee industry. Positive examples of farmer participation in tree crop IPM are described from Kenya, Nicaragua, Vietnam and the USA where growers collaborate with researchers and extension staff to test options for improving the ecological sustainability, human and environmental safety and cost-effectiveness of their cropping systems. The paper then outlines some potential activities for coffee berry borer IPM, as an example of the kind of discovery-learning and group experimentation required for a coffee FFS curriculum. It concludes with some recommendations for facilitating a more participatory approach in beverage crop R&D.

2. The context of commodity crop research and development

2.1 Characteristics of beverage crop production systems

Characteristics of beverage crop production systems in terms of the agro-ecological, social, economic and institutional factors which influence how farmers participate in commodity research and development.

National commodity boards have delivered massive achievements for their clients or members in many countries in the decades since their establishment, in terms of improving crop production and marketing. In some cases, the benefits have tended to accrue disproportionately to the larger growers but this does not hold true everywhere. In Colombia, for example, the Coffee Growers Federation FEDERCAFE with its research, extension and marketing wings has been responsible for an enormous rise in village living standards in the coffee zones, in comparison with other coffee-producing countries (Bentley & Baker, in press).

Nevertheless, commodity boards are renowned for their paternalistic attitudes towards farmers and general disregard for opinions of other agricultural development professionals whom they view as unqualified to comment on their activities. The following response by a senior extension manager to a question on the effectiveness of extension services illustrates well the attitudes prevalent among many commodity board staff: "Madam, farmers believe blindly what we tell them". Five minutes' conversation with coffee growers Is usually enough to dispel any notion that growers do believe or act blindly upon recommendations from their commodity board. More disturbingly, they often go on to display a complete lack of faith in the institution concerned to solve their problems or to represent their interests, particularly those of smallholders (McGee 1998) While such institutional paternalism may have served growers well enough in earlier, simpler times, today's complex and changing context for commodity production requires a fundamental change in organizational ethos, structures and methods, as well as in individual attitudes and behaviour.

Table 1 sketches some of the factors which influence how research and extension relate to their primary clients, the farmers. It contrasts typical commodity boards for beverage crops with the institutions involved in vegetable crop production. In most countries, farmers of beverage crops will also grow subsistence grains, legumes or vegetables, for domestic consumption and local sale.

Table 1 Comparison of vegetable and beverage crop systems

Characteristics	**Vegetable crops**	**Beverage crops**
Socioeconomic and political		
marketing	free market for local, also domestic consumption	internal and export markets highly structured but recently deregulated
political issues	relatively few, except in cases of pesticide residues/poisonings	high profile within national and provincial economies
Sociocultural importance	Low but some geographic focus	High, pride/tradition in coffee zones
Development of fair/organic trade	poorly developed but local markets for insecticide-free growing	may exist on small scale but often separate from dominant commodity agency
Research		
role of international research	dedicated CGIAR centre plus regional progs	"orphan" commodity
international interactions	collaborative	often competitive between countries
links between R &E	often weak but may be good in geographical or pest-focussed programmes	close in theory but rarely effective in practice
research agenda	set by broader coalition including donors and beneficiaries	set by commodity board
Extension		
extension service	variable, no specific vegetable mandate	well-defined, often via contact farmers
extension methods	T&V, FFS in x countries	emphasis on media campaigns, individual visits
recommendation domain	small to large scale	medium-large scale
in-country collaboration style	wide-ranging and inclusive from NGOs, universities, private sector	virtual dominance by Commodity Board/Assoc. and exclusive
use of participatory methods	increasingly common	virtually none
attitude of R&E to clients	trend from prescriptive to consultative/collaborative	highly prescriptive and paternalistic
Agro-ecological		
cropping cycle period	2-3 month cycle	12 month cycle
seasonality	Depends on dry/wet season water availability	Variable between climatic/geographical zones

Ecological/farming systems literacy of growers	Growing via IPM and other training/action research	negligible
stakeholder collaboration for integrated crop management	increasingly via national IPM progs. or multi-stakeholder working group	internal only and little holistic analysis

2.2 Issues in coffee commodity board research and extension

The following examples illustrate some of the issues arising from the peculiarities of the commodity board model of crop research, extension and marketing in the context of sustainable crop management. They were collected by the author during field work and workshop activities conducted in Colombia, India and Kenya from 1996-1998.

Socioeconomic and political factors

Deregulation of commodity board purchasing and the emergence of free markets in the last decade in most beverage crop countries has disrupted the close relationship which used to exist between Boards and farmers. Deregulation has led to higher incomes for farmers but these are often cut back by higher input costs and loss of subsidies. These factors have led to a lack of confidence in extension (from both farmers and extension staff), and loss of perceived control and prestige by commodity professionals. Extension staff complained bitterly about the deregulated coffee market in India which in early 1998 risked pest and disease spread as coffee quality was no longer monitored strictly. In fact, farmers selling beans damaged by the coffee berry borer beetle (CBB) *Hypothenemus hampeii* were not penalized by way of lower prices. Extension staff who were trying to raise awareness about district level quarantine measures to avoid the transport of bored beans from infested areas were understandably frustrated by the absence of economic pressure on farmers to control this pest.

In the 1980s the Colombian FEDERCAFE urged its members to concentrate exclusively on coffee cultivation in order to take advantage of high world prices and Colombia's competitive advantage. With the global market changes in the 1990s food security is now a serious issue for many Colombian smallholders, who dug up their plots of beans, maize, fruit trees and vegetables to plant more coffee. The extension service is now investing considerable resources in encouraging farm diversification again but have totally lost credibility among many smallholders. FEDERCAFE’s efforts in food security development are closely linked to coffee prices and interest drops when prices rise (Baker, pers comm, 1999).

Coffee remains a highly "political" crop in Kenya where it is still illegal for farmers to uproot healthy coffee trees on their land and forbidden to plant other crops between the coffee rows. These vestiges of centralized planning from a bygone era are hardly likely to promote an atmosphere of collaboration between growers and research/extension to tackle current production problems, especially when smallholders are in crisis due to low harvest prices and increasingly expensive inputs.

Research & Development factors

Unlike many subsistence crops, beverage crops suffer from an orphan crop syndrome, in that no major international research organization is mandated to study them. R&D is still a matter for each national commodity board or growers’ association and efforts to promote regional or global collaboration are often thwarted by competition and secrecy between countries.

The research agenda of individual commodity boards is often criticized for failing to address the needs and concerns of smallholder producers. A good example of this comes from Kenya where intercropping in coffee is officially discouraged by the Coffee Research Foundation and by Ministry extensionists because it may reduce coffee yields, despite widespread practice among smallholders anxious to improve their income and food supply. There is no information available for farmers and extension on which crops can be grown successfully with coffee, when, where and how. The rigid research-extension hierarchy is unable to translate preliminary research results on intercropping (e.g. Kememia and co. ref) into useful information for smallholders without going through a prolonged and bureaucratic message development process.

Beverage crop research frequently focuses on production practices in optimal zones, with experimentation carried out on-station or on large estates. There is little recognition of the particular problems faced by resource-poor growers or those in marginal areas. This is despite the fact that the majority of growers in India, Kenya and Colombia are smallholders, generally with less than 10ha land. In the few instances where research is conducted on small farms, the grower is not actively involved - Colombian smallholders complained that researchers had been releasing wasps (for control of CBB) on their plots but hadn't bothered to explain what they were studying or why. In India, the Coffee Board R&D ethos is "from lab. to field", implying that solutions will only be generated by research. Development of transgenic coffee with the *Bacillus thuringiensis* (B.t.) toxin for control of CBB and other beetle pests is a more attractive option for many scientists than the investment in extension required to get farmers to understand the need for continual berry removal from infested fields. As a consequence, farmers and many extensionists now expect research to provide ready answers to all their problems.

In theory, research linkages with extension should be close in the rigid structures of most commodity boards, in practice this is rarely so. In Colombia, only an estimated 2% of FEDERCAFE extension staff had met coffee researchers in the field and of the 20% who had been involved in field experiments, their role was limited to farmer selection and follow-up tasks (Uribe, 1996). There is considerable territoriality between research and extension departments, as demonstrated in two Latin American regional workshops on farmer participatory methods in coffee IPM. The concept of farmer participatory or action research where farmers, researchers and extensionists work together to identify production problems and possible solutions and then test and evaluate these in farmers' fields (e.g. BNI, 1999 gives an example with Kenyan vegetable growers) is still an unknown quantity in beverage crops and begs the question of the role of extension in this process.

Extension approaches

Extension methods used by commodity boards tend to be conventional lecture or slideshow meetings with farmer groups, visits to individual farmers and message-based media campaigns. The Indian Coffee Board, for instance, reflects the Training &Visit emphasis on "the right message at the right time" and formulates a monthly message for dissemination. In Colombia, village-level meetings are encouraged for smallholders while large scale growers may be invited to seminars at the FEDERCAFE district office. In Kenya, coffee production recommendations are passed on second-hand to smallholders through the Ministry extension service. All extension services are seriously under-resourced and a team of 2-4 staff may be responsible for contact with up to 2,000 growers.

The scale of the "recommendation domain" is a critical issue in whether centrally-generated extension messages are applicable to smallholders. The Colombian extension service recommends that all growers renew 20% of their coffee trees each year, in order to maximise productivity. For smallholders, this would mean sacrificing 20% of their cash income each year. Not surprisingly, few smallholders are able or prepared to do this. Kenyan smallholders can no longer afford the complete fungicide application regime recommended by research for control of coffee leaf rust *Hemeleia vastatrix*. They end up applying only half the recommended applications or dosage, and there is some evidence that this kills off microbial antagonists but does not control the disease pathogen (Joseph Kememia, pers.comm, 1996). A more useful message in this case would be that " if you can't afford the full protection regime, the next best thing is not to spray at all".

Demonstration farms or on-farm plots are sometimes used. In India the Coffee Board runs 15 farms for method demonstration and organizes 0.4ha plots on smallholder estates to compare pre- and post-adoption productivity over a three year period. While these comparisons are useful, smallholders often see demonstrations as far removed from their own reality or that of the market-place. There is little scope for farmers to learn about or gain confidence in the methods through their own experience.

The traditional teaching tools of flipchart and slideshow sessions have been successful in encouraging farmers to adopt relatively straight-forward technologies or changes in practice, e.g., improved varieties or fertilization regimes, but are increasingly unable to cope with new challenges in coffee production such as CBB, coffee wilt, and stemborers. Effective management of these pests and diseases requires a dynamic combination of management technologies and a high degree of on-farm decision-making.

In general, evaluation of the effectiveness of extension methods is weak or absent in beverage crops. Poor adoption by farmers is often blamed on inadequate or economically unviable technologies, lack of extension resources, or farmers' unwillingness to change. Rarely do extension staff (notably the management) admit that perhaps they need to reassess their approach or extension methods. Yet some of the methods are notoriously inefficient, the Indians estimate that it takes an extension team 8 days' work to arrange one seminar for 50-70 growers as individual invitations have to be delivered. Attendance at these activities has fallen, growers are bored with watching the same video or hearing the usual exhortations: "the current extension bag is empty, with little new to offer the farmer, large or small" (Mohan Das, pers.comm., 1998).

3. Constraints to farmer participation: the case of coffee berry borer IPM

This section concentrates on particular aspects of research and extension as it relates to the current difficulties in implementing integrated management of the coffee berry borer CBB. CBB is a very tricky pest problem: it is exotic outside its native Africa; it causes quality rather than quantity damage to coffee beans but its infestation level is critical for the export market; it lives most of its life hidden within the developing coffee bean; and the most effective control methods involve significant time and labour in removing infested and healthy berries from the field and processing yards in order to reduce breeding sites.

CBB is the current focus of massive research and extension efforts in Latin America, the Caribbean and Asia, by both national coffee boards and international programmes funded by development and global coffee marketing agencies. World-class research, particularly on non-chemical alternatives for control, has been conducted and disseminated (e.g. Baker, 1999) and each affected country has organized multi-media extension and implementation campaigns, with some success in reducing CBB levels in some areas. However, the pest is spreading to new areas and more farmers are turning to chemical insecticides (mainly endosulphan) as the control method of choice, with grave consequences for human and environmental health and possibly for export sales in the not-too-distant future.

A few examples illustrate some of the key problems in engaging farmers' active participation in controlling CBB by safe, cost-effective and sustainable means (for a fuller evaluation of the Colombian case, see Williamson, 1997).

Understanding the pest
In one CBB session for smallholders held in a hamlet in southern India, the extension staff showed slides of greatly magnified CBB adults and carefully described anatomical details including the dorsal hairs on the beetle's abdomen- a feature both invisible and irrelevant to farmers or IPM practitioners.

Indian extension material in local languages with pictures of pests and their natural enemies often uses English or scientific names, hence reinforcing attitudes that farmers know little and researchers know a lot.

Colombian extension material on CBB control includes how to sample to assess CBB levels in a plot and how to check how far the beetle has penetrated the coffee cherry. The latter is important for timing of insecticide or biopesticide application since once the beetle has bored inside the bean it is protected from contact action products. However, the sampling protocols were taken directly from research literature and the penetration assessment involved four different measurements when a simple *in the flesh/in the bean* observation would suffice for farmer decision-making.

Understanding natural enemies
Colombian smallholders interviewed by the author had heard about CBB natural enemies used for IPM- *Beauveria bassiana* fungal pathogen and 3 species of parasitic wasps- and some had received material for use on their farms or knew of neighbours who had. However, neither researchers nor extensionists had devoted time to explaining how these organisms worked or whether these were still under experimentation or proven in the field. Farmers had valid queries about both the fungus and the wasps; they wanted to know how to measure their impact in their plots, and compare this to cultural and chemical controls in terms of cost, labour and safety. They also asked about compatibility of action between the pathogen and insects and with regular berry removal.

Biocontrol researchers tend to be very enthusiastic about their subject and may generate unjustified optimism about its potential. It is important to be realistic about the role of CBB natural enemies and to emphasise their use as one option within an integrated strategy. Wholesale promotion of *Beauveria*, for example, without considering field efficacy or farmer access to necessary equipment, serves to perpetuate the “magic bullet” syndrome in pest control and can jeopardize the reputation of biological control.

IPM strategies for an individual farm
While farmers can readily appreciate the logic of cultural controls for CBB, the cost-effectiveness of methods such as picking unripe and unseasonal berries, removing fallen berries and stripping trees after the main harvest, or getting rid of old, overgrown trees, is far less convincing, especially where labour is scarce (India) or expensive (Colombia). Optimal strategies will vary from farm to farm, depending on size, availability of labour, climate, age and shading of trees, CBB infestation levels, market price and comparative costs of other IPM methods, and growers’ individual farming objectives, amongst others. It is hard to see how current research and extension approaches can help coffee growers develop the analytical skills to work out the best strategies for their farms year by year. Modelling may provide a useful framework but effective IPM implementation depends on farmers deciding for themselves how to tackle problems.

With an exotic and mobile pest like CBB, local level population dynamics are important and farmers are concerned that any control action they undertake may be a waste of effort if their neighbours do nothing. In India, large scale growers currently accuse smallholders of spreading CBB and vice-versa. In reality, it is more likely to be large estates which are not prepared to invest in cultural control or offer incentives to workers to collect the maximum number of fallen berries. However, these issues are not clear cut and research and extension have focused on technical rather than socio-economic aspects of CBB IPM. Farmers need to calculate for themselves the costs and benefits of different IPM options and see how these relate to their current farming practice and medium-term production prospects. Village-level experimentation and discussion may encourage community action but this is unlikely to take place solely by the exhortations of commodity boards or their work with “enlightened growers”.

Table 2 summarizes key constraints to implementation of CBB IPM related to current research and extension structures in commodity boards, as analyzed from these three case studies.

Table 2 Key constraints in research and extension approaches to effective CBB IPM implementation

Cause	Effect
Top-down extension approaches	Farmers discouraged from collaboration and sceptical of commodity board support
Inappropriate use of language and terminology	Farmers and extension staff confused and uncertain about CBB IPM
Technical detail at the expense of ecological understanding	Farmers and extension staff confused and uncertain about CBB IPM
Weak or conflicting linkages between research, extension, farmers and other IPM stakeholders	Few channels for information flow, feedback and multi-institution problem-solving

Farmers treated as passive recipients of knowledge/technologies	Farmers' decision-making processes ignored and undeveloped
Complexity reduced to easily-assimilated, generalized messages	Inappropriate recommendations ignored by farmers Extensionists lack conviction in providing IPM advice
Little emphasis on group experience sharing or farmer-farmer training	Farmers' own skills and experience devalued Opportunities for multiplication of promising field work missed
No active experimentation with farmers in the field	Coherent IPM strategies undeveloped or unvalidated Farmers' contribution to R&D missed
Extension staff undervalued	Morale low and extensionists unwilling to try out new methods Extension's role in CBB R&D unutilized
Lack of systems approach to CBB IPM	Little focus on socio-economic-cultural aspects, especially for smallholders Failure to learn from experiences in other cropping systems

4. Positive examples from participatory projects in tree crop ICM

4.1 Farmer Field Schools in coffee, Kenya

In 1996 a farmer IPM training pilot project took place with 65 smallholders growing coffee and vegetables, mainly tomato and kale. The training was a multi-institutional collaboration between an international research and training organization, Kenyan agricultural and coffee research organizations, extension staff from the Ministry of agriculture and an organic farming NGO, KIOF (Nyambo et al 1997). The FFS met once a week over 8 months or so in coffee and compared farmers' current practice (neglected coffee due to low prices) with IPM-decision making/good husbandry; and research recommendations. Despite the training finishing before a full season had passed, the farmers and facilitators were able to observe differences in tree health and yield potential between the comparisons after only a couple of months.

The main learning points in coffee were that good husbandry methods (pruning, mulching, manuring) were effective in improving yield potential compared to smallholders' current practice with out incurring large input costs. The IPM-decision making plots showed that the number of insecticide and fungicide applications recommended could be cut dramatically (by 100% and 50%, respectively) compared with the research recommendations plots, without reducing potential yield. The FFS groups learned the value of making management decisions based on regular monitoring of crop ecology and of substituting local inputs and own labour for expensive agrochemicals. For example, farmers were able to observe higher numbers of parasitized *Antestia* bugs (a key sucking pest of berries) in the well-pruned IPM plots. Motivation for coffee IPM was increased by the immediate visible results the same farmers could see in their vegetable FFS.

An independent evaluation of the project 6 months after formal training finished showed that individual FFS farmers were applying and adapting many of the principles and methods studied in the FFS group (Loevinsohn et al., 1998). FFS farm families were saving an average of US$ 145 equivalent per year as a result of changes in their cropping practices in coffee and vegetables. Their farm management capacity had increased and each FFS farmer shared her/his new knowledge and practices with an average of 4 other farmers. Women farmers have increased their role in managing coffee, traditionally controlled by men, and some FFS groups have gone on to collaborate in other community activities such as rotating credit funds and in collective marketing of insecticide –free produce.

4.2 Organic coffee production, Colombia

The Colombian Organic Coffeegrowers Association (ACOC) was set up in 1990 to meet the needs of smallholders in marginal coffee zones who were in serious credit difficulties and suffered food insecurity. An organic focus was provided by agronomists from a local NGO and farmer- to farmer training encouraged with support from them and local municipal extension staff. As of 1997, ACOC had 19 member families and milled, packed and sold its own brand of organic coffee for the local market. ACOC provides training and individual advice to families who wish to become members and certify members' organic coffee. The training is based around on-farm workshops and demonstrations and each new family is assigned an experienced ACOC farmer as mentor during their first 1-2 years. Organic production practices are tested and adapted from various sources including formal research, CBB IPM advice and farmers' knowledge and from biodynamic and other schools of thought. ACOC's principle is, however, in line with discovery-learning in that they stress that "each farm is a world of its own" and each farmer has to find out what works best for her/his situation.

Despite growing coffee at low altitude, ACOC farmers have managed to reduce coffee berry borer incidence significantly by cultural and biological methods. One farmer has adapted a production strategy based on the logic of FEDERCAFE recommendation to renew 20% of coffee bushes annually but recognizing that this is economically impossible for smallholders. He maintains his bushes well fertilized for 10 years but using a wider spacing to facilitate berry removal on the older trees. His coffee is shaded and mulched and Beauveria incidence is high under these conditions. He has succeeded in reducing CBB levels from 5% to 0.8 % in four years by these methods, combined with fortnightly berry removal and destruction of bored beans (Williamson ,1997).

Through their family and food security emphasis, ACOC have succeeded also in motivating young people in coffee production, a major achievement in a country where many children of farmers leave for the city and where coffee is increasingly grown by an aged population.

4.3 Biologically Integrated Orchard Systems, USA
The BIOS programme began in 1993 when almond and walnut growers in California approached IPM researchers via a local NGO, the Community Alliance with Family Farmers, for help in reducing agrochemical inputs on their farms (Schafer, 1998). By 1998 there were over 100 growers enrolled in projects and the programme brings together university researchers, pest control advisors, independent crop consultants, agricultural suppliers and governmental staff from agriculture and natural resource management agencies. Local management teams of these stakeholders meet monthly to plan and review on-farm research projects in conjunction with local farmers who sign up to take part in the scheme. To enrol , a farmer must agree to reduce pesticide use, especially of most toxic classes; dedicate 6-12 ha of his/her land to implement or study BIOS practices, collect and share information and data from the orchards; meet with the management team and attend field days and group meetings.

Research and development of biologically-based systems includes the use of biological pest management, pheromones and trapping, cultural practices, cover crops and soil and water management. By 1996 impact assessment of 53 BIOS growers showed that the percentage using organophosphate compounds had dropped from around 32% to under 10% whilst biological control users increased from 4% to 40%. Average synthetic nitrogen inputs had decreased by 42%. BIOS stakeholders attribute the field impact and growth of the programme to the following factors; building on farmers' experience; integrating scientific and practical knowledge; teamwork and effective coordination which encourages participation; and flexibility in program management, both at project and farm level. Whilst action research is carried out on individual farms, farmers evaluate results together with other stakeholders and implementation is promoted via specific training and demonstration days, educational material; and advice "hotlines" and "buddy systems" for supporting BIOS members. Equally important has been the institutional and policy support gained from agricultural development agencies and state organizations and the innovative multi-institutional partnerships developed (Thrupp, 1996)

4.4 Experimenting with coffee production methods, Nicaragua
A group participatory training approach to strengthen coffee farmer decision making abilities has been developed by the CATIE IPM Project in Nicaragua in collaboration with the Nicaraguan Coffee Growers Association (UNICAFE), the National Agrarian University, and numerous NGOs. Like FFS and other participatory IPM training approaches, it is based on

group methods for discovery-learning and analysis, season-long field studies, technology and knowledge contributions from formal research combined with farmers' experience and facilitation by specially trained field technicians. The emphasis on the Nicaraguan programme is on farmer observation
and analysis of crop health, pest incidence, shade levels, pest, disease and weed management options etc by focussing on crop stage, critical periods for decision making and ecological and climatic variability between farms and seasons. The approach has been field tested and refined with groups of coffee growers and extensionists throughout the coffee zones of Nicaragua since 1995. (Aguilar et al, 1999).

Groups of 10-25 farmers meet six times per year to discuss production problems, collect and analyze data together and to evaluate field studies and plan new activities. Some discovery-learning exercises are carried out by the group on-farm, such as observation of CBB, disease sampling assessment or weed incidence observations. Facilitators attempt to draw out as much knowledge from farmers as possible and to build on their cropping experiences, for instance, when introducing CBB studies, the farmers first discuss what they know and how they learnt about the pest and then
identify what else they would like to find out about CBB and its management. After joint discussion and planning, group members undertake research on new or improved cropping practices on their own farms by comparing plots with their current practice. They collect data periodically and then evaluate all the results from individual experiments in the group forum.

Crop phenology and production phase is key to planning training and experimentation activities. For example, farmers analyze symptoms of dry season pests at early flowering stage and compare incidence under sun and shade before discussing and trying out management options. Weed problems are studied after the first rains provoke new flushes of weed growth and farmers begin by collecting three types of weedy plant from the field: highly damaging to coffee; intermediate; and little damage. They go on to classify these by growth habit and study height, rooting depth, regrowth and seed potential and management options including ground cover promotion and targetted herbicide use (ILEIA ref). For CBB IPM, farmers observe
and draw coffee berries at different development stages, assess CBB presence and reproduction potential, then go on to develop management plans for their own farm.

Training impact assessment has shown that participating farmers are able to control CBB; they are more likely to share their experiences with other farmers; they continue to experiment after formal training; and request new skills and knowledge to improve production further. Coffee IPM farmer groups have gone on to collaborate with researchers on novel experimentation on topics including shade management, recycling of coffee pulp, sanitary pruning, disease forecasting, organic soil amendments, biological and botanical pesticides, and holistic plantation design. (Monterroso et al 1998). Similar IPM training has been run specifically for plantation foremen, pest observers and other farmworkers on large estates, leading to improvements in export quality production. On one estate where workers are joint shareholders along with the company, the CATIE programme ran a six year project in participatory training and management planning for CBB IPM with estate technical and support staff. By 1998 they had reduced CBB levels from 6-10% berries to less than 1% through regular monitoring, cultural and biological controls, using comparison plots for experimentation and decision-making (Morales, 1998)

4.5 Action research in tea IPM, Vietnam

The Vietnamese National IPM Programme began IPM training and development activities with the Bac Thai provincial Plant Protection Sub-Department in 1993, principally through the setting up of Farmer Field Schools. The NGO CIDSE has been active in farmer support in the province for over a decade and first got involved in rice FFS training. CIDSE trainers and farmers then requested that the FFS approach be developed for tea IPM since many smallholders rely on tea as a valuable cash crop and pesticide use is high, with an average of 17 applications per yearly cycle. Methamidophos made up 82% of pesticide applications in a 1994 survey, mainly because farmers believe it acts as growth promoter and stimulates new tea shoots after plucking. CIDSE started the tea IPM programme with a multi-stakeholder workshop to discuss tea production problems, including high external inputs, and to develop a plan for training and action research (FAO, 1997)

IPM strategies for smallholder tea in Vietnam were poorly developed so the project began with field studies by farmers on the economic and ecological aspects, as identified and discussed in five farming communes. Stakeholders included the extension and plant protection staff , CIDSE and the national tea research institute. Study groups of 3-10 farmers were facilitated by extension staff, with technical support from the research agencies, and they chose to investigate green manures, irrigation methods; fertilization and plucking regimes; and shade trees ,as well as the usual FFS comparison plots. A key feature for research was also to compare the effects of commercial plant growth stimulants with methamidophos. The groups met weekly to carry out tea agro-ecosystem analyses, collect data and decide on management practices under the different comparisons.

Based on the results from two years' of farmer participatory field studies, tea FFS groups for training and further research were set up in 1996, using extension staff and farmers from the field study groups as facilitators. The tea IPM programme has been very useful for providing researchers with a strong farmer view of technologies currently recommended and for helping farmers to make decisions regarding pesticide reduction and alternatives. The studies and FFS training have helped farmers understand that pesticides themselves are not plant stimulants and the fertilization research led to farmers halving synthetic fertilizer foliar application and switching to manuring where feasible. The programme has also shown that farmers can become trainers too: as one said, two years of doing action research is the same as graduating from a technical college.

5. Action for improving farmer participation in sustainable production of beverage crops

5.1 Overview of key issues

The examples given in section 5 sketch out some encouraging learning tools, methods and novel partnerships for farmer participatory training and research in a variety of tree crops. Many are very small-scale and at the early stages of development or evaluation. It will be important to assess the impact of such experiences in terms not only of outputs (knowledge acquired, changes in farming practice and farm income) but also process (learning and decision making processes, training and action research methodologies, institutional and policy changes). A recent meeting of the Global IPM Facility with international NGOs identified three key elements in empowering farmer decision making and investigation, based on the FFS experiences:

- Agroecological literacy (the principles of integrated pest and crop management in FFS)
- Appropriate learning methodologies (the tools and group dynamics of FFS activities)
- Ensuring a supportive environment (inter -institutional collaboration via national IPM Working Group and pressure for policy change)

These elements are applicable to other farmer participatory approaches. In the case of beverage crops, agroecology needs to be studied in close relation to crop phenology and within a farming systems context, with emphasis on soil and water management, shade trees and other crops, nutrient cycling and improved biodiversity.

It is also essential to look at socioeconomic factors, at local and macro-level, particularly in the context of the globalization of commodity trading. Smallholders need to be able to access up to date information on prices so as to make appropriate management decisions, whether they are producing for niche markets in organic, fair trade or environment-friendly produce or selling to conventional export or national markets. Farmer-centred socioeconomic methodologies such as participatory budgetting (Dorward et al, 1998) would be valuable in helping farmers and facilitators visualize and assess existing and potential scenarios at farm-level with changing farming practices or market factors.

With the exception of the BIOS program, the examples above focus on smallholder production but participatory training and research principles may also be adapted and used with larger farms and with farm managers. Australia has been leading much of this work, for example with soil nitrogen workshops for action research with wheat farmers in Queensland (Visser et al, 1998) and multi-stakeholder Problem Specification and Planning Workshops for IPM in tomato and weed management (Norton et al, 1999).

Box I gives some suggested discovery-learning exercises for coffee berry borer IPM, to illustrate the type of field studies which can be developed for farmer-centred training. Whilst these biological and physical concepts have been studied in detail by researchers, methods for combining technical options into cost-effective and flexible production strategies appropriate for individual farm contexts are poorly understood. Modelling is a useful tool for exploring strategies and scenarios "on paper" but action research with farmers and other stakeholders provides the best means of testing and refining production strategies in the real world and of motivating farmers to try out new farming practices. Frameworks for sustainable rural livelihoods offer a new opportunity to analyze the complexity of farmer options, with a focus on poverty alleviation, improved food security, reduced vulnerability of farm systems and sustainable use of natural resources (DFID, 1998). They recognize that rural households develop coping strategies based on multiple sources of income and inputs and that sustainable livelihoods must be able to withstand external shocks and adapt to trends in biophysical and socioeconomic factors. By studying the different capital assets (natural, physical, social, human and financial) which growers of beverage crops have access to, practitioners of sustainable crop production could work with farmers and other stakeholders to strengthen these assets and to work out flexible farm production strategies. Such frameworks specifically include institutional structures and processes and the cultural context which influence how farmers use capital assets. Rather than technical aspects, it is this wider set of influences which currently constrains sustainable production of beverage crops and which need to be considered in any programme aiming to achieve field impact, such as those for CBB IPM.

This paper concludes with some specific recommendations for improving farmer participation in coffee R&D and widespread implementation. These were derived from experiences in Colombia, Kenya and India and by Latin American regional workshops on farmer participatory methods in coffee in 1997 and 1999. Finally, an encouraging experience in coffee action research in Colombia demonstrates that change is possible within the bureaucracies and traditional approaches of commodity boards. The challenge is for farmer participatory approaches to be recognized and incoroporated at institutional level within beverage crop development organizations.

Box 1 Suggested discovery-learning exercises for aspects of coffee berry borer IPM

Objective 1: *farmers understand the potential risks and negative impact associated with chemical control for CBB as well as the skills and information required for safe and effective use of insecticides*

Title How can I make the most of insecticide sprays for CBB control?

Activities for field and indoors study:

- jamjar or coffee branch sleeving experiments ("insect zoo") to show effectiveness of application at different stages of borer attack and different positions within berry
- cost/benefit calculations of poorly timed/targetted applications
- safe use of insecticides/operator and environmental exposure hazards
- jamjar studies (48 hour mortality assessment) to show pesticide effects on natural enemies and other beneficials eg earthworms, bees

Objective 2: farmers understand biology and reproduction of Beauveria and its use as a CBB control method

Title How does Beauveria fungus work in the coffee grove?

Activities

- paintbrush application of fungal spore solution in jamjars to show fungal infection on insects
- recognition of fungal infection in bored berries on trees
- disease transfer under humid conditions (insect zoos using plastic bags, infected berries and CBB adults)
- best application times and methods (study UV degradation/fungicide and endosulphan compatibility/surfactants for water-based knapsack application)
- how to measure efficacy of a fungus application, field level sampling/assessment
- viability testing of commercial products using paintbrush/leaf dip methods

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5.2 Recommendations for improving farmer participation in coffee ICM

Training methods and materials

✓ Coordinate the design and production of training and educational materials with inputs from researchers, extensionists, farmers and educationalists working as a team,

✓ Target ICM training materials better to specific farming contexts

✓ Develop discovery-learning exercises for CBB IPM and other coffee management
✓ problems and test these out with farmers on a pilot scale. These should aim to help farmers understand key agroecological and biophysical processes and improve their decision-making skills.

✓ Develop a programme for systematic and participatory monitoring and evaluation of the impact and effectiveness training activities, including expertise in socio-economics and communications studies.

✓ Develop more user-friendly and farming system-specific sampling and recording methods. *Small-scale farmer focus groups, NGOs and farmers' associations involved in coffee training should be involved in designing and testing these*.

✓ Integrate information from current socio-economic and on-farm research into extension activity planning and analyze findings within Coffee ICM Working Group

✓ Actively involve those coffee farmers who already use ICM techniques, or who are experimenting with control options, in training and on-farm research activities.

Building inter-institutional partnerships

✓ Set up a provincial and/or national Farmer Participatory Coffee ICM Working Group to coordinate farmer-centred training and action research activities, evaluation and dissemination. *This should include researchers, extension staff, small and large scale farmers, university IPM staff, NGOs and other stakeholders involved in participatory IPM projects*.

✓ Create an informal space for dialogue between interested individuals in research, extension, farmers' groups and NGOs with the aim of improving communication and collaboration in coffee ICM

✓ Network with project activities which aim to create closer linkages between extension and research and develop farmer participatory methods in coffee

Promoting action research

✓ Develop a strategy for farmer participatory research in coffee ICM to explore technical and socio-economic feasibility and cost/benefit of various ICM options under different farm contexts.

- ✓ Evaluate and disseminate relevant experiences in action research in other crops and in coffee programmes elsewhere.

- ✓ Involve extension and NGO staff and small farmer representatives in setting coffee research agendas and improve linkages between these groups.

As a result of discussions on farmer participatory methods, in 1998 a group of young coffee researchers in Colombia decided to try out these methods with smallholder communities in one of the country's poorest and most marginal coffee zones. They wanted to see whether discovery-learning and action research would convince these sceptical and isolated farmers to reconsider their farming practices and to assess the practical application of the researchers' investigations in coffee berry borer IPM. The work is in its early days but within a few months, the research team along with local extensionists have built up mutual respect with the target farming communities, despite working in a conflict zone between the guerrilla and paramilitaries. They started with discovery-learning exercises to show farmers the emergence and dispersal of CBB from harvested berries at depulping stage, using plastic covers coated with glue to trap emerging adults from coffee sacks and puling hoppers. The farmers went on to develop their own grid for counting CBB numbers and monitoring emergence patterns and have adapted the use of sticky plastic as a trapping method too (Mauricio Salazar, perscomm, 1999) Contrary to conventional research and extension wisdom, these smallholders are quite prepared to make detailed observations, records and calculations, now that they have assessed together the usefulness of the activities and adapted them for their own farms. The experiences has been a steep learning curve for all concerned ,especially the researchers who have been developing their facilitation skills as they go along. Perhaps the most telling indication of the new approach lies in a spontaneous response from the farmers when they drew a process diagram of a coffee farm to illustrate what they had learnt about CBB IPM methods: by the farm house they drew the entire family waving and welcoming the facilitation team as they drove up in their pick-up truck.

References

Aguilar, A., Calderón, M., Guharay, F., Jimenez, C., Mendoza, R., Monterrey, J., Monterroso, D., Staver, C. (1999) Coffee growers make improved pest management decisions through group learning and experimentation by crop stage. Internal report, CATIE IPM Program, Managua, Nicaragu

Baker, P. (1999) The coffee berry borer in Colombia. Final report of the the DFID-CENICAFE-CABI Bioscience IPM for coffee project (CNTR 93/1536A). 144pp

BNI (1999) Kenyan farmers validate traditional methods. *Biocontrol News & Information* 20 (2) 57N-58N

Braun, A.R., Thiele, G. & Fernández. M. (in press) La Escuela de Campo para MIP y el Comité de Investigación Agrícola Local: plataformas complementarias para fomentar decisiones integrales en la agricultura sostenible. *Manejo Integrado de Plagas 53*

Campbell, A. (1994) Landcare: Communities shaping the land and the future. With case studies by Greg Siepen. St Leonards: Allen & Unwin.

Chambers, R., Pacey, A. and Thrupp, L. (1989) Farmer first: farmer innovation and agricultural research. Intermediate Technology Publications, London. 219pp

DFID (1998) Sustainable Rural Livelihoods. What contribution can we make ? Department for International Development, London. 213pp

Dorward, P., Galpin, M., and Shephered, D. (1998) Participatory budgets: a farm management type tool to assist farmers in their decision making. *Participatory Learning & Action Notes* 33 59-63

FAO (1997) Developing tea IPM for smallscale farmers- Bac Tha Province, Vietnam. In: Community Based IPM case studies. FAO Intercountry Programme for Rice IPM in S/SE Asia. Unpublished dossier. Innovations pp 14-19.

Hagmann, J., Chuma, E., and Gundani, O. (1997) From teaching to learning. Tools for learning about soil and water conservation. *ILEIA Newsletter for Low External Input & Sustainable Agriculture,* Netherlands 13(3): 26-27

Kenmore, P. (1997). A perspective on IPM. *ILEIA Newsletter for Low External Input & Sustainable Agriculture,* Netherlands 13(4): 8-9

Loevinsohn, M., Meijerink, G., and Salasya, B. (1998) Integrated Pest Management in Smallholder Farming Systems in Kenya: *Evaluation of a pilot project*. Unpublished report, ISNAR, Netherlands. 50pp

McGee, R. (1997) "El cafecito": algunas perspectivas desde una comunidad de pequeños caficultores. Lecture at Cenicafé, Chinchiná, Colombia, 25 July 1997.

Monterroso, D ; Guharay, F.; Aguilar, A.; Mendoza, R.; Méndez, E..; Monterrey, J.; Staver, C. (1998) Opciones de manejo de plagas de café en sistemas de bajos insumos . CATIE, Managua, Nicaragua. *Paper presented at:VII Congreso Internacional de Manejo Integrado de Plagas. 26 - 30 de Octubre 1998. Montelimar, Nicaragua*

Morales, R. Guharay, F. (1998) Manejo de la broca del café en fincas cafetaleras del norte de Nicaragua: de experimentacion a implementacion masiva. CATIE, Managua, Nicaragua. *Paper presented at:VII Congreso Internacional de Manejo Integrado de Plagas. 26 - 30 de Octubre 1998. Montelimar, Nicaragua*

Njoroge, JM & Kememia, JK (1995) Economic benefits of intercropping young arabica and robusta coffee with food crops in Kenya. Outlook on Agriculture 24 (1) 27-34

Norton, GA, Adamson, D, Aitken, LG, Bilston, LJ, Foster, J, Franck, B and Harper, JS. (1999) Facilitating IPM: the role of participatory workshops. *Int J Pest Management* 45 (2) 85-90

Nyambo, B., Kimani, M. & Williamson, S. (1997). Developing an African model for effective IPM training. *ILEIA Newsletter for Low External Input & Sustainable Agriculture,* Netherlands 13(4): 29-30

Ooi, P. (1998) Beyond the Farmer Field School: IPM and empowerment in Indonesia. Gatekeeper Series no. 78. International Institute for Environment and Development, London.

Pretty, J. & Chambers, R. (1994) Towards a learning paradigm: new professionalism and institutions for agriculture. In: Beyond farmer first. Rural people's knowledge, agricultural research and extension practice. Eds. I. Scoones and J. Thompson. Intermediate Technology Publications, London. 182-202

Röling, N. and de Jong, F. (1998) Learning:shifting paradigms in education and extension studies. J. Agric. Education & Extension 5 (3) 143-161

Schafer, K. (ed.) (1998) Learning from the BIOS Approach. Community Alliance with Family Farmers and World Resources Institute, California. 37pp

SDC (1999) Agriculture in a changing world. Swiss Agency for Development & Cooperation. http://www.sdc-gov.ch

Staver, C, Aguilar, A, Aguilar, V, & Somarriba, S. (1995) Selective weeding. Ground cover and soil conservation in coffee in Nicaragua. *ILEIA Newsletter for Low External Input & Sustainable Agriculture,* Netherlands 11(3): 22-23

ter Weel, P. and van der Wulp, H. (1999) Participatory Integrated Pest Management: policy and best practice. Ministry of Foreign Affairs, The Hague, Netherlands. 67pp.

Thrupp, L.A. (Ed.) (1996) New partnerships for sustainable agriculture. World Resources Institute, Washington. 136pp

Uribe, C.A. (1996) Resultados de las encuestas realizadas a 60 extensionistas de la zona cafetera colombiana sobre transferencia de tecnología. Federacion Nacional de Cafeteros, Bogota, Colombia.

Visser, I., Cawley, S. and Roling, N. (1998) A co-learning approach to extension: soil nitrogen workshops in Queensland, Australia. *J Agr Educ Ext* 5 (3) 179-191

Vos, J. (1998). Development of decision-making tools for vegetable farmers in SE Asia. In: Ecotoxicology; pesticides and beneficials organisms. Kluwer Academic Publishers, USA. 404-409.

Williamson, S. (1997) Farmer training capacity amongst Colombian institutions, with special reference to integrated management of coffee berry borer (broca). Final report on a consultancy mission to Colombia conducted between 2-24 March and 18-26 May 1997, on behalf of the DFID project: IPM for Coffee: Colombia, managed by the International Institute of Biological Control. IIBC unpublished report, 49pp.

Williamson, S. (1998) Understanding natural enemies; a review of training and information in the practical use of biological control. *Biocontrol News and Information* 19(4) N117 – N126

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