

CROP PROTECTION PROGRAMME

**Promotion of ICPM for smallholder coffee in Malawi
R8204 [ZA0521]**

FINAL TECHNICAL REPORT

1 September 2002 - 31 March 2005

Dr Rory Hillocks
Natural Resources Institute

[FTR completed 24-03-05]

This report is an output from a research project funded by the United Kingdom Department for International Development for the benefit of developing countries. The views expressed are not necessarily those of DFID [Project R8204; Crop Protection Research Programme]

CONTENTS

Colour plate	3
Project Summary	4
Executive summary	5
Background	6
Project Purpose	9
Research Activities	10
Outputs	11
Publications	33
Contribution of outputs to developmental impact	35
Log Frame	38
Appendices	Separate



White stem borer damage



Coffee berry disease



White stem borer beetle



Hedgerow system for Catimors



Coffee leaf rust



Catimor x banana intercrop
- demonstration plot

PROJECT SUMMARY

TITLE OF PROJECT: IPM for smallholder coffee farmers in Malawi

R NUMBER: R8204

PROJECT LEADERS: Dr Rory Hillocks, Natural Resources Institute

RNRKS PROGRAMME: Crop Protection Programme

PROGRAMME MANAGER: Dr. F. Kimmins

SUB-CONTRACTORS: Ministry of Agriculture, Lunyangwa Research Station, Mzuzu, Malawi.
CABI, Nairobi, Kenya

COLLABORATING ORGANISATIONS: Smallholder Coffee Farmers Trust [SCFT]
Tanzania Coffee Research Institute [TaCRI]

COMMODITY BASE: Coffee

BENEFICIARIES: Smallholder coffee farmers

TARGET INSTITUTIONS: Lunyangwa Research Station and Smallholder Coffee Farmers Trust.

GEOGRAPHIC FOCUS: Northern Malawi

START DATE: 01 September 2002
FINISH DATE: 31 March 2005

TOTAL COST: £225,222

Executive Summary

The project contributed to the sustainable improvement of rural livelihoods in northern Malawi by making coffee growing more profitable for smallholders. In the remote hillside farming systems of northern Malawi, coffee is one of the few options for cash cropping, the only other alternative being tobacco. Yields are among the lowest in the world due to poor management but, despite the poor world price for coffee, there is a market for 'Mzuzu' coffee because of its high quality. Having identified the pest constraints in an earlier project, this project promoted control measures within an integrated crop management [ICM] framework. The CPP project was associated with a much larger coffee rehabilitation project funded by the EU which provided smallholders with planting material of improved varieties [Catimors]. The CPP project promoted through on-farm demonstrations, an ICM system based on growing a derivative of Catimor 129 which removed the need for fungicide application as it is resistant to the two main diseases.

An integrated crop and pest management system that met the smallholders' requirements was developed and promoted as one of a basket of crop management options for the new dwarf Catimor varieties. Varieties promoted by the EU project were resistant to coffee leaf rust but not to the other main disease, coffee berry disease. The project advocated the use of a selection [known as Nyika] from Catimor 129 that was resistant to both diseases, but supplies of seed were scarce. We therefore set up a mother garden of Nyika trees that will eventually meet the demand for seed. On-farm demonstrations of Nyika intercropped with banana were used to promote the technology direct to farmers and this was backed by an information campaign on pest and disease control, using leaflets in two local languages.

White stem borer [*Monchamous leuconotus*](WSB) is the major insect pest and a threat to coffee rehabilitation based on Catimor varieties. On-farm trials to evaluate insecticides led to the approval of 'fipronil' for use on coffee. No further studies on WSB were conducted following the start of a CFC project which focuses exclusively on the biology and control of this pest.

Socio-economic research has focused on growers' management practices for Catimor coffee, the economics of chemical control for coffee borer, and the impact of Catimor coffee on livelihoods, particularly for poorer growers.

Management practices showed that early adopters had closely followed recommendations on terracing, mulching, manuring, and the frequency of weeding. But generally growers had not adopted recommended practices about hedgerow planting, planting in pure stand, or the use of lime and J Compound fertiliser. Nitrogen application rates were above recommended levels. This suggests that there is considerable scope to improve the efficiency of fertiliser use and reduce the costs of fertilising coffee.

Farmers' evaluation of chemical control using stem paints was positive, but formal economic evaluation showed that benefits discounted at 15 % over an eight-year coffee cycle were lower than costs. Application rates in on-farm trials are therefore not profitable at current rates, and given current knowledge of borer infestation rates. This analysis is provisional since full information on infestation rates is not yet available, and it may prove feasible to apply stem paint every two years rather than every year, as in on-farm trials. Nevertheless, these results suggest the need to continue efforts to identify control methods that may be less effective but more affordable and economically viable.

An impact survey over the first four years of Catimor adoption showed positive impacts on livelihoods, including accumulation of assets, improved household food security, and greater demand for hired labour at weeding and harvesting. Women in adopter households often planted their own coffee gardens to ensure a protected source of income. Households with more Catimor had lower income from banana, reflecting the SCFT recommendation to plant Catimors in pure stand. This confirms the importance of current trials to develop recommendations for intercropping coffee with banana.

Background

Coffee ranks fourth amongst Malawi's export crops and accounts for around 4% of Malawi's export earnings. The smallholder sector has in recent years contributed only about 5% of national production, but the earnings from coffee sales are a vital part of the livelihood strategy for rural communities in the hillside farming systems of northern Malawi. The bulk of coffee production comes from large estates in the south of the country. The estate sector has some of the highest yields in the world. The smallholder sector averages one of the world's lowest yields, but some of the coffee is of high quality. Since 2002, the smallholder sector has been expanding at a time when, due to the low world price, coffee output from the estate sector has been declining as they diversify into other crops, such as tea and macadamia nut. This expansion has been supported by EU funding to the Smallholder Coffee Farmers Trust, supporting capacity building and multiplication and distribution of new [Catimor] coffee varieties.

CPP support for coffee IPM in Malawi began in 1996 [R6807], just as the smallholder sector entered a period of conflict and change. At this stage the smallholder sector was in turmoil with poor prices being paid to farmers and coffee gardens neglected. Research activities had focused on the estate sector and were conducted by the Coffee Research Unit of the Tea Research Foundation. Coffee research for smallholders was based at Lunyangwa Research Station, near Mzuzu but suffered from chronic under-funding. Direct support to coffee smallholder at that time was provided by the Smallholder Coffee Authority [SCA]. This was a typical para-statal marketing authority with monopoly rights over coffee purchasing and marketing. The SCA provided, inputs, credit and extension advice and also ran the primary processing plants or 'pulperies'. General dissatisfaction about low prices paid for their coffee and lack of farmer representation in the SCA, coincided with the implementation of structural adjustment policies in the late 1990s. This was also the time when world coffee prices began to tumble due to global over-production. Following the recommendations of a consultants review of the SCA, coffee smallholders supported the change from the SCA to a Trust structure with greater farmer ownership and representation. Pulperies would now be owned, managed and run by farmers groups. Under the new agreement farmers are paid a minimum of 60% of the world coffee price. The new SCFT that came into being in 1999 was to be run by a Board of Trustees composed of elected smallholders and a salaried management team. The SCFT was to be funded eventually from export levy but initially the Trust was supported by the EU. The aim of EU financial support was to rehabilitate the smallholder coffee sector through supporting the establishment and capacity building of the SCFT and greatly increasing coffee production by supporting the distribution and planting of millions of seedlings of new 'Catimor' coffee varieties.

The first task of the SCFT was to organize the 4000 coffee smallholders into five Associations which were subdivided into 'Zones' centered on the pulperies and each

Zone was divided into the entry point for farmer representation the 'Business Centre' [Table 1].

Table 1. Membership and coffee production in the 5 Associations of the SCFT [2003]

Organisation	Misuku	Nkhata	Mzimba	Phoka	Viphya	Total
Business Zones	14	8	7	8	6	43
Business Centres	84	12	40	24	16	176
Production	145	5	17	20	35	222
Membership	1956	256	520	488	271	3491

The EU considered that in 2003, only in Misuku was there a possibility in the short-term to develop an economically viable production base. However, if new plantings proceed at the current rate, then all five associations should have a viable production level by 2008 [see Table 2].

Table 2. New Catimor plantings and production estimates

Year	Planting [No of transplanted seedlings]	Production estimate [tonne green bean]
1999/2000	259,000	
2000/2001	218,000	
2001/2002	739,000	
2002/2003	1,153,000	
2003/2004	1,750,000	160
2004/2005	2,500,000	339
2005/2006		733
2006/2007		1729
2007/2008		3379
2008/2009		5720

The first CPP coffee IPM project [R6807, 1997 – 2000] began at a time of conflict between the SCA and coffee farmers. Farmers were disillusioned and many had neglected their holdings. Where farmers were still cultivating the coffee gardens, the banana intercrop was regarded as the main crop. There was little research data. The main output from the project was a socio-economic evaluation of changes in coffee pest management by smallholders and survey reports of the main pest and disease problems in the 5 Associations. From this data an IPM system was devised [at this stage for the old varieties Geisha and Agaro]. A short project was funded [R7942, Jan 2001 – June 2002], to establish a participatory approach to the on-farm validation of this IPM system. By the end of R7942, the EU-funded rehabilitation of smallholder coffee was beginning to have an impact. The SCFT was fully functioning with the majority of coffee farmers being paid-up members of their local Coffee Business Centre, and more than 500,000 Catimor seedlings had already been planted. When the present project began in September 2002, after an interval of 6 months, SCFT were focusing their effort on the Catimor growers. One thousand trees was regarded as the minimum for commercial viability and 500 Catimor trees already planted, was the entry point to qualify for credit. Although most of the new Catimors were yet to come into bearing, the CPP project responded to the demand from

farmers to promote disease resistant Catimors as a component of the IPM system. Ten on-farm demonstration sites were set-up in the main coffee areas, to promote an appropriate ICM system [incorporating IPM] based on growing Catimor 129. By the end of 2004, 3.5 million Catimor seedlings had been planted by smallholders in northern Malawi with an average holding of 1200 trees and the EU smallholder rehabilitation project was meeting its target of commercial viability for the sector by 2008. One of the main indicators of economic viability was that funds derived from the coffee export levy would be sufficient to sustain the SCFT without further intervention from the EU. The role of the CPP project was now to ensure that the IPM/ICM messages we had developed over the years were promoted, through, extension literature, on-farm demonstrations and farmer training.

Project Purpose

The purpose of the project was to improve the income of coffee smallholders through improved crop and pest management. This was done by developing and promoting integrated crop and pest management [ICPM] systems for first, the traditional tall varieties and then for the dwarf Catimor varieties. On-farm demonstration plots were used to validate and to promote the ICPM systems and also as training sites for farmers.

Project Activities

Validation of ICPM for tall varieties [Geisha and Agaro] in randomized block experiments with 3 reps and six treatments in which one of the five crop management practice was withheld and the effect on yield assessed. The best of these sites was used for farmer training

Demonstration of ICPM for Catimor varieties. The project set-up ten on-farm demonstrations to promote the growing of disease resistant Catimor 129 intercropped with banana. The sites were also used to assess the effect of shading by banana on yield where the treatments were number of rows away from the banana row. [Yield results not available until end 2005].

Insecticides for control of WSB were evaluated over several seasons in 16 on-farm trials, each of which was intended to be a replicate.

The promotional activities were supported by a communication strategy based on information leaflets and a coffee manual translated into a local language.

In order to meet the demand for seed of Catimor 129, the project set-up a clonal mother garden which will eventually provide all the seed required.

Socio-economic studies using questionnaires and informal interviews evaluated smallholder coffee management practices and the impact of Catimors on livelihoods.

OUTPUT 1: Best practice/ICM demonstrated and promoted

Activity 1.1: Field trials to validate ICM component technologies. Almost all the farmers interviewed at the end of the previous project wanted to use pesticides. However, in many cases, the basic crop husbandry practices such as pruning were not being done. Crop husbandry practices have a direct influence on disease severity and insect pest damage, so all the correct crop and pest management activities should be carried out before resorting to the use of pesticides. These trials were farmer-managed and all activities in the trials are conducted with their participation.

Achievements

These trials were set up to serve two purposes: 1. To validate the ICM components for the traditional variety Geisha and 2. To demonstrate the ICM practices to participating and visiting farmers. The plot at Salawe [Table 1.1.] worked much better than the other one showing clearly in 2003 the benefit from using fungicide to control CLR [Fig 1.1.] in 2004 rust levels were too low to have much impact on yield but the benefit of the full ICM package was clear compared to the control plots which received no inputs [Table 1.1].

Table 1.1. Green berry yield [kg/plot] rust severity [CLR score 0 – 5] and defoliation score [0 – 5] from ICM trial at site 1

Treatment	2001/2002 Yield	2002/2003 Yield CLR* DEF**			2003/2004 Yield CLR	
All ICM treatments	44.8	36.3	2.3	2.2	61.8	0
No Pruning	65.5	39.6	2.8	2.7	53.5	0.46
No Fertiliser	47.3	25.3	3.0	3.1	32.5	0.25
No Fungicide	50.3	19.2	4.9	4.2	47.2	0.59
No Insecticide	34.7	34.0	1.9	2.3	41.0	0.42
Untreated	51.5	8.8	4.6	4.8	12.2	0.96
LSD [p = 0.05, 10 df]	28.5	27.5	1.3	1.3	18.0	***

* CLR score from period of maximum disease in February 2003 [no rust recorded in 2002]

** Score for degree of defoliation made 18/07/03

** No analysis performed due to mainly zero values

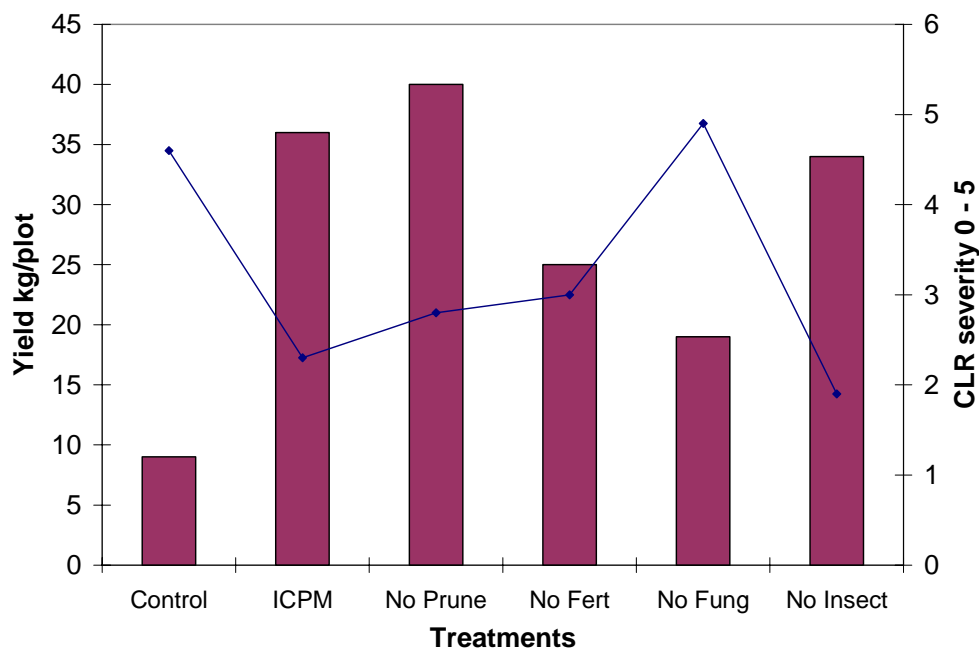


Fig.1.1. Yield [kg/plot] and coffee leaf rust severity [CLR 0 – 5] at Salawe February 2003.

We had difficulty finding sites where there were enough bearing trees for the trial. The second site was much more variable than the first but gave high yields in the first year [Table 1.2.]. The poor yields in the second season were due to heavy CLR infection – it is not clear why yields were particularly poor from the All ICM plots. In 03/04 poor yields were due to hot/dry weather that caused flower abortion. However, in 2004 the benefit of all ICM treatments is clear compared to the control plots.

Table 1. 2. Green berry yield [kg/plot] rust severity [CLR score 0 – 5] and defoliation score [0 – 5] from ICM trial at site 2

Treatment	2001/2002		2002/2003			2003/2004	
	Yield	CLR	Yield	CLR*	DEF**	Yield	CLR
All ICM treatments	109.2	0.0	27.3	0.8	0.7	25.3	0.37
No Pruning	131.5	0.4	65.7	1.1	1.0	17.4	0.63
No Fertiliser	129.8	0.2	83.3	1.1	1.6	19.7	0.75
No Fungicide	100.0	0.9	39.5	3.0	2.0	14.0	0.13
No Insecticide	142.5	0.4	33.8	1.7	1.3	14.2	0.75
Untreated	102.2	1.6	19.3	3.9	3.5	8.8	2.05
LSD	24.5	-	12.3	1.7	1.0	5.4	***

[P = 0.05, 10 df]

* CLR score from period of maximum disease in May 2002 [no ANOVA due to large number of zero scores] and June 2003.

** Score for degree of defoliation made 18/07/03

*** No analysis performed due to many zero values

Conclusions

The site at Salawe was used in 2003 by SCFT for farmer field days to demonstrate the benefits of using fungicide and that good returns can be achieved from well managed trees, even when they are old. The project also conducted its own field days. In 2004 it is unlikely that an economic return would have been obtained from the use of fungicide. Clearly, spraying would have to be based on crop scouting and simple action thresholds. This would require much more training of farmers to carry out. For farmers planting Catimor 129 there will be no need to use fungicide to control CLR or CBD [see blow].

Activity 1.2: Promote Integrated Crop Management through the SCFT [Zonal Centres and BCs] and by establishing a demonstration trial at three sites, showing all aspects of correct crop management. The trials are located close to the Zonal Centres [primary processing plants] whose members will form our target group and will participate in the farmer field schools.

Achievements

The trials described above were also used as demonstrations where all the component technologies of the ICM system were demonstrated: fertiliser application, shade management, pruning, fungicide application and insecticide application. However, by 2003 the first planted Catimor varieties were being harvested and we responded to farmer demand by planting a new series of 10 on-farm demonstrations to promote an ICM system based on Catimor 129 intercropped with banana. Catimor 129 is resistant to both the main diseases coffee leaf rust [CLR] and coffee berry disease [CBD], whereas the catimor 'populations' being distributed by the EU project are resistant to CLR but susceptible to CBD. These trials have been used for training purposes. Research data will be collected in 2005 on the effect of the banana intercrop on yield but the bushes only began bearing in 2004.

Implications of replacing cv. Geisha with Catimors

Catimor coffee cultivars are being distributed to smallholders in Malawi in order to improve the profitability of the crop. Although Catimors are potentially high yielding and are resistant to one of the main coffee diseases [CLR], they require careful management to produce high yield without overbearing. Furthermore, the practice of growing Catimors without shade, while maximising the yield potential, raises concerns about soil conservation and biodiversity. Added to this, there are pest management issues: WSB and CBD may yet threaten the rehabilitation of the smallholder coffee sector.

Catimors may need to be grown differently under smallholder conditions than under estate conditions. The previous generation of coffee cultivars grown by smallholders in Malawi, mainly 'Geisha' and 'Agaro' could be grown under low-input systems with shade trees or inter-cropped with banana. Catimors require comparatively heavy fertiliser application, all the more so when grown without shade. Much has been written about the impact on input use of the removal of subsidies under structural adjustment policies. If the smallholders who have adopted Catimors in Malawi are willing to apply the required quantities of fertiliser, it has to be available when and where it is needed, and, appropriate and accessible credit facilities must be in place.

These are issues currently being addressed by the SCFT with financial assistance from the EU.

The planting system adopted may also be important to the success of the Catimors. They are usually grown without shade to benefit fully from their high yield potential. Spacing recommendations vary, but in one of the most intensive systems, the plants are grown at close spacing within the row so that the canopies of neighbouring plants quickly close to form a 'hedgerow'. To be fully effective, this system needs to be well fertilised and weeded. However, the overlapping canopy may be undesirable in areas where CBD is a problem, as the dense canopy maintains a humid micro-climate suitable for sporulation of *C. kahawae* and the overlapping branches facilitate the spread of the disease. A system where the Catimor bushes are grown at a spacing that avoids canopy overlap and which includes banana to provide a food crop and some shade, might be more sustainable in CBD-prone areas, particularly if fertiliser use is constrained.

The CPP project established 10 on-farm demonstration plots in key coffee production areas, mainly Misuku Hills and the Chakaka Zone in Phoka Hills. These are areas where bananas are traditionally intercropped with coffee and have a role in food security. An additional plot was planted at Nchenachena experimental station. The OFDs were designed to demonstrate an alternative way of growing Catimors to the intensive 'hedge-row' system being promoted by SCFT. It was intended that this should be seen as part of a 'basket of options' contributing to the promotion of Catimors, not as a 'rival' system to that of SCFT. The plots were planted by the project team but managed by the farmer. Tall bananas varieties were planted after every 6 rows of coffee and data was taken on yield from each coffee row to assess the effect of the bananas on coffee yield. The coffee variety planted was the CLR and CBD-resistant 'Nyika'. The seedlings were properly fertilised and mulched at the outset, and protected from WSB by annual treatment with fipronil. The OFDs were used as the focus of farmer training. Each demo farmer was given a log book to record the number of visitors to the plot. The plots proved popular with farmers and one group in Viphya requested a similar OFD in their area.

OUTPUT 2: Methods for stem borer control evaluated.

New (to the smallholder sector in Malawi) chemicals for the management of coffee stem borers will be evaluated. There is a pressing need for a control measure to replace the dieldrin-based stem paint that was previously effective in controlling stem borer but has since been banned. There are a number of new insecticides, together with a number of non-chemical alternatives such as botanical repellents, which need to be evaluated for their efficacy against stem borers.

Activity 2.1: Test at least two candidate chemicals [fipronil (Regent) and imidacloprid (Confidor)] for their efficacy against, and specificity to, coffee white stem borers. Sixteen suitable sites were identified where there were sufficient uninfested bushes for the trial. The insecticides and another treatment with wood ash were applied in September 2001 during an earlier project.

Achievements

Fipronil and imidacloprid were compared with wood ash against untreated trees at 16 on-farm sites covering four of the five smallholder coffee areas in northern Malawi. Twice each year the trees that showed signs of invasion holes of WSB on the lower stem were recorded. Over the course of the project infestation levels increased until 60% of all untreated trees in the trials were attacked [Fig.2.1] (Actual infestation may have been greater than this as some trees were lost to flooding at the end of 2003).

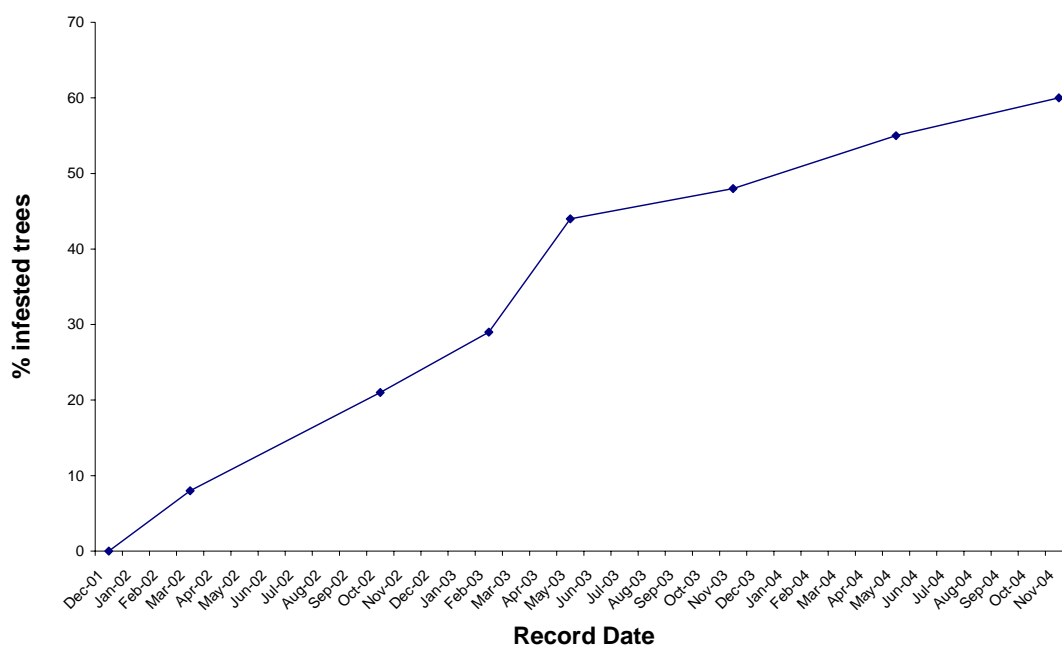


Fig 2.1. Increase in number of trees showing damage by WSB between December 02 and November 04 [total from 16 plots].

It was not considered worthwhile to conduct an analysis on the incidence data as only one or two [N = 80] trees treated with insecticide were attacked by WSB. Table 2.1 shows the mean infestation levels in May 2003 before some of the trees were destroyed by flooding. Infestation is expressed as number of trees attacked, for the four treatments on four farms in each of four coffee zones. Both fipronil and imidacloprid gave complete protection from WSB when applied annually as a stem

paint. Wood ash was not effective. This data was used to obtain clearance for fipronil to be used on coffee. Imidacloprid was considered too expensive.

Table 2.1. Effect of insecticide and wood ash on the number of trees damaged by WSB [May 03].

Treatment	Coffee Zone				Mean
	MISUKU (Number of infested trees per site = 5)	NCHENA	VIPHYA	MZIMBA	
FIPRONIL	0	0	0	0	0.06
	0	0	0	0	
	1	0	0	0	
	0	0	0	-	
Mean	0.25	0	0	0	0.06
IMIDACLO	0	0	0	1	0.17
	0	0	0	1	
	0	0	0	0	
	0	0	0	-	
Mean	0	0	0	0.67	0.17
ASH	2	3	3	1	1.92
	2	2	1	3	
	2	2	1	1	
	3	1	2	-	
Mean	2.25	2.00	1.75	1.67	1.92
CONTROL	1	4	2	3	2.44
	3	1	0	4	
	5	1	1	2	
	5	2	2	-	
Mean	3.50	2.00	1.30	3.00	2.44

Activity 2.2: Collect, identify and evaluate the potential of exotic natural enemies of coffee white stem borers, particularly in countries where the incidence of stem borer is low e.g. Kenya. The potential for biological control was investigated in the previous project, but the larvae of the white stem borer were found to be remarkably free of pathogens in Malawi. Although *M. leuconotus* occurs in Kenya for example, it is only a minor pest, which may be attributed to the presence of natural enemies. The possibility of collecting and identifying these natural enemies from Kenya will be investigated.

Achievements

Little progress has been made with the search for natural enemies of WSB. Those that have been collected and examined by CABI scientists in Nairobi seem to be remarkably free of parasitoids and pathogens. There is no evidence that the lower pest status of *Monochamus* in Kenya is due to more natural enemies. A fungal pathogen identified as *B. bassiana* and a predator (*Alaus* sp.) were found on WSB larvae collected from Misuku Hills in Malawi. Further work may be done on these under the CFC project.

Activity 2.3. Having obtained sufficient data on the efficacy of fipronil as a stem paint, the problem remained that insecticide is very expensive. This activity was modified from the PMF to test some alternative methods for WSB control.

Achievements

Three alternative control measures were evaluated at two sites where each treatment was applied to 15 plants. This was set up as a preliminary study and was not replicated because suitably large areas could not be found that were uninfested but close to an inoculum source, and it was expected there would be large numbers of zero values. The treatments applied to the lower stem of each plant were: 1. white paint, 2. wood ash and 3. banana leaf physical barrier wrapped around the stem. 15 trees at each site remained untreated. The treatments were carried out in October 2002 and the trees examined for signs of WSB attack in November 02, June 03, November 03, May 04 and at the second site in Nov 04, as there was still no attack by May 04. There was very little infestation until the May and November 04 inspections. By May 04 infestation had reached 33% at the Nchenachena site and by Nov 04 it had reached 27% at the on-farm site. Wood ash and white paint were ineffective [Table 2.2]. The banana leaf sheath appeared to offer some protection but it was tedious to apply and attracted termites to the coffee bush. Further work on alternative methods of control is now being conducted by the CFC project on WSB biology and control.

Table 2.2. Effect of non-chemical treatments on WSB invasion

Treatment	Site 1.	Site 2.
	% damaged trees	
White Paint	13	40
Banana Leaf	7	7
Wood Ash	27	53
Untreated	33	27

Implications of Catimors for stem borer control and IPM

Research reported in the FTR for an earlier phase of this project [R7942] showed that Catimors were at least as susceptible as the previous cvs to white stem borer. Catimor 129 from which cv. Nykia was derived was found to be as susceptible as the Catimor populations to WSB, and none of the cultivars tested were significantly less susceptible to this pest than the current cv. Geisha. Widespread adoption of Catimor cultivars will therefore have little effect on the status of WSB as the main insect pest of arabica coffee in Malawi. It remains a priority for the coffee industry in the Region

and for the smallholder sector in northern Malawi in particular, to find affordable control methods for WSB.

If WSB damage is observed in a farmers coffee 'garden' or on nearby coffee trees, it would be advisable to use an insecticidal stem paint to treat the bottom 30 cm of the stem of unaffected trees. Insecticides such as fipronil and imidacloprid are proving effective against WSB in Malawi, but they are expensive, and less well-off smallholders will be reluctant to purchase them unless they can do so as part of a group. Well managed coffee that is properly fertilised and weeded may be less prone to attack by WSB, but is certainly better able to withstand invasion. If neighbouring fields are heavily infested, the trial reported in this paper has shown that little can be done to prevent the spread of WSB into adjacent fields, if insecticidal stem paint is not used. Where one or a few trees are affected in a vicinity, without a high insect pressure, the affected trees should be uprooted and burned before the adult beetle emerges to lay its eggs, which occurs with the first rains in October/November, two years after the initial invasion. Young trees can be killed within a year or so of attack, but older trees may tolerate attack. In larger trees where exit holes made by the beetles are accessible, an insecticide such as fenitrothion can be introduced into the hole in an attempt to kill any developing larvae in their tunnels. Wire spokes have also been used as a mechanical means of destroying the larvae (Hillocks *et al.*, 1999). Bark-smoothing is practiced by some smallholders as a way of discouraging egg laying by the WSB beetle. Smoothing the bark with a maize cob removes some of the crevices that are attractive egg-laying sites.

Previous research conducted by Noah Phiri at Lunyangwa, has shown that the Catimor 'populations' that have been distributed under the EU programme, were all susceptible to CBD. It is likely therefore, that where these populations have been distributed to smallholders, it will be necessary to spray fungicides for CBD control. Should this prove to be the case when the newly planted cultivars reach full bearing, it will diminish the benefit of not having to spray for CLR control. In the longer term, resources will be required to multiply and distribute cultivars with resistance to both CLR and CBD. Cv. Nyika [derived from Catimor 129] would meet that need and seems to out-yield the Catimor populations under conditions at Lunyangwa, but it requires further agronomic evaluation under smallholder conditions. For this reason the CPP project has supported the establishment of a clonal garden at Lunyangwa to provide pure seed of 'Nyika'.

CBD is beginning to appear on the Catimor populations already planted by smallholders at the beginning of the rehabilitation programme. This requires close monitoring and farmers should be made aware that fungicide sprays will be required should the disease appear. Copper fungicides can be used alone or as a tank mix with an organic fungicide, among which, chlorothalonil has proved effective.

OUTPUT 3: Non -chemical control approaches to coffee berry disease and coffee leaf rust validated

A non-chemical approach to disease control will be validated. Results from the previous project indicated that the management practices, especially pruning for an open canopy could reduce levels of CBD and CLR.

Activity 3.1: Survey to assess disease levels under different levels of shade and comparing sites that have been pruned with those that have not.

Achievements

This survey has already been completed and although there was some indication that excessive shading enhances CLR severity, results were not consistent. With agreement from CPP [see new activity below] this activity has been modified and will continue in the ICM trials to test the effect of pruning on disease levels.

Activity 3.2: A new activity was agreed with CPP that a nursery should be established from selections from Catimor 129 that show resistance to both CLR and CBD. At present the SCFT are distributing Catimor populations and it is not known yet, the extent of the variability in these for CBD resistance, but trials at Lunyangwa have indicated a high degree of susceptibility. This activity has been initiated at Lunyangwa. In addition, the reaction of Catimor 129 to CLR and CBD [and WSB] will be evaluated in variety trials set-up some years ago in three of the coffee Zones.

Achievements

At the start of the 2003/2004 season, 47 trees were established by vegetative propagation. Cuttings were taken from trees of cv. 'Nyika' which were selected from disease resistant selections from a population of Catimor 129. The 47 clones are expected therefore to be resistant to both CBD and CLR but there is insufficient time in the project to evaluate seedlings derived from this nursery. As it is now official SCFT policy that at least 25% of the Catimor coffee plantations should consist of Catimor 129, the nursery established by the project will provide a useful source of seed. The nursery should provide material that is superior to Catimor 129 in disease resistance due to the additional selection that has been practiced. This will be of much greater benefit to smallholders than the other 'Catimor populations' that have been issued to smallholders which are CBD-susceptible and must still be protected from the disease with fungicide sprays.

The IPM/ICM messages now being promoted

- Destroy old cv. Geisha trees to prevent spread of white stem borer into the new plantings.
- Maintain healthy cv. Geisha by following ICM recommendations for shade management, fertiliser application and fungicide for CLR control.
- Planting Catimor populations which are resistant to CLR will eliminate the need to spray against this disease, but require protection from WSB and CBD.
- Planting Catimor 129[or cv. Nyika] which is resistant to both CLR and CBD will eliminate the need for fungicide sprays, but require protection from WSB.

- Catimors must be given adequate fertiliser each year to maintain health and vigour but they do not require pruning.
- Apply fipronil as a stem paint for protection against WSB
- Apply copper fungicides or a tank mixture of copper with chlorothalonil for control of CBD.

OUTPUT 4: Cost benefit analysis and constraints to adoption of ICM addressed.

Activity 4.1: Economic evaluation of all crop management and IPM components of the ICM package. This is an ongoing activity and an essential component of the ICM approach. Some preliminary cost benefit analysis is included in the ITR for the 2001/2002 period of the project.

Achievements

Economic evaluation focused on the chemical control of WSB under Catimor. This was conducted in two parts: farmer evaluation and formal economic analysis. Full results may be found in Working Paper A1063/3.

Farmer evaluation of two on-farm demonstration plots concluded that Fipronil was effective in controlling WSB. Farmers also considered chemical control more effective against WSB than their traditional strategy of bark-smoothing. Materials for demonstrations were supplied by SCFT and farmers were unaware of the costs of chemical control. Willingness to pay was explored in discussion with farmer participants. This suggested that none was prepared to pay more than 3 MK/tree for chemical stem paint. This is half the estimated cost of the current experimental treatment. This suggests that the levels of chemical control currently being tested on-farm are likely to be unaffordable for smallholder growers.

An economic evaluation of WSB control using stem paint was conducted based on recommended crop management practices over the 8-year cycle for Catimor coffee. Costs and benefits streams were discounted to reflect the time value of money. The analysis was made separately on a cash-cost basis (including only expenditure on purchased material inputs) and on a full-cost basis (including expenditure on labour, valued at the market rate). The results showed that discounted net benefits were lower with chemical control than without.

At a 15 % discount rate, the Net Present Value (NPV) for chemical control (Fipronil) on a cash-cost basis was 153,002 MK/ha compared to 243,935 MK/ha without stem paint. Thus, the NPV of untreated Catimor coffee was 37 % higher than that of the experimental treatment.

Table 4.1. Net present values (NPVs) for chemical control of WSB. Malawi (2004 prices)

Discount factor	10 %	15 %
Investment in Fipronil (MK/ha)		

Cash-cost basis	221,887	153,002
Full-cost basis	103,855	59,013
No investment in Fipronil (Mk/ha)		
Cash-cost basis	312,785	243,935
Full-cost basis	220,230	175,305

This economic evaluation is provisional since full information on WSB infestation rates is not yet available. Moreover, results are based on a number of technical assumptions that may be modified in future as more information becomes available on Catimor yields under smallholder field conditions and the effectiveness of chemical control at varying application rates. For example, if stem paints delivered effective control of WSB when applied every second year instead of annually as in experimental treatments, this would obviously halve the cost of chemical control. Hence, these results reflect our existing state of knowledge. Nevertheless, they highlight the need to reduce the cost of chemical control by optimising application rates, and to explore cheaper alternatives that are appropriate for poorer growers. For the majority of coffee growers, the factor determining adoption of chemical control is likely to be the relatively high cost of this strategy.

Activity 4.2: Assess constraints to adoption of IPM/ICM techniques developed and indicate means to address these within historical patterns of input use and other control systems. Some of the constraints have been identified by meetings with farmers groups but further work is required and steps taken to address these constraints. This will be one of the main activities of the social scientist and will involve close collaboration between the CPP project, SCFT, the EU projects [coffee and PROSCAP], DANIDA [supporting institution building in the SCFT] and farmers groups. Some of the issues already identified are; slow payment to farmers for coffee delivered to SCFT so that they do not have cash available in time to purchase inputs; late delivery of fertiliser by SCFT; poor availability of inputs for purchase even if cash is available. With all three projects working together, the resources are there to tackle these constraints but only if we all work to the same agenda. The social scientist has a role to play in linking the CPP, and EU projects to identify and meet coffee farmers needs.

Achievements

Constraints to adoption of IPM technology were explored within the wider context of the uptake of high-input Catimor coffee, which is the strategy chosen by the SCFT to secure the future of smallholder coffee in Malawi. Socio-economic research focused on three potential constraints on the effectiveness of this strategy to increase income for smallholder coffee growers. These included crop management practices and labour availability. In addition, we conducted a preliminary exploration of the impact of Catimor coffee on livelihoods.

Catimor management

Projected levels of coffee production and the sustainability of future production based on high-input Catimor coffee depend critically on farmer management practices. In the worst-case scenario, failure to follow correct management practices now might result in future pest and disease outbreaks that could jeopardise Malawi's nascent smallholder coffee industry.

Management practices for Catimor were explored through a survey of 66 early Catimor adopters in Misuku Hills and Viphya North Associations. The survey recorded management practices for Catimor seedlings from transplanting in 2001 or 2002 until the 2003 season. Full results may be found in Working Paper A1063/2. The main findings were that:

- Thirty-five percent of growers reported they were unable to obtain as much fertiliser as they needed. Very few growers used Compound J and Lime, while CAN and 23:21:0 + 4S were widely adopted (Table 4.2). Low use of lime and J Compound may reflect problems of availability rather than inability to pay.
- Growers had closely followed recommendations on terracing, mulching, manuring, and the frequency of weeding but had not followed recommendations about hedgerow planting, planting in pure stand, or the use of lime and J Compound fertiliser.
- Fertiliser application rates were generally above the recommended rate (Table 4.2, below). Application rates for J Compound averaged 103 grams/tree, compared to the recommended rate of 50 grams/tree. Application rates for CAN ranged from 49 grams/tree in year one to 72 grams/tree in year two, compared to recommended rates of 25 grams/tree and 50 grams/tree, respectively. Application rates for 23:21:0 +4S averaged 65 grams/tree in year one and 85 grams/tree in year two, compared to a recommended rate of 25 grams/tree in year one and 50 grams/tree in year two.
- Growers reported their three most common problems with Catimor as WSB, fertiliser, and general pests. CBD was a minor problem. Growers' main information needs were for information on pest management, fertiliser rates, and disease management. In addition, growers requested information about agronomic practices such as spacing, trench planting, irrigation, and general crop management. Few farmers requested information about CBD.

Table 4. 2 Catimor management, by number of bushes planted.

Variable	Tercile 1 (n=22)	Tercile 2 (n=22)	Tercile 3 (n=22)	Total (n=66)	<i>P</i>
Bushes planted	74	191	645	303	0.001
Sloping fields (no.)	18	17	19	54	0.869
Terraced (no.)	12	13	14	39	0.829
Hedgerow planting (no.)	7	10	4	21	0.152
Distance between rows (m)	2.13	2.41	2.23	2.56	0.422
Distance between stations (m)	1.24	0.91	1.00	1.03	0.121
Intercropped (no.)	13	14	13	40	0.939
Growers mulching (no.)	15	15	19	49	0.282
Growers manuring (no.)	17	17	19	53	0.682
Vetiver grown (no.)	1	2	2	5	0.805
Weedings (no/yr.)	2.84	2.59	2.80	2.74	0.658
Fertiliser users (no.): J Compound (Yr 1)	3	10	11	24	0.024

J Compound (Yr 2)	2	7	3	12	0.118
Lime (Yr 1)	1	5	5	11	0.175
CAN (Yr 1)	13	15	13	41	0.773
CAN (Yr 2)	16	13	15	44	0.555
23:21 (Yr 1)	16	11	14	41	0.294
23: 21 (Yr 2)	16	17	10	49	0.082
Fertiliser rates (grams/tree):	163	97	65	103	0.299
J Compound (Yr 1)	38	60	49	49	0.131
CAN (Yr 1)	74	70	71	72	0.966
CAN (Yr 2)	65	66	63	65	0.955
23:21:0 + 4S (Yr 1)	94	79	84	85	0.613
23:21:0 + 4 S (Yr 2)					
Pesticide Users (no.):					
Dursban	2	3	6	11	0.242
Daconil	8	11	14	33	0.195
Copper Oxychloride	11	12	16	39	0.268
Fenitrothion	2	3	1	6	0.577

These results suggest that growers had adopted selected components rather than the complete “technology package”. Non-adoption of hedgerow planting will reduce crop density and expected yields per unit area. It should also reduce the risk of rapid infection from CBD and WSB. Non-adoption of planting in pure stand reflects the importance of the banana intercrop as a source of cash in the farming system. This highlights the relevance of current on-farm trials on coffee-banana intercropping.

Results show scope to improve the efficiency of fertiliser use and reduce the costs of fertilising coffee. Higher nitrogen application rates probably reflect farmers’ enthusiasm for Catimor. This may be self-correcting once yield levels are known and farmers can make better judgements about the most economic fertiliser rates. The low applications of lime and J. Compound illustrate the reliance of the high-input strategy on inputs sourced outside Malawi.

Generally, results show that the first Catimor adopters have successfully managed the transition to management of high-input coffee. Early adopters may form a special category, however. Regular monitoring and evaluation by the SCFT will be needed to ensure that the same pattern is repeated with later adopters.

Labour availability

High-input coffee will also increase labour requirements, particularly for harvesting and weeding. The SCFT expressed fears that future growth in coffee planting and yields will face a labour constraint at peak periods.

Information on labour availability for Catimor was collected through discussion with two groups of growers, the first consisting of small-growers expecting to have 1000 + bearing Catimor trees within 2-3 years, and the second consisting of larger growers who already had 1000 or more bearing Catimor trees. The SCFT regards 1000 Catimor trees as the minimum number required to obtain a reasonable income from coffee. Full results may be found in Working Paper A1063/2. The main findings were that:

- The labour market in Misuku Hills was active, with 26 % of sample households hiring labour for weeding, and 38 % hiring labour for harvesting. Households with more coffee trees were more likely to hire labour for harvesting, but there was no significant difference between the number of trees and use of hired labour for weeding. This suggests that the main labour constraint lay with harvesting.
- Labour markets were flexible, with several options for households that required to hire labour. Communal labour paid in cooked food (nyitira) was widely used by coffee growers in the Misuku Hills and gave households with limited cash resources access to the labour market at peak periods. Similarly, households reported that women hired for harvesting would accept wages in kind rather than cash. Cash-wages for piecework (ganyu) was relatively uncommon, reflecting the shortage of cash income found even among fairly large coffee growers.
- Growers relied solely on local labour and did not employ migrants from outside the area. Statistics show a total of 1,465 registered male coffee growers in Misuku Hills, accounting for 33 % of the total 4,430 farm households in the Association. This suggests that demand for additional labour for Catimor will continue to be met locally in the near future. Further increases in demand will require hired labour through seasonal in-migration, and this is likely to require payment in cash wages.
- Growers reported that a family of five could manage 1,000 bearing coffee trees without the need for hired labour. If so, the demand for hired labour with Catimor may be less than previously projected. However, growers will have based their estimate of labour requirements on lower yields than the 10 kg/tree projected by the SCFT.

In conclusion, there seems no immediate threat of a labour constraint on the uptake of high-input coffee. At present, however, the labour market for coffee operates with traditional mechanisms of wage payment. Communal labour paid with cooked food is a traditional institution for coping with labour shortages in farming systems where households are not fully integrated into the cash economy. This system can operate only so long as labour requirements for coffee can be met using local labour. Employment of migrant labour will require transition to the cash-nexus. This will increase pressure on growers to develop sources of cash income as wages for hired labour. Hence, meeting labour requirements for high-input coffee in the future is likely to require investment in a range of cash crops and non-farm enterprises that will provide growers with additional working capital.

Impact on livelihoods

The socio-economic impact of Catimor adoption was explored through a survey of 95 coffee grower households in Misuku Hills Association, northern Malawi. Because the period of adoption covered only four seasons (2001-2004) the survey captured only the early impact of Catimor coffee. Nevertheless, the results were expected to provide first indications of the likely changes expected in the next 5-10 years. Full details may be found in Working Paper A1063/4.

For the purpose of analysis, growers were divided into “early adopters” (defined as those that had planted 50 Catimor bushes in 2001) and “others”. ‘Early adopters’ (both husbands and wives) averaged 2002 bearing trees of which 1310 (65 %) were Catimor while ‘others’ averaged 1222 bearing trees of which 591 (48 %) were Catimor. Results showed that:

- The difference in household income between Early Adopters (Mk 67,000) and Others (Mk 57,000) was relatively small because the full impact of Catimor had yet to be felt. Net income from coffee in 2004 was similar for both groups (MK 11,000 for Early Adopters and MK 9,000 for Others). Among Early Adopters, income from farming had risen by 10 % since 2001. However, off-farm income among this group was still three times higher than among Others, reflecting higher investment in business.
- Income from banana was lower for Early Adopters, reflecting the SCFT recommendation to plant Catimors in pure stand. This confirms the importance of current OFTs to develop recommendations for intercropping coffee with banana.
- Asset ownership had increased sharply for both groups. Purchases included livestock assets (goats, cattle), housing (brick-built house, tin roofs), and consumer durables (radios). Households in both groups reported similar changes in expenditure patterns, with greater expenditure on meat, fish, sugar, clothes, soap, and paraffin.
- Household food security had risen for both groups. On average, maize-deficits fell from 3.5 months to 2 months for Early Adopters and from 3 to 1.5 months for 'Others'. This reflected higher fertiliser use on maize through fertiliser credit.
- Catimor adoption had increased the use of hired labour for coffee and other crops. Most additional hired labour has been in the form of *nyitira* (group labour paid with a cooked meal) rather than through *ganyu* paid with cash wages. Households also reported reducing the area planted and the time spent working on crops other than coffee. This included crops like sweet potato and cassava.
- Income from banana was lower for Early Adopters, reflecting the SCFT recommendation to plant Catimors in pure stand. This confirms the importance of current OFTs to develop recommendations for intercropping coffee with banana.

These results suggest that Early Adopters were drawn from households with less experience of coffee cultivation than others but with much higher levels of off-farm income from business enterprise. This income has allowed them to finance investment in high-input coffee technology and provided a financial cushion until that investment is repaid. In 2004, only the first fruits of that investment were visible. Consequently, household income among first adopters was not substantially higher than those who had planted later. However, income from coffee had risen and this was directly attributable to Catimor. Consequently, this group can expect to see significant increases in household income within the next 5 years.

Later adopters were characterised by a lower level of off-farm income that makes them less able to bear the cost of high-input technology and its associated risks. This increases their reliance on SCFT credit and the risk of default. Nevertheless, the results suggest that Catimor has had a beneficial impact on this group. The impact on household food security – made possible by SCFT credit – has been immediate, with a decline in maize deficits of 3 months. Income from coffee has also been used to strengthen the asset portfolio of these households, which has reduced their

vulnerability to shocks, and to finance investments in human capital (health, schooling) as well as in basic needs like clothing. So far, income from Catimor among this group has been insufficient to finance livelihood diversification into higher-paying forms of off-farm enterprise. Hence, they remain highly dependent on the success of Catimor for cash income in the future.

Investment in Catimor has come at a price for other sources of farm income. In particular, early adopters have experienced a sharp fall in income from banana as a result of the recommendation to plant in pure stand. Banana is the single-most important cash crop after coffee. This underlines the importance of our OFTs with coffee -banana intercropping. Allowing Catimor to be intercropped with banana is likely to encourage adoption among poorer farmers for whom this is an important source of cash income. Expanded planting of coffee has also resulted in reduced areas planted to low value staples like millet, and to crops like beans and sweet potato that are a source of income for women. This may have disadvantaged women. However, it is likely to have been compensated by crop diversification into coffee. In male-headed households, women have chosen to plant Catimor in order to provide them with an independent source of income.

Finally, the multiplier effects from Catimor are significant. There are positive backward linkages with transport and local manufacturing through the purchase of fertiliser and pesticides. There are also forward linkages through increased investment (house-building) and consumption (retailing). There are also important impacts on the labour market. Catimor has increased the demand for hired labour, particularly in land reparation, weeding and harvesting. This demand has been met locally through group labour, benefiting those who may not have benefited directly from coffee.

We conclude that the livelihood impact of Catimor coffee has been positive and that this will help reduce poverty in northern Malawi, particularly in remote regions like Misuku Hills where few alternative livelihood strategies exist for households to earn cash income.

OUTPUT 5 : Farmers knowledge of pest management improved.

Existing technologies for crop management and pest control are often poorly understood by farmers. Demonstration trials, together with farmer participatory activities will be used for training farmers and extension officers who are members of our target business centres.

Activity 5.1: Training of farmers and extension workers. A number of business centres (BCs) will be chosen as the key entry points for our contact with farmers. The farmers who are members of their local business centre will be our target groups. On-farm trials will be conducted on their farms and training will be given in IPM implementation using the demonstration trials and farmer participatory activities such as holding workshops at the BCs.

Achievements

Training sponsored jointly by the DFID-CPP and CFC projects, was undertaken in September 2003, aimed at extensionists, who were in turn expected to train farmers in their respective stations.

The training (Monday 14th to Friday 19th) was attended by 25 coffee extensionists from different Sections of the 5 Business Associations of Northern Malawi (i.e. Misuku Hills, Phoka Hills, Viphya North, Nkhata Bay and S.E. Mzimba) where the bulk of the smallholder coffee farmers are. The meeting was opened by Mr Kalua (Managing Director, SCFT) who was also accompanied by Dr Lowole (Officer in Charge, LRS) and Mr Kamwera (Mzuzu ADD).

Mr Kalua reiterated the importance of the training, emphasising that the extensionists needed to put to practice what they were going to learn. He acknowledged the role that the DFID-CPP and CFC projects was playing in improving the coffee sector in Malawi. He also informed the meeting that a report of a recent consultancy identified the following areas as requiring urgent attention if the coffee industry in Malawi is to improve. Management of coffee stem borer (CSB), coffee berry disease (CBD) and coffee leaf rust (CLR); improved processing technologies; need for irrigation; improved spraying methodologies; better coffee nursery management.

Topics covered at the meeting [see programme below] included the economic importance and management of CSB, CBD and CLR, use and management of Catimor variety of Coffee in Malawi, the importance of farmer participatory approaches and different forms of disseminating research findings to stakeholders in the coffee industry. Three draft dissemination leaflets were given to the participants. Two field days were organised to 3 farmers' fields as well as to Lunyangwa Research Station. The training sessions were led by different resource persons (see attached programme), facilitated by participants from CABI-ARC and were characterised by active participation by the extensionists.

In addition, two project workshops have been held to present project achievements to various stakeholders and this has also served as a training exercise for SCFT coffee extensionists. Papers were presented on aspects of ICM and IPM.

SMALLHOLDER COFFEE FARMERS TRUST - MZUZU, MALAWI

TIME TABLE FOR COFFEE CROP MANAGEMENT TRAINING – 15TH – 19TH SEPTEMBER 2003

TIME	SUNDAY 14 TH	MONDAY 15 TH	TUESDAY 16 TH	WEDNESDAY 17 TH	THURSDAY 18 TH	FRIDAY 19 TH
8.00-9.00		Opening, House Keeping issues And Introductions	F i e l d V i s i t	Current Research Initiative And Expected Results on WSB GO	F i e l d 	Catimor Agronomy CC
9.01-10.02		Concept of Integrated Crop Management (George Oduor [GO])		Biological Survey And Preliminary Results GO		Future Plans On Screening Processes For CBD Mr Kaunda, NP
10.00-10.30		Break				
10.30-11.30		Conceptualizing of ICM Project, Implementation And Results (C. Chanika [CC])		Social Economic Survey And Preliminary Results (France Gondwe [FG])		Future Multiplication Of Screened Materials And Logistics Mr Kaunda, NP
11.30-1.00	L u n c h					
1.00-2.00	PART	Economic Importance Of Coffee Berry Disease among Smallholders (Noah Phiri [NP])	Management And Control of Leaf Rust NP	Interim Measures For Farmers To Use In Control Of WSB GO	Introduction Catimor in Malawi and their spread CC	Dissemination Material Mr Kaunda
2.00-3.00	ARRIVAL	Management And Control Of Coffee Berry Disease	Conceptualization and	Concept of Farmer Participatory Research	Characteristic of Catimors	Evaluation and Closure

		NP	implementation of CFC Project GO	And Training Martin Kimani [MK])	and their economic benefits CC	Mr B. Kalua
3.00-3.30	B r e a k					
3.30-4.30		Economic Importance Of Coffee Leaf Rust NP	Economic Importance of WSB among Smallholders GO	Experiences In Farmer Participatory Research And Training From Other Countries MK	Catimor Agronomy CC	

Farmer Training

Mini field days were held at Salawe coffee demonstration plot and at Chakaka (Mr. Chombas) Coffee /Banana intercropping plot on 19th November, 2004 and 18th November, 2004 respectively. Farmers were drawn from all Business Centres surrounding Salawe and Chakaka zones.

Salawe demonstration plot

The objective of the min-field day at Salawe was to bring farmers together at the plot so that they appreciate good agricultural practices which were being demonstrated at the plot as follows:-

While at the plot, farmers noted with concerns that in one of the plots for treatment "Non", the crop status was poor crop when everything was done as recommended and they wanted to know the reasons. Some of the reasons were:

- Shade trees were dying which were providing shade to that coffee plot and nutrients from tree leaves.
- Coffee trees overborne the previous year.

Seventeen farmers attended the min-field day.

Farmers perceptions:

- Farmers appreciated the good work done by the researchers because the time the researchers took over the plot, the production was 40kgs (2001) (but went up in 2002), 2003 yield was 1154kg and 960.5kgs. Farmers in 2004 appreciated these improvements.
- Farmers indicated that they have adopted the use of both fungicides and insecticide in their coffee fields.
- Farmers said they have learnt about fertilizer rates from the plot.
- However farmers requested for more information in coffee growing in general.

Chakaka Field day – Catimor x banana

The objective of the min-field day at Chakaka was to bring together farmers so that they appreciate the system of intercropping coffee with bananas. The total number of farmers attending the min-field day was 31. After a short background of the plot by the researchers, the owner of the field and other farmers were given chance to comment on what they have observed.

Owner's comments:

- The farmer said that due to prolonged rains the previous year, some of the coffee bushes were buried by floods.
- He told his fellow farmers that he recorded the coffee yield data
- He appreciated the system of growing coffee and bananas at the same piece of land because bananas act as a food for his family.

- Farmers liked the system of intercropping coffee with bananas because of land shortage in Chakaka.
- Both coffee and bananas were doing very well.
- Farmers requested that demonstrations be in all the 12 business centres.
- The effect of bananas on coffee was not yet observed because both coffee and bananas were in establishment phase.

Activity 5.2: In collaboration with the SCFT the project will contribute to extension literature on aspects of ICM and IPM to complement the training activities.

Achievements

Information leaflets on pest and disease recognition and management were written in /English by project staff and translated into two local languages by the SCFT [see e.g. below].

Malawi

LEAFLET 1. Coffee berry disease

LEAFLET 2. White stem borer

LEAFLET 3. How to grow Catimors

The leaflets were translated into two local languages Tumbuka and in Chisukwa by our Malawian collaborators at the SCFT and then designed at the University of Greenwich and printed in the UK.

Five hundred of each leaflet were printed and distributed to coffee extensionists and Catimor growers in northern Malawi.

The SCFT have published in English a Coffee Handbook for smallholders. All available evidence shows that farmers prefer to have information literature in their local language. Additional funding of £2000 was obtained therefore, from CPP to translate the Handbook into Tumbuka. The translated handbook was released from the printer in February 2005.



To produce high quality
arabica coffee

Smallholder Coffee Farmers Trust

**CHIWAU CHA
MBUMBU ZA
KHOFI
(CBD)**



To produce high quality
arabica coffee

Smallholder Coffee Farmers Trust

**IMBUNGO YA
MULUSEKE
LWA KOFI
(CBD)**



Ichifwanikisho cha kofi mumwo akuwonekera

Tanzania

Two of the leaflets on WSB and CBD were translated into Kiswahili at TacRI and printed in the UK for distribution to coffee smallholders in Tanzania.

The smallholder coffee sector in Tanzania is much larger than in Malawi. Where in Malawi only 5% of the national crop is produced by smallholders, in Tanzania there are some 420,000 coffee growers of which 90% are defined as smallholders. Total production of arabica coffee has however, fallen by around 40% from its peak, due largely to poor marketing structure and low prices. Corruption in many of the smaller co-operative unions, responsible in the past for buying coffee from farmers, resulted in farmers receiving an inadequate proportion of the export price and led to a collapse in confidence in coffee as a reliable source of income. This situation is not very different from that in Malawi before 1999 when smallholder coffee was administered under the Smallholder Coffee Authority. Under restructuring supported by structural adjustment and EU STABEX fund, and active lobbying from stakeholder groups, including the Tanzania Coffee Growers Association, the coffee industry has been liberalised. In addition, The former ARI Lyamungu responsible for national coffee research under the Ministry of Agriculture, was disbanded and in 2001, TaCRI was inaugurated as a private research institute run by a Board of Directors, representing all stakeholder groups.

The failings of ARI Lyamungu to meet the expectations of coffee growers are similar to those in most government funded NARS in Africa, primarily that is, inadequate funding. Nevertheless, over the decades, good work has been done at Lyamungu to produce new coffee varieties and recommendations for crop management. Recent success has been the development of new hybrids containing genes from Hybrid de Timor that have been selected for resistance to both CLR and CBD. However, due to financial constraints the pace of getting these varieties out to farmers in quantity has been very slow and this fueled discontent among producers. This contributed largely to the call for the replacement of the Government research institute by one funded by the industry.

TaCRI have selected 8 clones from among the hybrid material that are suitable for immediate release. CIRAD are assisting with training and development of tissue culture to speed-up the multiplication process. Meanwhile, plants derived from clonal cuttings in the mother garden at Lyamungu are being distributed to secondary clonal gardens for seed production. The EU is supporting the multiplication and distribution programme.

The biological constraints to production of arabica coffee in Tanzania are more or less the same as those in Malawi. The main insect pest is white stem borer, followed by Antestia bug, leaf miner and berry borer. The main diseases are coffee leaf rust [CLR] and coffee berry disease [CBD]. Farmers will continue to have to control CLR and CBD on their present varieties, but this will no longer be required if farmers are optimistic enough about the future of coffee as a source of income to invest in planting the new clones. White stem borer will remain as a major pest that will need to be controlled.

The main activity over the next few years at TaCRI with regard to crop production is to as quickly as possible, multiply and distribute to farmers, the 8 new high-yielding and disease resistant clones. These clones are resistant to both CLR and CBD. The two outstanding constraints to revitalisation of the smallholder sector based on the new varieties, are white stem borer and adoption of improved crop management packages.

In November 2003 a meeting was arranged with TaCRI to discuss the contribution that the project could make to the rehabilitation of smallholder coffee in Tanzania. Some of the outputs from the Malawi project are applicable to the region. The CPP project in Malawi has designed a series of extension leaflets to support the coffee ICPM packages being promoted in the country. The leaflets on biology and control of CBD and white stem borer were considered by TaCRI management as appropriate to the needs of smallholders in Tanzania. It was agreed that TaCRI would modify the leaflet drafts for Tanzanian conditions and translate the text into Kiswahili. The Kiswahili versions of the leaflet on CBD and WSB were then printed in the UK and delivered to TaCRI for distribution to extension offices and some farmers. With such a large number of coffee growers in Tanzania, many thousands of leaflets would be needed to reach them all. The template for the leaflets was given to TaCRI to enable them to print more copies if required.

In the longer term, if the present CPP project were to be extended, it was agreed that NRI should undertake a socio-economic base-line study to assess how the project outputs from Malawi could be adopted to meet the needs of Tanzanian growers. This was incorporated into the extension proposal for the period April 2005 – January 2006.

Publications

Visit Reports

ODUOR, G. (2002) Report of a visit to Malawi to initiate new phase of the coffee IPM project and supervise white stem borer trials, October 2002. Project R8204, Natural Resources Institute, Chatham, UK, 2pp.

ORR, A. (2004) Report of a visit to Malawi to participate in a planning workshop and visit field trials, 08 – 17 February 2003. Project R8204, Natural Resources Institute, Chatham, UK, 5 pp.

ODUOR, G. (2003) Report of a visit to Malawi to assess progress with coffee IPM activities, 22 June - 01 July 2003. Project R8204, CABI Biosciences, Africa Centre, Nairobi Kenya, 2pp.

ORR, A. (2003) Report of a visit to Malawi to pre-test questionnaire for survey of input use by coffee smallholders, 05 - 13 July 2003. Project R8204, Natural Resources Institute, Chatham, Kent, 12 pp.

ORR, A. (2003) Report of a visit to Malawi to conduct survey on smallholder coffee management and assess poverty impact of coffee expansion, 27 September-12 October 2003. Project R8204, Natural Resources Institute, Chatham, Kent, 10 pp.

HILLOCKS, R. J. (2004) Report of a visit to Malawi to plan activities for the new project on IPM of smallholder coffee, 08 - 14 February 2003. Project R8204, Natural Resources Institute, Chatham, Kent, 12 pp.

HILLOCKS, R. J. (2003) Report of a visit to Malawi to review demonstration trials and dissemination activities, 05 - 13 July 2003. Project R8204, Natural Resources Institute, Chatham, UK, 5 pp.

PHIRI, N. (2003) Report of a visit to the Malawi coffee IPM project 13 - 23 July 2003. Project R8204, CABI Biosciences, Africa Centre, Nairobi, Kenya, 2 pp.

ODUOR, G. (2003) Report of a visit to Malawi, 14th – 21st September 2003. Project R8204, CABI Biosciences, Africa Centre, Nairobi, Kenya ,3 pp.

ODUOR, G and PHIRI, N. P. (2004) Report of a visit to Malawi to attend project workshop and visit field trials, 23 May – 01 June 2004. Project R8204, CABI Biosciences, Africa Centre, Nairobi, Kenya, 2 pp.

ORR, A. (2004) Report of a visit to Malawi coffee IPM project by the Agricultural Economist, 22 May – 04 June. Project R8204 [A1063] Natural Resources Institute, Chatham, UK, 10 pp.

HILLOCKS, R. J. (2004) Report of a visit to Malawi for a project workshop and visits to on-farm trials, 22 May - 02 June 2004. Project R8204, Natural Resources Institute, Chatham, Kent, 4pp.

ORR, A. (2004) Report of a visit to Malawi to initiate a survey of the socio-economic impact of the introduction of new coffee varieties, 01 – 08 October 2004. Project R8204, Natural Resources Institute, Chatham, Kent, 13pp.

Working papers

HILLOCKS, R. J., PHIRI, N. and CHANIKA C. S. M. (2003) Crop protection implications for coffee smallholders in Malawi of the introduction of Catimor cultivars. Working Paper No. A1063/1, Natural Resources Institute, Chatham, Kent, UK. 11 pp.

ORR, A. (2004) Catimor Management Survey, Misuku Hills and Viphya North. Working Paper No. A1063/2, Natural Resources Institute, Chatham, Kent, UK. 31 pp.

ORR, A (2005). Farmer and Economic Evaluation of Chemical Control for Coffee Borer, Malawi. Working Paper No A1063/3. Natural Resources Institute, Chatham, Kent, UK. 14 pp.

GONDWE, F., ORR, A. W (2005). Catimor Impact Survey, Misuku Hills, 2004. Working Paper No A1063/4. Natural Resources Institute, Chatham, Kent, UK. 39 pp.

Workshop Proceedings

HILLOCKS, R. J. (Ed.) (2004) Promotion of IPM for Smallholder Coffee in Malawi. Proceedings of a Project Workshop, 25 May 2004. Natural Resources Institute, Chatham, UK, 31 pp.

Information Leaflets

NATURAL RESOURCES INSTITUTE/CABI/SMALLHOLDER COFFEE FARMERS TRUST (2004) White stem borer. Natural Resources Institute, Chatham, UK. [Chisukwa and Tumbuka].

NATURAL RESOURCES INSTITUTE/CABI/SMALLHOLDER COFFEE FARMERS TRUST (2004) Coffee Berry disease. Natural Resources Institute, Chatham, UK. [Chisukwa and Tumbuka].

NATURAL RESOURCES INSTITUTE/CABI/SMALLHOLDER COFFEE FARMERS TRUST (2004) How to grow Catimors. Natural Resources Institute, Chatham, UK. [Chisukwa and Tumbuka].

NATURAL RESOURCES INSTITUTE/CABI/TANZANIA COFFEE RESEARCH INSTITUTE (2004) White stem borer. Natural Resources Institute, Chatham, UK. [Kiswahili].

NATURAL RESOURCES INSTITUTE/CABI/TANZANIA COFFEE RESEARCH INSTITUTE (2004) How to grow Catimors. Natural Resources Institute, Chatham, UK. [Kiswahili].

Contribution of outputs to developmental impact

Project Goal - Benefits for poor people generated by application of new knowledge on crop protection to smallholder coffee.

The project has contributed to the above goal by adapting the knowledge gained in this and earlier phases of the project on coffee pests and diseases, to the present needs of coffee smallholders in northern Malawi. The knowledge gained was used to develop integrated crop and pest management systems, offered as a basket of options appropriate to smallholder conditions and adapted to both the traditional cv. 'Geisha' and to the new dwarf 'Catimor' cvs.

The project has been operating at a time of great change in the economic conditions for coffee production throughout the world and at a time of transition in Malawi. The world coffee price has slumped since the end of the 1990s and access to markets depends on being able to produce a high quality product. During the course of the project the organisation of the coffee smallholder sector in Malawi has moved away from a 'top down' and inefficient 'authority' to a more representational and less top heavy 'trust'. The traditional tall varieties, usually grown under shade, are being replaced with dwarf varieties that give high yields when grown without shade. A large-scale scheme to distribute millions of seeds and seedlings of the new Catimor varieties is being used as the vehicle to change the smallholder sector from 'near subsistence', to one that is much more commercially orientated.

From an IPM perspective these changes have meant continually changing set of production constraints. Those farmers who wish to benefit from the Catimor 'revolution' have planted large numbers of new bushes. One thousand trees is considered by SCFT to be the threshold for commercial viability and the level at which a farmer qualifies for credit to enable further expansion. The disadvantage of this system is that it becomes difficult for the poorer growers with neglected traditional varieties to find the capital to plant enough Catimors to reach the credit threshold.

The main emphasis from the beginning of the present project in 2002 has been to promote sustainable growing systems [ICM] for the Catimors in general, but more specifically for Catimor 129 [or cv. Nyika]. The project is promoting a coffee/banana system based on observed farmer practice. The use of Nyika, which is resistant to CBD and CLR eliminates the requirement for fungicide. This represents a large saving in labour and capital. However, for those farmers who have planted Catimor populations, the susceptibility to CBD means that they will have to continue to use copper fungicides.

Adequate application of fertiliser is also essential to prevent Catimors from over-bearing, especially when grown in full sun. Our socio-economic surveys have shown

that the Catimor farmers are willing and able to apply the required amounts but there is some doubt about sustainable supply chains as the demand for fertiliser increases.

Supported by the EU coffee rehabilitation project, smallholder coffee production is increasing in Malawi at a time when the estate sector is diversifying away from coffee. By promoting disease resistant selections from Catimor 129, intercropped with banana and protected from white stem borer, the project has provided farmers with an appropriate technology that delivers high economic returns without the need for fungicide application.

The ICPM systems developed by the project that have been promoted and will continue to be promoted through the SCFT are:

[i] For traditional varieties Geisha/Agaro

Shade management to prevent over-shading
Use of fertiliser and fungicide as a package with the action threshold for fungicide application at 5% of leaves affected.
In areas where coffee is prone to CBD, both CLR and CBD need to be controlled.

[ii] For Catimors in general

Intensive hedgerow system is being promoted by SCFT. We would recommend that this be used in areas less prone to CBD unless the farmer is committed to a full fungicide spray programme.

The less intensive system offered as an alternative is to grow Catimors with bananas. Tall banana varieties are grown after every 6th row of coffee.

For both systems it is essential that the full fertiliser programme is followed at planting and for subsequent crop maintenance.

[iii] For Catimor 'populations'

Stem paint with fipronil once the bushes are established in the field. Insecticide applied in late September, before main flight period for egg laying beetles.
Fungicide spray to fruiting branches against CBD

[iv] For Catimor 129 or cv. 'Nyka'

Stem paint with fipronil once bushes are established in the field

ADOPTION AND EXIT STRATEGY

Because of the importance of coffee as a source of income for rural households in northern Malawi both the EU and CFC are currently supporting projects there. The EU supported the transition from the old Smallholder Coffee authority to the SCFT. The SCFT has a much more sustainable structure building right from the community level with the so-called Business Centres, run by farmers themselves. The pulperies that used to be under the control of SCA are now managed by farmers and funded by a levy on beans brought for processing. Farmers representatives sit on the Board of the SCFT. Coffee farmers are also guaranteed a minimum of 60% of the world coffee price. Once the organisation was in place, the EU supported multiplication and distribution of seed and seedlings of the Catimor populations. This has considerably

revitalised the smallholder sector with output increasing each year, at a time when the larger estate sector in the south of the country has largely abandoned coffee. Current projections in coffee production in the north suggest that production will increase to the point where the SCFT will be self-sustaining from the export levy, by the time the EU project ends in 2007. The CFC project on white stem borer will also end around the same time. Both these projects will therefore continue for a year or so after the end of the CPP project. The CFC project has already become the uptake pathway for the work on WSB that was initiated by the CPP project. The sustainable organisation structure and new varieties introduced by the EU project will ensure that the smallholder coffee sector in Malawi is thriving in 2007. The main uptake pathway for CPP project outputs is the SCFT with which we have been working since the project began. The SCFT extensionists have been an integral part of the project, involved in all on-farm activities. There are too many Business Centres for us to interact at that level, but the CPP project has worked with farmers associations at the Zonal Level. Finally, the project has provided training directly to farmers using the OFDs as contact points.

Project logframe

Narrative Summary	Indicators of Achievement	Means of Verification	Risks and Assumptions
Goal			
<p><i>The goal is given by DFID:</i></p> <p>Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems..</p>	<p><i>These are under discussion with DFID. Leave blank.</i></p>	<p><i>These are under discussion with DFID. Leave blank.</i></p>	
Purpose			
<p>Benefits for poor people generated by application of new knowledge on crop protection to smallholder coffee.</p>	<p>Adoption of ICM/IPM technologies increases by 20%</p>	<p>Monitoring against baseline data.</p>	<p>World and National economic do not act as a disincentive for coffee production.</p>
Outputs			
<ol style="list-style-type: none"> 1. Best practice/ICM demonstrated and promoted. 2. Methods for stem borer control evaluated 3. Non-chemical approach to disease control promoted. 4. Cost benefit analysis and constraints to adoption of ICM addressed 5. Farmer knowledge of ICM/IPM improved 	<ol style="list-style-type: none"> 1.1 ICM trials being used to demonstrate best practice to farmers in 3 'coffee zones' by mid 2002. 1.2 ICM and IPM promoted with all stakeholders in smallholder coffee in Malawi by 2004. 2.1 First evaluation of stem paint insecticides at 16 on-farm sites completed by mid 2002. 2.2 Field trials on stem paint insecticides completed by mid 2004. 3.1 Effects of good crop management on 	<ol style="list-style-type: none"> 1. Research Programme report and ICM training manual [unpublished] 2. Research Programme reports and scientific paper[if insecticides are effective]. 3. Research Programme reports and scientific paper. 	<p>Falling world price acts as disincentive to invest in coffee. Important that farmers believe that SCFT works in their best interest and that they obtain a fair price.</p> <p>Lack of food security so farmers neglect cash crops in favour of food crops.</p> <p>Poor access by farmers to inputs and to credit for input purchase.</p> <p>Political and social stability</p>

	<p>disease severity assessed by mid 2003.</p> <p>3.2 Role of disease resistant Catimors cvs in management of CBD and CLR assessed by mid 2004.</p> <p>4. Cost benefit evaluated of all ICM and IPM practices recommended by the project mid 2004.</p> <p>5.1 Key entry points for farmer training fully functioning by mid 2002.</p> <p>5.2 Training materials on ICM and aspects of pest management completed by final season of project [Oct 2003].</p>	<p>4. Report to SCFT on ICM including cost benefit.</p> <p>5. Extension literature</p>	
Activities			

<p>1.1 Management of ICM trials and their use for farmer training.</p> <p>1.2 Continue to develop uptake pathways for knowledge of ICM by farmers.</p> <p>2.1 Test insecticides and wood ash for control of stem borer.</p> <p>2.2 Collect, identify and evaluate natural enemies of white stem borer in Kenya.</p> <p>2.3 Conduct two further field trials for WSB control and evaluate resistance of Catimor cvs.</p> <p>3.1 Compare effect of pruning with fungicide application for disease control in the ICM trials.</p> <p>3.2 Assess contribution of Catimor cultivars to disease control in field trials and carry out vegetative propagation from Catimor selections that are resistant to both CBD and CLR.</p> <p>4. 1 Economic evaluation of all crop management and IPM components of the ICM package.</p> <p>4.2 Use information from farmers and other stakeholders to determine constraints to adoption of ICM and promote initiatives to remove major constraints.</p> <p>5.1 Conduct training</p>	<p>1.1 Farmers being trained at ICM demonstration sites by April 2002.</p> <p>1.2 ICM being promoted by SCFT by Sept 2003.</p> <p>2.1 Insecticides applied by end of September in each year of the project at 16 sites.</p> <p>2.2 Survey for natural enemies conducted by April 2002.</p> <p>2.3 Two additional field trials set-up by September 2002.</p> <p>3.1 Data on disease incidence in ICM trails in relation to pruning or fungicide use available by May 2003.</p> <p>3.2 Sites for Catimor evaluation identified by April 2002 and data on disease and pest levels completed by mid 2004.</p> <p>4.1 Cost-benefit data available from beginning of ICM trials and regularly updated in relation to coffee prices.</p> <p>4.2 Constraints listed by April 2002 and strategy for removing major constraints in place by Sept 2003.</p> <p>5.1 Zonal centres and demonstration trails being used for farmer</p>	<p>1.1 Project reports.</p> <p>1.2 SCFT reports and training literature.</p> <p>2.1 Trials in place and results summarised in project reports. Recommendation to SCFT.</p> <p>2.2 Report on natural enemies available from CABI.</p> <p>2.3 Trials in place and results summarised in project reports.</p> <p>3.1 Trials in place and results summarised in project reports.</p> <p>3.2 Trials in place.</p> <p>4.1 Project reports</p> <p>4.2 Project reports</p> <p>5.1 Numbers of farmers attending training sessions.</p> <p>5.2 Extension materials (e.g. leaflet, poster, calendar)</p>	<p>Weather conditions are conducive to disease development.</p> <p>That sufficiently large fields can be found for new trials.</p> <p>Transport continues in good working order.</p> <p>SCFT is able to off-set cost of insecticides for stem borer control by re-packaging in smaller volumes.</p> <p>EU continues to support rehabilitation of the coffee smallholder sector.</p>
--	--	---	---

Biometricians Signature

The projects named biometrician must sign off the Final Technical Report before it is submitted to CPP. This can either be done by the projects named biometrician signing in the space provided below, or by a letter or email from the named biometrician accompanying the Final Technical Report submitted to CPP. (Please note that NR International reserves the right to retain the final quarter's payment pending NR International's receipt and approval of the Final Technical Report, duly signed by the project's biometrician)

I confirm that the biometric issues have been adequately addressed in the Final Technical Report:

Signature:

Name (typed):

Position:

Date: