CROP PROTECTION PROGRAMME

IPM for smallholder coffee farmers in Malawi
R7942 [ZA0457]

FINAL TECHNICAL REPORT

[1 January 2001 - 30 June 2002]

Dr Rory Hillocks, Natural Resources Institute

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1. Project summary

TITLE OF PROJECT:	IPM for smallholder coffee farmers in Malawi
R NUMBER:	R7942
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
COMMODITY BASE:	Coffee
BENEFICIARIES:	Smallholder coffee farmers
TARGET INSTITUTIONS:	Lunyangwa Research Station and Smallholder Coffee Farmers Trust.
GEOGRAPHIC FOCUS:	Northern Malawi
START DATE: **FINISH DATE:**	1 January 2001 30 June 2002 [funded only until 31 March 2002]
TOTAL COST:	£97,066

Executive summary

The objective of Project R7942 was to develop a management strategy for the priority pests and diseases of coffee in Malawi identified in an earlier project [R6807]. Funds were granted for a 15 month period in the first instance, to develop a participatory framework for the development and promotion of an integrated crop management [ICM] approach to pest control and yield enhancement. In collaboration with Lunyangwa Research Station and the Smallholder Coffee Farmers Trust (SCFT), participatory on-farm trials were set-up in four out of the five areas [Extension Planning Areas (EPAs) where coffee is grown by smallholders in northern Malawi. These activities were closely linked to those conducted with funding from EU STABBEX [Export Stabilisation Fund] who are supporting the SCFT. Two main sets of trials were established. The first were aimed at evaluation and promotion of ICM. The second set was designed to evaluate two chemicals not previously used on coffee for control of white stem borer [WSB].

ICM trials were established in three EPAs. The sites for two of these were on extension demonstration plots that were now owned by a consortium of farmers. The third was on a single farmer's field. The farmers involved were all members of their local 'Business Centres' which provided uptake pathways for training and technology dissemination on aspects of ICM. Fungicide application decreased CLR severity but had no effect on CBD. Insect pest damage was not decreased by insecticide application sufficiently to justify their impact on beneficial insect populations.

Four trials for stem borer control were set up on 16 farms [4 in each of the EPAs] with each farm representing one replicate. Early indications were that the insecticide fipronil and wood ash provide some control.

Baseline data on pest and disease incidence was collected at each of the trial sites and some of the ICM treatments such as pruning and insecticide application were carried out in preparation for the start of the 2001/2002 cropping season. As far as possible ICM activities were conducted with the participation of the farmers who have received or will receive training in shade management, pruning, fertiliser use and pesticide application.

The case for further funding is presented in order to complete the evaluation and promote the ICM approach and the efficacy of fipronil and imidacloprid for stem borer control.

Background

This project is in effect a follow-on from Project R6807. The previous project ended on 31 March 2000 and the present project did not begin until January 2001 which was already a third of the way through the 2000/2001 growing season. The previous project provided data on the incidence and distribution of the diseases, insect pests and potential natural enemies of coffee in northern Malawi. A stakeholder workshop at the end of the project identified the pests of main concern to farmers and called for further funding to develop the outputs from the first project into a management system that was sufficiently flexible to be adopted by farmers with low and medium-input farming systems.

Funding was agreed for a period limited to 15 months with a provision for the FTR to be delayed until June 2002 [without additional funding] to allow for the completion of the disease scores in the 2001/2002 crop. The possibility of further funding was to be the subject of a review based on the initial achievements and the development of effective dissemination pathways. This interim report is submitted in support of the request from the Ministry of Agriculture and Smallholder Coffee Farmers Trust, that funding be continued for a further three years. This will allow for full promotion of the integrated crop management system developed with our target farmer groups.

Project Purpose

To develop and promote strategies to reduce the impact of pests and stabilise productivity of coffee to improve the livelihood security of poor people in Africa.

Research Activities

Research activities were based around participatory on-farm trials conducted in northern Malawi. There were two main sets of trials. The first were designed to both evaluate and demonstrate integrated crop management [ICM] and are being used to train farmers in crop management techniques. The second set of trials were designed to test two insecticides applied as stem paints to replace dieldrin which was withdrawn from use some years ago for the control of white stem borer.

Outputs

OUTPUT 1: Market access improved.

[Activity 1.1: Assist SCFT in gaining an awareness of fair trade marketing channels and enable initial contacts to be made by them . This is a key area for developing a sustainable future for the industry. It also has a relatively high chance of success (particularly if production continues to increase) because of the manner in which the industry is managed, which would meet the requirements of fair trade partners in the West.**]**

Duncan Overfield, the social scientist on the project worked with the SCFT to raise their awareness of 'fair trade issues and criteria. In addition a number of coffee samples obtained from the SCFT were sent to marketing organisations in the UK to be tested for quality.

The report from Twin Trading Ltd in London indicated that Mzuzu coffee could have a place in the Fair-trade market provided there was sufficient volume [minimum 17,250 tonnes]. However, Malawi coffee was not known in fair trade markets and would therefore be more difficult to market than coffee from Tanzania or Kenya. Twin Trading sent copies of their document 'Gaining Access to FT' to indicate the labelling standards required and eligibility to sell in the Fair-trade marketplace under the terms of the Fair Trade Labelling Organisation.

One of the main obstacles to marketing Mzuzu coffee as a 'single origin' coffee is the low output. Less than 100 tonnes were delivered to the SCFT in 2000 and this would

not all be of good enough quality for single origin sales in Fair trade markets. Nevertheless, 400 tonnes were produced by smallholders in 1987 and the SCFT are confident that they can exceed that amount by 2005 and reach their target of 1000 tonnes in 2017.

[Activity 1.2: Facilitate the development of an effective point of sale quality control system. The development of this is again crucial for long-term sustainability of the industry so that it meets the strict requirements of international coffee buyers. This will involve capacity building with SCFT, coffee business zones and coffee business areas, and possibly with private buyers, by looking at systems applied to other smallholder industries around the world (and potentially applying these in Malawi**]**.

The departure of Duncan Overfield from the project means that this output cannot be addressed. Capacity building within the SCFT was to be addressed with funding from DANIDA. However, DANIDA have not met this commitment having reduced the scale of their activities in Malawi. The EU are continuing their support for the SCFT for a further three-five years from 2002 and may be able to address some of these marketing issues.

OUTPUT 2: ICM system for pest and disease management in coffee promoted and demonstrated.

[Activity 2.1: Promote Integrated Crop Management through the Business Centres and by establishing a demonstration trial at three sites, showing all aspects of correct crop management. The trials will be located close to the business centres whose members will form our target group and will participate in the farmer field schools. The trials will be managed by extension personnel with the SCFT with close involvement by farmers**]**.

Achievements:

ICM demonstration trials were set-up in three of the 5 areas where smallholder coffee is grown in northern Malawi. The choice of site was limited by the requirement for reasonably uniform coffee and sufficient numbers of trees. Two types of site were chosen. One type was a field owned by an individual farmers. The second type was a field co-operatively farmed by the members of a business centre. This provided access to a group of coffee farmers to form the 'farmer research group'.

These sites provided the entry points for farmer training in management practices such as pruning and pesticide application. All activities were conducted by the farmers themselves or by farmers together with the research team.

Baseline data was collected on initial levels of rust and trees affected by WSB were also noted. At the Misuku site most of the trees were severely affected by CLR with a mean severity score of 4.6 [0-5 scale], at Phoka Hills CLR severity was only 1.5 and 2.7 at the Viphya site.

Table 1. Baseline data from the ICM trial sites

Site	CLR incidence [% trees]	CLR severity [score 0 - 5]	No. of trees with Stem borer N = 162
Misuku	100	4.6	15
Viphya	100	2.7	144
Phoka	100	1.5	133

The ICM treatments had little effect on disease severity. CBD was unaffected but CLR was significantly more sever in plots from which fertiliser was withheld (Table 2). Leaf miner damage and the number of beneficials per tree were greatest where no insecticide was applied (Table 3). Ants, parasitic wasps and spiders were most abundant in the control plots (See Figs 3a,b,d). At these levels of pest damage it seems unlikely that routine spraying with insecticide would give an economic return while causing non-target effects on the beneficial insects. Fungicide use may be justified for leaf rust control but the relationship between disease severity and yield loss is a complex one. Due to the project starting only in January, delayed spraying may have been the reason for the lack of significant effect of fungicide application on CBD.[Yield data for the ICM trials will not be available until September].

Table 2. Disease severity scores in ICM trial [averaged over 3 sites]

Treatment	CBD	CLR
All ICM components	0.4	0.1
Without pruning	0.8	0.1
Without fertiliser	0.6	0.1
Without fungicide	0.5	0.3
Without insecticide	0.4	0.1
No ICM components [control]	0.4	0.4
LSD	0.53	0.18

Table 3 . Leaf miner score and number of beneficial insects in ICM trial.

Treatment	Leaf miner	Ants	Spiders
All ICM components	0.3	1.0	0.4
Without pruning	0.4	2.0	0.7
Without fertiliser	0.3	1.0	0.2
Without fungicide	0.3	2.2	0.4
Without insecticide	0.5	1.0	0.5
No ICM components [control]	0.5	5.5	1.2
LSD	0.14	4.38	0.41

Fig. 1. Effect of ICM treatments on disease severity a) CBD.

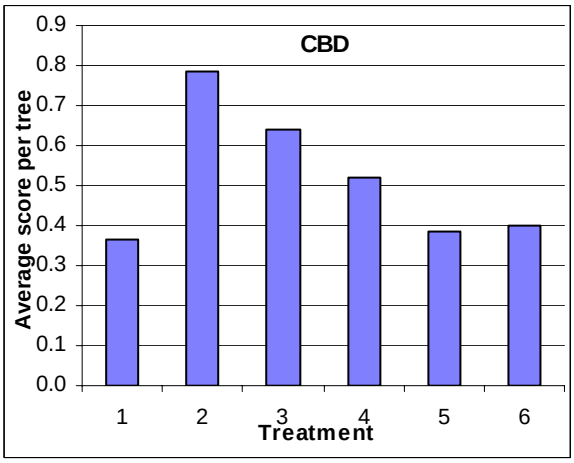


Fig. 1. Effect of ICM treatments on disease severity b) CLR.

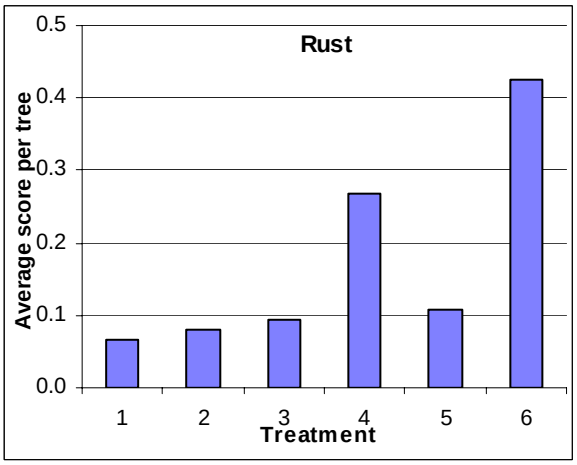


Fig 2. Effect of ICM treatments on insect Pests a) Antestia bug.

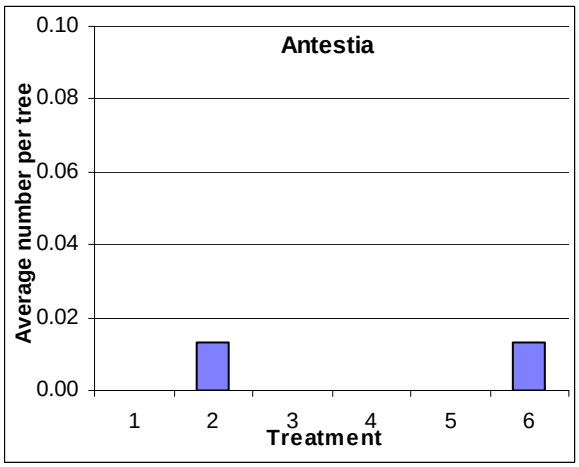


Fig. 2. Effect of ICM treatments on insect pests
b) Leaf miner

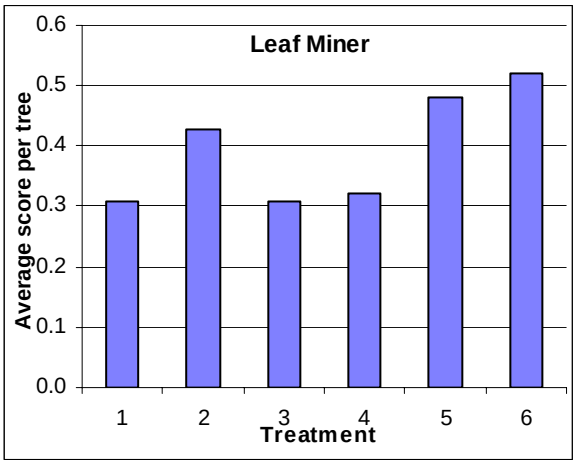


Fig. 2. Effect of ICM treatments on insect pests
c) Leaf skeletoniser

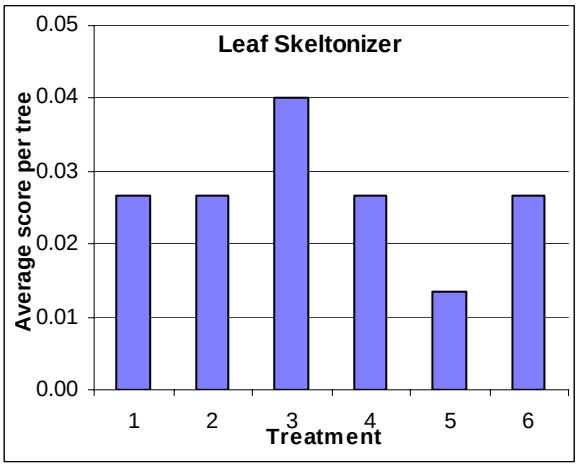


Fig. 2. Effect of ICM treatments on insect pests
d) Yellow-headed borer

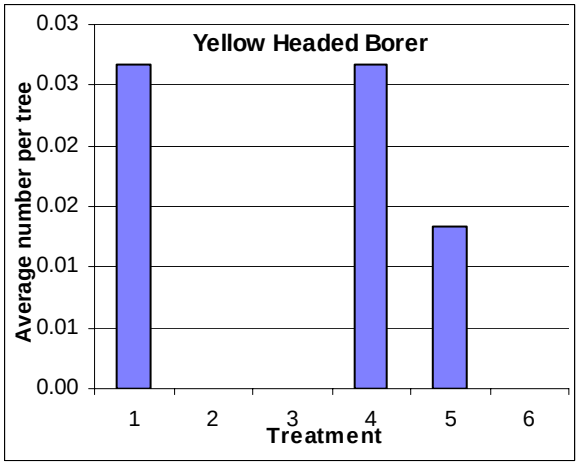


Fig. 2. Effect of ICM treatments on insect pests
e) Green scale

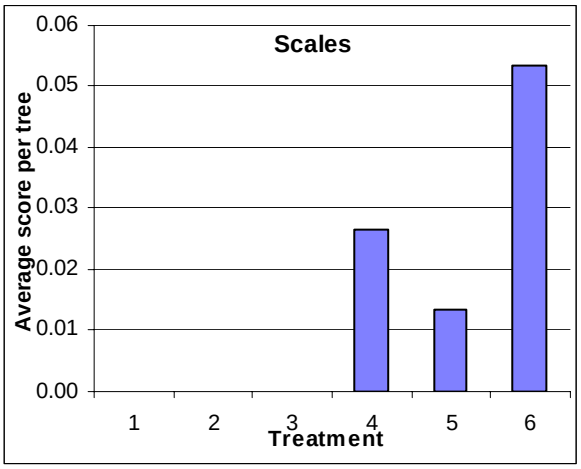


Fig. 3. Effect of ICM treatments on beneficials
a) ants

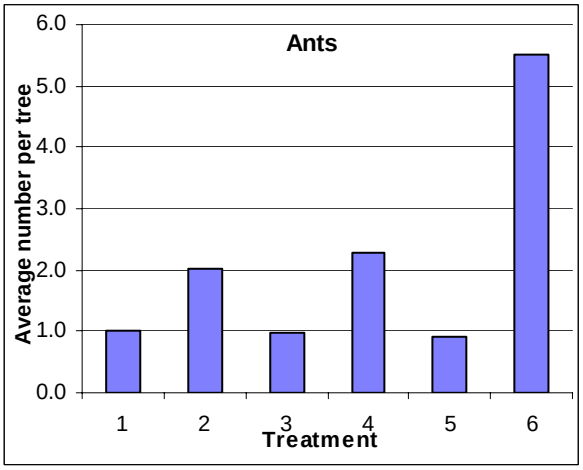


Fig. 3. Effect of ICM treatments on beneficials
b) parasitic wasps

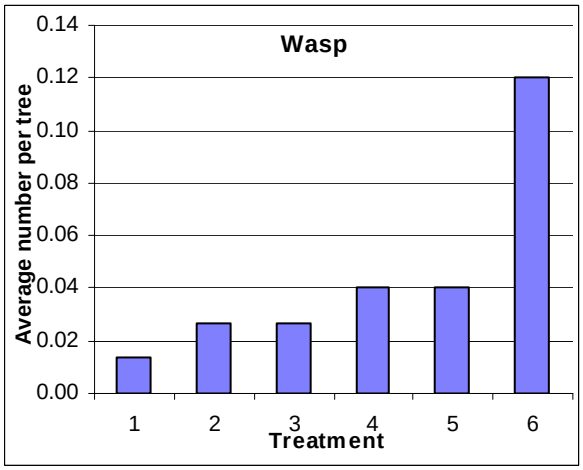


Fig. 3. Effect of ICM treatments on beneficials
c) praying mantis.

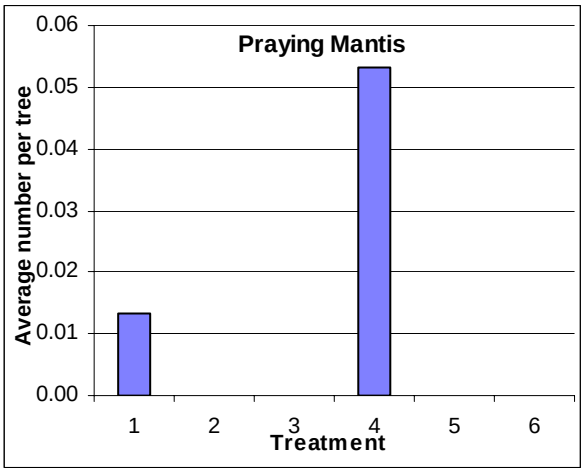
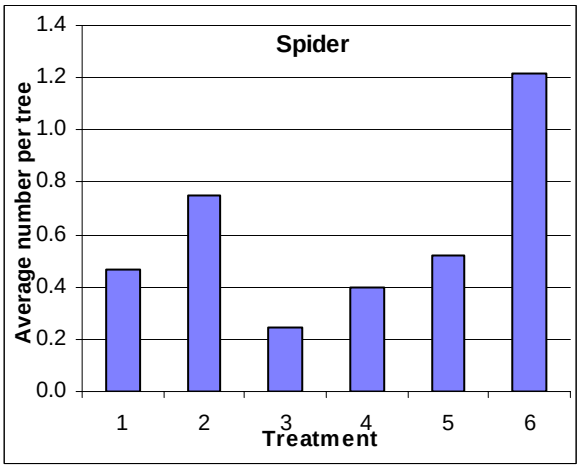


Fig 3. Effect of ICM treatments on beneficials
d) spiders



OUTPUT 3: Novel methods for the management of coffee white stem borers identified and tested.

New (to the smallholder coffee 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 aldrin-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 physical barriers and botanical repellents, which need to be evaluated for their efficacy against stem borers.

[Activity 3.1: Test at least two candidate chemicals for their efficacy against, and specificity to, coffee white stem borers. The first stage, which can be delivered within the time-span of this project will be to make the insecticides available for testing to the SCFT and to set-up the trial. The trial would be laid out in a randomised complete block design with 3 replicates, ideally at one site but more than one site may be required to have sufficient replication**]**.

Achievements:

Site selection was based on two main criteria. First, the sites had to have sufficient numbers of trees for a replicated experiment. Secondly, the site had to be infested with WSB but only sufficient to provide a source of egg laying females but with some of the trees still free of WSB symptoms. The trial was laid out on four farms in Misuku Hills, Phoka Hills, Viphya North and on three farms in S E Mzimba..

Two candidate insecticides were identified by the CABI entomologist and obtained in Malawi through the local agents. The chemicals were fipronil ['Regent'] and imidacloprid ['Confidor'] which are registered in Malawi for use on crops other than coffee. 16 on-farm sites {Table 4] were selected that were infested with stem borer but where there were sufficient unaffected trees for the trial. The treatments were applied to the stems using a paint brush in September 2001. The aim was to protect the trees before the main egg-laying period at the start of the rains in October/November. Eggs laid of the bark hatch and the larvae tunnel into the wood during the period November - February. New tunnelling is being recorded in December, February and April. Data will be available only at the end of this period.

Results from the first season of trials with insecticides for the control of white stem borer indicate that fipronil is more effective than imidacloprid [Table 5]. Least invasion occurred with the wood ash treatment. In view of the low cost of wood ash, this is worth further investigation. The difficulty in this trials is that WSB occurs at low density and the number of new invasions per season seems to be low although the impact is great as most invaded trees will eventually die. The effect of insecticide treatment will accumulate over time and greater impact may be seen next season.

Table 4. On-farm trials for stem borer control with insecticidal stem paints [4 trials x 4 sites with each site representing one replication]

Zone/section	Farmers name	Intercropping	Variety	Initial infestation	Age	Shade*	Alt
Mondo	Langson Kayange	banana	Geisha	50%	5	Partial	4603ft
Chisi	Alent Mlamboghi	banana	Geisha	35%	6	No	5492ft
Katowo	Jacob Musukwa	banana	geisha/cat	70%	4	No	4808ft
Katowo	Lameck Kayuni	banana	Catimor	25%	4	No	5125ft
Nchenachena	Research plot	no	Geisha	50%	3	No	5122ft
Junju	Nashon Msiska	banana & mango	Geisha	50%	6	No	4992ft
Salawe	Brston Msiska	banana	Geisha	35%	4	Yes	4101ft
Junju	Masyen Msiska	no	Geisha	85%	5	No	4107ft
Khanga	Kondwani Mshani	no	Geisha	70%	4	No	4694ft
Jintha Jembe	Mwachirinda Munthali	peach	Geisha	20%	4	No	4808ft
Khanga	Amani Chiwona	no	Geisha	25%	3	No	4811ft
Uzumala	Richard Mzumala	beans and maize	Geisha	60%	6	No	5033ft
Kapita	Fletcha Tembo	no	Geisha	15%	3	No	4032ft
Kapita	Austin Phiri	no	geisha/cat	40%	6	No	4100ft
Khosolo	Michael Shaba	no	Geisha	90%	6	No	4150ft
Kapita	Fletcha Tembo	no	Geisha	20%	3	No	4032ft

* Shade other than banana.

Table 5. Effect of insecticide or ash on stem borer damage.

Treatment	Stem borer *
Imidacloprid	0.36
Fipronil	0.29
Wood ash	0.27
Control	0.41
LSD	0.202

* Number of new invasions out of 5 trees per plot.
Means over 16 sites.

Activity 3.2: 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:

One of the alternative ways of controlling this pest is by the use of natural enemies. Although widespread in Africa, the white coffee stem borer occurs in very low levels in some countries in Africa. One of these countries is Kenya. Assuming that these low pest populations are due to the regulatory effects of natural enemies, a survey was undertaken to search for these natural enemies in Kenya with a hope of identifying and evaluating them for the management of this pest in Malawi.
Many authors have reported that adult *M. leuconotus* usually emerge soon after the onset of the rains. The gigantic adults (up to 5cm in length) then proceed to mate and then deposit eggs under the bark of coffee stems. The eggs take an average of 15 days to hatch (Schoeman, 1998) and ring-barking stage of the larvae lasts about 3 months (Knight, 1939; Tapley, 1960). The survey aimed to collect natural enemies of especially the eggs and the ring-barking stages of the larvae, since these are the developmental stages of the pest which most exposed to natural enemies. There are 2 rainy seasons in Kenya, with the short rains beginning in October and the short in March. The surveys where therefore conducted in December 2001 and April 2002 to target the early developmental stages of *M. leuconotus*.
Small-holder coffee farms in Tharaka Nithi and Embu districts (Eastern Province) and Kirinyaga, Muranga and Thika districts (Central Province) of Kenya were visited. Farms were selected randomly, and at each the general status *M. leuconotus* attack was assessed before individual trees were examined for the presence of immature stages of the pest. When present, farmers were asked about the age of the coffee and if any borer control methods were applied. Collected larvae were placed in plastic

containers with tightly fitting perforated lids. These were maintained on coffee twigs in the laboratory at CABI-ARC and observed daily.

Due to the low world coffee prices, most of the farms visited were not well maintained. Many of the farms were either extremely weedy and the coffee unpruned or intercropped with other crops (especially beans). Most of the coffee trees were extremely old (over 40 years).
Many of the farmers did not attempt to control the borer. Others however used inorganic insecticides (e.g. diazinon) which were introduced into the borer tunnels using either the tip of a feather or cotton wool attached to the tip of a wire. Other used bicycle spokes to crush the borers in their tunnels.

A total of 45 and 57 coffee farms were sampled in 2001 and 2002, respectively (Table 1). Coffee farms were divided into either newly infested (with ring-barking or frass evident), previously infested (only exit hole evident) or not infested. Less than 10% of the farms surveyed in both years had coffee with actively feeding pest larvae. Most of the coffee farms, although infested, only had signs of attack by earlier generations of the pest.

A total of 2 and 20 adult *M. leuconotus* were collected from the surveys in 2001 and 2002, respectively. Only 1 and 3 larvae were collected in the respective years. These larvae are healthy and no sign of infection or parasitism have been observed. Ants (*Pheidole* spp) were often seen in the tunnels created by the borers. No eggs of *M. leuconotus* were observed.

Parasitoids and predators of the *M. leuconotus* have been reported from Kenya (Knight, 1939). However, the current survey recorded unusually low pest numbers. The high proportion of farms which were previously infested and low proportion of those which are newly infested may indicate that the borer was a more serious problem in the past. However, this emphasizes the fact that searches for natural enemies should be intensified in the surveyed districts, should the decline in pest numbers be in deed due to the action of natural enemies.

Table 6. Number of smallholder coffee farms visited and larvae of the white coffee stem borer, *Monochamus leuconotus* collected from different districts during the survey for natural enemies of this pest in Kenya.

	December 2001					April 2002				
District	Farms visited	Uninfested farms	Newly infested farms	Previously infested farms	Larvae collected	Farms visited	Uninfested farms	Newly infested farms	Previously infested farms	Larvae collected
Tharaka Nithi	15	6	3	6	1	15	3	0	12	1
Embu	13	4	0	9	0	22	2	0	20	2
Kirinyaga	10	2	1	7	0	10	2	0	8	0
Muranga	2	2	0	0	0	5	1	0	4	0
Thika	5	5	0	0	0	5	5	0	0	0
TOTAL	**45**					**57**				
Percentage		**42.2**	**8.9**	**48.9**			**40.4**	**0**	**59.6**	

OUTPUT 4: Non -chemical approaches to control of coffee berry disease and coffee leaf rust validated

A non-chemical approach to disease control will be validated. Results from the previous project showed that the management practices, especially pruning for an open canopy could reduce levels of CBD and CLR. This will include an evaluation of the new variety, 'Catimor' which has been distributed to smallholder coffee farmers since 1998 and is reputed to have resistance to both CBD and CLR.

Activity 4.1: Survey to assess disease levels under different levels of shade and comparing sites that have been pruned with those that have not. This will be done with the aid of a light meter and an altimeter to allow for variations in disease incidence that occur with altitude. This will not involve the extensive surveys that were done in the previous project as different levels of shade can be found in a single field and it is not necessary to obtain data from a wide geographic area.

Achievements:

This survey was conducted on 8 farms in Viphya and 20 more in Misuku. CBD levels were generally low in the 2000/2001 season and this may be due to the persistent heavy rains washing spores from the berries. Some cases of severe CBD were found but they were occasional trees. However, the wet weather has prevented us from making the disease scores earlier and some berries had already been lost. As most of the berries were now past the first period of susceptibility to CBD, berries with scab lesions were counted as infected. Scoring at this stage is an underestimate of the amount of CBD because most of the infected berries drop off during the susceptible berry stage.

Most fields visited had at least some rust. Although it was early in the season for this disease, it was severe enough on some trees to cause defoliation later in the season. At least some rust was found at all eight sites but CBD was found at only 5 sites and only at three of these, would it have had a significant impact on yield. Rust was sufficiently severe at five sites (Table 6.) to cause significant defoliation later in the season which would be expected to decrease yield substantially next season [2001/2002] . Mean disease incidences in Viphya were 18% of trees affected by CBD and 68% of trees affected by CLR.

Soon after beginning the survey, it was clear that bearing levels were highly variable between trees in the same field. Rust severity seemed to be more associated with bearing level and this outweighed any effect of shading. A scoring system was therefore developed to account for both shading and bearing. The use of a light meter to give an objective measure of shade level was unsuccessful due to the effects of changing cloud cover. Field means for this data would not be meaningful. The data from 7 fields (150 trees) for rust and 3 fields (90 trees) for CBD was entered onto a spread sheet and a correlation analysis done between disease severity scores and shade score and between disease severity and bearing level score.

Unexpectedly, the strongest positive correlation [significant at 1%] was between CBD severity and bearing level but CBD did not correlate with shade level. CLR was correlated [significant at 5%] with both shade and bearing. Severity score for CLR and CBD were not correlated (Table 7.). However, the large amount of variation in bearing level between trees in close proximity makes it very difficult to study the interaction between disease level, shade and bearing.

Table 7. Coffee leaf rust and coffee berry disease incidence and severity in fields In Viphya North [May 2001]

Field No.	Farmer	Crop age	CLR		CBD	
			Score	%	Score	%
1	Mziya	10	2.90	97	0.37	20
2	Unknown	14	2.13	83	1.27	53
3	Mzumara	10	2.43	90	1.03	40
4	Nyirenda	25	0.07	7	0.00	0
5	Ngambi	23	0.53	37	0.20	7
6	Chiuma	4	2.97	100	0.00	0
7	Longwe	8	2.23	90	0.77	23
8	Dzimbira	10	0.83	40	0.00	0
Mean incidence/field				68%		18%

Disease severity scoring system:

0 = No disease
1 = A few infected berries or leaves but less than 2%
2 = 2 – 10% infected berries or leaves
3 = 11 – 25%
4 = 26 – 50%
5 = Above 50%

Table 8. Correlation coefficients and significance levels for CLR and CBD against shade level and bearing level [Viphya North].

Disease	d.f.	Shade level	Bearing level	CLR
CLR	>100	+0.2458 [0.05]	+0.2085 [0.05]	-
CBD	88	-0.1219 [NS]	+0.3117 [0.01]	+0.1876 [NS]

A further 22 fields were surveyed in Misuku Hills. Disease incidence and severity were greater in Misuku than in Viphya [Table 8] with mean incidences [trees/field] of 59% for CBD and 84% for CLR. In this case the only corellations were between CBD and bearing level and between CBD incidence and CLR incidence [Table 9].

Table 9. Coffee leaf rust and coffee berry disease incidence and severity in fields in Misuku Hills [May 2001]

Field No	Farmer	Crop age	CLR		CBD		
			Score	%	Score	%	
9	Kayange	15	0.87		53	1.00	70
10	Sikwese	7	0.27		27	0.83	57
11	Mlenga	>10	3.47		100	1.23	67
12	Kabaghe	>10	0.77		53	1.43	80
13	Chabinga	>10	3.10		97	1.93	90
14	Chabinga	>10	2.10		93	0.90	57
15	Chabinga	>10	3.90		100	0.73	47
16	Chabinga	-	1.03		67	1.07	50
17	Chabinga	>10	3.43		97	0.93	57
18	Katowo Demo	>10	2.20		100	0.77	50
19	Kayange	>10	2.70		97	0.93	67
20	Chizumira	>10	2.60		100	1.43	80
21	Kitha	>10	0.43		30	0.77	43
22	Msukwa	17	2.17		87	0.57	40
23	Msukwa	15	2.03		83	0.30	30
24	Lwesya	>10	4.07		100	1.30	73
25	Kitha	>10	1.27		63	0.27	27
26	Kitha	16	0.40		30	0.40	40
27	Kitha	>10	2.40		80	0.83	50
28	Kanyika	>10	0.63		53	0.53	43
29	Masebo	>10	2.70		87	0.43	30
30	Masebo	>10	2.73		93	0.30	27
Mean					84		59

Table 10. Correlation coefficients and significance levels for CLR and CBD against shade level and bearing level [Misuku Hills]

Disease	d.f.	Shade level	Bearing level	CLR
CLR	>100	0.156 [NS]	0.014 [NS]	-
CBD	>100	0.102 [NS]	0.472 [0.001]	0.250[0.05]

Activity 4.2: Compare the effect of pruning, shading and variety on the incidence and severity of CBD and CLR.

This activity was abandoned in view of the results obtained from the shade survey [see above]. The great variability between trees and the interaction between shade and bearing level would make it almost impossible to show significant differences in a controlled trial.

A new output agreed with CPP management. The was to conduct vegetative propagation of individual bushes of the cv. Catimor 129 (Nyika) that have been selected for resistance to CLR and CBD, with a view of developing clonal material which will serve as a source of seed.

Activity 4.3: Observation trial comparing disease levels in fields of cv. Catimor with disease levels in nearby fields of Geisha/Agaro.

Achievements:

This activity could not be carried out as originally envisaged as the number of sites with established Catimor were so few, and CBD would not be expected to appear until the trees reached full bearing. By March 2002 available Catimor plantings were either too young i.e. had not reached full bearing, to allow for assessment of CBD or were of cv. Catimore 129 that has some resistance to CBD.

Assessments for symptoms of White stem borer damage, were made in two Catimor variety trials being run by the SCFT. The trials were laid out as randomised blocks with 4 replications. The number of trees with stem borer damage was expressed as a percentage of the stand in each plot. The results presented in Table 10 show clearly that the Catimors are no less susceptible to WSB than the local control [Geisha]. The gradual replacement of Geisha with Catimors will not therefore alter the pest status of WSB.

Table 11. Effect of white stem borer on Catimor cvs.

Cultivar	WSB incidence at two sites			
	Nchenachena		Misuku	
	%	arcsin	%	arcsin
Catimor [unknown]	57	49.6	35	36.2
Cat 129	52	47.3	35	36.3
Cat 15077	72	59.2	35	35.8
Cat 15066	66	59.2	30	32.4
Cat 15069	62	51.1	42	40.1
Geisha	76	58.2	17	23.6
LSD		±28.79		±21.49

There has been widespread adoption of Catimor seedlings (See Tables 11a,b,c) but these planting are only one or two years old.

Table 12a. 2000/20001 Coffee seedling production by variety in five Associations [No. of seeds planted in nurseries].

Association	Varieties				
	Cat. Pop.	Nyika	Geisha	Other	Total
MISUKU	163682	2665	20371	23112	209830
NKHATA	111167	570	480	0	112217
MZIMBA	12722	0	9101	0	21283
PHOKA	47797	0	5923	0	53720
VIPHYA	20500	1400	4662	4085	30647
Total	355868	4635	40537	27197	**428237**

Table 12b. No. of seedlings in the field issues 2000/2001 in five Associations.

Association	Varieties				
	Cat. Pop.	Nyika	Geisha	Other	Total
MISUKU	50657	0	22429	74149	147235
NKHATA	12438	0	120	0	12558
MZIMBA	4685	0	6793	0	11478
PHOKA	6181	0	19241	9486	34908
VIPHYA	3775	0	3976	3951	11682
Total	77716	0	52559	87586	**217861**

Table 12c. Field planting by area in five Associations [area planted (ha)] 2000/2001.

Association	Varieties				
	Cat.pop*.	Nyika	Geisha	Other	Total
MISUKU	25	0	11	37	73
NKHATA	6	0	0	0	6
MZIMBA	2	0	3	0	5
PHOKA	3	0	10	5	18
VIPHYA	2	0	2	2	6
Total	38	0	26	44	**108**

* These Catimor populations were originally selected for resistance only to CLR.

Implications of distribution of Catimor cvs.

Tables 1 and 2 above clearly show that there is considerable interest in establishing new coffee gardens although the new area planted remains small (Table 3). It is of some concern that most of the Catimor being planted is not clonal and is of Catimor population, a fair proportion of which can be expected to be susceptible to CBD. Cv. Nyika, on the other hand, originated from a selection made by Noah Phiri at Lunyangwa which is resistant to both CLR and CBD. However, the seedlings being distributed as 'Nyika' may be variable and might contain individuals that are susceptible to CBD.

[I would also like to reiterate here my view that Catimor cultivars require intensive management to produce well without over-bearing and may not be suitable for all smallholders. Furthermore, it was observed in Colombia that Catimors tend to be shallow-rooting and were unsuitable for cultivation on steep slopes. The shallow-rooting is mainly a problems on estates with heavy use off fertilisers and irrigation

which result in taller coffee bushes that are very susceptible to lodging. Lodging may not be a major problem under smallholder conditions because the coffee is not over-fertilised or irrigated. Overbearing die back may be a problem, especially where farmers do not apply fertilisers at all. Use of shade trees with some fertiliser could reduce the amount of overbearing die back].

There is an urgent need to go back to the original Nyika selections at Lunyangwa and propagate from these in isolation to ensure that there is no out-crossing. It is suggested that we begin this activity within the current project instead of conducting the proposed trial on the effect of shading on disease levels. The results presented above from the survey conducted on this visit indicate that the level of bearing on an individual coffee tree also has some influence on susceptibility and that studies on shade intensity in relation to disease would probably be inconclusive.

NEW OUTPUT: Clonal propagation of Catimor selection [cv. Nyika] with resistance to both CBD and CLR.

Achievements:

Staff at Lunyangwa were instructed in methodology of regenerating plants from cuttings taken from young shoots so that they continue the propagation with subsequent shoot development. The mother plants were selections from Catimor 129 made by Noah Phiri some years ago and maintained at Lunyangwa. Clonal propagation was initiated and the number of plants will increase as more shoots develop on the mother plants. This stock will form the basis of future 'Nyika' plantings rather than relying on the mixed 'Catimor population' currently being distributed with financial assistance from EU-STRABEX fund. About one hundred and fifty cuttings were planted and most of these have established.

OUTPUT 5: Cost Benefit Analysis of IPM/ICM techniques developed and constraints to adoption addressed

Activity 5.1: Conduct cost-benefit analyses of IPM/ICM systems developed by the project.

Achievements:

The yield increments required to cover the cost of treatments included in the ICM trials have been calculated and are shown below.

Summary [derived from calculations below]

If fertiliser, fungicide and insecticide are all used as recommended, the total cost per ha would be 50404 kw [£560]. This would require a yield increment of 1008 kg/ha to cover the purchase cost of the inputs [@ 50 kw/kg of parchment]. This amounts to c. 1kg per tree [at 1000 trees/ha].

Labour has not been included in the benefit analysis as most smallholder suse family labour. The minimum wage is 50 kw/day and 24 man-days would be required to apply the inputs giving an additonal cost of 6200 kw which is equivalent to another 124 kg extra yield.

The purchase price for a CP15 knapsack sprayer is 4450 kw which represents another 89 kg of yield but this outlay would not be required each year.

Farm gate price [parchment] [2001] 50 k

Fertiliser

For Mature trees:

	N	P	K
Fertiliser requirement/ha	200	60	250

Conversion table - fertiliser wt to give 1 kg of NPK:

CAN	3.57		
Sulphate of potash			2.0
Single superphos		5.26	
Compound J	6.67	20.0	5.0

Actual fertiliser applied/ha:

Compound J	1250		
CAN	892	@ 1200 k/ 50 kg	= 21408
SSP	316		= 7584
SP	500		= 12000
			40992 [£455]

[£1 = 90 kw]

£455 = 40950 kw equivalent to 819 kg of parchment
Based on 1500 trees per ha this would require an increased yield of 0.546 kg/tree

Fungicide spray

4 sprays of Cu oxychloride @ 10 kg/ha = 40 kg/season @ 220 kw/kg = 8800 kw [£98]

Equivalent to 176 kg/ha of extra yield or 0.117 kg/tree

OR

2 sprays of Bayfidan @ 1.5 l/ha = 3 l/season @ 2911 kw/l = 8733 kw
Equivalent to 175 kg/ha of extra yield

Insecticide spray

Fenitrothion - 2 sprays @ 850 ml/ha = 1.7 l/season @ 360 kw/l = 612 kw
Equivalent to 12 kg/ha of extra yield

Activity 5.2: 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.

Meetings were arranged with our contact farmers using the Business Centres associated with some of the Coffee 'Zones' in our target 'Associations'. These meetings were used to raise awareness of the project and its activities and to obtain farmers views on the constraints to adoption of the ICM packages.

Summary of Meetings:

1. The total number of attendees at three meetings was 325.

2. Great interest was shown in the stem borer control trials. Farmers wanted more information on the chemicals - how much they would cost and how safe were they.

3. Substantial numbers of farmers said they had planted out Catimor seedlings in new coffee gardens this season. Several individuals said they had planted more than 500 seedlings.

4. Few of the farmers had alternative sources of cash income. Two farmers said they also grew tobacco.

5. The main constraint mentioned was low coffee prices and high cost of inputs.

6. Several farmers mentioned that loans were a problem. Although credit is available through the PROSCAP programme this was for maize not coffee. Also, they must be repaid within the season. Farmers regarded this as unrealistic, especially in view of late payment for coffee delivered to SCFT.

7. Late delivery of fertiliser was a common complaint and the difficulty of purchasing inputs with cash when they did not receive their payments from SCFT until after the season had started.

8. There was a disincentive for farmers to begin coffee growing for the first time because of lack of capital and poor availability of credit.

9. The preferred method of technology dissemination was extension training by mobile units. Newsletters were regarded as useful but only if in the vernacular.

10. Coffee nurseries previously managed by the SCA, now it is the responsibility of individual farmers but some farmers said they did not have the know-how.

11. There seemed to be some consensus that insufficient Catimor seedlings were available for cash sale.

OUTPUT 6 : 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 6.1: 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.

Some farmers will wish to continue using pesticides and for this group the project will develop extension literature on safe and rational pesticide use which will be promoted through the BCs.

All but one ICM trials are on farmer group plots. Almost all operations, are being done with farmers. i.e. the trials are being used as training grounds. Trimming of shade trees was done with the farmers. Pruning was done in their absence because of the urgency of the operation when Drs Oduor and Phiri arrived. It was done in farmers absence, but with their knowledge and an arrangement was made to train farmers in pruning at a later date.

An extension leaflet on management of CBD has been designed [see below]. This is the basis for a technical leaflet but requires refinement after discussion with SCFT Training Officer. We will not be able to produce the leaflet before March 2002.

The SCFT has produced a Coffee Growing Handbook for smallholders. Until now the only handbook available to coffee farmers directed at the estate sector. The Handbook is a compilation of 18 extension leaflets and 1000 copies of the English language version were distributed. Our farmers groups have told us that extension literature is much more useful to them if written in the vernacular. Project funds available for extension literature were used therefore to produce a version of the Handbook in the

local language. These funds were made available to the SCFT in June and we hope to see the translated text by the end of the year.

TECHNICAL LEAFLETS FOR SMALLHOLDER COFFEE IN MALAWI

MANAGEMENT OF COFFEE BERRY DISEASE

How to identify CBD. How does it differ from fusarium berry rot and berry moth damage?

[If a colour version is to be produced then:]

Photograph of CBD
Photograph of scabs and active lesions.
Photograph of Fusarium berry rot and of berry moth damage for comparison.

[This is not essential as surveys have shown that farmers know the symptoms of CBD and CLR.]

Factors influencing severity of CBD

Altitude - farms at higher altitude such as those in Misuku Hills and parts of Viphya North may require control measures for CBD.
Rainfall - CBD is more severe in areas that regularly experience high rainfall.
Bearing level - CBD is more severe when bushes are heavily bearing

Control

1) Avoid over-shading
2) Prune for open canopy
3) Fungicide application
4) Use resistant cultivars [certain Catimor cultivars e.g. Nyika]

Fungicide application - Indicators for fungicide requirement:

- Has CBD been a problem last season or in previous seasons?
- Altitude 1400 m and above
- Cost benefit analysis:

I. Estimate of production. [Regardless of disease severity, spraying should be considered only for crops with an average yield expectancy of at least 1 kg of cherry].
II. Estimate of yield loss due to CBD in previous years
III. How much yield loss is required to cover cost of purchasing the fungicide.
IV. If predicted loss exceeds purchase cost then fungicide application may be justified.

Fungicide application:

- Good cover required of berries and bark on branches producing berries.
- Minimum requirement - 3 sprays
- Berry needs to be protected from 4 - 14 weeks after flowering.
- First spray at weeks 3 - 4, 8 and 12 after main flowering. If weather is dry between sprays then a spray can be omitted and applied immediately after the next heavy rain.
- If you cannot afford 3 sprays do not use fungicide at all.
- Apply 50% copper formulations @ 11 kg/ha
- OR, tank-mix of 5kg/ha copper and 2 kg/ha chlorothalonil.
- Actual amount of water used will depend on size of the trees. The quantities of fungicide to add to one 15 l knapsack would be 200 g of 50% copper [Kocide] OR 100 g copper + 40 g [or 40 ml] chlorothalonil [as either Daconil 500g/kg or Bravo 500ml/l]

<u>What to do if coffee leaf rust [CLR] is also a problem</u>

If leaf rust usually causes severe loss of leaves from your coffee trees, then you will have to include an additional copper spray just before the first rains to protect the leaves. In addition, the spray cover applied for CBD control will have to be increased to a full-cover spray from the top of the tree.

Alternatively, use Bayfidan [Triadimefon 250 e.c.] at dilution rate of 20 ml per 15 l of water [CP15 sprayer]. Apply as full cover spray when first rust spots are seen and repeat again after 4 weeks. Maximum two sprays per season.

Bayfidan can be applied after rust appears on the leaves but if copper sprays are used against rust, the first spray must be applied at the beginning of the season before the first rust spots are seen.

<u>Summary of key factors in deciding whether to spray against CBD or not.</u>

Is there a history of severe CBD on your farm?
If no, then do not spray unless the disease becomes severe in the future.
If yes, consider spraying if:

Your trees are producing an average yield of at least 1 kg of cherry.
You can begin spraying at 3- 4 weeks after main flowering.
You can afford at least 4 sprays.

<u>Resistant cultivars</u>

In areas where CBD is usually severe, it may be worth considering gradual replacement with a CBD-resistant cultivar. The Catimor cultivars are resistant to rust and some are also resistant to CBD. In Malawi the cv. Nyika is resistant to both. [If the Catimor seed used is not certified as 'Nyika' it may not be resistant to CBD]. Catimors are high yielding dwarf types that require high fertiliser use to achieve their yield potential without overbearing die-back.

Dissemination

Refereed Papers:

PHIRI, N. A., HILLOCKS, R. J. and JEFFRIES, P. (2001) Incidence and severity of coffee diseases in smallholder plantations in northern Malawi. *Crop Protection* 20, 325 – 332.

HILLOCKS, R. J. (2001) Coffee: Is it still a viable cash crop for smallholders in Africa? *Outlook on Agriculture* 30, 205 - 212.

Internal Reports:

HILLOCKS, R. J (2001) Report of a visit to Malawi to initiate phase two of the coffee IPM project. 14 – 24 January 2001. Natural Resources Institute, Chatham. 5 pp. BTOR.

OVERFIELD, D. and JEFFRIES, D. (2001) Report of a visit to Malawi to initiate activities under project A0996 concerning integrated crop management (ICM), white stem borer control and sustainable marketing of smallholder coffee in northern Malawi 25 March - 8 April 2001. Natural Resources Institute, Chatham. 6 pp. BTOR.

PHIRI, N. A. (2001) Report of a visit to Malawi 22 April - 13 May 2001. CABI Bioscience, Nairobi, 2pp. BTOR.

HILLOCKS, R. J. (2001) Report of a visit to Malawi to investigate the association between shade cover and disease severity in coffee 29 April - 11 May 2001. Natural Resources Institute, Chatham. 8 pp. BTOR

PHIRI, N. AND ODUOR, G. (2001) Report of a visit to Malawi, 13 - 25 September 2001. CABI BioScience, Nairobi. 2 pp. BTOR

ORR, A. (2002) Report of a visit to the coffee IPM project in Malawi, 9 – 26 April 2002. Natural Resources Institute, Chatham. 7 pp. BTOR

Other:

NEW AGRICULTURALIST ONLINE (2001) Focus on coffee - making the most of IPM in Malawi. http://www.new-agric.co.uk/01-4/focuson.html. October 2001. [Newsletter].

logframe:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Goal			
Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems	To be completed by Programme Manager	To be completed by Programme Manager	To be completed by Programme Manager
Purpose			
Promotion of strategies to reduce the impact of pests and stabilise productivity of tree crops important to livelihood security of poor people in Forest Agriculture systems	To be completed by Programme Manager	To be completed by Programme Manager	To be completed by Programme Manager
Outputs			
1.Market access for smallholder coffee improved. 2. Best practice/ICM demonstrated and promoted. 3. Methods for stem borer control tested. 4. Non-chemical approach to disease control validated. 5. Cost benefit analysis and constraints to adoption of best practice addressed. 6. Farmer knowledge of ICM and pest	1. SCFT selling into 'fair trade' markets. 2. Increase in farmers pruning in particular and using best practice in general. Trials planted to test effect of best practice on disease incidence. 3. Insecticides for stem banding . delivered to target farmers and trials set-up to evaluate them. 4. Survey completed of disease incidence at different levels of shade and in pruned vs. unpruned crops.	Project reports, Ministry of Agriculture and SCFT reports Records of numbers of farmers attending demonstrations Extension literature on best practice and aspects of pest management.	Farmer confidence in coffee continues and in particular that they continue to receive at least 60% of the export price. Weather is conducive to CBD and CLR.

management improved.	One season evaluation of Catimor competed by March 2002. 5. Economics of input use and constraints to adoption of ICM assessed by March 2002. 6. Business centres used to disseminate pest management messages to farmers in at least 3 EPAs		.
Activities	**Inputs**	**Means of Verification**	**Important Assumptions**
1. 1.Assist SCFT to develop markets. 1.2.Facilitate development of effective point of sale control system	Total Budget here £149,617	Project report	
2.1. Establish demonstration trials in 3 EPAs.		Trials set up. Project report	On-farm work requires access to reliable transport (currently transport at Lunyangwa is very scarce). The coffee area is large and often inaccessible for anything but 4 wheel drive.
3.1 Test chemicals for stem borer control. 3.2. Evaluate potential for obtaining natural		Chemicals delivered and trials set up.	Supplier is willing to provide relatively large quantities of the

enemies of stem borer from Kenya.			chemicals not presently registered in Malawi. Ministry of Agriculture and SCFT continue their support and can provide staff to manage the trials
4.1. Conduct survey to assess disease levels in relation to shade and pruning. 4.2. Set-up a trial to evaluate the effect of pruning and different levels of shade on CBD and CLR. 4.3. Compare disease levels in cv. Catimor with Geisha and Agaro.		Project report and refereed paper.	. As above Farmers willing to undertake correct pruning practice
5.1. Conduct cost benefit analysis of adoption of project recommenedations. 5.2. Assess constraints to adoption.		Project report.	Extension staff continue to be available to assist in the workshops
6.1 Use BCs to train farmers in IPM/ICM		Extension leaflets. Records of attendance at meetings.	Transport available

Contribution of Outputs

Reorganisation of the SCFT has increased farmer representation and the organisation is now more responsive to farmers' needs. Trade liberalisation has opened up the market for smallholder coffee and the SCFT agreed to pay farmers not less that 60% of the export price. The EU is supporting rehabilitation of the smallholder sector through financial assistance to SCFT and in funding the replanting programme. Together these changes have brought about a revival of the smallholder sector and this is most evident in the number of farmers who are replanting with Catimor. Against the background of this improved outlook for smallholder coffee, despite the poor world price, three areas of demand for research services were identified and articulated at the stakeholder workshop held at the end of the previous project.

1. Improved knowledge required of and access to fair trade markets.
2. Appropriate crop management packages needed that were flexible enough to be accessible to farms with different income levels.
3. Control measures for white stem borer required.

1. Improved knowledge and access to fair-trade markets.

The project economist worked with the SCFT to raise awareness of access to fair trade markets and recently a marketing specialist has been employed by the SCFT with whom the economist was able to liaise before he left the project. Links were established between SCFT and fair trade organisations in the UK which tested some Mzuzu coffee samples. The conclusion was that some of the Mzuzu coffee samples met the required standard for fair trade marketing but that minimum volumes of good quality coffee would have to be guaranteed.

2. Appropriate crop management packages needed

The approach at the outset was to involve farmers in the development of crop management packages. The trial sites are all on-farm and all operations were carried out by the farmers or with the farmers. The aim was to demonstrate 'best practice' and to promote the message that sound crop management was the first step towards improved yields and that the decision to use pesticides should be based on cost benefit analysis.

Each of the trials is in a 'business zone' served by a 'business centre'. The business centres are based around the primary processing plants and are the basic unit of farmer participation. Almost all coffee farmers are members of their local business centre which is funded by subscription. The business centres provide the key entry points for dissemination of project outputs beyond the directly participating farmers and to business centres outside the project areas.

Results from the trials so far [no yield data available yet] show that fungicides application for rust control may be economically worthwhile but that on mature trees, routine use of insecticide decreases populations of beneficial insects.

The ICM component that has most interested our contact farmers has been fertiliser use and this will be particularly important for the new Catimor cultivars.

3. Control measures for white stem borer

Previously, 70% of farmers had at some time used dieldrin stem paint to control WSB. When dieldrin was withdrawn from the market, there was no suitable alternative available. The chemicals fipronil and imadacloprid were identified as candidates for WSB control. The chemicals have been applied but their effect on penetration by WSB larvae cannot be evaluated until May 2002.

The project has contributed to the control of biological constraints to coffee production and therefore to the improvement of rural livelihoods by involving farmers in running trials to demonstrate correct management practices. An important part of this has been to raise awareness that pests and disease are partly caused by poor management and that sound crop management is the starting point for pest management. The use of pesticides has to be justified on economic grounds and can only protect yield, they cannot increase yields on poorly managed coffee.

Data collected by this project has shown that White stem borer will continue to threaten rehabilitation of the sector due to the susceptibility of the new [Catimor] cultivars. A simple control measure for white stem borer is needed immediately and of the two insecticides tested, fipronil looks more promising than imidacloprid. The control achieved with wood ash requires further investigation as a low cost and environmentally benign treatment.

What further research is necessary

The adaptive phase of this work has been funded for only one coffee-growing season. In this time we have been able to establish on-farm trials with links to the extension and farmer networks for wider dissemination and uptake. The on-farm trials are designed to obtain research information on the effect of crop management practices on pest and disease levels while at the same time providing an entry point for both farmer training in, and demonstration of, the principles of integrated crop management. At least two, preferably three more seasons will be required to validate and promote the system.

White stem borer has become a serious pest of arabica coffee throughout southern Africa. The project has established on-farm trials to test the efficacy of two chemicals to replace dieldrin as an insecticidal stem paint. WSB has a long generation time and at least two annual applications of the chemicals will be required to obtain useful data on their efficacy. The approach adopted in this case has been to evaluate the chemicals in such a way that the trials will serve as demonstration and promotion sites if the treatment is successful. However, promotion of these expensive chemicals as a control measure for WSB will require business centres to co-ordinate the sub-division of the packs into smaller units that are affordable by smallholders. A future project would also evaluate the feasibility of this as part of a wider exercise to improve access to farm inputs.

With respect to marketing, there is not much more the project can do. Of the samples of 'Mzuzu' coffee we have had tested in the UK, one report was favourable the other less so. The unfavourable report mentioned that the sample seemed 'old'. It would therefore be useful to have some fresh samples analysed.

Socio-economic activities would centre around assessment of the constraints to adoption of the ICM packages and taking steps to relieve the constraints by working closely with the BCs and SCFT. Alistair Orr has been identified as a socio-economist with experience of developing IPM systems for smallholders in Malawi and we hope that he will work with us to widen dissemination and uptake.

We would wish the proposal for an extension to include visits to Tanzania. Coffee smallholders on the other side of the border with Malawi share common problems with Malawian smallholders. The southern highlands of Tanzania has also been a target area for the EU coffee rehabilitation programme and should offer the opportunity for more direct dissemination of the ICM approach promoted by the project.

The EU is committed to supporting the SCFT for a further three years with a likely extension for two more years. This will contribute substantially to the sustainability of the smallholder coffee sector and will assist the SCFt until production increases allow them to become self-funding through the export levy.

The project is linked to another project on white stem borer. The linked project on management of white stem borer has been approved by the Common Fund for Commodities [CFC] and is expected to begin in 2002. The CFC project will complement the CPP activities by focusing on alternatives to chemical control such as natural enemies, trap crops and particularly pheromones. Pheromones may offer a viable alternative to chemical control because the most appropriate chemicals are very expensive. This work has strong regional implications as WSB has become a major pest of arabica coffee throughout southern Africa [this may include southern Tanzania, although we have no information at present].

Pathways whereby present and anticipated future outputs
Will impact on poverty alleviation or sustainable livelihoods

The importance of coffee as a source of cash income to the 4000 households that grow coffee in northern Malawi is clear. Those close to the main roads and main towns may be able to obtain some income from horticulture but this is not open to those in more remote areas which includes the main smallholder coffee area, Misuku Hills. The only other cash crop in the area is tobacco but there are ethical and environmental reasons for promoting coffee rather than tobacco, quite apart from the issue of reliance on a single source of cash income. Coffee as a perennial tree crop contributes more to the maintenance of the resource base in terms of water, soil and biodiversity than does tobacco cultivation.

The SCFT have done much to improve coffee growing as a sustainable livelihood approach through guaranteeing the farmer at least 60% of the world price and by establishing new markets for 'Mzuzu' coffee. The effect of this has been to increase

farmer confidence in the crop, despite poor world prices and this is shown by the enthusiasm for new plantings with 'Catimor'.

Yields in the smallholder sector are still very low with only about 12% of farmers achieving a yield that would be considered 'economic' if labour is taken as a costed input. More than 50% of smallholder obtain only 100 kg/ha although 10 times as much is achieved by around 4% of growers, so it is not unrealistic for any smallholder to target 3 - 400 kg/ha which would have a major impact on their livelihoods. The way to achieve this sustainably, is to maintain confidence in the crop by ensuring that farmers can market their harvest at a fair price and by raising the standards of crop management. The most important contribution to this aim that the project can make, in addition to developing and promoting crop management packages is to help to develop the farmers groups [' Business Centres'] to facilitate 'farmer to farmer' extension.

Reorgansiation of the smallholder coffee sector with financial assistance for EU STABBEX fund was based from the outset on the principles of devolution and democratistion. Farmers groups became managers of the primary processing plants previously owned by the former Smallholder Coffee Authority. Farmers organised themselves at grass roots level into the Business Centres and their needs are articulated upward to the SCFT through the Zonal Coffee Advisors and the farmers representatives elected to the board of the SCFT. Surveys conducted by the project indicate that farmers are well represented at grass roots level with more than 80% membership of the BCs. [In 2001 all members of the BCs in Misuku Hills had paid their subscriptions of 500 kwatcha].

The project has been working and will continue to work through on-farm trials with farmers and farmers groups but will use the BCs to promote project activities and outputs. The project is already having some success in bringing researchers from the National Programme into closer contact with farmers and the BCs. We wish to build on this in the future to improve the researchers competence in participatory research and farmers belief that they are a part of the research process. The BC initiative should be supported as it provides an excellent opportunity for the two-way flow of information, whereby farmers can articulate their needs and research/extension can deliver their messages.

In addition to the BCs the SCFT is planning, with support from the EU project, to establish 'Extension Information Centres' in the coffee-growing areas and in any future project these would provide additional channels for technology dissemination and training.

The project represents one of the first attempts to evaluate and promote ICM as opposed to IPM, for African smallholders and therefore, project methodology and outputs have regional implications. Project outputs will be relevant to coffee smallholders throughout eastern and southern Africa and there are two main routes for this wider dissemination. The first is through the coffee research network [CORNET]. We are fortunate that CABI is the network co-ordinator and this gives us direct access to the umbrella organisation, ASARECA. The second is the EU which, in addition to its involvement in smallholder coffee in Malawi, is funding coffee research and rehabilitation programmes throughout the region.

A new project funded by the Common Fund for Commodities began in 2002 on biology and control of white stem borers. This project has Malawi, Zimbabwe and India as the target countries. This project will provide an additional uptake pathway for outputs from the CPP project.