NATURAL RESOURCES SYSTEMS PROGRAMME

***FINAL TECHNICAL REPORT*[1]**

DFID Project Number

R7962

Project Title

Linking soil fertility and improved cropping strategies to development interventions

Project Leader

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Organisation

Imperial College London and Kenya Forestry Research Institute (KEFRI)

NRSP Production System

High Potential

Date

October 2005

[1] This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

Contents

This report is supported by the following annexes:

Abbreviations and Acronyms

DSS – decision support system

KEFRI – Kenya Forestry Research Institute

LIMDEP – econometric software package

LR – long rains (season)

OVI – objectively verifiable indicator

SCOBICS – Sustainable Community Based Input Credit Scheme

SCODP - Sustainable Community Oriented Development Programme

SR – short rains (season)

1 Executive Summary

Project R7962 aimed to improve the livelihoods of farmers in Western Kenya by expanding their options for resource and crop management and enhancing their capacity to make the relevant management decisions. Its main activities were 1) the establishment of a community-based credit scheme with the aim of enabling a category of poor farmers, identified in earlier studies in SW Kenya to be of intermediate ranking in the scale of poor to very poor, to access limiting inputs (fertilizers, new / improved crops), 2) the development and promotion of three pictorial decision support systems (DSSs) - for better land management, correcting nutrient deficiencies and striga weed control – amongst contact farmers and other development organisations working in western Kenya, and 3) making an improved basket of crops and varieties available to enable farmers to simultaneously improve their economic returns from farming and enhance the soil resource base.

By the end of the project in 2005, the project's credit scheme (SCOBICS) was operating in eight locations in western Kenya, each comprising multiple villages, and serving 323 borrowers. The SCOBICS scheme has been the main entry point for the project into new communities, with other activities being conducted where SCOBICS is in operation. Throughout the life of the project, project staff liaised with Wedco, the main microfinance organization in western Kenya, which had expressed an interest in taking SCOBICS over as its own commercial pilot for agricultural lending. However, in 2005 the total loan portfolio of SCOBICS was only around KShs 1.2 million, whereas Wedco's business model requires a single loan officer to handle KShs 6-7 million p.a. For this reason and also because recent internal difficulties within Wedco meant that it was not in a position to take on risky new products, the management of SCOBICS still remains at KEFRI-Maseno. The scheme is planning to continue operations in 2006, whilst further funding is sought (*inter alia* from the Financial Sector Deepening programme in Nairobi) for a further transitional phase during which the scheme's loan portfolio can be built up to a size where it represents a credible business proposition for a microfinance organisation to take over.

The end-of-project Impact Survey (Annex B), conducted in May-June 2005, found that farmers who have participated in project activities do indeed acknowledge a stronger knowledge base for their decision-making on crop and soil fertility management. Moreover, the majority of such participants have made changes to their cropping systems (adoption of striga-resistant maize varieties, more intensive maize cultivation, diversification into crops other than maize and beans in the short rains seasons) as a result of the project's activities. These have enhanced household food security and nutrition and respondents claimed that they have also increased income from crop sales (by an unspecific amount). However, no beneficial impact of participation in project activities on asset holdings was recorded by the Impact Survey.

In addition to training the contact persons of SCOBICS borrower groups in the use of the DSSs, these have been distributed to over 400 lead farmers and to a large number of research and extension organisations, CBOs and NGOs working with farmers in western Kenya, Uganda and elsewhere.

2 Background

Although the project has worked in various locations in western Kenya, from Kericho to Busia, the main focus of its activities has been in Siaya and Vihiga districts. National poverty

surveys consistently show the highland districts around Lake Victoria to be amongst the poorest in Kenya. According to the 2005 Economic Survey produced by the Ministry of Planning and Economic Development, 67% of households in Nyanza Province (in which Siaya is found) fell below the KShs 80 per person per day national poverty line, making it the poorest province in Kenya. Western Province (in which Vihiga is found) was the third poorest province in Kenya, with more than 60% of households below the KShs 80 per day poverty line. High population densities and high levels of HIV/AIDS are commonly cited as major factors explaining these figures.

Although almost all households in these areas draw on multiple income sources to sustain their livelihoods, crop production is overwhelmingly the most important income source. However, the agricultural potential of the project areas is open to debate. On the one hand, total rainfall is generally adequate across both rainy seasons, albeit more reliable and better distributed in the long rains season (March-July) than the short rains season (August-November). On the other hand, soils in the area (nitrosols) suffer from chronic phosphorus deficiency, resulting from significant concentrations of iron oxides that quickly fix available phosphorus. At high population densities, this phosphorus deficiency can only be managed by continual applications of phosphorus fertiliser, which add significantly to the cost of achieving high yields, especially given the high price of fertiliser in western Kenya.

Whatever the true potential, the project areas are currently heavily dependent on food imports. Moreover, strategies to reverse this situation have to engage with the reality of very high population densities and, therefore, small land holdings. The impact survey recorded a mean land area cultivated per household during the 2005 long rains season of just 1.28 acres (0.5 hectares) with a third of households cultivating 0.5 acres or less. Less than 10% of households cultivated in excess of 2.5 acres (one hectare).

Due to continuous cropping and little investment in soil fertility replenishment, the soil in these areas has become severely depleted. Neither phosphorus nor nitrogen levels are now sufficient for even moderate agricultural performance. As a result, many poor households in these districts are caught in a "maize-focused poverty trap": their first agricultural priority is to provide themselves with maize for home consumption, yet yields are low and returns are insufficient to support investment in either organic soil fertility enhancement technologies or inorganic fertilisers. Thus, despite the fact that the average household puts around 80% of its land under maize (with/without bean intercrop) during both cropping seasons, it is still unable to feed itself for several months of the year. Meanwhile, it earns little or no cash income from the land. In addition to the problem of low soil fertility, continuous cropping of maize has also led to an endemic infestation of the striga weed throughout these districts, further depressing maize yields.

If their agricultural activities are to begin to lift them out of poverty, households in the project areas need to be able to diversify *beyond* maize, i.e. intensify their maize production sufficiently (principally in the long rains season) that they can free up scarce land for planting to other (preferably higher value) crops in the short rains season. Successful intensification of this nature should enable them to simultaneously feed themselves, generate cash income from their farms and invest in their natural resource base for future productivity. Provision of a coordinated range of support services was believed to be key to assisting poor households to diversify *beyond* maize.

The project built on years of previous work in western Kenya, both biophysical and socio-economic, by a range of national and international research institutes. It sought to synthesise existing biophysical research findings into pictorial decision support systems (DSSs) that would be readily understood by farmers and to combine dissemination of these DSSs with

provision of other support services (credit, access to improved seeds, exposure to new output markets), so as to study the impact of such coordinated service provision on technology adoption, patterns of crop and soil fertility management and household livelihoods.

3 Project Purpose

The project aimed to provide the technical information and other complementary services that would enable farmers to make better informed and less constrained choices regarding their crop and soil fertility management. It was expected that this would enable them to move towards a situation where they could simultaneously feed themselves, generate cash income from their farms and invest in their natural resource base for future productivity. Given the lack of replicable models of seasonal credit provision for semi-subsistence agricultural producers in Sub-Saharan Africa, one particular research question was to investigate whether a sustainable system of credit provision for farmers in the project areas could be devised. This was nested within the wider question of what impact the provision of a coordinated range of support services would have on technology adoption, crop and soil fertility management and livelihoods.

4 Outputs

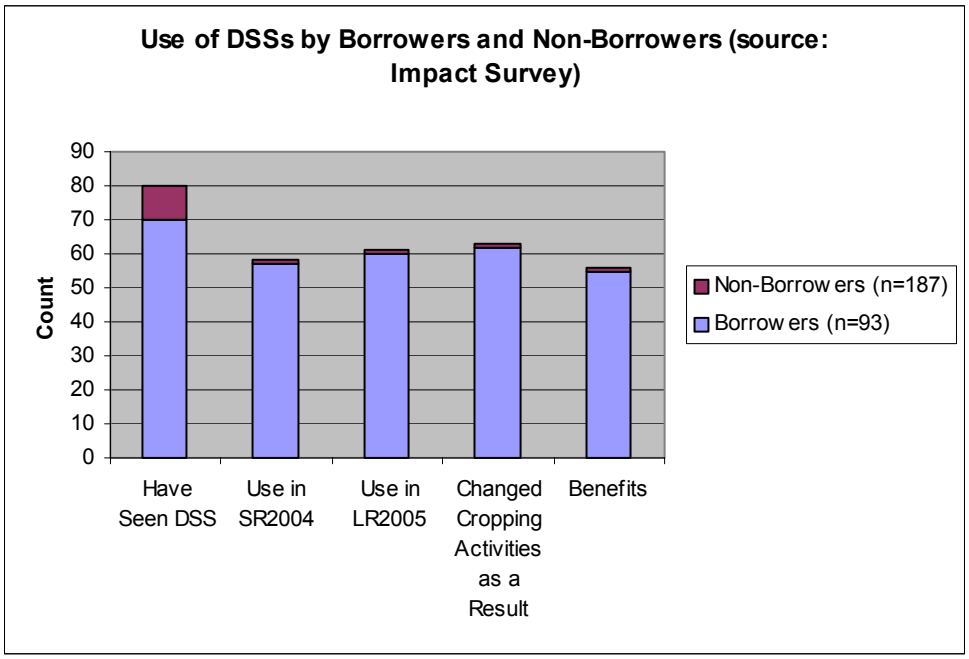
Project outputs can be grouped under three main headings: production and dissemination of DSSs, development of the credit scheme and outcomes in terms of enhanced crop and soil fertility management as a result of the project's intervention. (We also report on livelihood impacts in this section). The specified outputs in the logframe include detailed steps towards production and dissemination of the DSSs and development of the credit scheme, which in practice were not followed to the letter, as the credit scheme evolved in a slightly different way to that originally foreseen. However, the reach of the credit scheme has surpassed that originally intended and we are able to assess management outcomes and livelihood impacts in line with the original OVIs.

Farmers' Knowledge Base for Decision Making Strengthened

The project logframe foresaw the development of a single decision support system for biophysical management. In practice, and in important part as a result of the feedback from farmers during DSS development, what has emerged are three pictorial DSSs, dealing respectively with better land management, correcting nutrient deficiencies and striga weed control. These are supplemented by a number of posters (for example, on soyabean cultivation). Selected farmers from the project areas provided feedback, during a series of workshops, on the types and formats of DSSs that would be useful to them. The final products were then distributed to the contact persons of all 46 SCOBICS borrower groups in 2004 and these contact persons received training on how to use them, and help their fellow group members to understand and use them.

Figure 1 reports responses from the impact survey showing that the majority of respondents from borrower households claimed to have used a DSS in both the short rains 2004 season and the long rains 2005 season. Moreover, most of them who used the DSS claimed to have made some change to their cropping system as a result of consulting it and also to have gained benefits as a result. Figure 1 also shows, however, that by mid-2005 there had been very little diffusion of DSSs beyond immediate project participants. Project R8400 has provided an opportunity to try to change this situation.

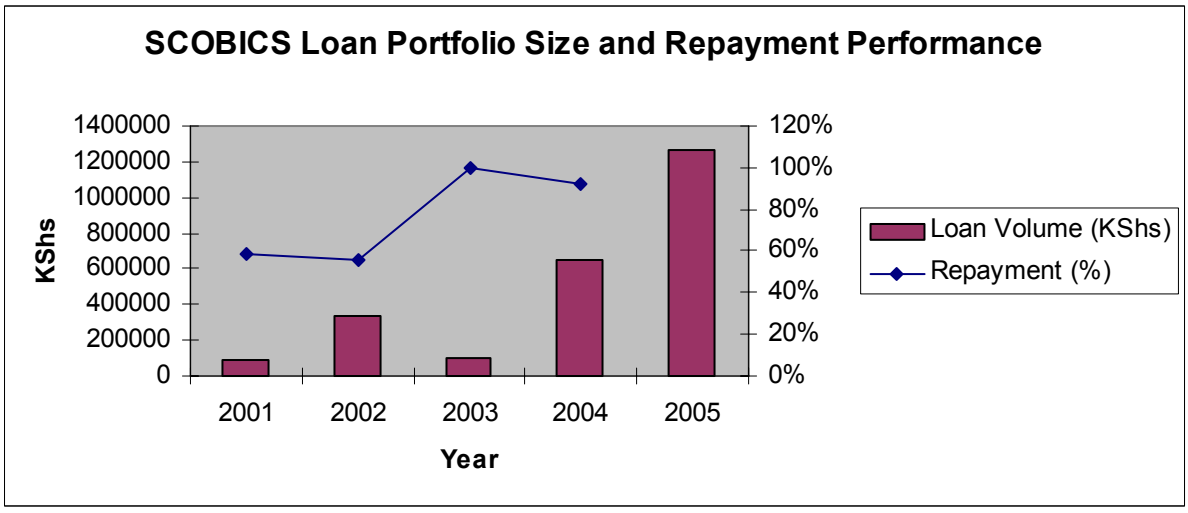
Figure 1



Development and Sustainability of the Community-Based Credit Scheme

Figure 2 summarises the growth of the SCOBICS credit scheme over time. The basic story is of poor initial performance, but then some improvement over time, as early lessons have been learnt and the operation of the scheme adjusted accordingly. In 2005 the scheme provided loans to 323 borrowers in eight locations. Since 2001 it has extended loans to around 790 clients, of whom 52% were men and 48% women.

Figure 2



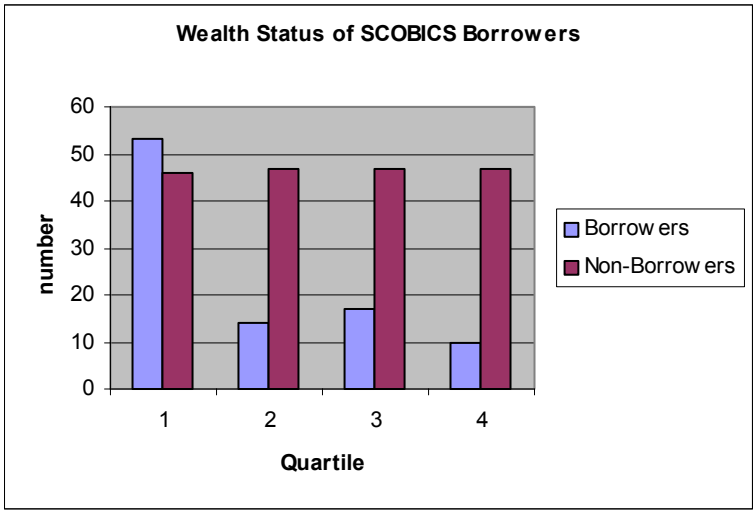
The SCOBICS loan product has several features that distinguish it from a conventional microfinance loan. Perhaps the most significant of these is its repayment incentive system, which provides greater incentive for loan repayment by group members in bad years (in the face

of the covariant risk inherent in agricultural production) than a conventional joint liability system. Combining this incentive system with a small group lending model in 2004 generated a repayment rate of 92%. This can be further improved through strengthening borrower training, although scheduling this training before new borrowers are accepted onto the scheme is a challenge, given the pronounced seasonality of scheme operations.

Evolving a lending model that has promises acceptable repayment rates from poor, dispersed, rural clients is a fair achievement. However, this has then highlighted the next constraint to commercial viability of the scheme: its scale of lending. The scale of SCOBICS lending in 2005 is at least in line with expectations at the outset of the project, but the total loan portfolio is still only around 20% of the break-even portfolio size within the business model of Wedco, the microfinance institution that the project was hoping to interest in adopting the scheme. This is principally because SCOBICS loans are much smaller than conventional microfinance loans targeted at (peri-)urban small businesses. The small loan sizes - an average of KShs 2483 (US$31.8) in 2004, rising to KShs 3931 (US$51.7) in 2005 – also mean that, unlike in conventional microfinance lending, the loans officer cannot afford to meet with all his/her clients individually. Instead, group contact persons have to be relied upon to act as intermediaries between group members and the loans officer. The success (or otherwise) of this approach within the SCOBICS scheme could generate broader lessons for microfinance institutions in Africa that are seeking to extend their outreach to poorer strata of borrowers.

However, partly as a result of the still modest loan portfolio size and partly because of its own recent internal difficulties, Wedco was ultimately unable to commit to taking the scheme on. At the time of writing this report, project staff are planning to continue operations in 2006, whilst further funding is sought (*inter alia* from the Financial Sector Deepening programme in Nairobi) for a further transitional phase during which the scheme's loan portfolio can be built up to a size where it represents a credible business proposition for a microfinance organisation to take over. If such funding is not forthcoming, then a decision has to be taken either to continue running the scheme out of remaining funds (gradually running its capital down as the volume of operations cannot sustain the full costs of a loan officer) or to close it down. Even then, part of the scheme could continue to be run by the Tatro farmers' organisation, which is to be given greater autonomy in managing its part of the scheme during 2006 on a trial basis.

Figure 3



source: Impact Survey Report

Meanwhile, Figure 3 shows that SCOBICS borrowers were drawn primarily from the top wealth quartile of households in the project areas. Perhaps surprisingly, very few borrowers in the sample were drawn from quartile 2 – the group that the project proposal summary had stated as the project's target group. However, almost 30% of borrowers were drawn from quartiles 3 and 4. This provides an interesting insight into both who participated in the original contact groups (e.g. Ministry of Agriculture focal area committees and ICRAF-established sub-locational committees) and whom these people thought could be trusted to repay loans as the scheme was expanded.

It should be pointed out that the project did not at any time try to influence committee members or subsequent borrowers to include poorer borrowers within the SCOBICS scheme. The initial expectation was that the wealthiest households would have access to finance from other sources, so in many cases would not be interested in the small loans from the project, whilst the poorest households would be unable to efficiently use and repay credit. Thus, "upper-middling" households were thought to be the most likely to participate. These initial expectations apparently over-estimated both the ability of the wealthiest households in the project areas to access finance from other sources and the ability of households in quartile 2 to repay loans. However, certain individuals from households not just in quartile 2, but also in quartiles 3 and 4, *were* perceived to be both able and willing to repay loans.

Relating these observations to the previous discussion of scheme viability, we note that wealthier borrowers can generally use and repay larger loans than poorer ones. Given the fairly marginal viability of commercial lending to farm households in the project areas, even under optimistic assumptions about increasing borrower density and maintaining repayment rates, it would not be feasible to specifically target poorer households for access to loans.

Adoption of Integrated Crop Management as a Result of Project Interventions

As well as developing and disseminating DSSs, the project undertook a number of other activities (e.g. on-farm demonstrations, market visits) to spread knowledge of crop and soil fertility management options open to farmers. SCOBICS borrowers were again the main beneficiaries of the knowledge generated by such activities. According to the impact survey, the development interventions undertaken by the project have encouraged adoption of a number of new crop and soil fertility management technologies by SCOBICS borrowers. These include:

- Adoption of new, striga-resistant maize varieties from Western Seed Company
- Adoption of soyabean, improved bean and rosette-resistant groundnut varieties
- Intensification of maize production through application of (additional) inorganic fertiliser
- Modification of cultural practices.

Conclusively attributing these adoption decisions to one or other intervention is problematic, however, given that SCOBICS borrowers received a range of services not accessed by non-borrowers. We suggest that availability of credit may have had the largest direct impact in the area of fertiliser use and that other activities undertaken by the project may have had a bigger direct influence on the other adoption decisions.

Table 1: Have You Changed the Maize Variety that you Plant Since 2001/02?

	Borrowers	Non-Borrowers	Total
Switched	61 (65%)	19 (10%)	80
Not Switched	33 (35%)	168 (90%)	201
TOTAL	94 (100%)	187 (100%)	281

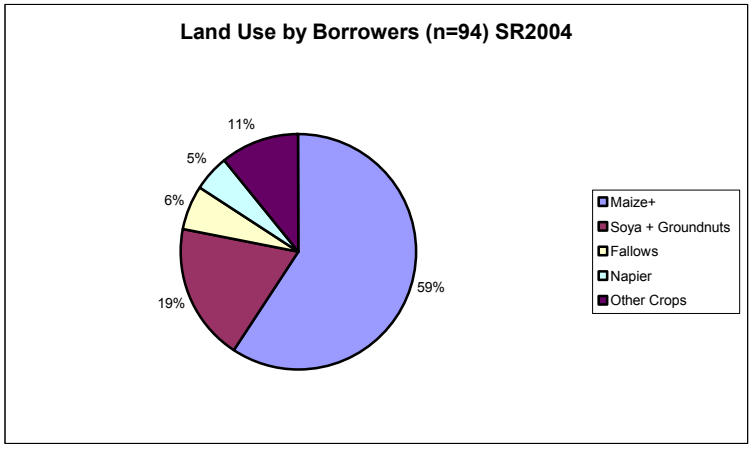
Source: Impact Survey Report

Table 1 shows that SCOBICS borrowers were much more likely to have changed the maize seed that they used during the past three-four years than non-borrowers, with adoption of striga-resistant maize varieties being the main change undertaken by borrowers. Whilst some borrowers switched from existing hybrid varieties to the new striga-resistant maize varieties, others changed from local to improved varieties. For producers who were already purchasing hybrid maize seed, a switch to the Western Seed varieties from existing Kenya Seed hybrids has only a small cost implication. Within the SCOBICS credit scheme, Western Seed varieties were KShs 10 per kg (7%) more expensive than Kenya Seed hybrids in 2005. Thus, given the severity of striga incidence in project areas, we would expect considerable adoption to take place once producers became aware of the new varieties, even in the absence of credit. The obstacle to adoption here is more likely to relate to availability. Western Seed Company has been struggling to increase production of its striga-resistant maize varieties in response to rising demand. SCOBICS, however, managed to obtain seed for the benefit of its borrowers. In this case, the project activities that are most likely to have encouraged adoption, therefore, are the dissemination of knowledge about the new varieties through on-farm demonstrations and inclusion in the striga DSS (with borrowers the main beneficiaries of this information) and the role that SCOBICS played in making the varieties available to producers. The credit facility per se was probably not that important to these producers, although it may have been more important to those switching from local to improved varieties.

A similar story can be told in relation to changes in bean varieties planted by some project participants following the visits to Kisumu markets organised by the project. Thirteen of the respondents to the impact survey reported changing the bean varieties that they cultivated as a result of knowledge gained during these market visits. Through these visits it was discovered that some of the varieties grown locally for sale in local markets were not demanded in Kisumu markets, whereas other varieties were demanded in both local and Kisumu markets. For producers who were previously cultivating local beans, switching to improved varieties may have entailed a modest cost. However, in most cases the existence of a credit facility was probably not critical to the decision to adopt the new variety.

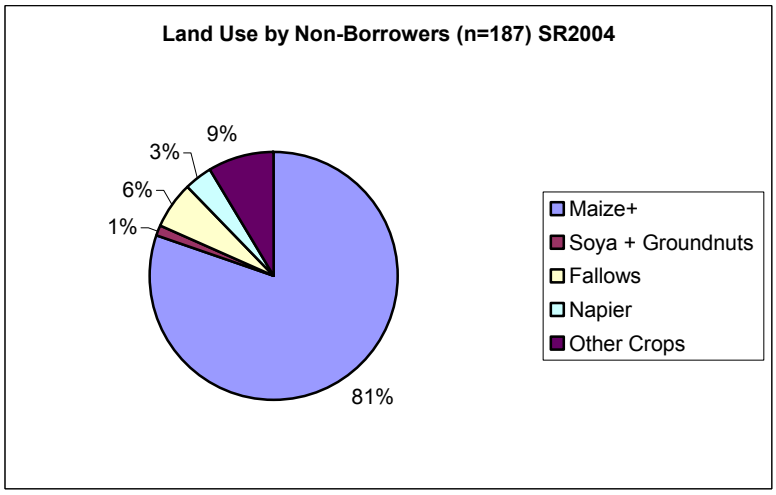
Figures 4 and 5 show that, by 2004, borrowers had begun to diversify their short rains season cropping pattern, whereas non-borrowers had yet to make any changes. (These statements use long rains production patterns – not presented here - as the comparator). The figures show that the main difference between the cropping patterns of the two groups lay in the proportion of their land area devoted to soyabean and groundnuts, with smaller differences in the proportion of their land area devoted to napier and other crops.

Figure 4



source: Impact Survey Report

Figure 5



source: Impact Survey Report

Adoption of both soyabean and groundnuts was encouraged by the on-farm demonstrations. Groundnuts are typically either consumed at home or sold in local markets. By contrast, soyabean is a less familiar crop, the local markets for which are very thin. The rate of adoption recorded in Figure 5 was, therefore, probably dependent in large measure on the willingness of the project to buy much of the soyabean harvest from borrowers for inclusion within the following season's credit transactions. Establishing a reliable external market for soyabean will be critical to its wider adoption by farmers as a component of a diversification *beyond* maize strategy.

The impact survey did not collect data directly on fertiliser use. However, it did find that borrowers were much more likely to have experienced increasing maize yields in the previous three-four years and that the reasons given for these increased yields related principally to increased fertiliser use (Table 2).

Table 2: Reasons Given for Increased Maize Yields

	Borrowers	Non-Borrowers	Total
Use of Fertiliser (inorganic)	21	6	27
Use of Fertiliser (organic and inorganic)	14	8	22
Use of Fertiliser and Improved Seeds	22	6	28
Use of Fertiliser and Improved Seeds + Weeding	3		3
Good Agronomic Practice / Better Management	2	2	3
Credit Availability	1		1
TOTAL	63	22	84

Source: Impact Survey Report

The bottom row of Table 20 could be read as suggesting that credit availability actually played a rather small part in this story. However, this is simply a statement of the immediate causes of yield increases as reported by respondents. Purchase of fertiliser represents a lumpy investment, which it can be difficult for resource poor farmers to afford.

Finally, we note that looking at cases of technology adoption in isolation may understate the importance of SCOBICS lending to the technological innovation that we observed during this project. We suggest two reasons for this:

- The first is that the diversification beyond maize approach requires producers to make a number of *interdependent* changes to their cropping system and soil fertility management strategy. Even where just one of those changes requires lumpy investments, the approach as a whole stands a lower chance of success without the availability of credit.
- The second is that, of all the project activities, it is the SCOBICS credit scheme that has excited the most interest amongst farmers in the project areas. This has been the entry point for all the project's interventions, including dissemination of DSSs and on-farm demonstrations. Through their interest in SCOBICS loans, farmers have thus come into contact with all the other activities and information. The driving force behind the Tatro farmers' organisation, Paul Okong'o, explained it as follows: Tatro works with a number of development partners, several of which bring new technologies for Tatro members to explore. However, only SCOBICS has also enabled Tatro members to afford the technologies that it has promoted. Paul Okong'o also argues that, the dedicated efforts of his team notwithstanding, the growth of Tatro owes much to its links with the SCOBICS credit scheme. This is because access to SCOBICS loans provides a tangible benefit for Tatro members that makes their participation in Tatro immediately worthwhile. Other benefits are appreciated, but would not encourage so many people to join in the first place as access to SCOBICS loans does [P. Okong'o, *pers.comm.*, 23/5/2005].

Impact of Project Interventions on Food Security and Income Generation

Turning to the impact of project interventions on maize yields, Table 3 presents the results of two different regression models explaining the maize yields reported by respondents for the long rains 2004 season. The two models adopt different responses to the fact that there could be endogeneity in the selection of SCOBICS borrowers, i.e. those chosen by their peers to be

borrowers may be chosen at least in part on their superior agricultural skills and/or commitment - factors that would raise their maize yields even in the absence of SCOBICS credit. (However, we note that, according to LIMDEP, in practice no endogeneity problem was observed). The table shows that both wealth, which may allow households to afford fertiliser because they can obtain cash through other activities, and access to SCOBICS credit have a significant impact on yield.

Meanwhile, Table 4 reports a regression seeking to explain the degree of crop diversification achieved by households in the short rains 2004 season. The dependent variable used in this regression is a Herfindahl index of crop diversification, for which a lower value signifies greater diversification. Again we see the significance of being involved in project-related activities through the DSS variable. Reinforcing the point about the difficulty of attributing uptake to one or other activity, either this variable or the access to SCOBICS loans variable showed up as significant in this equation, but not both, as they are so closely correlated.

Table 3: Explaining Maize Yields in Long Rains 2004

Variable	Two-Stage Model		Simple Linear Regression	
	Coefficient	Significance	Coefficient	Significance
Credit Selection (Probit)				
Intercept	-3.7145	.0000		
Village	1.9277	.0000		
Wealth	0.8355	.0004		
Other Savings / Credit Activity	0.3457	.0158		
Agricultural Dependence	0.5119	.0125		
Yield Regression				
Intercept	38.9063	.8667	32.757	.871
Access to SCOBICS Credit	597.5337	.0287	610.965	.000
Wealth	590.4800	.0021	587.677	.000
Ebukhaya Sub-Location Dummy	-587.2415	.0001	-583.050	.000
Land Area Cultivated (acres)	-269.7840	.0000	-268.882	.000
Adults 15-60 in the Households	105.2493	.0001	105.779	.000
Main Income = Agriculture	526.0597	.0002	526.845	.000
		F =	17.927	.000
		R^2 =	0.296	

Source: Impact Survey Report

Table 4: Determinants of Crop Diversification in Short Rains 2004

Variable	Coefficient	Significance
Constant	0.787	.000
Maize Yield in LR2004 (kg/ha)	-0.00006	.000
Available Land Area (acres)	-0.0445	.000
Use of DSS	-0.0985	.003
F =	24.006	.000
R^2 =	0.216	

Source: Impact Survey Report

As well as indicating the effect of project activities on cropping systems, consideration of these two tables together suggests that the diversification *beyond* maize approach is indeed consistent with farmers' own strategies and aspirations. In Table 3 we see that the land holding variable is negatively correlated with maize yield, whilst in Table 4 we observe that, the higher the maize yield achieved in the long rains 2004 season, the greater the diversification into other crops during the following short rains (although the coefficient is quite small). At the same time, the greater the land holding size, the more likely the household would be to diversify (as, even with low maize yields, a household with more land is better able both to feed itself and devote some land to other crops).

One of the project's Output OVIs was that, "By end of year 4 survey enumerators determine that at least 250 farmers have changed their cropping systems as a result of the project". The Impact Survey Report suggested 60% as a crude estimate of the percentage of SCOBICS borrowers who had been influenced *by the project* to modify their cropping systems. During 2004 and 2005 – when we consider the encouragement given by the project to modify cropping systems to have been most effective - the total number of loan recipients across all project areas was 414. If we take 60% of this figure, this gives 248 farmers who had made some change to their cropping system as a result of the project's activities. Including farmers who participated in project activities prior to 2004, but have not participated since, the total should, therefore, have exceeded 250.

Table 5 shows that SCOBICS borrowers were able to eat for longer from their 2004 harvests than non-borrowers, a function both of their larger average farm sizes and the higher maize yields that they achieved. The impact survey indicated that borrowers overwhelmingly perceived that the food security of their households had improved as a result of being able to access SCOBICS loans. In addition, 39% of borrowers (compared with only 11% of non-borrowers) reported that the quality of their diet had improved in the previous three-four years.

However, Table 5 also makes the point that the yield improvements generated by the project's activities still fall some way short of ensuring household food self-sufficiency. Combining their two harvests, the average borrower household was only able to provide their own maize for seven months of 2004/05. For non-borrower households, the mean figure was just five months. Thus, households have to earn income off-farm (as almost all their land is occupied with maize cultivation) just to acquire their staple food for around half of each year.

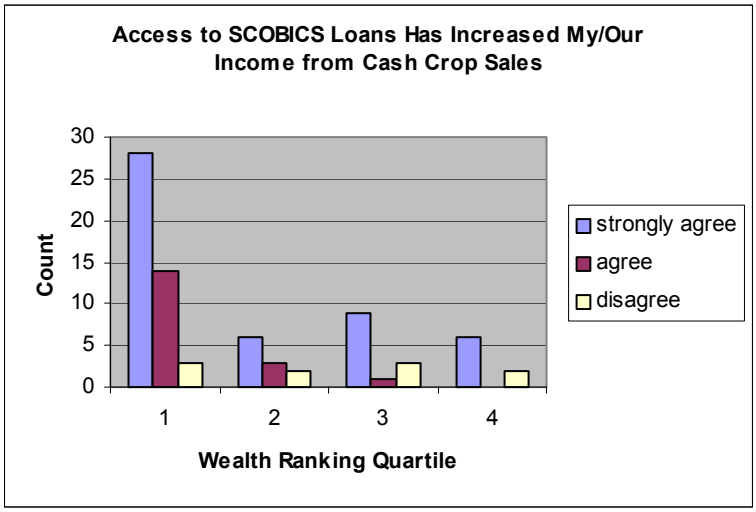
Table 5: For How Many Months Did You Eat from your 2004 Harvests?

	Borrowers		Non-Borrowers	
	Mean	Median	Mean	Median
Months Eaten from Long Rains 2004 Harvest	4.68	4.00	3.00	3.00
Months Eaten from Short Rains 2004 Harvest	2.32	2.00	2.02	1.75

Source: Impact Survey

Unfortunately, the impact survey did not collect primary data on household crop sales. However, as shown in Figure 6 the majority of borrower respondents (87%) agreed that access to SCOBICS loans had increased their (household's) income from cash crop sales. Anecdotal evidence during the course of the project leads us to the assumption that the main source of increased income would be sales of beans and groundnuts in local markets.

Figure 6



source: Impact Survey Report

The Impact Survey Report also reported borrowers' responses to questions about the impact of SCOBICS borrowing on the riskiness of their agricultural activities and on their indebtedness. In general, borrowers were unconcerned about the risk associated with borrowing from SCOBICS. However, a small but noteworthy minority (especially of borrowers in wealth quartile 4) stated that borrowing had saddled them with debts that they could not manage to repay.

The impact survey also asked respondents about changes in their asset holdings during the previous three-four years. Information was gathered on three main categories of assets: livestock, selected durable items (bicycles, radios, sofa sets, beds, mobile phones) and housing stock. In general no impact of participation in the project on asset holdings could be identified from the data collected. However, one (negative) exception to this was found for poultry holdings, where regression analysis indicated that access to SCOBICS loans had had a negative effect on poultry holdings. It was suggested that this could be linked to the use of livestock sales

to repay SCOBICS loans.

Insights into Agricultural Intensification and Poverty Reduction in Western Kenya

The main finding of the project's work on markets and market opportunities was that, for all crops studied, the price that a farmer in Siaya district could obtain if selling to a wholesaler in Kisumu was consistently lower than the price that the same producer could obtain for selling the crop in Siaya market during the same week. Indeed, it could be anything between 14% (non-perishables) and 52% (perishables) lower (Table 6).

The results presented in Table 6 were not the results that the project had hoped, or indeed expected, to find! However, their explanation is actually fairly straightforward: the project areas are food deficit areas and, therefore, local market prices are effectively "local import parity" prices, i.e. the cost of buying produce in a regional market and transporting them into the area. By contrast, the prices that farmers in the project areas would obtain if selling to a wholesaler in Kisumu are "local export parity" prices.

Table 6: Comparison of Prices Obtainable by Producers in Siaya if Selling to Kisumu or Locally

Crop	Net Price if Selling to Kisumu as Proportion of Local Market Price	
	2003	2004
Maize	84%	81%
Groundnuts	86%	84%
Wairimu Beans	68%	76%
Tomatoes	62%	58%
Onions	56%	48%

Source: Market Survey Report

Looked at another way, Table 6 provides an indication of how far prices in local markets could fall if local production rose to the point at which the areas became surplus areas. This would indicate the possible magnitude of the gains that would accrue to poor, food deficit households if agricultural intensification by better-off households within the project areas led to the areas switching to food surplus areas.

In Table 7, therefore, we ask what contribution agriculture could make to the livelihoods of households in the project areas under a "best case" agricultural intensification scenario. To do this, we split households in the project area into two and make the rather crude assumption that households with larger land holdings are able to benefit from the uptake of available technologies more fully than those with less land. The two types in Table 7 are defined by their land holding sizes, these being set at the 25th and 75th percentile as found in the impact survey.

The yields assumed for the 75th percentile farm (in the middle of the table) are thought to be attainable yields in a well-managed farm that applies sufficient inorganic fertiliser (one bag DAP and one bag CAN top dressing per acre), combined with cultivation of dual purpose soyabeans and the inclusion of a small area of improved fallows each year (rotated around the farm). The yields assumed for the 25th percentile farm are those achieved by SCOBICS borrowers in 2004. In other words, whilst the 25th percentile farm does not make the strides in

intensification that the 75th percentile farm does, it does emulate some of the improved practices of its intensifying neighbours.

Under these optimistic yield projections, the 75th percentile farm produces a maize surplus that is 90kg greater than the deficit of the 25th percentile farm. As each type is designed to represent half the farms in the area, the area thus becomes net surplus. (We note, however, that takes quite optimistic yield projections to generate a situation of maize surplus in our study areas. Agricultural intensification can thus proceed quite a long way before local food prices begin to fall from "import" to "export" parity). In Table 7, "adopting" farm households achieve the triple objectives of the diversification beyond maize strategy. They feed themselves, earn (net) cash income from their farms and invest in the resource base that will enable them to continue to do this. However, their agricultural value added is still just under half that required for this farm type to escape poverty, as defined by the first international MDG and is only a third of that required to escape poverty, as defined by the higher Kenyan rural poverty line.

Table 7: "Best Case" Agricultural Incomes for Representative Farm Households in Project Areas

	75th percentile Farm (figures in acres)		25th percentile Farm (figures in acres)	
Cropping Pattern	Long Rains	Short Rains	Long Rains	Short Rains
Maize (intercrop)	1.05	0.3	0.5	0.5
Beans (intercrop)	1.05	0.3	0.5	0.5
Soya (pure)	0.15	0.6		
Kales	0.3	0.3		
Improved Fallow		0.3		
Total	1.50	1.50	0.5	0.5
Assumed Yields (t/ha)				
Maize (intercrop)	3.0	1.5	1.37	0.7
Beans (intercrop)	0.6	0.4	0.29	0.2
Soya (pure)	1.5	1.5		
Kales	5.0	5.0		
Family Size	6.5		5.9	
Net Cash Income (KShs p.a.)	22191.46		-8005.06	
Value Added per person / day:				
KShs	16.63		2.56	
US$ PPP (current)	0.47		0.07	

Source: based on impact survey data

Poorer farm households do not achieve the basic objectives of the diversification beyond maize strategy, despite realizing the productivity gains that SCOBICS borrowers have so far achieved. They spend more on food purchases and on acquiring agricultural inputs than they obtain from crop sales and their agricultural value added is still less than 10% of that required to escape poverty, as defined by the first international MDG. However, they do benefit from lower food prices in local markets (already factored into the net cash income calculation) and should also benefit from greater casual employment on "adopting" farms.

These simulations confirms that, whilst agricultural intensification has an important role to play if households in the densely populated areas of western Kenya are to escape poverty, non-farm income sources are also vital to poverty reduction.

5 Research Activities

The project was designed as an action research project, with two primary activities being the development of the DSSs and the running of the SCOBICS credit programme. In addition, a number of other activities (e.g. on-farm trials, farmer-to-farmer visits, market visits, participatory crop budgeting workshops) were undertaken to introduce farmers to new crop and soil fertility management options and to help them to think critically about them. The project collaborated with other organizations on certain of these activities, e.g. with TSBF on promotion of soyabeans.

A number of surveys were undertaken in parallel with these activities to monitor whom the project was reaching and to assess the outcomes and impacts of its interventions. These included:

- Three biophysical surveys, of increasing size, in 2002, 2003 and 2004-05, which looked in detail at the crop and soil fertility management practices of SCOBICS borrowers, at plot level, including their use of inputs obtained through the SCOBICS credit scheme. A report of the 2004-05 biophysical survey is appended as Annex C;
- A socio-economic survey of 188 SCOBICS borrowers in Nyamninia, Sauri and Anyiko sublocations, conducted in 2002. As the operations of the SCOBICS credit scheme shifted away from Sauri in particular, this survey was not used as a baseline at the time of the impact survey. However, findings from the survey, combined with participatory wealth ranking exercises in the same communities, were used to construct a composite wealth indicator that was used heavily in the analysis of the impact survey (see Appendices 2-3 of the impact survey report);
- A survey of 40 traders in three Kisumu wholesale/retail markets, conducted in 2003. A report of this survey is contained within Annex D;
- Collection of prices of over 20 crops from three local markets – Luanda, Yala and Siaya - on a weekly basis during 2003 and 2004 (note that this data set is more complete for 2003 than 2004). This data was used to compare the prices that project participants could obtain through selling their produce locally with the prices that they could obtain from selling in Kisumu markets. Findings from this work are also contained within Annex D;
- The end-of-project impact survey, which interviewed respondents from 94 SCOBICS

borrower households (currently and past) and 188 non-borrower households randomly selected from household lists in three sublocations: Nyamninia, Gongo and Ebukhaya. This data was used to compare the status of, and trends in, crop and soil fertility management across project participants and non-participants and to assess the impact of project interventions on the livelihoods of beneficiary households. A report of this survey is appended as Annex B.

The datasets from the three project surveys will be stored at KEFRI-Maseno, at ICRAF in Nairobi and at COSOFAP, from where they will be available for other researchers to use.

6 Environmental assessment

6.1 What significant environmental impacts resulted from the research activities (both positive and negative)?

Farmers participating in the project have been able to increase their investment in the fertility of their soils, principally through increased use of inorganic fertilizer and the cultivation of dual-purpose soyabeans.

6.2 What will be the potentially significant environmental impacts (both positive and negative) of widespread dissemination and application of research findings?

Further investment in soil fertility enhancement by poor farm households in western Kenya.

6.3 Has there been evidence during the project's life of what is described in Section 6.2 and how were these impacts detected and monitored?

The impact survey and 2004-05 biophysical survey provide evidence of increased use of inorganic fertilizer and cultivation of dual-purpose soyabeans by project participants. There has so far been little change in crop or soil fertility management by non-participants.

6.4 What follow up action, if any, is recommended?

Project staff are awaiting word from the Financial Systems Deepening programme (ex-DFID) in Nairobi as to whether it will fund a further period of work during which the SCOBICS scheme could scale up, so as to represent a credible business proposition for Wedco. If this funding is not forthcoming, then a decision has to be taken either to continue running the scheme out of remaining funds (gradually running its capital down as the volume of operations cannot sustain the full costs of a loan officer) or to close it down.

Project R8400 has been continuing to disseminate the DSSs and other materials (e.g. A Guide to SCOBICS, appended as Annex E) produced under this project.

7 Contribution of Outputs

The project has demonstrated how an integrated package of support services can assist poor, semi-subsistence farm households to modify their crop and soil fertility management systems so as to raise land productivity, diversify their cropping patterns and invest more in their depleted soils. There have been demonstrated food security benefits from such interventions, with claimed increases in cash income from agriculture (unfortunately not quantified), but no

perceptible benefits in terms of asset accumulation. The experience of the project is that "less poor" households will be the principal beneficiaries of improved service provision, although some of the poorest households have also participated in project activities.

In food deficit areas, sufficiently widespread agricultural intensification could lead to significant (20%+) falls in the real price of staple foods, with benefits to the real incomes of the (poor) majority of the local population. However, in project areas, given the small farm sizes and extent of the current food deficit, considerably more progress will need to be made on agricultural intensification (in terms both of degree of intensification and incidence of uptake) before such price falls occur.

The project has demonstrated that seasonal agricultural credit provision can make a valuable contribution to adoption of new crop and soil fertility management technologies as part of an integrated package of support services for poor, semi-subsistence farm households. It has developed a seasonal credit product, compatible with the mode of operation of conventional microfinance enterprises, that includes several distinctive features (e.g. seasonality of disbursement and loan recovery, loan repayment incentive system, linkages to input supply and technical knowledge) tailored to the needs of smallholder farm households. The experience of the project suggests that commercially attractive repayment rates (95%+) can be achieved even amongst poor, semi-subsistence farm households. However, it has also highlighted the need to scale-up lending if the SCOBICS product is to become a viable commercial proposition for a microfinance organization to pilot.

The purpose OVIs of the project were as follows:

1. By end of project community-based assessment scheme that assists micro-finance decision making operating in at least 5 villages

   In 2005 the SCOBICS credit scheme operated in eight locations, each consisting of multiple villages. The impact survey found evidence that the DSSs developed by the project were being used by borrowers to inform decisions on crop and soil fertility management.

2. By mid-project year 5, local institutions have taken steps to sustain credit schemes for farm inputs

   As noted above, no firm commitment has been received yet that Wedco, the microfinance institution with which the project has been liaising, will definitely take over the running of the credit scheme.

3. By mid-project year 4, farmers acknowledge stronger knowledge base for their decision-making on management of their resources and expenditures on farm inputs

   The impact survey found evidence that the DSSs developed by the project were being used by borrowers to inform decisions on crop and soil fertility management. It also showed that project participants had made changes to their crop and soil fertility management practices as a result of other project activities, e.g. on-farm demonstrations and market visits.

4. By end of project at least 10% of farmers who have participated in the project achieve better income generation from agriculture

   Figure 6 showed that 87% of respondents believed that access to SCOBICS loans had enhanced their income generation. Unfortunately, however, we do not have primary data to support this claim. More robust evidence exists to show the impact of project activities on food security and diet.

5. By end of project, at least 2 Domain X stakeholders plan to make use of the project's

decision support tools and express interest in replicating the project's mode of credit provision.

Project R8400 on **NRSP UPTAKE PROMOTION IN EAST AFRICA** has been continuing to disseminate the DSSs, posters and other materials (e.g. A Guide to SCOBICS) to various stakeholders that provide services to farmers in Kenya and Uganda

Although the project has networked actively in western Kenya, including organizing a workshop for NGO, research and local government organizations in Kisumu in early, it has had little engagement with national policy processes. A workshop organized at Silver Springs Hotel in Nairobi on May 26th 2005 failed to attract either the government or donor community. Further attempts to disseminate findings can be made now that project findings are available in written form.

8 Publications and other communication materials

8.1 Books and book chapters

None so far

8.2 Journal articles

8.2.1 Peer reviewed and published

None so far

8.2.2 Pending publication (in press)

None so far

8.2.3 Drafted

Poulton, C., Ndufa, J. and Gitau, M. 2004 *The Viability of Seasonal Agricultural Lending in Africa: Experiences from SCOBICS in Western Kenya.* Submitted to Journal of Development Studies (invited to revise and resubmit).

8.3 Institutional Report Series

N/a

8.4 Symposium, conference and workshop papers and posters

Ndufa, J., Cadisch, G., Poulton, C., Noordin, Q. and Vanlauwe, B. 2004 *Integrated Soil Fertility Management and Poverty Traps in Western Kenya.* International Symposium on Improving Human Welfare and Environmental Conservation by Empowering Farmers to Combat Soil Fertility Degradation, Yaounde, Cameroon, May 10-12

Cadisch, G., Poulton, C., Mugendi, D. and Jama, B. 2004 *Replenishing Soil Fertility in Sub-Saharan Africa: Remaining Challenges.* 1st World Agroforestry Conference, Orlando, USA, 2004. Book of abstracts

8.5 Newsletter articles

N/a

8.6 Academic theses

N/a

8.7 Extension leaflets, brochures, policy briefs and posters

KEFRI 2004 Decision support system for striga management and control.

KEFRI 2004 Decision support system for better land management.

KEFRI 2004 Decision support system for nutrient deficiency diagnosis and corrective measures

KEFRI 2004 A poster on improved soil fertility and improved crop yields using fertilizer trees

KEFRI 2004 A poster on types of improved fallow species suitable for soil fertility improvement.

KEFRI 2004 A poster on integrated striga control strategies for increased crop yield and food security

KEFRI 2004 A poster on improved soil fertility/food security and income generation

KEFRI 2004 Escaping a Maize-Focused Poverty Trap in Smallholder Farm: How can Policy Help?

8.8 Manuals and guidelines

KEFRI 2004 A guide on sustainable community based input credit scheme (SCOBICS)

8.9 Media presentations (videos, web sites, TV, radio, interviews etc)

None so far

8.10 Reports and data records

8.10.1 Project final technical reports (FTR) and programme development (PD) final reports

Poulton C, and Ndufa J.K 2005 Final Technical Report Annex A: Linking Soil Fertility and Improved Cropping Strategies to Development

8.10.2 Project technical reports including project internal workshop papers and proceedings

Poulton C, Ndufa J.K, Ogolla G and Maina P 2005 Impact Survey Report Annex B: Linking Soil Fertility and Improved Cropping Strategies to Development Interventions

Ndufa J.K, Wasonga D, Maina P, Poulton C and Cadisch G 2005 Biophysical Survey Report Annex C: Linking Soil Fertility and Improved Cropping Strategies to Development Interventions

Poulton C, Ogolla G and Gitau M 2005 2005 Market Survey Report Annex D: Linking Soil Fertility and Improved Cropping Strategies to Development Interventions

8.10.3 Literature reviews

N/a

8.10.4 Scoping studies

N/a

8.10.5 Datasets

2005 Impact survey data

2005 Biophysical survey data

2005 Market survey data

8.10.6 Project web site, and/or other project related web addresses

N/a

9 References cited in the report, sections 1-7

N/a

10 Project logframe

Narrative Summary	Objectively Verifiable indicators (OVI)	Means of Verification (MOV)	Important Assumptions
Goal			
A suite of integrated management strategies offering improved and sustainable benefits to the poor developed and promoted.	By 2002 in three target areas where demand exists: - causes of long term yield decline identified and impacts on the poor understood. - New methods of crop nutrient management	NRSP Annual Reports DFID NRSP review reports	Adoption of strategies changes behaviour in the private sector Enabling

	- New methods of crop nutrient management validated - New strategies validated for optimising inorganic and organic inputs to achieve environmentally benign IPM. - By 2002 a new system wide strategy for the successful introduction of improved plant and animal varieties validated. - By 2003 an integrated natural resources management strategy adopted by target institutions in three targeted countries.	reports NRSP PAC minutes	Enabling environment exists Budgets and programmes of target institutions are sufficient and well managed
Purpose			
Improved techniques for integrated crop management (ICM) developed and promoted for upland rainfed farmlands in South Western Kenya through enhancing farmers' capacity to make relevant livelihood-related management decisions and expanding the options available to them for resource and crop management.	In target domains of the project: 1. By end of project community-based assessment scheme that assists micro-finance decision making operating in at least 5 villages 2. By mid-project year 5, local institutions have taken steps to sustain credit schemes for farm inputs 3. By mid-project year 4, farmers acknowledge stronger knowledge base for their decision-making on management of their resources and expenditures on farm inputs 4. By end of project at least 10% of farmers who have participated in the project achieve better income generation from agriculture 5. By end of project, at least 2 Domain X stakeholders plan to make use of the project's decision support tools and express interest in replicating the project's mode of credit provision	End of project survey report Records of meetings of community-based organisations and credit organisation(s) Project records on administration of revolving fund Mid-term review report Project annual reports End of project survey	Economic circumstances of target country do not drastically deteriorate during project term Climate conditions favourable
Outputs 1. Community-based scheme for provision of micro-credit for farm inputs developed and promoted and the transaction process for the community-based scheme documented. (serves purpose OVIs 1+2) 2a. Means for farmers to make decision on resource management and purchase of farm inputs improved. 2b. Opportunities for suppliers to provide better advice to	1a. By month 6 local credit organisation(s) identified to be involved in community-based credit scheme. 1b. By month 8 key 'promoters' sensitized and bought on board in at least 3 villages 1c. By end of year 1 main technical and financial attributes of DSS identified and agreed with community based groups/communities in target villages 1d. By month 18 DSS for credit developed using participatory methods 1e. By end of year 3 DSS tested and validated in project area 1f. By mid year 4 project takes steps to institutionalize use of DSS by credit organisation(s) 2a. By end of month 8 key promoters in at least 3 target villages for community-based credit scheme sensitized about the resource management DSS component of the project 2b. By end of year 2 farmers of three groups agree to participate in assessment of resource management decision support system 2c. By end of year 3 resource management	Progress report Workshop reports Account of credit provider incl. re-imbursement record Journal articles Monitoring and survey reports Project	Prevailing market conditions do not render most fertiliser use unprofitable Farmer attitudes to credit do not make loan repayment costly to achieve, thus undermining viability of even the best designed scheme. Rainfall in is adequate for at least 3 out of 4 season's cropping

farmers on resource management and purchase of farm inputs improved 3 More profitable, diversified and sustainable integrated cropping systems adopted and effectively communicated.	2c. By end of year 3 resource management decision support system pilot tested in at least one village 2d. By end of year 4 resource management decision support system tested and validated in three villages 2e. By end of year 4 resource management decision support system used by at least 10 farmers' groups and disseminated to input suppliers 3a. By end of year 4 survey enumerators determined that at least 250 farmers have changed their cropping systems as a result of the project. 3b. By end of year 4 at least 50 farmers report financial benefits arising from new resource management strategies adopted as a result of the project. 3c. Onwards from year 3 communication plan implemented and by year 4 key stakeholders and supportive actors in Domains W and X well informed on the project and its policy implications.	Project quarterly/annual reports KEFRI/KARI/ICRAF reports Decision support tools Dissemination/ Recommendation materials Tailored products and marketing tools available Project communication plan	

Activities	Milestone		
1.1 Meetings with local credit organisations to gather experiences in rural lending and to explore potential for participation in community-based credit scheme.	By month 6	Meeting report forms	Local credit organisation(s) remains operational in study area
1.2 Meetings with village committees to discuss utility of, and potential for, credit scheme. Where initial discussions are promising, to further discuss requirements for providing and recovering credit.	By month 8	Workshop report	Committee members believe that there are farmers within the project's target group (middling poor) who can profitably use and repay loans.
1.3Further iterative discussions with credit organisation(s) and village committees to discuss principles of community-based credit scheme.			
1.4 Workshop with all stakeholders to agree mechanism and assessment schemes (DSS) for operation of credit facility.	By month 11	Project quarterly/ annual reports	
1.5 Further meetings with credit organisations and village committees to finalize DSS.	End of year 1		
1.6 Training of staff of credit provider(s) (if required).			
1.7 Establishment of credit facility.	By month 15	Accounts of credit provider	
1.8 Meetings to introduce credit scheme (terms, conditions and principles of DSS) to each new farmer group interested in accessing credit.	Month 15-36		No sudden withdrawal of external funds from collaborating NGO
1.9 Re-assessment of DSS with village committees and credit provider(s)	By mid year 3	Publications in national and international journals	
1.10 Meetings with local credit organisation(s), village committees, AHI and NGO's to discuss continuation (and expansion) of credit scheme.	Mid year 4		No change of focus of collaborating institutions
2.1 Workshops with individual farmers groups to identify:	1 by end year 1, 2-4 year 2		
- current NRM practice		Publications at conferences	
- possible improvements with no external inputs			
- farmers identification of constraints			
- considerations of possible options (see 3)			
- initial choice and ranking of preference by farmers		Radio	

- participatory farm budgeting for different options - farmers assessment of risk and livelihood impacts of options - re-assessment of best options		announcements	
2.2 First draft of DSS developed through relevant literature and discussions with key resource people. 2. 3 Assess farmers indigenous knowledge on soil fertility assessment 2.4 Link farmers perception of soil fertility with yields, literature knowledge about soils and selected lab results to verify and improve farmers judgment power. 2.5 Pilot testing of revised DSS 2.6 Distribution and introduction of resource DSS to input suppliers. 2.7 Workshop with village committee members, farmers, local P specialists, TSBF to discuss findings and new fertilizer management strategies.	By end year 1 Year 2-3; By mid year 2 second draft of DSS, further improved draft mid year 3 Year 3 Year 3, 4 Year 4, arising final DSS	**Budget**:	Existing lab facilities operational Rainfall in is adequate for at least 3 out of 4 season's cropping
3.0 Increase basket of crop and management options for farmers that reduce identified constraints by providing new germplasm in collaboration with KARI, ICRAF, IITA, CIMMYT: - increased disease resistance: climbing beans, groundnuts - labour saving, wood, fodder: zero-till fallow - striga: new varieties, break-crops (soya, cowpea, fallows). - cash income: soya, cowpea, sunflower, vegetables 3.1 PLAR (participatory learning and action research) with 1-2 farmers per group to test/evaluate improved crop-fertilizer options of their choice. Farmer, extension and researcher designed and farmer managed trials. 3.2 Monitoring of crop management, yield, profitability and loan repayment 3.3 Participatory farm budgeting with selected farmers. 3.4 Assess sustainability of new options: - nutrient balance (N/P/K yields using ORD (organic resource database; soil fertility changes (analytical and modelling approaches) - pest and weed incidence 3.5 Exploratory study of market opportunities for crops related to basket of management options. 3.6 Farmers field visits. Cross group visits 3.7 Workshop with farmers to discuss biophysical, economic and livelihood impact of improved options 3.8 Study on information flow and effective communication modes in the V to X domain. 3.9 End of project survey	Year 2 Year 2-3 Year 2-3 Year 2-3 Year 2-3 Year 2 Year 3-4 Year 4 Mid year 3 Year 5	Staff-UK 39 835 Staff-Kenya 48 000 Overheads 39 068 Capital 24 500 Travel 32 340 Miscellaneous 95 814 Total 279 557 (over 4 years)	
Pre-conditions	Local credit organisation(s) able and willing to participate in pilot credit		

	scheme on terms accessible to poor farmers		

11 Keywords

Integrated crop & soil fertility management, technology adoption, credit, livelihoods, Kenya,