Linking Soil Fertility and Improved Cropping Strategies to Development Interventions

Final Technical Report Annex A
NRSP Project R7962

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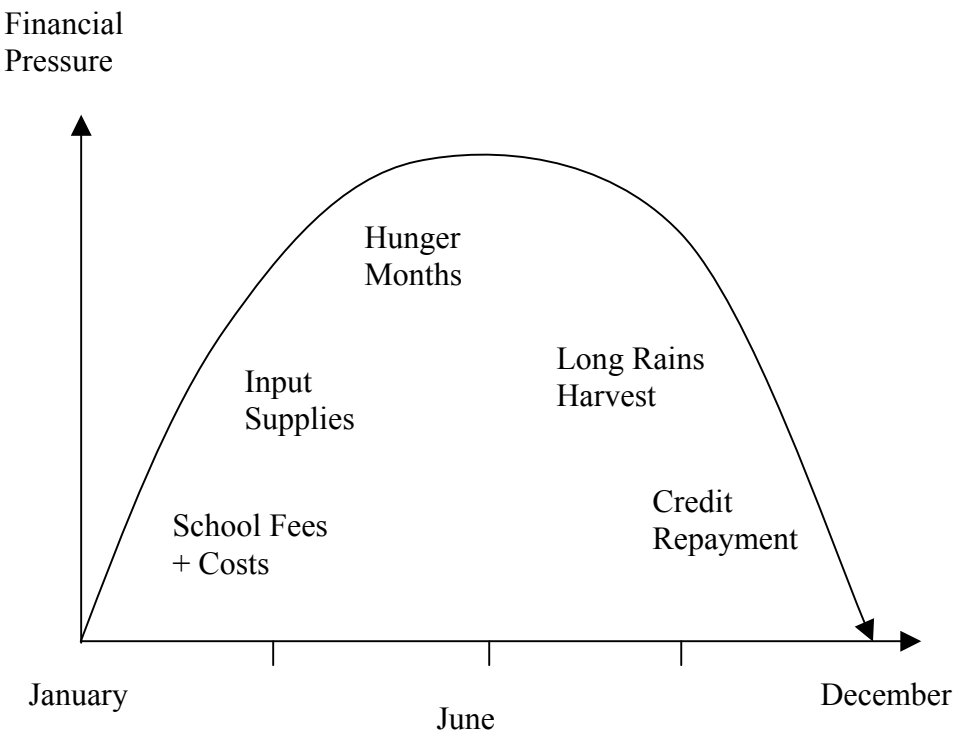
Acronyms

ASCA - accumulating savings and credit association
CAN - calcium ammonia nitrate (fertiliser)
COSOFAP - Consortium for Scaling up Options for Increasing Farm Productivity in Western Kenya
DAP - diammonium phosphate (fertiliser)
DFID – Department for International Development
DSS – decision support system
ICRAF – International Centre for Research on Agroforestry (now World Agroforestry Centre)
IITA – International Institute for Tropical Agriculture
KEFRI – Kenya Forestry Research Institute
KEPHIS – Kenya Plant Health Inspectorate Service
KShs – Kenyan Shillings
LR – long rains (season)
MDG – Millennium Development Goal
NGO – non-governmental organisation
NRSP – Natural Resources Systems Programme
OVI – objectively verifiable indicator
PPP – purchasing power parity
PRA – participatory rural appraisal
ROSCA – rotating savings and credit association
RP – rock phosphate (fertiliser)
SACCO - savings and credit cooperative
SCOBICS – Sustainable Community Based Input Credit Scheme
SCODP - Sustainable Community Oriented Development Programme
SR – short rains (season)
TSBF – Tropical Soil Biology and Fertility Institute
TSP - triple super phosphate (fertiliser)
UNDP – United Nations Development Programme
VCR – value:cost ratio

Introduction

According to the original project proposal summary, the purpose of Project R7962 was 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". Amongst the available "options", the original project outline made particular mention of phosphorus (P) fertilizers, given the chronic problem of phosphorus deficiency in the soils of the project area, along with new and/or improved crops. The main intervention envisaged to assist farmers in adopting such options was the establishment of a community-based credit scheme, whilst "decision support systems" were to be produced as vehicles for summarising and disseminating technical information on available options. From the outset, it was understood that these two interventions (credit plus technical information) had to go hand in hand. Whilst poor farm households needed access to information on "best bet" technological options to tackle the known biophysical constraints affecting their farming systems, it was also recognised that there was little chance of them adopting new technologies unless efforts were simultaneously made to relax the financial constraints that prevented many of them from using modern inputs.

Figure 1: Stylised Portrayal of How Credit Assists Household Cash Flow



Source: Paul Okong'o (Tatro Farmers' Association)

The cash flow constraints affecting households in the project area are illustrated by Figure 1. As pointed out by Paul Okong'o of Tatro Farmers' Association in Siaya District, the early months of each year are characterised by rising financial pressure. During this period, two major and unavoidable costs are incurred: school fees (now only for secondary pupils) and

associated costs (uniforms, books etc) in January, followed by food purchases as household stocks from the previous harvest(s) run out. A household that is short of cash (as most households in western Kenya are) will always give higher priority to these expenditures than to purchase of farm inputs, which comes in between them Thus, purchase of farm inputs tends to get squeezed out, even though greater use of purchased inputs could ease the financial pressure in future years by reducing the quantity of food that the household needs to purchase in and/or by producing agricultural surpluses that could be sold for cash. Okong'o explains to Tatro's members that credit is a way of helping them with their annual cash flows: providing extra cash when they most need it and allowing them to pay it back when the financial pressure on their household is low and/or easing.

Consistent with this, in the original project proposal summary it was envisaged that the project would be able to reach farmers "of intermediate wealth ranking in the scale of poor to very poor" (shown as Group 2 plus some of Group 3 in Table 1, which was an output from PRA work done by ICRAF staff in the project areas in the late 1990s and which was presented in the project proposal). The thinking behind the identification of this intermediate group as a target for the project was that households in Group 1 would have sufficient cash that they would not be interested in credit, whilst most households in Group 3 would be too poor to manage credit so as to be able to repay it.

Table 1: Soil Fertility Management and Resource Endowment of Farmers in Siaya and Vihiga Districts, Western Kenya

Group1 (Good soil fertility managers = 14%)	**Group2 (Average soil fertility managers = 22%)**	**Group3 (Poor soil fertility managers = 64%)**
- Uses inorganic and organic fertilizers - Land preparation and weeding done on time - Crop rotation practiced, fallowing practiced - Soil conservation structures present - Little striga - High yield	- Use organic and sometimes inorganic fertilizers - Land preparation and weeding done on time - Few practice crop rotation/fallowing - Few have soil conservation structures - A lot of striga weed - Medium yield	- Sometimes use organic during long rains - Late land preparation and weeding - Crop rotation not practiced/fallowing common - No soil conservation structures - A lot of striga - Very low yield
Resource endowment	Resource endowment	Resource endowment
- Off-farm income available - Visited by extension staff - Knowledgeable on modern farming practice - Hire labour - Have formal education/training	- Little off-farm income available - No visit by extension staff - Little or no knowledge on proper farming method - Labour available - Little formal education	- No off-farm income - No visit by extension - No knowledge on proper farming methods - Labour available and hired out - No formal education and training

Source: Mary Nyasimi

The project began in February 2001 and operated until June 2005. Table 2 summarises the specific areas of project operation and the contact groups through which the project has worked in each area. The operation of the community-based credit scheme – known as SCOBICS[1] - is used as an indicator of the scope of the project's activities in each year, as other project activities have in practice been organised around SCOBICS operation. With the exception of Kericho district, which is south-east of Kisumu, all the other locations are in highland areas north of Kisumu.

Table 2: Areas of Project Operation

		SCOBICS Lending				
Project Contact Group	District(s)	2001	2002	2003	2004	2005
Sauri Sub-Locational Committee	Siaya	√	√	-	-	-
Nyamninia Sub-Locational Committee (NYAMSAC)	Siaya	√	√	-	√	√
Tatro Farmers' Organisation	Siaya, Butere-Mumias	√	√	-	√	√
Gongo Catchment Committee	Siaya	-	-	√	√	√
Ebukhaya Catchment Committee	Vihiga	-	-	√	√	√
Ebusiloli Farmer Field School	Vihiga	-	-	-	√	√
Muyafwa Farmer Field School	Busia	-	-	-	√	√
Kaplelartet Catchment Committee	Kericho	-	-	-	√	√
Wakulima Youth Group	Vihiga	-	-	-	-	√

SCOBICS records show that, over the course of the project, loans have been given to around 790 individuals[2], of whom 52% were men and 48% women. During 2004 and 2005 the total number of loan recipients across all project areas has been 414.

In the following section, we explain the extent of poverty in the project areas and justify the focus of the project on agricultural interventions. We then set out the project's understanding of the agricultural challenge in the project areas, as it has clarified during the lifetime of the project and with the concept "diversification beyond maize" developed. The main body of the report discusses the project's experience with the two interventions highlighted in the original project summary - the establishment of a community-based credit scheme and the production of "decision support systems" for producers – along with work on input supply and market opportunities for crops produced in the project areas. This leads to the conclusion of the need for an "integrated intervention" approach. In the final section of the report, we return to the question of whether development interventions in the project areas should really focus on agriculture, by asking what agriculture can be expected to contribute to poverty reduction in the context of tiny farm sizes.

[1] SCOBICS stands for Sustainable Community Based Input Credit Scheme. Further details can be obtained from "A Guide to SCOBICS", which is being submitted to NRSP along with this report and which is also available upon request from Dr.James Ndufa (jndufa@africaonline.co.ke).
[2] The number of households involved may be slightly fewer than this.

This report draws heavily on four other reports produced by the project team:

- the report of the end-of-project Impact Survey conducted in May-June 2005, covering a total of 282 households (94 containing members who has borrowed from the SCOBICS credit scheme and 188 households with no direct participation in project activities) in three of the sub-locations listed in Table 2 (Gongo, Ebukhaya and Nyamninia);
- the report of a biophysical survey conducted in late 2004 – early 2005, covering 233 SCOBICS borrower households across the seven areas in which the scheme was active in 2004 (see Table 2);
- a report of the project's work on markets in the project areas and in Kisumu, conducted during 2003 and 2004;
- "A Guide to SCOBICS 2005", which describes the history and workings of the SCOBICS credit scheme.

Poverty and Livelihood Context

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[3], making it the poorest province in Kenya[4]. 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.

Kristjanson *et al.*, 2004 report official poverty rates specifically for Siaya and Vihiga districts. In 1999, 58% of Vihiga's population and 64% of Siaya's population fell below the rural poverty line (at US$0.55 per person per day, lower than the aggregate national poverty line discussed above). Poverty rates had risen in both districts during the 1990s. They cite high population densities and high levels of HIV/AIDS as major factors explaining these figures, noting that, "Siaya has the highest levels of HIV prevalence and HIV-related sickness and death rates in Kenya" (p2).

Drawing on local perceptions of poverty arrived at through participatory methods, their study showed that large numbers of households have moved out of, as well as into, poverty in these two districts in the past 25 years. Poor health, health-related expenses and funeral costs were the dominant factors highlighted by respondents as sending households into poverty, whilst households that escaped from poverty did so predominantly by having a household member obtain a job in the urban formal or informal sector or by diversifying on-farm income through cash crop production or investment in livestock (especially poultry or dairy).

Table 3 presents data from the impact survey on respondent household's main income sources. Nearly all respondents reported that their household received income from two (or more) sources during the previous twelve months, with about half of all respondents reporting

[3] As of 27/09/2005, US$1 = KShs 73. A year previously, on 27/09/2004, the rate was US$1 = KShs 82. The rate has fluctuated within this range during the life of the project. This means that a national poverty line of KShs 80 per person per day is approximately US$1 per person per day at *current* exchange rates. In other words, this is a much higher line than that used for monitoring progress towards the first Millennium Development Goal (MDG) – see footnote 30.

[4] Reported in "The Standard" newspaper, Thursday 26/05/2005.

that their household received income from three or more sources during this period. Thus, there is a fair degree of income diversification. However, crop production was overwhelmingly the most important income source, especially if considered in conjunction with horticulture (Table 3).

Table 3: Respondents' Ranking of Household Income Sources

Income Source	Rank (rank = 1 if main income source 2004/05, 2 if second source etc; 0 = not ranked in top three)				Total
	1	2	3	0	
Crop Production	99	110	36	27	282
Business	57	26	15	184	282
Casual Employment	38	38	13	193	282
Formal Employment	25	3	5	249	282
Remittances	24	19	14	225	282
Livestock	15	35	40	192	282
Horticulture	14	10	18	240	282
Pension	5	1	0	276	282
Other	2	2	1	277	282
Total	279	244	142		

Source: Impact Survey Report

According to Table 3, 35% of households ranked income from (non-farm) business activity as one of their three most important income sources and for many of these it represented the single most important income source entering the household. Casual employment[5] was also an important income source for over 30% of households. Meanwhile, whilst livestock production was the most important income source for just 5% of households, it was the second or third income source for many more.

By contrast, only 12% of households ranked income from formal employment as one of their three most important income sources and only six households benefited from pension income. Where such incomes were received, however, they were generally the most important income source entering the household. These figures provide some justification for a project focus on raising agricultural productivity and important context for later discussions on the most appropriate approaches for reducing poverty in these areas of western Kenya.

[5] We did not collect data that would allow us to assess the importance of casual on-farm labour within this. However, we did find that 38% of respondent households hired labour in and 29% of households hired labour out for agricultural activities during the long rains season 2005, with very similar figures also for short rains 2004. (In other words, hire of casual on-farm labour is common in the project areas).

Analysis of the Agricultural Problem

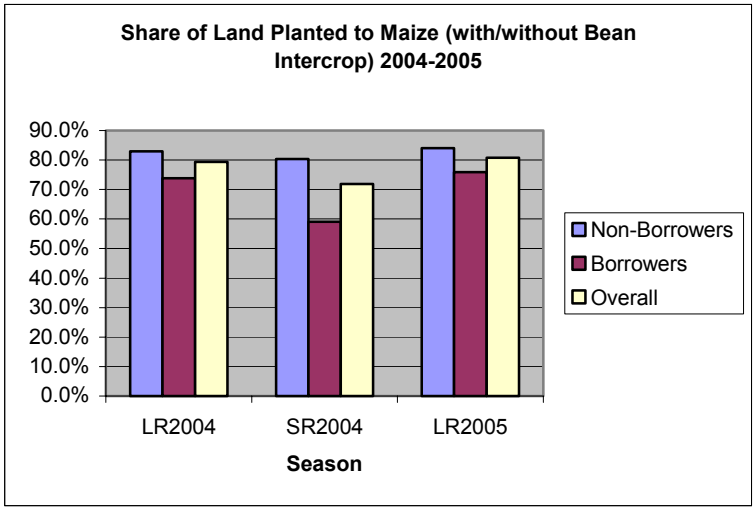
The agricultural potential of the project areas is open to debate. On the one hand, total rainfall is generally adequate across both rainy seasons, albeit more reliable and better distributed in the long rains season (March-July) than the short rains season (August-November). On the other hand, soils in the area 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.

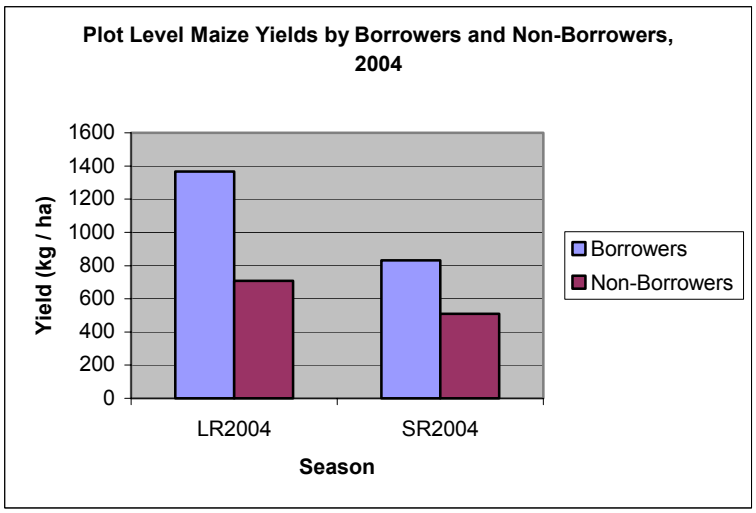
This analysis is supported by the following figures from the Impact Survey. Figure 2 shows the share of land planted to maize (with/without beans intercrop) during the most recent three seasons. Both borrowers and non-borrower households were found to plant around 80% of their land to maize during the two long rains seasons. Non-borrower households planted a similar share of their land to maize during the 2004 short rains season as well, while borrowers significantly reduced maize area during this time.

Figure 2



source: Impact Survey data

Figure 3



source: Impact Survey data

Figure 3 shows maize yields achieved by borrowers and non-borrowers during the two seasons of 2004. Whilst this figure again gives some initial indication of the effect of the project on households' agricultural performance (a topic we return to later), we note that even the yields achieved by borrower households fall well short of what an average household in this area needs to feed itself from its tiny land holding.

According to the impact survey data, the average household size in the three surveyed areas was 6.2 persons. In a year, a household of this size might expect to consume around 870kg of maize. Even at the mean yield achieved by borrower households during long rains 2004, this would require around 1.6 acres of land – considerably more than the 1.28 acres that the average household had at their disposal.

The impact of these low yields on household food self-sufficiency are shown by Table 4. 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 4: 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

Finally, according to the Biophysical Survey, 58% of the 545 plots cultivated by surveyed SCOBICS borrowers in the long rains 2004 season suffered from striga infestation.

Diversification beyond Maize

Households in the project areas are, therefore, caught in a trap. Unless they have a sizeable and reliable source of non-farm income (remember most are currently drawing on non-farm income just to buy maize and other basic food items), they need to generate cash from their agricultural activities in order to invest in their soils. However, they will only plant crops for sale[6] if they can first (or simultaneously) raise their maize yields, so as to feed themselves. Unfortunately, they cannot raise their maize yields without investing in their soils…

Policy dialogue regarding poor semi-subsistence farming households sometimes assumes that they can be persuaded to give up production of low value staple products, such as maize, so as to plant higher value crops. Then, from the money generated by the sale of these crops, they can buy their staple food products. However, the balance of evidence from surveys across Africa is that it is households that are already self-sufficient in staple foods that will *also* grow significant quantities of cash crops for sale. (These may be households with above-average land holdings or those that achieve above-average yields in their production of staple foods). In other words, households prioritise their own food production first. This is also the strong feedback that the project team has received from farmers with whom it has worked during Project R7962.

The reasons for this are not entirely clear. It has been argued by some that households are rational (in an economic sense) to prioritise production of staple foods, even when other crops generate higher returns, either because food prices are volatile (Fafchamps, 1992) or because marketing margins are large, hence farmers have to pay a much higher price to buy staple foods than they would receive if they sold them (Jayne, 1994). Project R7962 monitored prices over 20 crops in three local markets (Yala, Luanda and Siaya) on a weekly basis throughout 2003 and 2004. In 2003 the highest wholesale price recorded in all three markets was 90% above the lowest price recorded; in 2004 it was 60% above in two of the markets and 33% above in the third. These figures reveal quite significant inter- and intra-annual price

[6] Our assumption during the project has been that these additional crops will also generate higher returns than maize. We consider this point later in the report.

volatility, especially when we recall that western Kenya enjoys two growing seasons per year, and suggest that risk aversion may play some role in explaining the preference for own production. To the extent that this is true, measures to dampen price volatility, either by improving market efficiency or, in a deficit area, through raising and reducing the variability in local production levels, could encourage households to *plan to* depend on the market for a greater share of maize purchases. However, we cannot rule out the additional explanation that there is a strong cultural element to being self-sufficient in your staple food.

Either way, the approach taken by the project has been to assist households to raise their maize yields (with an emphasis on production in the long rains season), so as to free up land (principally in the short rains season) that can be planted to other crops. These other crops can then be used to pay for the inputs required to intensify maize production, hopefully also leaving cash over for other uses. In other words, the objective has been to create a sustainable cropping system that, in comparison with existing practices:

- leads to households growing and consuming more food;
- generates more cash from crop sales;
- is based on (and permits) greater investment in the soil resource base.

The approach of assisting households to raise their maize yields, so as to free up land that can be planted to other crops, we have called "diversification *beyond* maize". This is instead of the alternative (and, we believe, fruitless) approach of attempting to persuade households to diversify out of maize, i.e. stop growing it so as to concentrate on higher value crops.

Regression results from the Impact Survey report suggest that the diversification *beyond* maize approach is indeed consistent with farmers' own strategies and aspirations. Firstly, Table 5 presents the results of two different regression models explaining the maize yields reported by respondents for the long rains 2004 season. For current purposes, the important point to notice is that, holding other factors such as wealth level constant, the coefficient related to land holding size is both negative and significant. In other words, households with smaller areas of land at their disposal make extra effort to raise yield, so as to feed themselves. (A similar result was obtained from the biophysical survey data – see Table 10 – although this looks at plot-level, rather than household-level yields).

Secondly, Table 6 reports a regression seeking to explain the degree of crop diversification achieved by households in the short rains 2004 season. (It should be noted that the dependent variable used in this model was a Herfindahl index of crop diversification, for which a lower value signifies greater diversification). Here we see 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)[7]. 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).

[7] Thus, raising maize yield in long rains 2004 by a ton per hectare would, other things being equal, reduce the Herfindahl index in short rains 2004 by just six points (e.g. from its mean of 0.84 to 0.78). However, we expect that the coefficient associated with maize yields would increase if mean maize yields in the area increased (i.e. as more households approached food self-sufficiency) and possibly also if more clear market opportunities were identified for alternative crops produced by households in the project areas.

Table 5: 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
Total 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 6: 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

Coordinated Service Provision

Diversification *beyond* maize does indeed seem to be what households in the project area aim to do. However, the growing understanding during Project R7962 has been that households will only be able to do this if they can access a number of important support services. The original project document highlighted two of these. Firstly, it recognised that farmers need technical knowledge, on best cultural practices for any new crops that they seek to plant and, critically, on how to manage their natural resource base, so as to increase their yields both of maize and of the new crops. Secondly, it recognised that many will also need access to credit,

so as to be able to acquire inputs for more intensive maize production. The thinking behind the SCOBICS credit scheme was that this credit could then be repaid out of the sale of the additional crops later in the year.

Marketing work occupied a minor place in the original project document, but households must also have sufficient information about markets to be able to identify higher value cropping opportunities. Currently, many producers are only familiar with local markets, as they rarely visit any but the closest one (Table 7). They must also be able to market their crops once they have grown them. As they will only initially be able to offer small quantities of produce, which reduces their attractiveness to potential buyers, they may also need some facilitation to undertake marketing activities on a group basis.

Table 7: Proportion of Respondents Visiting Different Markets During the Previous Year

		Borrowers (n=92)	Non-Borrowers (n=183)	Total (n=275)
"Local"	Yala	49%	58%	55%
	Luanda	48%	40%	43%
	Siaya	13%	9%	11%
	Ugunja	8%	8%	8%
Kisumu	Kibuye	13%	9%	11%
	Jubilee	10%	5%	7%
	Kondele	4%	6%	5%
Busia	Busia	3%	2%	3%

Source: Impact Survey Report

Finally, producers need to be able to access good quality seeds of crop varieties that are both suited to their local production conditions and are demanded in the market-place. The importance of this point in the western Kenya context only became apparent as the project progressed.

Critically, all of these services need to be in place within the local area before poor households can hope to shift from a maize-only production system to one that delivers enhanced food and cash, whilst simultaneously enhancing the soil fertility on which future production depends (FARM-Africa *et al.*, 2004).

In the next sections we, therefore, look at what the project has done to provide each of these services to its participating households. From this we attempt to draw lessons regarding sustainable service provision for poor, semi-subsistence farm households. In all of the communities listed in Table 2, the entry point for the project was the SCOBICS credit scheme. Once agreement had been reached to provide SCOBICS loans to farmers in an area, other project activities (dissemination of decision support tools, on-farm demonstrations etc) were also introduced into the area, generally focusing on those farmers who were taking credit, although not restricted to these borrowers.

Technical Knowledge

In this section we first summarise what we have learned about existing crop and resource management practices, then examine the potential from additional fertiliser application (given the prominence attached to fertiliser within the SCOBICS credit scheme) and finally report the lessons from the project's attempts to expand farmers' knowledge of available options for resource and crop management and to enhance their capacity to make the relevant management decisions.

Current Practice: Organic Matter Management

Early participatory work with committee members from Sauri, Nyamninia and Tatro showed that producers in these areas were using a range of technologies (organic and inorganic) to manage their land. The importance of the different techniques varied by wealth status, with poorer producers, in particular, unable to afford chemical fertilisers.

More recently, the biophysical survey showed that a range of approaches was being used by SCOBICS borrowers to manage their soil fertility (Table 8). This table shows findings at plot level, with some households using different strategies on different plots. Organics here includes application of animal manure, compost or crop residues, natural fallowing or biomass transfer, as improved fallows and legume (soyabean) cropping are listed separately. About 44% of the farm plots received inorganic fertilizer alone whereas 39% of the plots received both inorganic and organic manures. The most common types of the fertilizers were DAP (diammonium phosphate), CAN (calcium ammonia nitrate), Urea and TSP (triple supper phosphate). In 87% of cases, the fertilizers in question were obtained through the SCOBICS loans scheme. We would expect non-borrowers to use inorganic fertiliser less frequently than borrowers, given the affordability constraint.

Table 8: Proportion of Plots Under Different Land Management Regimes, by Area

Project area	No inputs	Organic only	Inorganic Fertilizer only	Fertilizer + Organics	Improved fallows + fertilizer	Legume + fertilizer	Total (%)
Tatro	11.4	17.1	36.6	27.6	0.8	6.5	100
Nyamninia	-	18.2	40.9	27.3	-	13.6	100
Gongo	2.7	2.7	46.6	39.7	-	8.2	100
Muyafwa	7.7	7.7	46.2	17.9	17.9	2.6	100
Ebukhaya	1.5	4.6	50.8	43.1	-	-	100
Ebusiloli	4.7	17.6	27.1	44.7	-	5.9	100
Kaplelartet	6.4	12.8	57.4	23.4	-	-	100

Source: Biophysical Survey Report

A disappointing finding of the Biophysical Survey Report was that use of organic technologies apparently had negligible effect on crop yields, at least in the short term (i.e. ignoring longer term benefits for soil structure etc). Plots were classed into four management categories – no inputs, organic only, inorganic only and integrated (organic + inorganic). In

long rains 2004 the mean maize yields realised on plots under inorganic and integrated management were significantly higher than those realised on plots where no inputs or organic technologies only were used. However, no significant difference was found either between no inputs and organic or between inorganic technologies only and integrated management[8] and nutrient application from organic sources did not come out as a significant determinant of yields when included in equations such as the one recorded in Table 10. One of the problems was that animal manure and compost were supplied at insufficiently high rates to contribute much in the way of nutrients to the soil (especially in comparison to the nutrients obtained through inorganic fertiliser)[9]. However, a related problem is that households are not well informed about methods of preparing and using compost and manure. As a result, and because of limited availability, the nutrient content applied of these inputs is believed to be low.

It is also worth commenting upon the extremely limited use of fallows (either natural or "improved" tree fallows) found by the project's final surveys. The one exception to this is Muyafwa, which is a drier area than the others, such that other crops do less well in the short rains season. Similar findings were recorded during the impact survey, where only 0.4% of land was placed under improved tree fallows during short rains 2004. This is notable given the efforts made by ICRAF to promote improved fallows during the 1990s and their prominence within the UN Millennium Project report (UN Millennium Project, 2005) based in some part on experience in western Kenya. By contrast, 5.6% of land was left to natural fallow and 3.5% was planted to soyabeans in single stand (with more planted to soya in various intercropping arrangements). Feedback from field demonstrations conducted during the life of the project indicated that, where land holdings are very small, farmers are reluctant to put land under improved fallows, despite the benefits in terms of future yields. The dual purpose soyabeans promoted by the project (in collaboration with TSBF) appear to have more potential for adoption by farmers looking to enhance the fertility of their soil on very small holdings, because they generate nutrition and cash benefits, in addition to their contribution to soil fertility. These two observations reinforce our proposed strategy 'diversification beyond maize' as a viable entry point.

Table 9: Land Management Regimes, by Plot Type

Soil fertility perception	No inputs	Organic only	Inorganic Fertilizer only	Fertilizer + Organics	Improved fallows + fertilizer	Legume + fertilizer	Total
Good	5.7	5.7	38.6	39.8	2.3	8.0	100
Medium	3.7	6.5	43.7	39.6	1.6	4.9	100
Poor	11.6	26.4	31.4	25.6	1.7	3.3	100

Source: Biophysical Survey Report

[8] This was true when all plot types were considered together and generally true even when the analysis was conducted separately for plots ranked by respondents as having good, medium and poor soil fertility respectively. The one exception occurred for plots ranked by respondents as having medium soil fertility. Here, the mean maize yield under integrated soil fertility management strategies exceeded that realised when inorganic fertiliser alone was used.

[9] Organic sources contributed just under 24% of nitrogen and 8% of phosphorus on plots surveyed during the Biophysical Survey.

Meanwhile, Table 9 considers land management regime by plot type, where plots are classified according to their soil fertility status as perceived by the farmer. This soil fertility status may reflect past land management practices on the plot. However, susceptibility to striga also contributes significantly to farmers' perceptions: 83% of plots classed as low soil fertility status suffered striga in long rains 2004 compared to only 19% of plots classed as high soil fertility status.

Table 9 shows that farmers appear to differentiate in their input resource allocation according to soil fertility. On poor quality plots they are more likely to cultivate without applying any inputs or using organic technologies only. In contrast, on either medium or good soil fertility status plots, they use predominantly inorganic fertilizers alone or combined with organics. In relation to the amounts of nutrients applied per unit area large variations were observed and no significant differences between soil fertility status occurred.

The project has so far only taken initial steps towards devising different management recommendations for plots of different soil fertility quality, e.g. the DSS for striga infested plots (i.e. poor soils) recommends a variety of strategies. However, this is an area worthy of further consideration in future for both organic and inorganic management options. In particular, might tree fallows be experimented with as a technology for restoring plots of low soil fertility while farm yard manure plus inorganic fertilizer are used for the more fertile plots? On low soil fertility plots, the opportunity cost of missing a season's harvest is much lower, whilst tree fallows act as an effective break crop for striga.

Practice and Potential: Inorganic Fertiliser

Demand for fertilisers amongst farmers in the project areas is high and hence there has been huge interest in the SCOBICS credit scheme as a means by which farmers can access them. However, is fertiliser use profitable? Using a cross-sectional approach, the Biophysical Survey Report was able to assess crop response to fertiliser amongst SCOBICS borrowers.

Table 10: Determinants of Maize Yield in Long Rains 2004

Variable	Coefficient	Significance
Constant	1191.9	.000
Total Nutrients (N+P) in Inorganic Fertiliser (kg/ha)	8.46	.000
Available Land Area (acres)	-284.2	.000
Dummy if Perceived Low Soil Fertility Status	-340.6	.000
Dummy if Late Planted	-211.6	.004
Dummy if Anyiko, Nyamninia or Kaplelartet	620.0	.000
Dummy if Ebusiloli	-528.3	.000
F =	46.4	.000
$\mathbf{R^2}$ =	0.38	

Source: Biophysical Survey Report

Table 10 presents a regression analysis of plot-level maize yield in the long rains 2004 season. Various specifications of this model were tested, also incorporating management variables such as the number of times the plot was weeded. However, the latter was rarely significant. A variable recording the incidence of striga in a plot was too closely correlated with the dummy for perceived low soil fertility status for both to register as significant in the same equation. Surprisingly, a seed type dummy (distinguishing hybrid seed from local) was never significant, whilst a variable capturing seed application rate was only significant in a minority of model specifications.

Table 10 reinforces the point made earlier that farmers try to achieve higher yields when they have less land available to them (although note that Table 10 uses plot-level and not farm-level data). It also shows the significance of soil fertility gradients across plots, with plots of low soil fertility status recording yields of 340 kg/ha (135 kg/acre) less than plots of medium or good fertility, *ceteris paribus*.

The multiple regression also records significant area effects, which we believe capture either inherent differences in soil quality (better in Kaplelartet where land pressure is lower and regular fallowing still occurs; lower in Ebusiloli, where land pressure is highest) or better agronomic practices (in Tatro due to the farmer-farmer extension promoted by the Tatro group; in Nyamninia because all but the most dedicated farmers were excluded from SCOBICS in 2003). Ultimately, however, the R^2 of 0.38 means that plenty of yield variation remains unexplained by the model.

Turning to fertiliser application, the variable used was the total quantity of nitrogen and phosphorus nutrients supplied through inorganic fertiliser application. Table 10 shows that, for every kilogramme of nitrogen and/or phosphorus nutrients applied in the long rains 2004 season, maize yield rose by around 8.5 kg/ha. This is a disappointingly low response rate.

Table 11 converts this physical response rate, plus a similar calculation done for the beans that were commonly intercropped with the maize in the surveyed plots, into an assessment of the economic profitability of fertiliser application, using the value:cost ratio (VCR). The VCR is the value of additional yield obtained from fertiliser use, divided by the cost of the fertiliser used. As a rule of thumb, "a ratio equal to two [is generally considered] as the minimum requirement for a farmer to adopt fertiliser and a ratio of three or four to be necessary when production or price risk is high" (Kelly, V.A. *et al.*, 2005, p14).

According to Table 11, the value:cost ratio realised by the surveyed farmers only ranged from 1.48 to 1.88 (i.e. below 2), depending on the time at which the crops were valued. This supports the perception that emerged from participatory budgeting workshops (see below) that fertiliser application on maize and beans is not a particularly profitable activity for farmers in the project areas under current circumstances. However, what Table 11 does not capture is the benefits that are gained from fertiliser application if the resulting higher yields allow him or her to free up scarce land for planting to other crops. Fertiliser application may thus still be profitable as part of a broader strategy of diversification beyond maize.

Table 11: Value:Cost Ratio (VCR) for Fertiliser Application on Maize and Beans, LR 2004

Maize Response per kg Nutrient	8.5	
Beans Response per kg Nutrient	1.02	
Weighted Price per kg Nutrient (KShs)[10]	103	
	After Harvest	Peak Price
Maize Price (KShs / kg)	15	18
Revenue per kg Nutrient	128	153
Beans Price (KShs / kg)	25	40
Revenue per kg Nutrient	25.5	40.8
Total Incremental Revenue (KShs)	153	194
VCR	1.48	1.88

Source: Biophysical Survey Data

We suggest four reasons why the VCRs reported in Table 11 are low:

- Most obviously, the price of fertiliser is high in western Kenya. Moreover, the prices used for calculating the VCRs reported in Table 11 include the 20% interest charged on SCOBICS loans. (Without this interest charge, i.e. making the unrealistic assumption that farmers could obtain the inputs on a cash basis and ignoring the opportunity cost of their capital, the VCR under the peak price option rises to 2.26);
- As mentioned earlier, the need for continual applications of phosphorus because of the nature of soils within the project areas adds to cost – and hence reduces VCRs – compared with a situation where mostly nitrogen needs to be supplied through inorganic fertiliser application;
- Related to this, the fertiliser variable in Table 10 was a simple aggregation of kilogrammes of nitrogen and phosphorus applied, with no reference to the balance of nutrients that farmers were applying. In fact, the Biophysical Survey Report showed that, whilst median phosphorus application was at the level recommended by the Ministry of Agriculture (i.e. 21kg of elemental P per ha), only 13% of farmers applied nitrogen at or above recommended levels (60kg of elemental N per ha). Thus, relatively speaking, too much phosphorus was applied relative to nitrogen, limiting the response to the phosphorus applications. On almost all plots (96%) where inorganic fertiliser was applied, DAP was applied as a basal fertiliser. This could often supply all the recommended phosphorus. However, in only 64% of cases was any top dressing (CAN or Urea) applied, meaning that many plots received insufficient nitrogen relative to phosphorus. Moreover, even where top dressing was applied, the proportion of total nitrogen supplied at this stage was much less than would be recommended[11,12]. This behaviour is partly the legacy of years of promotion of DAP by the Ministry of Agriculture in western Kenya. ICRAF also promoted primarily phosphorus fertilisers (rock phosphate and TSP) on the assumption that farmers could obtain the required

[10] This was calculated taking into account the quantities and prices of different types of fertiliser used, and the N and P composition of each.

[11] It is recommended by the Ministry of Agriculture that twice as much nitrogen is applied as top dressing as is applied as basal dressing. However, in only 11 cases (out of 454 plots) was this ratio achieved or exceeded.

[12] Having made these observations about the inefficiency of fertiliser use, we note that, when we tried to incorporate variables capturing appropriate balances of nutrient application in regression equations to explain maize and beans yields, these either came out as insignificant or had the wrong sign.

nitrogen inputs from organic sources - something that our data suggests that they do not do. However, even Project R7962 only first included top dressing fertiliser (CAN and Urea) within the SCOBICS credit scheme in 2004, although draft decision support tools had highlighted the importance of top dressing fertiliser prior to this. Thus, the majority of farmers surveyed for the biophysical survey in 2004-05 had had relatively little exposure to messages about the importance of top dressing;

- Finally, although Table 9 showed that farmers were less likely to apply inorganic fertiliser on plots considered to have poor soil fertility, the Biophysical Survey Report showed that, where they did apply fertiliser on such plots, they sometimes did so at higher rates than they used on plots with good soil fertility[13]. Given the problems of striga in most of these low soil fertility plots – and the resulting low yields achieved – this represents something of a wasteful application of fertiliser (reinforcing the earlier point about considering extension advice differentiated by plot type). If a separate regression is run to explain yields only on plots of medium or good soil fertility status, the maize response to nutrient application rises fractionally to 8.9 (still only enough to give a VCR of 1.95 in the high crop output price scenario).

In conclusion, fertiliser application on maize and beans is at best a marginally profitable activity for farmers in the project areas under current circumstances, and this only if adopted as part of a broader strategy of diversification beyond maize. High fertiliser prices obviously reduce profitability of use, whilst the inherent soil characteristics of the area mean that more fertiliser is required to generate a crop response than in some other areas. It also has to be noted that soil fertility problems in the area are not only due to P and N deficiencies, e.g. some 20% of soils also suffer from potassium deficiency and it has been noted in other projects and experiments that there are soil degradation effects relating to other less well defined problems (soil structure, pH, etc). However, there are also improvements that could be made to on-farm fertiliser management, so as to raise the profitability of fertiliser use. These include achieving a better balance between phosphorus and nitrogen application through sufficient top dressing and concentrating fertiliser application on plots where crops are better able to respond (especially plots free of striga, unless the maize variety used is striga resistant). These insights should feature in future advice provided to farmers in the area.

Project Activities: Decision Support Tools

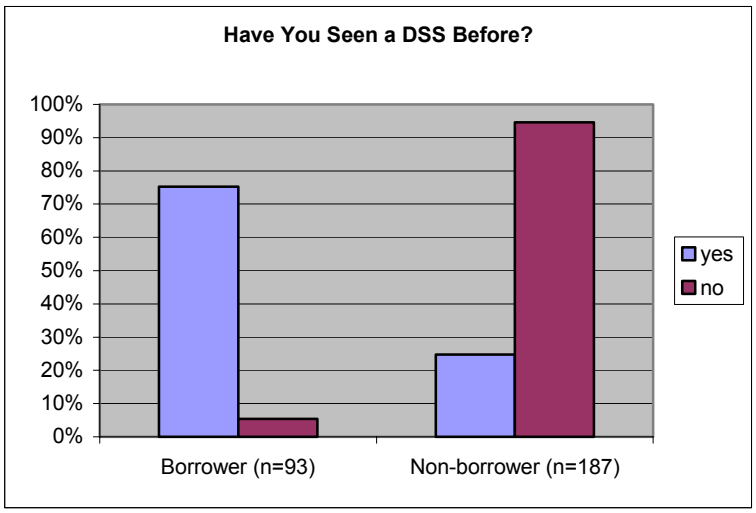
The project team produced and disseminated three pictorial decision support tools (DSSs) for use by farmers. These posters (which covered respectively better land management, correcting nutrient deficiencies and striga weed control) were developed in consultation with selected farmers, who commented upon them during two workshops dedicated to their development. Once finalised, all group contact persons within the SCOBICS credit scheme were trained in the use of the three available DSSs in 2004. In addition, the DSSs were presented at the annual Credit Information Days held in each area in late 2003 and late 2004[14]. Further feedback on the DSSs was received from a variety of stakeholders (farmers, extension staff, NGOs and input stockists) at a multi-country workshop held in April 2004. In response to the feedback from this workshop, the DSSs have been revised and simplified in preparation for

[13] It is commonly thought that application of N helps to 'outgrow' striga damage.

[14] The project proposal also talked of a DSS for credit management. However, during project implementation it was decided that it was not feasible to produce such an item. Instead, all borrowers now receive training on credit management both at the Credit Information Days and in their groups.

broader dissemination within western Kenya and further afield (Kenya, Tanzania, Uganda) as part of the dissemination follow-up project to R7962, known as R8400 ("NRSP Uptake Promotion in East Africa").

Figure 4



source: Impact Survey data

Figure 4 shows that it remains essentially borrower households who have seen the DSSs. Responses from borrower households claiming that they have not seen a DSS are explained partly by the fact that DSSs were not actively promoted even amongst borrower households until 2004 and partly by the fact that the questionnaire respondents may not have been the household member who had been trained in DSS use. However, this latter explanation also suggests that intra-household transmission of such information is weak.

Encouragingly, most of those who had seen the DSSs claimed to be using them and also to gain benefit from doing this. A total of 80 respondents claimed to have seen a DSS. The majority of these had seen it/them either at a training day organised by the project (46), at a contact person's home (14) or at a credit information day (12)[15]. Of these 80 respondents:

- 69 said that they could access a DSS if they wanted to, with a SCOBICS borrower group contact person's home (49) or project staff (11) being the most commonly cited places where they could do this;
- 68 said that they knew someone who could explain the DSS to them if they needed this, with contact persons (44) and project staff (12) being the most commonly cited people who could do this. A further 12 were confident that they could explain the DSS themselves (probably because they were themselves contact persons);
- 58 claimed to have used a DSS(s) when planning their cropping activities for short rains 2004 and 61 when planning their cropping activities for long rains 2005;

[15] Credit Information Days are annual events organised by the SCOBICS credit scheme in all its areas of operation at which staff explain to current and prospective future borrowers the procedures for applying for a loan for the next lending cycle. Staff also use these opportunities to reinforce the technical (agricultural) knowledge of borrowers, so as to enhance their chances of making productive use of their loans and being able to repay them out of an agricultural surplus.

- 63 claimed to have made changes to their cropping activities as a result of referring to a DSS. The claimed changes could be grouped into two: commencing crop rotation and in some cases also other good agronomic practices (34), and commencing use of top dressing fertiliser, compost and/or striga resistant maize varieties (29). 56 of these respondents reported benefits as a result of the changes (principally better soil fertility, higher yields and greater income from farming) with just two stating that they had not seen benefits (and 5 missing data points).

These results show the potential benefits from dissemination of clear and well-presented information on improved farming practices. However, so far dissemination has largely been restricted to farmers participating in the SCOBICS credit scheme. As most of these farmers have been thoroughly trained in the use of the DSSs, it is difficult to say how useful they would be to a farmer who encountered them without receiving training. The thinking during Project R7962 was that, if resource persons within villages were trained in the use of DSSs, then they could assist neighbouring farmers to use them for their own planning purposes[16]. However, the additional efforts to simplify the DSSs as part of Project R8400 is recognition that use of the DSSs will probably spread faster amongst poor, often semi-literate farmers if they are more readily understood by someone who has not received special training. On the other hand, there are limits to how far one can simplify such products if their aim is to provide information on a variety of possible crop and soil fertility management options (suitable for households with differing resource endowments), rather than to prescribe a single technological package.

Project Activities: Participatory Evaluation of New Crops and Varieties

The project also organised a number of on-farm demonstrations to expose farmers in project areas to new crops (primarily soyabean) and varieties (most notably, striga-resistant maize varieties developed by Western Seed Company and rosette-resistant groundnut varieties). Field days were held wherever there were demonstrations and farmer-farmer visits were organised, so that farmers from different areas of project operation could exchange views and experiences.

There are two strong parallels between the findings of the Impact Survey with regard to on-farm demonstrations and to DSS dissemination. Firstly, as with the dissemination of DSSs, the Impact Survey found relatively little diffusion of the knowledge generated by the on-farm demonstrations beyond SCOBICS borrowers and almost none beyond the villages where these borrowers live. This mirrors the findings of recent research evaluating the impact of low external input agriculture projects (http://www.id21.org/society/r2rt2g1.html).

[16] Ten impact survey respondents from non-borrower households claimed to have seen a DSS prior to being shown one during the survey. Of these, only one claimed to be using DSSs in their agricultural planning. They claimed to have done this in both the 2004 short rains season and the 2005 long rains. They had heard about DSSs at a field day and had subsequently been able to talk to a project contact person about the information contained within them.

Table 12: Sources of Information about On-Farm Demonstrations

	Borrower	Non-Borrower	Total
Another Farmer	18	17	35
Contact Person	31	2	33
Project or NGO Staff	22	1	23
Chief's Baraza	6	4	10
Self-Observation		5	5
Extension Worker	3		3
TOTAL	80	29	109

Source: Impact Survey Report

Table 12 shows how respondents to the Impact Survey, who had heard about the demonstrations, had heard about them. This shows the importance of farmer-farmer communication and, amongst borrower households, particularly the role played by the credit group contact persons. It is difficult to draw any conclusions about the effectiveness of chief's "barazas" from this table, because we do not know how many of the demonstrations in question were publicised through such meetings. However, the limited importance of local extension workers as a source of information is noteworthy. Indeed, they appear to have been of no significance except when working in conjunction with the project! This reflects, amongst other things, the chronic lack of resources made available to extension staff (e.g. almost no fuel for their motorbikes or, alternatively, fares for public transport).

Before overly pessimistic conclusions are drawn about the ability to disseminate new knowledge to smallholder farming communities, however, it should be pointed out that the project did not place great emphasis on contact persons reaching out beyond their fellow borrowers, for whom they felt particular responsibility. Indeed, at a project review workshop held in Yala on 24/5/2005, some contact persons explained that they had not realised that the project wanted them to disseminate information beyond their fellow borrowers. Now that they appreciated this, they would happily share information with others. Similarly, as local (sub-) chiefs have become better informed of the project's activities, they have expressed interest in working with project staff to scale-up the project's interventions within their sub-locations.

Secondly, a high proportion of those who acquired new knowledge through the on-farm demonstrations claimed to make use of this knowledge. Many were obviously impressed by the performance and/or potential of both the soyabeans and the striga resistant maize varieties that were being demonstrated. However, there was also some indication from the Impact Survey that such demonstrations can be useful vehicles for encouraging changes in cultural practices, e.g. spacing (Table 13).

Table 13: Changes Made to Farming Practices as a Result of On-Farm Demonstrations

	Borrower	Non-Borrower	Total
Planted Soyabeans (in some cases, also groundnuts)	28	1	29
Use of Recommended Spacing	10		10
Plant Striga Resistant Maize / Change Maize Variety	10		10
Use fertiliser, improved seeds and legumes	6	4	10
Top dress	1		1
TOTAL	55	5	60

Source: Impact Survey Report

Participatory Budgeting

During 2002 and 2003 the project made some initial attempts to encourage SCOBICS borrowers to keep records of their expenditure and labour input into particular crop production activities so as to construct activity budgets that could be used to assess the returns from different crops and technologies (use of improved seed, fertiliser use, other soil fertility enhancing technologies). Two half-day workshops were held on the subject and on several subsequent occasions forms to assist farmers to keep records were distributed to any farmers who wished to take them. However, the impression gained at the time was that, whilst farmers found it interesting to attend the workshops and discuss the worked examples that were developed there, the concept of keeping records at home was an alien one for which the time was perhaps not yet right.

As part of the impact survey, respondents were asked about their experience with budgeting. Perhaps surprisingly, half of the respondents who had attended a budgeting workshop (again, almost entirely SCOBICS borrowers) claimed to have kept (or to be keeping) records and to have constructed a budget for at least one plot during both short rains 2004 and long rains 2005. We did not ask to see evidence of this, so there may be an element of "telling the researchers what you think they want to hear" in these responses. In all cases, it was claimed that the budgets being constructed related to some combination of maize, beans, groundnuts and soyabeans. Asked about what they had learnt from their experience, respondents tended to give rather general answers such as the benefits of keeping records and treating farming as a business, whilst the main claimed change to cropping practices as a result of record keeping was equally general: "plant profitable crops". Amongst those who said that they had made no changes as a result of budgeting experience, the main reasons given were "not food secure" (8) and "no capital to adopt new technologies" (7).

It is hard to know how to interpret these findings. Benefits from budgeting are most likely to accrue once a farmer – or preferably a group of farmers – has constructed a sufficient number of budgets to be able to compare across crops and varieties, allowing for idiosyncratic effects in particular seasons and for changes in relative market prices. It is possible (although more evidence would be desirable to confirm or refute this) that a small group of farmers with an interest in crop budgeting does now exist, in which case further input to help them compare results and lessons would be beneficial.

SCOBICS Credit Scheme

As already indicated, the SCOBICS credit scheme has been Project R7962's main entry point for engagement with new communities and farmer groups. It is also the aspect of the project that has aroused the most interest amongst other communities and farmer groups in western Kenya [Q.Noordin, *pers.comm*.].

The development of the SCOBICS credit scheme was designed to address two sets of research questions:

- Could a sustainable agricultural microfinance model be developed for semi-subsistence smallholder agriculture in a poor region such as western Kenya? This is part of the broader agenda of "shifting the frontier" of microfinance in Africa (Johnson *et al.*, 2004), but also specifically addresses the question of whether traditional microfinance models can be adapted to cope with the particular demands of seasonal lending in agriculturally-dependent communities. So far, semi-formal[17] microfinance lending in Africa has largely ignored clients whose primary economic activity is seasonal agriculture, as pronounced seasonality, risk covariance, the need for 9-12 month loan cycles and the inability to make regular loan repayments do not fit well with conventional microfinance lending products (Dorward *et al.*, 1998; Morduch, 1999).
- Would access to credit assist adoption of crop and soil fertility technologies by resource-poor farmers?

We address the first of these questions in this section and the second in the penultimate section of the report.

The Evolution of the SCOBICS Lending Model

SCOBICS began with efforts by ICRAF in 1999 to promote the use of rock phosphate fertiliser amongst farmers in pilot villages of Sauri sub-location, Siaya District, through the provision of credit in kind. Under ICRAF management, the pilot credit scheme expanded to take in an additional sub-location (Nyamninia) plus a range of groups associated with the Tatro farmers' organization. It also expanded to support provision of improved maize and bean seeds as well as the original rock phosphate (RP) fertiliser. In 2001, the management of the scheme was transferred to the Project R7962, its mode of operation changed and the name SCOBICS was born. As shown in Table 2, in the 2003 long rains season, two Ministry of Agriculture and Rural Development extension "focal areas" - Ebukhaya and Gongo - joined the scheme. As of October 2003, the total size of the scheme was KShs 435,388[18].

Up to and including the 2003 lending cycle, the scheme worked through either village / sub-locational or catchment committees. These were originally established either by ICRAF or by the Ministry of Agriculture and Rural Development to support the promotion of agricultural production technologies. Under SCOBICS, committee members played a key role in deciding which farmers could deservedly receive credit and in channelling repayment from these farmers back to KEFRI. Starting with the 2002 long rains season, each sub-locational committee was given an annual credit allocation, based on the previous year's repayment

[17] Some informal lending organisations, such as SACCOs, do serve significant numbers of agricultural clients, albeit more often cash crop farmers than semi-subsistence food producers whom the project worked with.
[18] Some of this represents loans outstanding since 2002.

performance, and was given the responsibility of compiling farmers' requirements for RP, TSP and DAP fertilisers, plus maize and beans seed, up to the total sum fixed by SCOBICS. How the committees accomplished this was left up to them. The compiled requirements were returned to KEFRI-Maseno by the beginning of December and a competitive tendering process was instigated to choose a supplier for the products demanded. The winner of this process[19] was contracted to acquire the required inputs, repackage them as necessary and distribute them to a central location within each of the three sub-locations. This distribution took place in early February, in good time for planting in the long rains season.

The administration and recovery of credit represented a significant additional responsibility for committee members and one that was not always compatible with their original roles. Therefore, for the 2004 long rains season a new system of operation, based on smaller borrower groups, was introduced. Under this new arrangement, lending is based on borrower groups of 5-10 members. These are either groups of borrowers from existing areas who have repaid their previous loans, new members accepted into such groups by existing members or groups of new borrowers in newly accepted areas. Borrowers are required to organize themselves into groups, i.e. select whom they wished to associate with. Any prospective borrower who is not accepted into a group by his/her peers is not allowed to take a SCOBICS loan. Each group also selects a "contact person", who acts as the main channel of communication between SCOBICS and group members as a whole.

Each group is given a credit allocation for the year. In the case of established groups, this is based on the total value of loans repaid by group members in the previous year. In the case of new areas, it is a proportion of the initial allocation made to the new sub-location or catchment as a whole. It is then up to group members to decide how to divide this allocation amongst themselves. Once the inputs are delivered to members, it becomes the responsibility of group members to encourage each other to repay their loans. Each contact person (a total of 46 within the scheme in 2004) has been trained in record keeping. It is their responsibility to collect loan repayment from group members and pass the sums collected onto SCOBICS staff.

SCOBICS has also continued to expand both geographically, as shown in Table 2, and in terms of the products supported. Thus in 2005 borrowers could obtain top dressing fertilisers, soyabean, groundnut and horticultural seeds, as well as the products mentioned above. In 2005 the total value of loans disbursed was KShs 1,269,838.

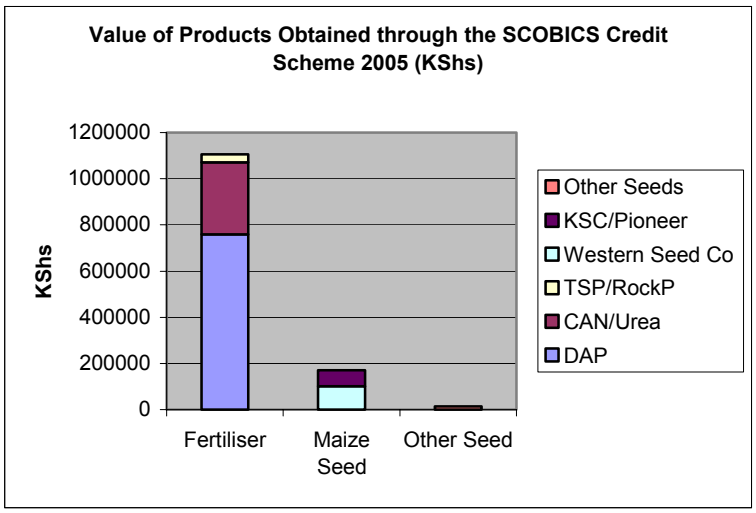
Figure 5 shows that DAP fertiliser represented the major part of this total (59%), with fertiliser more generally accounting for 86% of the value of lending. The two phosphate fertilisers, that had been promoted by ICRAF in the 1990s, accounted for less than 3% of the value of lending in 2005. In 2001 rock phosphate was the only fertiliser supported by the scheme. In that year, 2215kg were supplied through the scheme, with a total value of KShs 39,870. In 2005, only 350kg of rock phosphate fertiliser were demanded by SCOBICS borrowers.

Aside from fertiliser, maize seed occupied most of the rest of the lending, with striga-resistant varieties developed by Western Seed Co. (only introduced into the scheme in 2004) more

[19] For both 2002 and 2003 the winner was Jumbo Agrovet, an input stockist with a store in Luanda. The tendering process remains a part of the operation of SCOBICS. In 2004 the winner was SCODP. In 2005 three stockists – Midland Emporium, Soko Farm Inputs and Jumbo Agrovet – were selected to each deliver part of the scheme's total requirements.

demanded than conventional hybrids produced by Kenya Seed Company or Pioneer. This is one indicator of the impact of the on-farm demonstrations, when combined with ready access through SCOBICS to the products that farmers had been most impressed with.

Figure 5



source: SCOBICS database

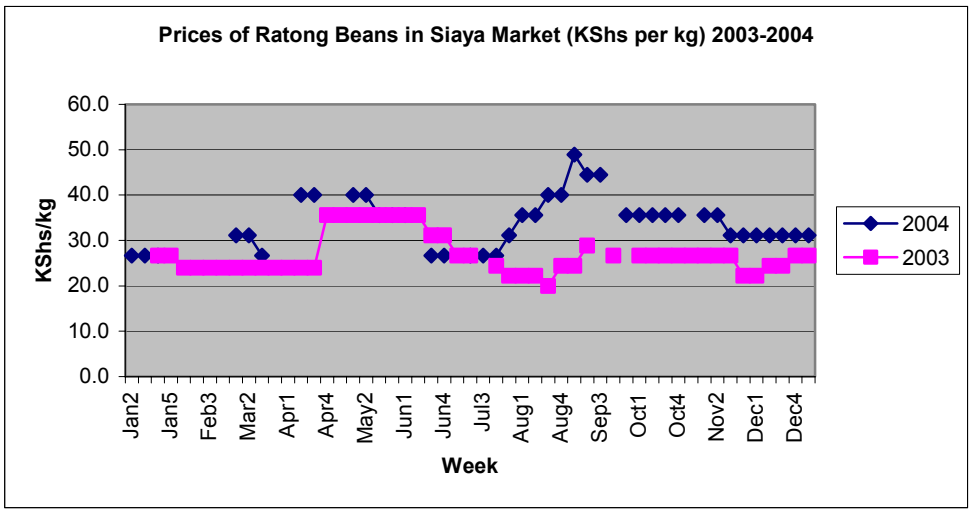
Novel Features of the SCOBICS Loan Product

From the start, one of the aims of SCOBICS has been to reach a sufficient scale and repayment performance that it could be taken on by an established microfinance organisation as a pilot for an agricultural loan product of their own. Whilst this product would share some features of existing microfinance loan products (e.g. since 2004, the emphasis on lending through groups of 5-10 borrowers), the SCOBICS product is different from traditional microenterprise loans in a number of important respects. These novel features are designed to tailor the product to the conditions and needs of seasonal smallholder agriculture.

Most obviously, SCOBICS loans are made on the basis of an annual cycle, rather than being for 3-6 months. In theory, this could allow borrowers to acquire inputs to intensify maize production in the long rains season, then, having secured the household's basic food needs for the year, to concentrate on production of other crops during the short rains season in order both to replenish the soil (legume cultivation) and earn cash through which the loan could be repaid. Some borrowers in the Kaplelartet area have suggested that a shorter-term product could also be tested, with loans taken and repaid twice a year. Conversely, some borrowers have requested a longer lending cycle, as commodity prices are still at quite low levels in December and indeed remain so through until April (Figure 6)[20]. If they could repay in April, prices of beans, soyabeans and groundnuts would be significantly higher. However, this is incompatible with lending for the next long rains season, for which inputs have to be acquired by mid-February.

[20] Our more complete weekly price series for maize shows prices rising as early as February in 2004, but staying low until April in 2003.

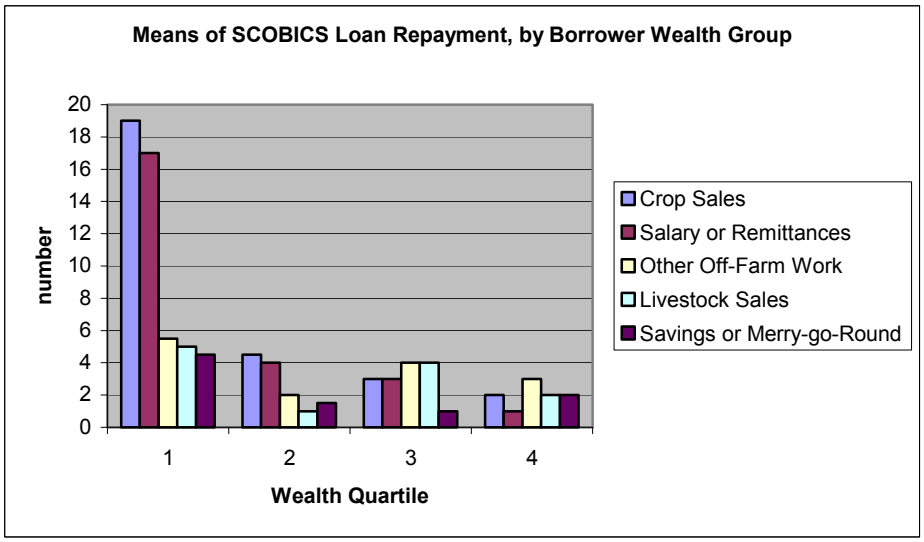
Figure 6



source: weekly market data collected by project

Secondly, no loan repayment has been required prior to the long rains harvest, as this is the main "hunger period" for poor households. Moreover, whilst the project staff member responsible for SCOBICS has visited all contact persons to encourage repayment on a monthly basis from July onwards[21], no fixed repayment instalments are specified. All that is actually required is that loans are repaid by the end of the loan period. This is because, whilst borrowing households do generally have access to one or more income sources outside of agriculture (Table 3), these are not necessarily conducive to the regular repayments that are typical of microenterprise loans.

Figure 7



source: Impact Survey Report

[21] A once per month visit to each contact person is believed to be a sustainable level of staff input that a commercial microfinance provider could maintain (see below).

Figure 7 shows the income sources that borrower respondents to the impact survey claimed that they had used to repay their previous SCOBICS loan. The concept of wealth quartiles will be explained below. For now, the important point to note is that few of the cited income sources are received on a regular basis; most are "lumpy" to a greater or lesser degree.

That said, putting all the emphasis on repayment at the end of the loan period may not be the most helpful arrangement for poor borrowers with many competing and sometimes unpredictable demands on their scarce cash. Thus, assuming that a means is found to sustain the SCOBICS scheme, efforts will continue to encourage borrowers to begin loan repayment more than just a week or two before the annual repayment deadline.

The third novel feature of the SCOBICS loan product is that, whilst the project staff member has visited all contact persons on a monthly basis from July to November/December so as to encourage repayment, they have not sought to meet with all individual borrowers. Instead, it is the responsibility of the contact persons to collect repayment from their fellow group members. In this way, the group membership effectively internalises some of the transaction costs that would otherwise have to be borne by the lender. This permits a single staff member from the lender to handle more loans than would be the case under a traditional microfinance model, which in turn enables the lender to administer smaller loans (reaching poorer clients) whilst still breaking even. We return to this issue below.

Fourthly, SCOBICS loans are distributed in kind. This ties in neatly with the focus of Project R7962 on integrated crop and soil fertility management. However, it is not envisaged that a specialist microfinance organisation will be keen to take over the tendering process for input acquisition described above. The most promising strategy for "exiting" from dependence on this tendering process, assuming that the scheme can be handed over to a specialist leading microfinance organisation, is the introduction of input vouchers.

An input voucher scheme is currently being developed by the Rockefeller Foundation-funded AGMARK programme, also based in Kisumu, and it is hoped that SCOBICS could eventually benefit from this. Thus, participating stockists in SCOBICS' areas of operation would sign a memorandum of understanding with the microfinance organisation, whereby the stockists agreed to accept "official" input vouchers and would exchange them for agricultural inputs, whilst the microfinance organisation agreed to redeem vouchers from stockists within a stated period after receipt. Thus:

- borrowers would receive input vouchers from the microfinance organisation (rather than receiving inputs as at present)
- they would exchange them for the inputs of their choice at the participating stockist(s) of their choice
- the stockists would send the vouchers back to the microfinance organisation for redemption
- the borrowers would repay the microfinance organisation in cash.

Such an arrangement could contribute to strengthening the business of agricultural input stockists within western Kenya. However, to provide an adequate level of support and service to borrowers, stockists would simultaneously have to be encouraged and enabled to stock a wider range of products than they currently hold. Fertiliser is not a major problem here, with the possible exception of rock phosphate - which few SCOBICS borrowers now opt for anyway (Figure 5). However, few of the improved seed varieties supplied through SCOBICS

can currently be obtained through local stockists. Weaknesses of the private seed distribution system in Kenya are discussed below.

Finally, the fifth – and perhaps most innovative – novel feature of the SCOBICS loan product are the incentives for peer pressure to achieve loan repayment. These are different from those pioneered by Grameen Bank and widely adopted by microfinance organisations around the world[22]. The Grameen-style incentives may be summarised as follows:

- A group of 5-10 self-selecting borrowers accepts mutual liability for each others' loans;
- Two or more group members take loans at any given time;
- No one else gets access to credit until all previous loans have been repaid.

Whilst this may work well where group members are engaged in activities, such as small-scale trading, where turnover is quick and regular, it has a number of drawbacks in a context of seasonal smallholder agriculture Dorward *et al.*, 1998. These include the fact that:

- For agricultural lending, all borrowers require loans at once, so that they can apply their first inputs (seeds and basal fertiliser) as soon as the rains begin.
- Given the covariance of risk amongst agricultural borrowers, there is a problem of perverse incentives in a bad year Stiglitz, 1990. Where a subset of group members sees that a number of their peers are facing repayment difficulties, they may decide not to repay their loans (even though they could) as their own reduced crop will not permit them to repay their own loans and repay the debts of their peers, which is what they would have to do to qualify for further loans in the following season.
- Combining the problem of inflexible disbursement schedules with the observation of periodic bad years, there is an additional difficulty. In microenterprise lending, if one group member delays in repaying a loan, other group members have the option of repaying on their behalf or giving them additional time to complete repayment. In the case of agricultural lending, this latter option does not exist, as new loan applications have to be processed by a set deadline in time for the start of the new planting season. In this context, excluding a whole group whilst a single loan remains outstanding is unreasonably rigid. Instead, the "rigidity" of the timing of new disbursements requires some flexibility on the repayment criteria that qualify for future access.

The SCOBICS response to these problems is as follows. For (members of) existing borrower groups, two criteria are set for access to credit in a new borrowing season:

- The *group* as a whole gets access to a sum that is dependent on the repayment performance during the previous season. The relationship is set out in Table 14. This builds on the observation that access to increased credit volumes is the single greatest incentive for poor borrowers to repay loans (Dorward *et al.*, 2001). It also aims to keep credit repayment, even in a bad year, above 80%, which is the level of repayment claimed by successful cash crop lending schemes, such as that operated by Cottco in Zimbabwe, in drought years.
- An *individual* can stay within the scheme only if they repay more than 80% of the outstanding sum owed at the start of season. Debts are rolled over at the prevailing scheme interest rate of 20% p.a.

[22] Note that the system of incentives outlined here has evolved during the life of SCOBICS. As will be seen below, until 2004 experience within SCOBICS was either of 100% repayment performance or of very poor performance (below 80%) within a given area. However, the switch to the small group-based model in 2004 allowed the incentive regime to be more fully tested.

Table 14: Linking Current Repayment Performance with Future Credit Allocation

Repayment Rate in Current Year(s)	Total Credit Allocation in Following Year compared with Current Year
99-100%	Double
95-98.9%	+ 50%
90-94.9%	Same
80-89.9%	- 25%
Below 80%	Excluded

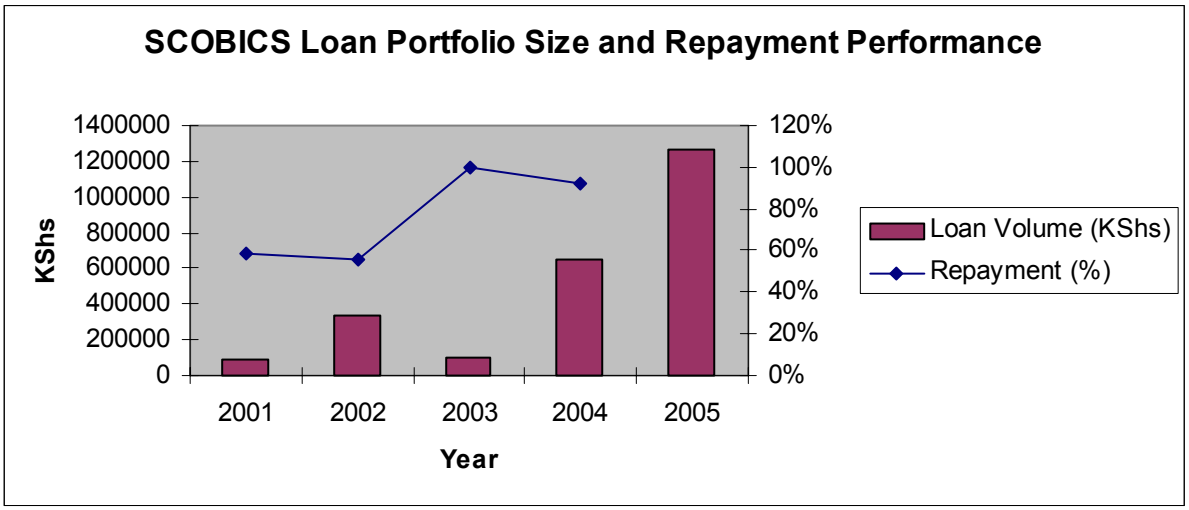
Thus, after a good year, the group as a whole gets access to an expanded volume of credit for the following year and gets to choose whether to let additional members join the group or whether to increase the sum that each member borrows. If the group takes in additional members, it can grow until it reaches a ceiling of 10 members, at which point it has to split if it wants to include additional family members or neighbours in the credit scheme.

In a bad year, there are still incentives for individual members to repay, if the group as a whole can achieve 80% repayment. These are strengthened if excluded members can "re-enter" at a future date upon repaying their outstanding debt plus interest and at the discretion of the members still "in" (i.e. if the members still in believe that the misfortune experienced in the bad year was genuinely unavoidable, not the result of laziness or a deliberate choice to default). Thus, members who are unable to repay 80% of their outstanding debt still have reason to repay what they can, even in a bad year, so as to help the rest of the group stay in business until such time as they themselves can rejoin.

Loan Repayment Performance Under SCOBICS

Figure 8 shows SCOBICS loan disbursement and repayment performance during 2001-05. 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.

Figure 8



source: SCOBICS database

The 2001 and 2002 repayment figures reflect some basic inefficiencies in scheme operation from the project side plus factors specific to the individual borrower locations. In Sauri, repayment was hindered by divisions within the sub-locational committee, plus word spread by some members that SCOBICS loans were just "government money" that did not really need to be repaid. In Nyamninia, a reasonable repayment effort in 2001 could not be replicated in 2002, as insufficient attention was paid to screening new borrowers when the total volume of lending was increased quite dramatically.

During this time, the repayment incentives set out in Table 14 were applied at the sub-locational level. If anything, this exacerbated repayment problems. Committees were neither coherent enough, nor able to exert sufficient influence over borrowers, to ensure loan repayment. Furthermore, where a significant proportion of borrowers had no intention of repaying their loans, there was no incentive for "trustworthy" borrowers to do so either. The incentives set out in Table 14 will only work where there is a basic commitment to repay loans amongst the majority of borrowers, such that 80% repayment is a feasible objective. From there, those committed to continuing to access loans can apply peer pressure to their fellow borrowers to achieve even higher levels of repayment. If 80% is seen as an unreachable target, then an outcome close to zero is likely.

By contrast, the Tatro farmers' organisation is a highly centralised and well organised grouping that made great efforts to ensure, firstly, that those who took inputs on credit were people who were likely to repay the loans and, secondly, that the inputs were applied in a timely manner to maximise the likelihood that the borrowers could repay their loans. Even with this effort, however, 2002 loan repayment was completed too late for new loans to be disbursed during the 2003 long rains season[23].

These early experiences highlighted the importance of strengthening borrower education, so loans officers from Wedco, a leading the microfinance organisation based in Kisumu, were brought in to provide basic training on screening and planning for loan repayment to both committee members / group contact people and individual borrowers for 2003 and 2004.

Following the disappointing early experience, no new loans were issued to Sauri, Nyamninia or Tatro in 2003, although lending did begin in two new areas. Instead, borrowers in Sauri, Nyamninia and Tatro were given an additional year to repay their 2002 loans. Towards the end of 2003 it became clear that the 80% repayment target per sub-location was an obstacle to repayment in both Sauri and Nyamninia. Thus, the decision was taken to move from sub-location-based to group-based lending for 2004 and borrowers were invited to qualify for loans through the new approach by repaying their individual outstanding debts by a given date. This elicited a certain amount of additional repayment in Nyamninia, but little in Sauri. For 2004, therefore, two borrower groups (a total of 16 borrowers) were formed in Nyamninia. However, in Sauri the few borrowers who had repaid their loans by the qualifying date were unwilling to form themselves into a single group for 2004, as they did not feel they could trust each other to repay future loans. Thus, SCOBICS has not been operating in Sauri since 2004.

[23] Only 68% loan recovery was achieved by the scheme's deadline in November 2002. Whilst all outstanding loans were repaid by February 2003, this was too late for inclusion of new loan requirements in the scheme tender for 2003.

Meanwhile, repayment in Ebukhaya and Gongo in 2003 was exemplary. This was despite the fact that hail decimated the maize crop in half of Ebukhaya during the long rains. Several factors explain the good performance. Firstly, the focal area committees were stronger than the sub-location committees in Sauri and Nyamninia. Secondly, these areas did not have the history of subsidised interventions that Sauri and Nyamninia had. Thirdly, all borrowers received training from Wedco at the start of their participation in the scheme, rather than once things had already started to go wrong. Finally, the local chief in Ebukhaya strongly urged borrowers in his area to repay, even if that meant doing some work on other people's farms to get the money for loan repayment. Nevertheless, scaling up the scheme created some problems in both areas. As in Nyamninia in 2002, screening of new borrowers (who were brought in as the quantity of funds increased) was insufficiently rigorous, leading to defaults.

Overall, the move to small group-based lending in 2004 appears to have assisted loan repayment, despite these weaknesses in screening. Table 15 shows a wider spread of repayment performances than encountered previously, when repayment was calculated at sub-location or catchment level. As intended, poor repayment by some groups in an area did not discourage repayment by other groups within the same area. Thirty-one of the 46 borrower groups achieved full loan repayment, whilst, at the other end, six groups failed to function at all effectively and five more achieved less than 90% repayment. Two of these five were within 1% of the 90% threshold, however, suggesting that the scheme's incentive system did not function as intended for them. It remains to be seen whether they did not understand the incentive system or whether they were incapable of doing the sums to find out where they stood in relation to the incentive thresholds.

Table 15: Loan Repayment Performance by Group (Number of Groups), 2004

Repayment (%)	Kaplelartet	Muyafwa	Ebusiloli	Ebukhaya	Gongo	Tatro	Nyamninia	Total
<80%			3	1	2			6
80-89.9%				3	2			5
90-94.9%		1		2				3
95-98.9%		1						1
99%+	5	4	5	4	1	10	2	31
Total	5	6	8	10	5	10	2	46

Most groups contain both male and female members, and identical repayment performances were recorded for male and female borrowers across the scheme in 2004.

Looking forward, there are grounds for optimism that future repayment could be as good as, or better than, that achieved in 2004. However, continued training is likely to be the key to success. The loan repayment experience in 2004 encourages us that self-selected groups should indeed be able to exercise more effective peer pressure for repayment than sub-locational and village committee structures[24]. Most existing borrowers are all now well trained in the basics of taking credit and the disciplines required for repayment. However,

[24] When the small group model was announced, some borrowers commented that it was becoming more like the SACCOs that already exist within their communities, particularly amongst women. The trust and relationships that underpin these could also underpin loan repayment within borrower groups.

further attention is required to how groups screen new members to ensure that they share the commitment to loan repayment of existing members – even in years of poor harvest. In traditional microfinance lending, aspiring new borrowers are required to attend several training sessions before being accepted onto the books of the microfinance organisation. In this way, attendance at and responsiveness to the training provided generates useful information about the likely future performance of the potential client. However, the pronounced seasonality of the SCOBICS scheme and the fact that, during the months prior to extending new loans, the loan officer is fully occupied with collecting repayment from previous loans, mean that SCOBICS has not so far been able to run borrower training prior to advancing loans. This is a detailed operational issue that an organisation interested in taking the scheme over would have to look into.

An additional novel feature of the SCOBICS scheme is that training on credit management is increasingly integrated with provision of technical advice on integrated crop management, e.g. appropriate strategies for soil fertility management and for diversification beyond maize. As noted above, the contact persons of the 46 borrower groups within SCOBICS in 2004 were all trained on the use of the DSSs so as to assist their fellow group members with decisions on integrated crop management. Over time, increasing biophysical knowledge should improve the selection of inputs acquired through the scheme and the efficiency of their use and thereby raise the level of farm production out of which loans have to be repaid. Borrowers are now encouraged to plant (at least) one crop during the long rains that could contribute to loan repayment and one or more such crops during the short rains season. They are also encouraged to consider in advance of taking a loan what fallback strategy (e.g. off-farm labour) they will rely on to repay their loan in the unlikely event that both rainy seasons turn out to be disappointing.

Scaling Up the SCOBICS Scheme

As noted above, one of the aims of SCOBICS has been to develop an agricultural credit scheme that can be taken on by an established microfinance organisation as a pilot for an agricultural loan product of their own[25]. Whilst consistently achieving high repayment rates (preferably 95%+) is a necessary condition for a commercially viable scheme, it is not a sufficient condition.

We have already considered two further challenges that will have to be confronted if SCOBICS is to be transferred to a specialist microfinance organisation: moving away from

[25] An alternative approach would have been to try to develop farmer organisations that were strong enough to manage a loan portfolio entirely on their own account. However, governance is a key issue in such decentralised systems (Johnson *et al.*, 2004) and the project team lacked both the skills and resources to attempt to build strong organisations that could perform this role. (The experience with the Sauri and Nyamninia sub-location committees is instructive here). Connecting SCOBICS borrowers into an established microfinance organisation should also enable them to access a continually expanding stream of credit over time, whereas a credit scheme run by a farmer organisation may be constrained simply to recycle its initial capital stock - unless it could be linked to a financial institution (such as a microfinance organisation) as a supplier of wholesale finance. That said, for 2006, the project staff have agreed that Tatro farmers' organisation will play a much bigger role in the administration of the loans to their members as an experiment to see whether they can assume full responsibility for lending to their members from then on. It is envisaged that in 2006 Tatro committee members will negotiate with local stockists for supply of desired inputs, put loan repayments into a dedicated bank account owned by the organisation and keep all the records of loan repayment performance until the end of the year, when project staff will audit them to check that all monies have been accounted for.

provision of loans in kind, whilst still retaining the link to supporting seasonal agricultural production, and delivering training to prospective borrowers prior to accepting them into the scheme. Both of these relate to the bigger challenge of coordinated service provision highlighted earlier in this report and to which we return again below.

However, the biggest and most immediate challenge is to show that SCOBICS can reach a sufficient scale – whilst maintaining its strong repayment performance - to be run as a fully commercial venture. Whilst SCOBICS borrowers have not received any more follow-up from project officers than they would expect to receive from a loan officer from a commercial microfinance organisation, the volume of lending undertaken by SCOBICS has not so far been sufficient to cover these operating costs out of interest payments received.

Compared to traditional microfinance loans, SCOBICS loans are tiny. Thus, in 2004 the average SCOBICS loan was KShs 2483 (US$31.8), rising to KShs 3931 (US$51.7) in 2005[26]. Male borrowers within the scheme have always tended to take slightly larger loans than female borrowers. Thus, in 2004 the average loan size amongst male borrowers was KShs 2816 (US$36.1), rising to KShs 4266 (US$56.1) in 2005, whereas the comparable figures for female borrowers were KShs 2177 (US$27.9) in 2004, rising to KShs 3496 (US$46.0) in 2005.

By contrast, Johnson *et al.*, 2004 report that, in the case of Wedco, "Average loan outstanding in 2003 was KShs 15,000, which is relatively low for an MFI [microfinance institution] in the Kenyan MFI context. Johnson 2003 indicates that average outstanding loan size for MFIs in Karatina in 2003 was KShs 50,500 (US$675)" (p6+footnote). The AGMARK programme that has started up elsewhere in western Kenya in 2005, serving rice and horticulture farmers on irrigation plots, was anticipating loan sizes of upwards of KShs 10,000 per borrower for horticulture farmers and up to KShs 70,000 for rice farmers [J.Mutonyi, *pers.comm.*].

Smaller loans sizes mean that a single loans officer has to handle more clients in order to cover their costs. This is where contact persons come in. However, SCOBICS borrowers are also more dispersed than the typical portfolio of a microfinance loans officer would be. Although retaining a focus on Siaya and Vihiga districts, the scheme has expanded by taking on new groups suggested to it by the Secretariat of the COSOFAP consortium (http://www.ugunja.org/cosofap/consortium.htm), irrespective of their precise location within western Kenya. To keep travel time and costs for a loans officer to manageable levels, the scheme needs to show that it can identify much larger numbers of reliable borrowers within fairly concentrated areas.

Discussions with Wedco[27] indicated that their business model is based on a single loans officer managing a total loan portfolio of KShs 6-7 million (depending on the qualifications and seniority of the officer, plus the transport that that officer would have at their disposal).

[26] Borrowers groups that repaid their loans in full in 2004 chose primarily to expand the sizes of the loans received by existing borrowers in 2005, rather than to invite many new members to join them. Amongst the older groups, this may have been partly because of the screening difficulties that they experienced in 2003-04. Amongst the new borrower groups in Kaplelartet, Muyafwa and Ebusiloli, there was a feeling that their starting loans in 2004 were too small.

[27] 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, this did not happen firstly because the total loan portfolio of SCOBICS was still too small and secondly because recent internal difficulties within Wedco have meant that it has not been in a position to take on risky new products.

As Figure 8 shows, SCOBICS is still only around 20% of that sum. More intense promotion of the scheme within its existing core areas of operation is called for if a convincing case is to be made that lending to poor farmers in western Kenya can be a viable business proposition.

At the time of writing of this report, project staff are awaiting word from the Financial Systems Deepening programme (ex-DFID) in Nairobi as to whether it will fund a further transition phase during which the scheme could scale up, so as to represent a credible business proposition for a microfinance organisation to take over. In the meantime, the scheme is planning to continue operations with limited additional funding in 2006, whilst more substantial funding is sought for further scaling up. 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 (as discussed in footnote 24) is to be given greater autonomy in managing its part of the scheme during 2006 on a trial basis.

Whom Has SCOBICS Reached?

Returning to the project proposal summary, it was envisaged that Project R7962 would be able to reach farmers "of intermediate wealth ranking in the scale of poor to very poor". In this section we report on what types of households have actually borrowed from the SCOBICS scheme. The Impact Survey Report noted three areas in which SCOBICS borrowers were distinctive from non-borrowers living in the same sub-locations.

Firstly, and of most direct relevance to the project's initial expectations, SCOBICS borrowers were found on average to be wealthier than non-borrowers.

For the purposes of the Impact Survey Report, a composite wealth indicator was created. The construction of this indicator is explained in full in two appendices to the Impact Survey Report. The first stage was the identification of local indicators of household "wealth" and well-being through participatory wealth ranking exercises conducted in the project areas. Local indicators of wealth that were highlighted by this process related to both asset holdings and livelihood outcomes: access to non-farm income sources, education of the household head, area of land accessed for cultivation, livestock ownership, land and labour hire (in/out), house ownership and nutritional status. Once these indicators had been identified, each household was scored on each of them using information obtained during the impact survey. Seven variables were constructed, each with a range of roughly 0-4. The composite wealth indicator was then constructed as the mean of these seven individual indicators. Across the 282 households surveyed during the impact survey, the maximum score achieved on this composite wealth indicator was 3.13 and the minimum 0.48, with a mean of 1.39.

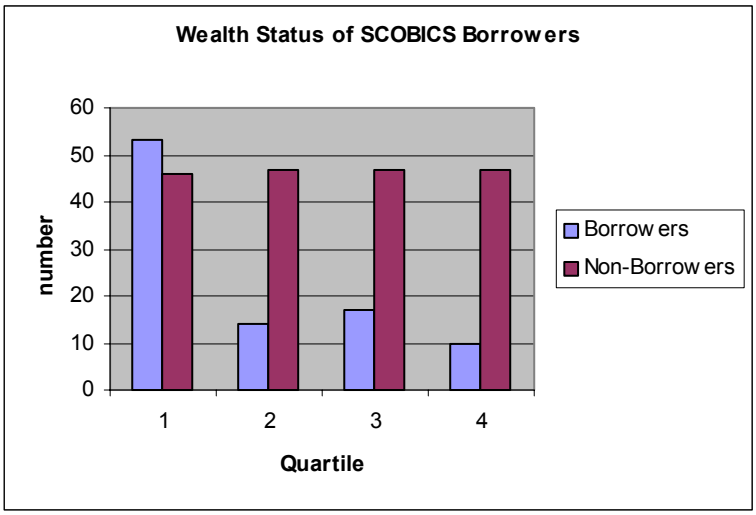
The composite wealth indicator was used to allocate survey respondents to wealth quartiles. The quartiles were defined by the scores achieved by the 188 non-borrowers, and borrowers were then assigned to these quartiles according to their scores. Figure 9 shows that borrowers were drawn primarily from the top wealth quartile. 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.

We note that the borrowers from quartiles 3 and 4 did not have access to any more land than their non-borrowing control group in the same quartiles. As will be argued shortly, we assume that they were chosen as borrowers because they were believed to be trustworthy enough to repay even out of their limited means.

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 relatively 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 (Table 1). 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.

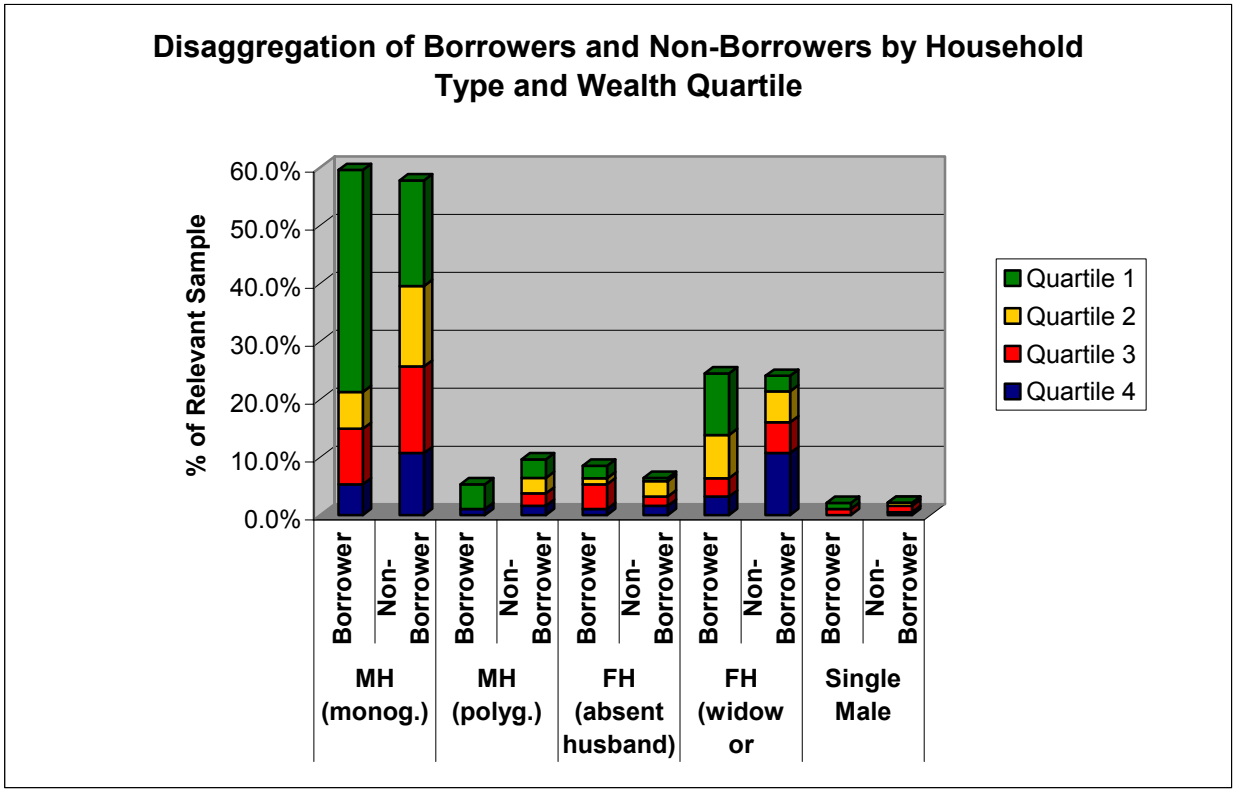
Figure 9



note: wealth quartile 1 = wealthiest; 4 = poorest
source: Impact Survey Report

Meanwhile, Figure 10 disaggregates both borrowers and non-borrowers by household type as well as wealth quartile. Each column in the figure shows the proportion of the relevant sub-sample from the impact survey (borrowers or non-borrowers) accounted for by households of a given type. Thus, monogamous male-headed households were the most common household type (almost 60%) both in the random sample of the local population and within the sample of borrowers. Indeed, a striking observation from Figure 10 is how similar the composition of the borrowers and random (non-borrowers) sample was when disaggregated by household type.

Figure 10



source: Impact Survey Report
Notes: MH = male-headed household; FH = female-headed household; monog. = monogamous; polyg. = polygamous

Perhaps surprisingly, the second most common household type (around 25% of both borrowers and the local population as a whole) was households headed by widows[28]. Moreover, of all the household types, households headed by widows are the most concentrated within wealth quartile 4. (Within the random sample from the local population as a whole, 45% of households headed by widows were found to be within wealth quartile 4, compared with only 19% of monogamous male-headed households). Figure 10 suggests that the participation by borrowers from households headed by widows within the SCOBICS scheme has been proportional to the prevalence of such households within the local population as a whole. However, as is true of SCOBICS more generally, it has tended to be people from better-off households headed by widows who have managed to access loans.

Before considering other distinctive features of borrowers, we relate our discussion of scheme outreach to the discussion of scheme viability from the previous section. 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. Figure 9 suggests that scaling up of the SCOBICS scheme would enable some of the poorest households in the project areas to access seasonal credit. However, the main beneficiaries would be the top quartile of (still poor) households.

[28] Although Figure 9 mentions both widows and divorcees, there was, in fact, only one household headed by a divorcee (a non-borrower household) in the whole sample.

An important finding of the Impact Survey Report was that borrowers are more likely to participate in other savings and loans activities than non-borrowers. A number of other savings and loan groups and movements operate in the project areas, including various self-help groups (e.g. church groups, women's groups), merry-go-rounds (ROSCAs), savings and credit cooperatives (SACCOs) and table banking (ASCAs). For example, 118 respondents to the impact survey reported that one or more household members were involved in a self-help group and 53 that one or more household members were involved in a merry-go-round. The findings of the Impact Survey showed that members of SCOBICS borrower households belong to more savings and loan groups than members of households that have not participated in SCOBICS (Table 16). Whilst it is possible that participation in these other groups has commenced since involvement in SCOBICS (data was not collected on this), a more likely story is that people with a track record of saving and/or of taking and repaying loans have been accepted as SCOBICS borrowers as the scheme has developed.

There was a significant difference in the mean number of such groups (other than SCOBICS) that members of borrower and non-borrower households belong to. Moreover, this effect was not just the result of there being a disproportionate number of wealthier households within the borrower group. A similar result was found if only households in wealth quartiles 3 and 4 were considered. Our interpretation of these results is that SCOBICS clients are often members of households who signal their trustworthiness (and perhaps also their demand for financial services) by participation in other savings and loan groups found in the area

Table 16: Mean Number of Savings and Loans Groups (other than SCOBICS) that Household Members Participate In

	Mean Number of Groups	
	Whole Sample	Quartiles 3 and 4 Only
SCOBICS Borrower Households	0.97	0.85
Non-borrower Households	0.59	0.42

Note: difference between means significant at 1% in both cases
Source: Impact Survey Report

Finally, given the focus of SCOBICS on supporting agricultural production, we might expect agricultural production to be a major economic activity for the majority of borrower households. Table 17 indicates that this is only partially true. A higher proportion of SCOBICS borrower households (56%) than non-borrower households (41%) indicated that their main income source in 2004/05 was either agriculture, horticulture or livestock production. Of the 41 borrower households (44%) for which neither agriculture, horticulture nor livestock were the main source of income in 2004/05, 29 (31%) ranked one of these as their second most import source. Returning to Table 5 we recall that households for which either agriculture, horticulture or livestock production was the main income source were likely to achieve usefully higher maize yields than those for which this was not true. In turn this should influence ability to repay an agricultural loan. It does, therefore, seem plausible that commitment to agricultural production is one criterion by which a prospective borrower would be assessed for suitability to receive a SCOBICS loan.

Table 17: Is Agriculture, Horticulture or Livestock Your Main Income Source in 2004/5?

Response	SCOBICS Borrower Household?		
	Yes	No	Total
Yes	52	76	128
No	41	110	151
Total	93	186	279

Source: Impact Survey Report

However, this still leaves 12 surveyed borrower households (13%) for which neither agriculture, horticulture nor livestock featured within the top two income sources in 2004/05. These could be households with reliable non-farm income sources, which a) wished to increase their food production for own consumption (even though they could presumably buy their own food if they so needed) and b) were believed to be of reliable enough character to repay.

Returning to Figure 7, we recall that SCOBICS borrowers were found to rely on a variety of income sources for loan repayment. Less than half of respondents reported that they (or their fellow household member who was a borrower) had repaid their last loan out of crop sales and it was wealthier borrowers who were more likely to rely on crop sales than poorer borrowers. This reflects the fact that many poorer borrower households, with lower land holdings, still do not produce enough staple food to feed themselves. Therefore, they are reluctant to sell food that they will need for their families to repay a SCOBICS loan, even though the loan was given to support agricultural production. (This may be reinforced by the fact, illustrated in Figure 6, that prices of crops that they might sell are still generally low around the time that loan repayment is due). Meanwhile, borrowers from the top two wealth quartiles were almost as likely to rely on income from salaries and remittances to pay their SCOBICS loans as they were to rely on crop sales, whilst households in the two poorer quartiles were more likely to do some work off-farm or to sell some small livestock to repay their loans than they were to sell crops for this purpose.

That borrower households take agricultural production loans, but still (have to) repay out of non-farm income sources, is a sign that the project's vision of sustainable intensification of local agricultural production has yet to be achieved even amongst the project's core participants. On the other hand, it is also a reflection of the importance that households in western Kenya attach to their agricultural production and specifically to their desire to increase their production to enhance their food security.

Seed Supply

Access to credit can assist poor households to adopt new technology to intensify their agricultural production. However, this technology – often embodied in seeds – needs to be readily available for them to purchase close to their farms. The observation of Project R7962 is that, whilst there has been a large increase in the number of stockists serving farmers in the project areas in recent years – indeed, Kenya is often held up as an example of a successful private response to input market liberalisation (Kelly, V *et al.*, 2003) – there is still some way

to go before one can truly talk of a network of input retailers in the west of the country capable of supporting sustainable intensification by numerous smallholder producers.

Project activities have shed light on this in two ways. The first relates to competition for the annual input tender to supply the SCOBICS credit scheme. In both 2002 and 2003, this was won by a stockist in Luanda (close to the KEFRI regional research centre in Maseno), Jumbo Agrovet, because Jumbo was the only stockist that had bid to supply the entire tender as requested. Others could only commit to supply a part of the tender, even though this was relatively small in both value terms and range of products required. Of course, the limited competition in response to these initial tenders may have had something to do with private sector suspicions about dealing with KEFRI, a state sector organisation (and hence possibly liable to delay payment). Moreover, competition has increased somewhat in subsequent years. Nevertheless, doubts remain about the capability of private stockists to supply a sufficient range of inputs to allow producers to pursue optimal paths towards sustainable intensification – let alone to bring this choice of inputs close to the majority of producers. The AGMARK programme that we have already mentioned is building the managerial, technical and financial capacity of local stockists to enable to perform their role more effectively.

The second observation is as follows: whilst producers in project areas with access to some form of transportation plus a means to pay for inputs (including an input voucher if such a system does develop) should be able to obtain the type of fertiliser that they require, this would not be the case for seed. Of the seeds made available through the SCOBICS credit scheme in 2004 and 2005:

- Western Seed hybrid maize varieties are commercially available, albeit at times in short supply because demand for them (in Central Province as well as in the west of the country) has been outstripping the capacity of Western Seed Co. to multiply them. Kenya Seed hybrid maize varieties can also be readily obtained through local stockists;
- Kenya Seed Co. is unable to multiply its improved bean seed varieties, so has been looking for local bulkers who can gain accreditation as Kenya Seed agents and multiply specific varieties for sale to nearby communities. Within the project areas, Tatro farmers' organisation has gained such accreditation and has, therefore, been selling seed to the SCOBICS scheme. However, borrowers in areas away from Anyiko sub-location would be unable to access these seeds if it were not for the SCOBICS scheme;
- The dual-purpose soyabean seeds are a variety developed by IITA in Nigeria, which TSBF has been given permission to import into Kenya for research purposes. They are as yet unregistered with the Kenyan authorities for commercial release. The SCOBICS scheme has bought seed from its own borrowers as they have produced it (effectively bulking it up). If SCOBICS were not there, many of its borrowers would not be able to access dual-purpose soyabean seeds.

Farmers in western Kenya tend to demand a limited range of standard fertilisers, most of which are available across Kenya and indeed the world, and which are used on a range of crops. This makes it relatively easy for stockists and their wholesaler suppliers to meet the farmers' needs. (Major challenges nevertheless exist in relation to financing, transportation and storage of large quantities of bulky product). By contrast, the seeds that will be required to support sustainable intensification in project areas are likely to be tailored in some way to local conditions, although not confined to them (as the examples immediately above show). Whilst demand for improved seeds remains relatively low (i.e. until agricultural intensification takes off in western Kenya) commercial incentives to develop new seeds

remain weak. Moreover, where public research efforts demonstrate the value of (and, hopefully, nascent demand for) a new variety, there remains the challenge of finding a commercial seed company willing to multiply the product (possibly including negotiating the time-consuming process of certifying it with KEPHIS). Many promising varieties may fall through the net at this point. On the other hand, if this challenge can be negotiated, the "best bet" seed types may then be expected to change more rapidly than the most demanded fertilisers. This in turn makes new demands on stockists, who (with their limited capital stocks) have to take decisions as to which varieties to stock for each season. Failing to sell product by planting time can result in scarce capital being tied up for six months or more. Thus, the temptation is to go for products that have a history of selling well, unless a stockist is very well attuned to the new seed types that farmers are interested in.

In short, there are good reasons – linked to the "thinness" of the seed market in western Kenya at this stage of its development - why seed supply will remain more problematic than fertiliser for some time to come. This has led to the project taking quite an active role in assuring seed availability to producers and communities with whom it is working. However, it begs the question of how one maintains expanded "options for resource and crop management" once a project ends. Project staff have been working with TSBF to make it possible for commercial multiplication of soyabean seed to begin in western Kenya. Even then, it is one thing to ensure commercial multiplication of particular varieties that have proven popular during the lifetime of a project; another to give impetus to the development of a seed system that will continually deliver new options to producers.

Output Marketing

The starting point for project activities in relation to output marketing was the apparent "chicken and egg" situation that:

- Farmers in project areas had little knowledge of markets beyond their immediate area (Table 7). Their small surpluses were a major reason for this;
- Prices in local markets were perceived (without any strong foundation) as not sufficiently remunerative to encourage investment in production intensification. At the same time, the small quantities demanded within local markets could discourage investment in particular products, e.g. sunflower and soyabean.

It was, therefore, hoped that more remunerative output marketing opportunities could be identified for a number of crops that would encourage local producers to invest in their production, with a particular eye on land use in the short rains season. However, marketing had been given limited priority in the original project proposal, so time and funds to be allocated to marketing work were modest. It was thus decided to spend available funds on an exploration of Kisumu markets, which were not well known by producers in the project area, but which seemed the most obvious outlet if local production volumes rose. The main focus was placed on Kisumu's various large "informal" markets: Kibuye, Kondele and Jubilee.

Project activities in this area included:

- A survey of traders in Kibuye, Kondele and Jubilee markets;
- monitoring of prices in three local markets (Luanda, Yala and Siaya), for comparison with Kisumu market price data, which was collected from the Ministry of Agriculture office in Kisumu;

- taking farmers from the project areas to Kisumu markets to see how the markets operated and to talk to traders about market opportunities;
- preliminary discussions with supermarkets, millers and other larger buyers about possibility for supply direct from smallholder producers.

The survey of 40 traders, conducted in March and November 2003, found that a small number of them (primarily retailers, but also a few wholesalers) do receive direct supplies from smallholder producers. Moreover, others expressed an interest in doing so. Conditions that traders would expect smallholders to fulfil if they were to supply to them regularly included the ability to: supply at competitive prices and to meet transport costs themselves; supply good quality produce and, in some cases, to deliver an (unspecified) minimum quantity. In addition, some traders said that they would only wish to receive supplies direct from smallholders if there was a prior agreement that the smallholder should bring the produce to the trader.

Thirty-one traders (77%) stated that there are months when they are regularly short of supplies; only three said that there are no such months. The early months of the year were found to be the months when traders perceived the greatest produce shortages, even though, as already noted, these tend to be months of relatively low prices.

Whilst these findings suggested that some market opportunities might exist, discussions with key informants at the markets also suggested that brokers (and perhaps traders more generally?) have their tactics to exploit "new" farmers trying to sell into the markets. For example, brokers were said to pose as traders and negotiate prices with uninitiated producers, then pretend the price is too high and leave (to search for a real trader). After some time the broker (who has been posing as a trader) will emerge in the company of a trader who has been offered the farmer's produce at a higher price. The farmer will be surprised to see the broker get the money from the trader, deduct his commission and then hand the rest of the money to the farmer. At this point the farmer can only count his/her losses since s/he would have sold at that higher price had s/he been able to sell directly to the trader.

In the event, thoughts of market opportunities in Kisumu were cut short by the main finding of the markets work: that crop prices in local markets are almost always higher than those that producers could obtain by sending the same produce to Kisumu.

The following steps were taken in order to compare prices that producers could obtain by sending their crops to Kisumu on the one hand and by selling them in local markets on the other. Firstly, Kisumu wholesale buying prices (what Kisumu traders might pay their suppliers) were deduced from the wholesale selling price data collected from the Ministry of Agriculture. The difference between the two prices is the mark-up that traders make per bag of produce sold. In key informant interviews, traders were (perhaps surprisingly) willing to provide this information, which is summarised in Table 18. This shows that the margins that traders obtain vary by crop (with tomatoes the highest and beans the lowest amongst the crops for which data was obtained), but that they are fairly constant in percentage terms throughout the year, with the possible exception of tomatoes. Similar figures were obtained from key informant interviews in April 2004 in major wholesale markets in Nairobi (Ukulima) and Eldoret.

Table 18: Wholesaler Margins in Kisumu Markets (Selected Crops) 2003

	Wholesaler's Margin (as % of buying price)					
Month	Maize	Beans (Canadian Wonder)	Beans (Rose Coco)	Tomatoes	Groundnuts	MEAN
Feb-03	20%	13%	12%	20%	16%	16%
Mar-03	20%	13%	11%	21%	16%	16%
Apr-03	22%	13%	10%	20%	16%	16%
May-03	19%	12%	11%	20%	15%	15%
Jun-03	25%	14%	12%	18%	16%	17%
Jul-03	22%	13%	15%	29%	16%	19%
Aug-03	20%	14%	12%	26%	15%	17%
Sep-03	19%	13%	13%	24%	16%	17%
Oct-03	19%	13%	12%	21%	16%	16%
Nov-03	19%	15%	12%	22%	16%	17%
Dec-03	20%	14%	11%	27%	17%	18%
MEAN	20%	13%	12%	22%	16%	

Source: market survey data

Once the wholesale buying price in Kisumu had been obtained, this was adjusted by the full costs of transporting produce from Siaya district to Kisumu. Matatu operators and local owners of one-ton pick-up trucks were approached for costings if produce was to be transported from the local area to Kisumu. The resulting "local export parity" price in Siaya district was then compared with the wholesale price obtaining in Siaya market (adjusted for the same cost of taking produce from the homestead to the main road that was used in the calculations for transportation to Kisumu). This comparison was conducted for every week that we had price data in both 2003 and 2004, i.e. around 90 times per crop.

A summary of the findings of the final price comparisons is presented in Table 19. The figures in this table are annual averages across the available weekly figures. They show that 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.

We should at this point note that we only conducted our analysis for a limited range of crops, even though price data were collected for a much wider range in both local and Kisumu markets. The main constraint to extending the analysis was that many crops (e.g. kales, bananas) are sold in units of varying (non-standardised) weights in local markets. In some cases, the price stays relatively constant throughout the year, but the unit weight varies with changes in supply and demand. We were unable to measure samples of produce on a regular enough basis to obtain a reliable series of prices per kilogramme that we could compare with the prices obtaining in Kisumu (which are quoted for standardised weights throughout the year). We assume that our findings are indicative of the situation for other common crops in local markets, but have not verified this for the full range of crops.

Table 19: 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%

Note: An example of the weekly prices in local markets was given in Figure 6. As this figure showed, the data set for 2003 was more complete than that for 2004.

Source: Market Survey Report

The results presented in Table 19 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.

The difference between these two prices has two components: transportation costs and trader margins. Although cash-poor farmers in the project areas view the costs of transporting produce to Kisumu as large, the analysis showed that the wholesalers' margins were actually much larger than these transport costs. Siaya and Vihiga districts are, after all, not that far from Kisumu (30-50km on good main roads), even if the tracks linking the communities that participated in the project to these roads are sometimes difficult to negotiate by vehicle except with a 4x4.

We do not know the basis for determining traders' margins or the scope for lowering them. Our discussions with key informants during the trader survey suggested that various restrictive practices are used to protect these margins. However, even if this is the case, a fuller picture of the functioning of trader associations (formal or informal) and the role of pricing agreements within them needs to be obtained before conclusions are drawn as to whether (and how) margins can be reduced (Smith and Luttrell, 1994). This topic may indeed be worthy of more research, but was outside the scope of this project.

Meanwhile, the immediate practical consequence of the findings presented in Table 19 was that the project has not identified any new, more remunerative marketing opportunities for local producers than those already existing in their local markets. This begs at least two major questions:

- Firstly, are there opportunities that the project has yet to identify for producers in the project areas to grow higher value crops for sale outside the project areas? It has to be admitted that the exploration by the project of this question has been limited. However, it should also be pointed out that the limited capacity of most producers in the project areas to grow crops primarily for market, until maize yields are raised and land freed up, reduces the likelihood of high value cropping opportunities being identified for the time being. As with soyabean (discussed in more detail below), significant investment in

production by local producers is likely to depend on the existence of some form of guaranteed market outlet – from a processor looking to build up their capacity utilisation or a trader well connected to processors or exporters elsewhere in the country but committed to assisting the growth of a smallholder supply base in western Kenya. Such buyers in turn could be expected to provide some additional assistance with pre-harvest service provision (especially seed and crop-specific technical advice). However, under current production conditions, such investments are unlikely without the active cooperation of a local project or NGO – perhaps through COSOFAP – to bear some of the transaction costs of identifying and dealing with numerous, poor and dispersed producers all capable of producing only tiny surpluses[29].

- If producers are to continue producing primarily for local markets for the time being, how large are the volumes of different crops traded in these markets? This is an important question, because Table 19 provides an indication of how far prices in these markets could fall if local production rose to the point at which the areas became surplus areas. Our analysis in the final section of this report suggests that there is plenty of scope for expansion of maize production before local prices begin to fall. However, discussions with retailers selling soyabean in Luanda, Yala and Siaya markets (there are no wholesalers) indicated that their turnover is extremely modest, ranging from half a bag per (weekly) market day in Yala to two bags per (weekly) market day in Luanda. The main customers are currently Seventh Day Adventists who make hot beverages out of soyabean as they are not supposed to drink tea or coffee. These volumes mean that it is a time-consuming business even for current SCOBICS borrowers to sell their soyabeans, as they cannot expect to sell more than one bag per visit to the market.

Whilst efforts can usefully be made to promote greater local utilisation of soyabean (e.g. in bread and cake making and as an ingredient to increase the nutritional value of porridge), establishing a reliable external market for soyabean will obviously be critical to its wider adoption by farmers as a component of a "diversification beyond maize" strategy. Discussions with a Kisumu-based miller, Millennium Millers, indicated that they would be prepared to pay only KShs 18-22 per kilogramme of soyabeans (compared with mean recorded prices in local markets of KShs 35 per kg in 2003 and KShs 43 per kg in 2004)[30]. Even with their soil fertility advantages, it is unlikely that local producers would adopt soyabeans at this price, when they can sell beans for KShs 30 per kg or more (Figure 6)[31]. A feasibility study is thus required to see whether, with investments in specialised processing equipment, a viable soyabean processing business could be developed that could pay farmers in western Kenya around KShs 30 per kg for soyabeans[32]. There would seem to be a strong case for public collaboration with a strategic private investor to develop local processing capacity if such

[29] One trader approached COSOFAP looking for partners to assist in sunflower production, which he would assemble and market. However, the quantities that SCOBICS borrowers could have produced were well below the quantities that he was looking for to make the marketing logistics economically viable and he decided to make his first effort to build a sunflower production base in a different area.

[30] However, they do not have specialised processing equipment for soyabean, which would allow them to extract a higher percentage of oil from the beans and hence pay producers a higher price for them.

[31] Note that ratong beans fetch a lower price than varieties such as Canadian Wonder, which sold for around KShs 5 per kg more than ratong beans in local markets in 2004. SCOBICS borrowers planting improved varieties would hope to achieve these higher prices for their beans. Comparing the two crops, soyabean (if appropriately densely planted) requires more seed and labour per acre at planting time, but then less labour at weeding time because it covers the ground, so reducing weed growth. With higher planting densities, it should also generate higher yields per acre than beans.

[32] Currently Kenya imports around 90% of its soyabean requirement, much of it in the form of low value cake for animal feed.

sums could be made to add up[33]. A research student on the Imperial College Distance Learning Programme was due to be exploring this question during 2005, but ended up deferring his research report to 2006 for personal reasons.

Outcomes and Impacts from Project Interventions

Although the sustainability of these interventions will be discussed further in the next section, what we have established so far is that the project has achieved some success in providing technical knowledge, credit and access to improved seed varieties to several hundred farm households. It has, however, made no noteworthy progress in enhancing the access of these households to output markets. In this section, we present evidence from the Impact Survey Report on some key outcomes from these interventions and resulting livelihood impacts. The evidence can be summarised as follows:

- The development interventions undertaken by the project have encouraged adoption of various new crop and soil fertility management technologies;
- They have enabled farmers to raise maize yields and to begin diversifying their cropping systems;
- As a result, the food security of participating households has been increased and there has been a positive (although, unfortunately, not quantified) impact on cash income generation;
- However, these benefits have not yet fed through into asset accumulation, either because the increases in cash income have been too small or because they have not yet been sustained for a sufficient period of time (or both).

Technology Adoption

An important research question underlying the original project design was: what effect would availability of seasonal credit have on adoption of new crop and soil fertility management technologies? The background to this was that various apparently promising technologies existed, but uptake had until then been disappointing.

Here we show that the development interventions undertaken by the project have encouraged adoption of a number of new crop and soil fertility management technologies. These include:

- Adoption of new, striga-resistant maize seed 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.

[33] In Zimbabwe, smallholder soyabean production has grown in part thanks to the willingness of Olivine to buy all smallholder production at a remunerative price announced at the start of the year to organisations promoting soyabean. However, Olivine had already invested in its processing capacity, which was originally supplied by commercial farmers. (Commercial farmers cut back their soyabean production in the 1990s). In Uganda, the government works closely with large agribusinesses to leverage investment in local processing capacity that is designed to handle the production of smallholder farmers.

Conclusively attributing these adoption decisions to the availability of credit 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. Looking at changes in isolation may, however, understate the importance of SCOBICS lending to the technological innovation that we observed during this project. We consider two reasons for this at the end of this section.

To provide a framework for thinking about these matters, we suggest that:

- The first requirement for adoption of a new technology is that information about that technology becomes available. Through one means or other, the farmer needs to become convinced that the new technology offers him/her benefits that exceed those that s/he is realising from his/her current technology set. Within the project, the development and dissemination of DSSs, the on-farm demonstrations and farmer-to-farmer visits, and the market visits were designed to make producers aware of new technological options;
- If the new technology yields significant benefits for negligible net cost, then farmers are likely to adopt straight away with no additional assistance required, assuming that the technology is readily available for them to purchase;
- If there are both benefits and costs, but the benefits outweigh the costs sufficiently to compensate the producer for any additional risk involved in adoption, then the main constraint to adoption is likely to be affordability. The major contribution of SCOBICS loans to technology adoption is increasing the affordability of new technology for poor farm households;
- Benefits will always be dependent on the market price of the crops in question. However, one may distinguish changes to the production of existing crops, where market channels (and prices) remain unchanged during adoption, from adoption of new crops, where producers have to be convinced of the strength of market demand (price, reliability of market) for the crop to be adopted.

We commented upon the uptake of striga-resistant maize varieties in relation to Figure 5 and Table 13 above. Table 20 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[34].

Table 20: 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

[34] By contrast 4/14 non-borrowers who explained the nature of the change that they had made said that they had switched from hybrid seed back to local seed since 2001/02.

For producers who were already purchasing hybrid maize seed, however, 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. As mentioned in our earlier discussion of seed supply, Western Seed Company has been struggling to increase production 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.

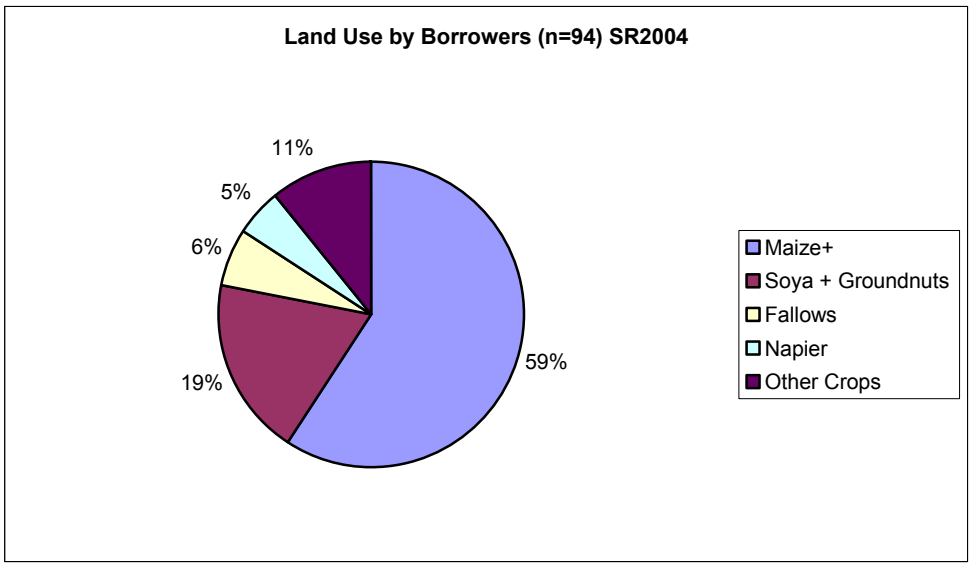
A similar story can be told in relation to changes in bean varieties planted by some project participants following the visits to Kisumu markets organised by the project. Thirteen of the respondents to the impact survey reported changing the bean varieties that they cultivated as a result of knowledge 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 other cases the existence of a credit facility was probably not critical to the decision to adopt the new variety.

In Figure 2 we showed that, by 2004, borrowers had begun to diversify their short rains season cropping pattern (using long rains production patterns as the comparator), whereas non-borrowers had yet to make any changes. Figures 11 and 12 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.

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. As discussed earlier, the local markets for soyabean are rather thin. The rate of adoption recorded in Figure 11 was, therefore, probably dependent in large measure on the willingness of the project to buy much of the resulting soyabean harvest from borrowers for inclusion within the following season's credit transactions. As already noted, 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.

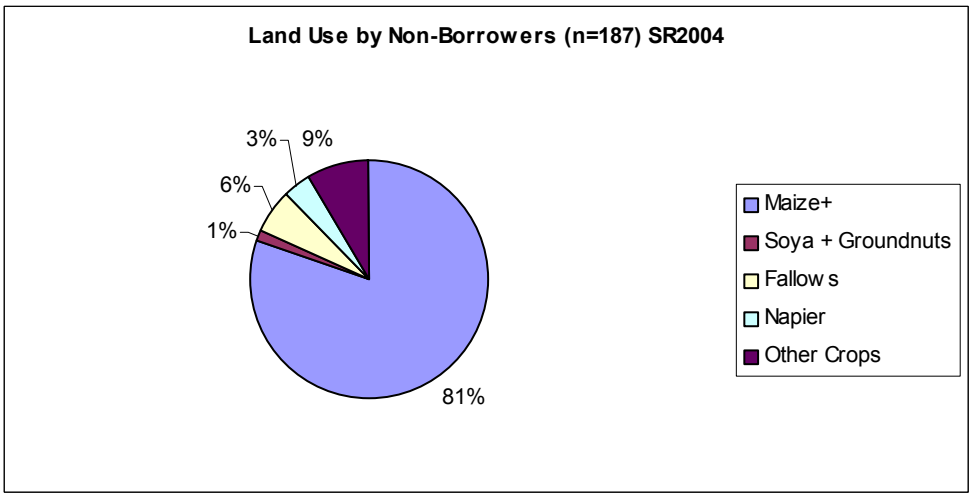
In the case of neither soyabean nor groundnuts do we think that the existence of a credit facility was critical to the decision to adopt the crop/variety. However, in the case of soyabean the project's "market" intervention may well have been.

Figure 11



source: Impact Survey Report

Figure 12



source: Impact Survey Report

The impact survey did not collect data directly on fertiliser use. However, in addition to the evidence already presented in Table 5, the Impact Survey Report found that borrowers were much more likely to have experienced increasing maize yields in the previous three-four years and that the main reasons given for these increased yields related to (increased) fertiliser use (Table 21).

The bottom row of Table 21 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. Wealthier households may be able to afford fertiliser because they can obtain cash through other activities. Thus, in Table 5 the wealth variable had a significantly positive effect on maize yield (with a similar coefficient to that of SCOBICS borrowing). However, even holding

wealth constant, access to SCOBICS loans had a significantly positive effect on maize yield. We believe that this demonstrates the importance of the affordability constraint to fertiliser use amongst households in the project areas.

Table 21: 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

Could such increases in fertiliser use have happened in the absence of credit? The experience of SCODP in western Kenya since the mid–1990s suggests that fertiliser use can be stimulated without credit. Their promotional model features demonstrations and technical advice, with the affordability constraint being tackled through sale of fertiliser in small packs. However, our respondents found that SCOBICS lending enabled them to increase fertiliser use, even though SCODP shops are present within the relevant project areas.

Finally, it is worth recalling that some farmers claim to have modified their cultural practices associated with crop production as a result of project interventions (Table 13). Again, we do not see credit as being the proximate driver of these changes.

Looking at changes in isolation may, however, 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 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].

Outcomes in Terms of Cropping Systems

The project proposal foresaw that technology adoption would lead to changes in cropping systems, which in turn would drive the livelihood impacts associated with the project's activities. We have already presented our main evidence on these changes in cropping systems in earlier sections of the report. To briefly recap, they are:

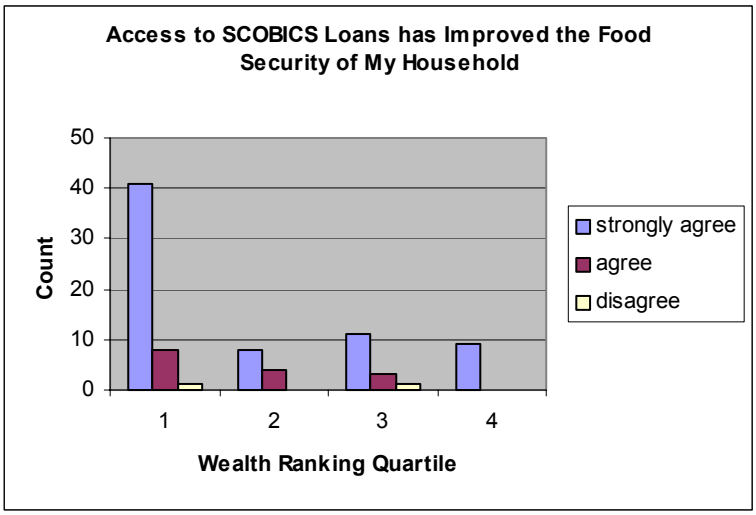
- Intensified maize cultivation, leading to higher yields (Figure 3 and Tables 5, 10 and 21), albeit not high enough yet for many households to approach self-sufficiency in maize production (Table 4);
- Diversification away from maize+beans cultivation in the short rains season (Figures 2, 11 and 12), assisted by higher maize yields in the long rains season (Table 6).

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.

Impacts in Terms of Food Security

With at best modest increases in cash income generation as a result of the project, we would expect the main impact on household food security to come through increases in households' own production of staple foods, especially maize. Table 4 has already shown 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. Figure 13 shows that borrowers overwhelmingly perceived that the food security of their households had improved as a result of being able to access SCOBICS loans.

Figure 13



source: Impact Survey Report

Table 22 goes beyond food self-sufficiency to explore changes in diet during the lifetime of the project. This shows that respondents from borrower households were more likely to report improvements in diet, and less likely to report deteriorations in diet, than non-borrowers.

Table 22: Reported Changes in Diet Since 2001/02

Nature of Change	Borrower	Non-Borrower	Total
Diet Has Improved	36 (39%)	21 (11%)	57
More Fish and Milk	1 (.)	1 (.)	2
No Change	49 (53%)	138 (74%)	187
Unspecified Change		3 (2%)	3
Diet Has Become Worse	7 (8%)	23 (12%)	30
TOTAL	93	186	279

source: Impact Survey Report

Cash Income from Crop Sales

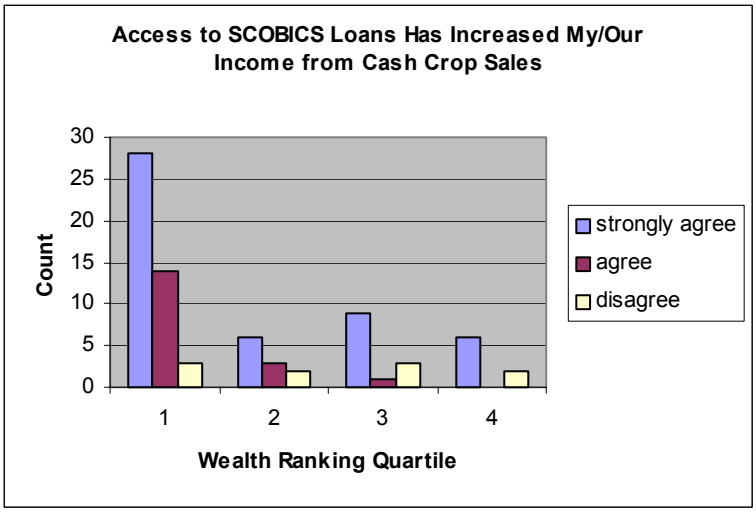
One objective of the project was to assist households to increase their income from crop sales (having diversified into new crops), so as to:

- pay for simultaneous intensification of maize production
- be able to invest more in enhancing the soil fertility resource base upon which future production depended
- meet other pressing cash needs.

Increased crop diversification does indeed suggest increased potential to earn income through crop sales. Equally, however, the project's lack of success in identifying promising new market opportunities for crops produced in the project areas leads us to expect at best only modest increases in income from crop sales.

In the light of the importance of this objective, it is unfortunate that we did not collect primary data on household crop sales. We, therefore, have to rely on the qualitative assessment of borrower respondents to the impact survey as to the impact of access to SCOBICS loans on their income from cash crop sales. According to Figure 14, the majority of respondents (87%) agreed that access to SCOBICS loans had increased their (household's) income from cash crop sales. We note that there were only 77 respondents to this question out of 94 borrowers and it is likely that some of these missing values should really have been recorded as statements of disagreement. However, even taking this into account, this represents quite a positive assessment. 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 14



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[35].

Changes in Asset Holding

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

[35] The impact survey interviewed ex-SCOBICS borrowers, most of whom would not now be borrowing because of past loan default, as well as current borrowers.

housing stock. The basic finding was that no impact of participation in the project on asset holdings could be identified from the data collected.

Livestock are the most liquid of the three types of assets studied and, as expected, livestock holdings had undergone the greatest changes during the life of the project. The biggest change, however, was a dramatic decline in any above-average holdings held in 2001/02. The Impact Survey Report suggested that there were factors particular to the livestock sector – for example, disease incidence or a collapse in the type of support services that would allow households to maintain large holdings – driving the decline in large holdings over this period, whilst the more modest gains achieved by some households represented "normal" processes of asset accumulation by those able to save.

No evidence could be found that access to SCOBICS loans had increased livestock holdings during the life of the project. Indeed, when livestock were disaggregated by type, there was some evidence that access to SCOBICS loans had had a negative effect on poultry holdings (Table 23). It was suggested that this could be linked to the use of livestock sales to repay SCOBICS loans (Figure 7).

Table 23: Explaining Changes in Poultry Holdings (Number of Birds) 2001/02 – 2004/05

Variable	Coefficient	Significance
Constant	2.80	.260
Number of Poultry Owned 2001/02	-1.000	.000
Wealth Ranking	7.564	.000
Non-Farm Income Score	-2.454	.001
Access to SCOBICS Loan	-2.256	.018
Agricultural Dependence	-1.813	.083
F =	1540.675	.000
R^2 =	0.966	

Source: Impact Survey Report

Meanwhile, there were fewer changes in the holdings of other asset types during the course of the project. In these cases, no influence – positive or negative – of access to SCOBICS loans could be found on changes in asset holdings during this period.

Reflections on Coordinated Service Provision

In this penultimate section we consider the prospects for sustaining coordinated service provision to support smallholder agricultural production in the project areas now that the project has officially finished and, briefly, the lessons from the project for achieving such coordinated service provision in western Kenya more generally.

The project has supplied three services to participating households: technical knowledge, credit and inputs (in the sense that it has availed producers of inputs that they could not readily have obtained from other sources).

One of the principal activities of the project was to distill considerable accumulated technical knowledge from years of research in project areas into a few pictorial DSSs. These resources should remain useful for years to come. However, further work (e.g. to present baskets of options for the management of plots at different points on the soil fertility gradient or to summarise information on particular new crops or technologies) will need to seek new sources of funding. Meanwhile, a number of contact persons have been trained in the use of the available DSSs in the expectation that they can assist other farmers to make productive use of them. Providing such training for new contact persons (e.g. if the SCOBICS credit scheme continues to take on more borrower groups) will need additional funding, but the sums involved should be modest.

With regard to inputs, we have discussed the possibility of an input voucher scheme to maintain a link between SCOBICS lending and input access, even if SCOBICS is run by a specialist financial institution, rather than an agricultural research project. However, we have noted that the "thinness" of the seed market in western Kenya means that, for some time to come, this is likely to be more effective in guaranteeing access to fertiliser than to the latest seed technology. The one totally new crop that the project has introduced to producers is soyabean and project staff have been working with TSBF to make it possible for commercial multiplication of the preferred soyabean variety to begin in western Kenya. However, it is one thing to ensure commercial multiplication of a particular variety that has proven popular during the lifetime of a project; another to give impetus to the development of a seed system that will continually deliver new options to producers.

Finally, the portfolio size necessary for the commercial viability, and hence sustainability, of the SCOBICS credit scheme has been discussed. We have, however, saved discussion of one aspect of the commercial viability of SCOBICS until this point. This relates to the integration of SCOBICS with other service provision to SCOBICS clients. Early on in this report we argued that service provision to smallholders needs to be coordinated. This point is well illustrated by discussions with Wedco with regard to the possible transfer of Wedco. In these discussions, Wedco management were keen to know who would be providing the *complementary* services that will contribute to the commercial viability of SCOBICS. They may have expertise in financial service delivery, but, in the challenging conditions of western Kenya, with its numerous very poor farmers with tiny holdings, they would like to know that other players will be working alongside the same farmers, assisting them to make good use of their inputs and to access remunerative output marketing opportunities.

In fact, SCOBICS has been designed in part to bring together different services within the same scheme. Thus, borrowers receive training in basic biophysical knowledge along with credit management and contact persons are trained in DSS usage. The input voucher scheme should achieve a measure of integration between input supply and credit delivery, although the limitations of this in relation to seed have just been reiterated. What no one is currently on hand to do is to further explore and develop links to new output markets.

COSOFAP exists at least in part to foster linkages between different agricultural development organisations working with poor farmers. However, so far the emphasis has been as much on information sharing across geographic locations as on coordination of service delivery to

producers within given locations. The Rockefeller Foundation Intersection Programme is seeking to coordinate the efforts of a variety of Rockefeller-funded projects in western Kenya, recognising the need to offer a range of complementary services to farmers whom they serve. In addition, district-level planning processes are beginning, which may begin to grapple with this issue. However, it has to be said that, at present there is no model for coordinated provision of services to smallholder farmers in western Kenya. This should be an urgent priority at the interface of research and development in the next few years.

The Potential Contribution of Agriculture to Poverty Reduction in the Project Areas

Finally, assuming that coordinated service provision can be achieved and that a broad-based intensification of smallholder agriculture does occur in the project areas, what contribution would this make to the achievement of national and international poverty reduction goals within the project area? This is a pertinent question because there is some scepticism amongst leading experts as to the poverty reduction that can be achieved through agricultural intensification where farm sizes are now very small (Jayne *et al.*, 2003; Marenya *et al.*, 2003; Waithaka *et al.*, 2003).

Marenya *et al.*, 2003 express their doubts as follows: "At current levels of land availability and with the inexorable population increases, even intensified farm production may offer only a modest foundation for secure livelihoods. Moreover, it is unclear whether the funds necessary to invest in agricultural intensification can be generated through farming. … In land-scarce settings such as much of western Kenya, the path to agricultural intensification and conservation of soils and other forms of natural capital may, somewhat paradoxically, begin with the education and non-farm employment necessary to generate investible resources in communities lacking broadly accessible financial services." (p1-2)

Note that their concerns are twofold: firstly that, due to tiny farm sizes, "even intensified farm production may offer only a modest foundation for secure livelihoods", and secondly that small farms may be unable to generate "the funds necessary to invest in agricultural intensification" in the first place. This latter concern assumes that there is no financial service provision to support small farms, a point that the SCOBICS credit scheme has set out to address directly. In this section, therefore, we concentrate on the former concern.

In Table 24 we estimate the cropping incomes earned by representative SCOBICS borrower farm households, defined by their land holding sizes[36], namely the mean and median holding sizes (of all respondents) as found during the impact survey. This shows how households with average land assets in the study areas would fare if they benefited from project interventions to the extent that existing SCOBICS borrowers have done[37].

[36] Implicit in this approach is the assumption that land is the limiting factor to poverty reduction through agricultural growth in the study areas; not labour or (with a functioning credit scheme) capital.

[37] Recall that in practice SCOBICS borrowers had mean land holdings above the mean for the sample as a whole.

Table 24: Agricultural Incomes for Representative SCOBICS Farm Households

	Mean Farm Size (figures in acres)		Median Farm Size (figures in acres)	
Cropping Pattern	LR2004	SR2004	LR2004	SR2004
Maize (intercrop)	1.02	0.77	0.8	0.6
Beans (intercrop)	1.02	0.77	0.8	0.6
Soya (pure)	0.26	0.38	0.2	0.3
Kales		0.13		0.1
Total	1.28	1.28	1.0	1.0
Net Cash Income (KShs p.a.)	-1718.63		-5481.22	
Value Added per person / day:				
KShs	7.60		5.94	
US$ PPP (current)	0.21		0.17	

Source: based on impact survey data

The upper half of the table shows the assumed cropping pattern for each farm "type". This is based loosely on the patterns observed during the impact survey (see, for example, Figure 11). Using the mean yields recorded by borrowers for the crops in question, plus representative input (seed and fertiliser) costs, the mean prices observed for the crops in local markets in 2004 and the input prices charged by SCOBICS (inclusive of interest), we calculate:

- The net cash income derived from the farm. This is based on the assumptions that:
    - Family members each consume 140 kg of maize per year. If the farm does not produce sufficient maize itself, then the household has to buy what is lacking;
    - Both farms support families of 6.2 people, the mean family size as found by the impact survey;
    - Households also consume modest quantities of beans and kales. If the farm does not produce these itself, then again the household has to buy what is lacking;
    - Expenditure on inputs is also factored into net cash income;
- Value added created on the farm, i.e. the gross margin once input costs are deducted from the value of output (all valued at local market prices). This is a measure of the consumption that can be supported through agricultural production. In the lower part of the table it is expressed in terms of the consumption per family member per day (of the year), either in current KShs terms (for comparison with the Kenyan rural poverty line of KShs 45 per person per day) or in purchasing power parity adjusted US$ (for comparison with the international measure of "dollar a day" income poverty) [38].

[38] The first MDG is based on the proportion of people with daily consumption per person below US$1 in 1993 purchasing power parity terms (Lipton and Waddington, 2004, p146). The purchasing power parity adjustment factor used here is 2.30, which was calculated from figures supplied in the database to the 2005 UNDP Human Development Report (http://hdr.undp.org/statistics/data/countries.cfm?c=KEN). We have not obtained a value for 1993. However, the adjustment factor has been falling over time and was probably in excess of 3.00 in 1993. Thus, if 1993 PPP US$ were used, the value added per person per day would be higher than shown in Table 23, implying that the potential contribution of agricultural production to internationally measured poverty reduction targets amongst our surveyed households could be higher than shown in this table. Nevertheless, value added per person per day would still be way below US$1.

Table 24 shows that:

- Even after benefiting from the services of project R7962, including SCOBICS credit, both household types are net food deficit, i.e. they have to buy in more food than they sell (net cash income was negative). This reinforces the point made earlier that, whilst the project's development interventions have enhanced food security, they have not raised yields enough to bring even average households to self-sufficiency;
- Agricultural activities only make a small contribution (15-20%) to the consumption levels required for these households to escape poverty, as defined either by the Kenyan rural poverty line or the first international MDG. Even after participating in project activities, these "average" households would desperately need non-farm income to survive.

In Table 25 we ask what contribution agriculture *could* make to the livelihoods of households in the project areas under a "best case" agricultural intensification scenario. In this case, however, we do not present results for the mean and median household types. Rather, 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 technologies more fully than those with less land. The two types in Table 25 are still defined by their land holding sizes, but this time their holding sizes are the 25th and 75th percentile.

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[39] 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.

One final additional dimension to this scenario is the crop pricing. 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. As a result, the crop prices are adjusted downwards from those used in Table 24 by proportions suggested by Table 19. This has the effect of reducing the net cash income of the 75th percentile farm, but reducing the deficit of the 25th percentile farm.

[39] Dual purpose soyabeans are improved varieties developed by IITA to produce both above-average bean yields and high biomass that can incorporated into the soil to improve fertility.

Table 25: "Best Case" Agricultural Incomes for Representative SCOBICS Farm Households

	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

We note that it has taken 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 (although, as discussed earlier, prices of soyabean and other crops where local demand is limited will fall long before maize prices do). This is perhaps good news for "adopting" farmers seeking to intensify their agricultural production, but bad news for poorer farmers with small holdings who have little prospect of ever supplying all their own maize requirements and would, therefore, benefit from lower local food prices.

Under this optimistic scenario, "adopting" farm households do 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. Poorer farm households do not achieve these objectives, but benefit from lower food prices in local markets and should also benefit from greater casual employment on "adopting" farms (see Table 3). For "adopting" farms, agricultural value added is greatly increased compared with the scenarios presented in Table 24, but is still just under half that required for this farm type to escape poverty, as defined by the first international MDG. (It is only a third of that required to escape poverty, as defined by the higher Kenyan rural poverty line). This confirms beyond doubt that non-farm income sources are vital if households in the densely populated areas of western Kenya are to escape poverty.

However, before one jumps to the conclusion that all efforts should be poured into increasing non-farm employment opportunities, rather than supporting agricultural growth, we note that

demand for non-farm goods and services (many of which are non-tradables) is highly dependent on the incomes of farm households. In other words, there are also limits to the ability of the rural non-farm economy to act as an exogenous engine of growth. Thus, recognition of the limits to the contribution that agricultural intensification can make to poverty reduction in rural areas with high population densities and small farm sizes should lead us to a balanced growth strategy. It is not a case of either agricultural growth or non-farm growth.

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