Integrated Soil Fertility Management and Poverty Traps in Western Kenya

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Abstract

Based on agro-climatic conditions, the highland districts around Lake Victoria in western Kenya should be a food surplus area. In practice, they are heavily dependent on food imports, whilst national poverty surveys consistently show them to be amongst the poorest in the country. At the root of this problem are high population densities and, therefore, small land holdings, and limited access to markets. As a result of continuous cropping with very little investment in soil fertility replenishment, the soils have become severely depleted. Many poor households in these districts are now caught in a "maize-focused poverty trap", whereby 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 fertilizers. Thus, despite that the majority of average household puts large portions of its land under maize during both cropping seasons, it is still unable to feed itself for several months of the year. 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.

To invest in soils, most households (unless they have a reliable source of non-farm income) need to diversify into higher value crops than maize. However, the combination of small land holdings and existing maize deficits mean that they will only plant other crops if they can simultaneously raise their maize yields. Achieving this requires that a number of conditions must be in place. Firstly, households must be linked to markets, so that they can identify higher value cropping opportunities and be able to market their crops once they have grown

them. In the western highlands, most producers are only familiar with local markets (where opportunities are limited) and they can initially only offer small quantities of produce, which reduces their attractiveness to potential buyers. Secondly, they need technical knowledge, on best cultural practices for the new crops and, critically, on how to manage their natural resource base, so as to increase their yields both of maize and of the new crops.

Thirdly, they 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. Finally, most will also need access to credit, so as to be able to acquire inputs for more intensive maize production. This credit can then be repaid out of the sale of the additional crops later in the year. Critically, all these conditions need to be in place within their 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.

This paper reports the experience of a DFID-funded action research project that, since 2001, has been exploring the potential for coordinated development interventions to enhance livelihoods through the promotion of integrated soil fertility management in collaboration with national and international institutes and extension services. Experiences with the provision of technical advice, the development of a community based credit scheme for agricultural inputs, initial steps towards linking farmers to new markets and making new seeds available to producers are reviewed and constraints identified, along with initial indications of the impact that coordinated service provision could have on agricultural production and livelihoods. Finally, the over-arching challenge of how to coordinate the provision of these services on a sustainable basis is considered.

Key words – *Integrated soil fertility management, Poverty traps, Access to credit, decision support system, Access to market, quality seed, subsistence farming, rural households, western Kenya.*

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Introduction

Most rural households in Africa are dependent on agriculture for an important part of their livelihood. Increasing farm productivity for the millions of people engaged in agriculture is clearly required for living standards to rise and for these people to come out of poverty. However, land degradation and soil fertility depletion in smallholder farms are serious threats - the fundamental biophysical root cause of declining per capita food production (Sanchez et al., 1997) and a major cause of poverty amongst rural households (Krishna et al., 1994). Large numbers of rural households are trapped in a vicious cycle between land degradation and poverty, and the lack of resources and knowledge to generate adequate income and opportunities to overcome the degradation. Consequently, investments by national governments and the international community have been insufficient to arrest poverty, ensure food security and reduce environmental degradation, as national economies have remained stagnant and the quality of services and governance have deteriorated.

In Kenya, national poverty surveys consistently show the highland districts around Lake Victoria to be amongst the poorest. About 55% of the households in this region were classified poor in 1992, 54% in 1994 and 59% in 1997 (GOK, 2003). Based on agro-climatic conditions, these districts should be a food surplus area. Instead, they are heavily dependent on food imports. At the root of the problem in these districts are high population densities and, therefore, small land holdings (ranging between 0.5 and 2.0 ha per household). Due to continuous cropping and little investment in soil fertility replenishment, the soil has become severely depleted. Neither phosphorus nor nitrogen levels are sufficient for even moderate agricultural performance (Shepherd and Soule, 1998). In addition, small-scale subsistence farmers still lack access to i) the basic agricultural inputs (fertilizer and good quality seed etc) ii) capital or credit, iii) extension service and information and iv) crops for market.

As a result, many poor households in these districts are now 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 a third of its land under maize during both cropping seasons, it is still unable to feed itself for several months of the year (Sanchez et al, 1997). Meanwhile, it earns very little 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.

There is therefore need to develop an integrated soil fertility management approach (ISFM and integrated agricultural research for development) to assist farmers to fight hunger, reduce poverty and generate economic growth. In turn, this will require coordinated provision of a number of support services. Sanchez et al (1997) suggested three basic requirements for increasing per capita agricultural production as being i) an enabling policy environment for the smallholder faming sector (improved infrastructure, access to education, credit, inputs, markets and extension services, ii) reversing soil fertility depletion, and iii) intensifying and diversifying land use with high value products

In the highland districts of western Kenya, most households (unless they have a reliable source of non-farm income) will need to diversify into higher value crops than maize if they are to invest in their soils. However, the combination of small land holdings and existing maize deficits mean that they will only plant other crops if they can simultaneously raise their maize yields. They will only be able to do this if they can access the following support services. Firstly, households must have sufficient information about markets to be able to identify higher value cropping opportunities. Currently, many producers are only familiar with local markets (where opportunities are limited). 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. Secondly, they need technical knowledge, on best cultural practices for the new crops and, critically, on how to manage their natural resource base, so as to increase their yields both of maize and of the new crops. Thirdly, they 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. Finally, most will also need access to credit, so as to be able to acquire inputs for more intensive maize production. This credit can then be repaid out of the sale of the additional crops later in the year. Critically, all these services need to be in place within their 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.

The objective of this paper was to evaluate the potential for coordinated development interventions to enhance farmers livelihoods through the promotion of integrated soil fertility management in collaboration with national and international (ICRAF, TSBF, etc.) institutes and extension services. In particular, we evaluated i) the impact of Decision Support Systems (DSS's), ii) options to diversify *beyond* (as opposed to *out of*) maize, iii) the introduction and impact of a community based credit scheme, iv) market opportunities and pricing structures in Western Kenya and v) the over-arching challenge of how to coordinate the provision of these services on a sustainable basis. This objectives were evaluated based on the experience of a DFID-funded action research project that, since 2001, has been exploring the potential for coordinated development interventions in Western Kenya.

Project Background

Since 2001 an action research project funded by the UK Department for International Development's Natural Resource Systems (Research) Programme has been working within the food-crop based land use system in the highlands of western Kenya to pilot a new integrated approach to improving farmers' livelihoods. Building on much previous and ongoing research by many institutions, it is exploring the potential for coordinated provision of support services to enhance livelihoods through the promotion of integrated soil and crop management.

The project operates in villages of Yala division (Siaya district), Emuhaya division (Vihiga district) and, from 2004, Matayos divison (Busia District) and Sigowet division (Kericho Districts). Typically a village contains between 80 and 140 households, a sublocation contains 240-320 households and a location contains 680-750 households or 4-5000 people (Noordin et al., 2001). The project activities were located in existing KARI/KEFRI/ICRAF pilot project village committee (Noordin et al., 2002), Ministry of Agriculture National Agricultural and Livestock Extension Programme (NALEP) Focal Area committees (Baiya, 2000) and Farmer Field School committees sites. The districts have the densest rural population in the world – 500 to 1200 people km^2 (Hoekstra and Corbert, 1995). The soils in the region are high Padsorption Alfisols and Oxisols,.There are about 6 million people and 2 million farms in the highlands in a total area of 10 000 km^2 with average farm size of 0.5 ha. Annual rainfall ranges from 1200 to 1800 mm with a bimodal distribution. However, maize yield is often as low as 1 ton ha^{-1} over two cropping seasons and with households needing > 1000 kg yr^{-1} of maize for food security, most households are only producing enough maize to feed themselves for a few months. Most household purchase maize on the market during the remaining months or endure a hunger period. About 80% of farms are severely deficient in P and most are deficient in N when P deficiency is overcome (Shepherd and Soule, 1998). Heavy striga infestation occurs in many farms in the region. About 40% of farmers use some fertilizer, but at lower than the recommended rates and often too late for optimum timing of application (Swinkel et. al., 1997). Over 70% of households are below the poverty line and depend mainly on subsistence farming (Wangila et al., 1999).

The project encompasses all four areas of intervention highlighted earlier (Figure 1). To enhance technical knowledge, the project is producing and testing a range of decision support tools (DSSs) that present accumulated technical knowledge in farmer-friendly ways. The first DSSs to be produced have been biophysical. The DSSs empower farmers and service providers to carry out nutrient deficiency diagnosis and give corrective measures, give options for striga management and control and lastly give options for better land management for better returns. They stress the importance of combining organic and inorganic inputs, given their complementarities in enhancing soil fertility and the lower cost and risk involved when compared with relying on inorganics alone. Project staffs are now working on DSSs covering the use of credit and aspects of produce marketing. Farmers are also nominated by their peers to establish pro-active demonstration trials for new innovations and seed varieties obtained from various public organizations and private companies.

Secondly, the project is developing a community based credit scheme for agricultural inputs, known as SCOBICS[1] (Figure 1). The SCOBICS scheme was developed together with, and has up till now worked largely through, either village / sublocational or catchment committees. These were originally established either by a previous ICRAF-run project or by the Ministry of Agriculture and Rural Development to support the promotion of agricultural production technologies. Committee members have played a key role in deciding which farmers may deservedly receive credit and in channelling repayment from these farmers back to KEFRI.

Thirdly, initial steps have been taken to link farmers in the pilot areas to new markets, especially in Kisumu. Linking farmers to market has involved price data collection from local markets, price data analysis from Kibuye market, survey of traders at Kisumu markets, farmers' visits to Kisumu market, plus interviews with millers and supermarkets. The data is then discussed with the farmers.

[1] SCOBICS stands for Sustainable Community-Based Input Credit Scheme. SCOBICS builds on an earlier credit initiative by ICRAF, expanding in scope (in terms both of products supported and geographic areas covered) over time. A document "Introduction to SCOBICS - 2004" is available from jndufa@africaonline.co.ke. This contains rules and procedures on whom SCOBICS will work with, the role of borrower groups, how annual credit allocations are determined, excluding non-performing groups from participation in SCOBICS, the annual lending schedule, credit information days, screening of loan applications, input acquisition and distribution, record keeping, management of the SCOBICS account, the interest rate charged and inputs supported.

Finally, having identified crops and varieties with potential both at farm and market level - and preferably which contribute to both soil fertility and income-generating objectives – there is the challenge of making seeds available to producers in adequate quantities. Farmers are encourage to start informal community based seed production systems using the seed obtained from National Agricultural Research Systems (NARS) and International Agricultural Research Centres (IARCs) while discussions are held with the commercial seed production sector.

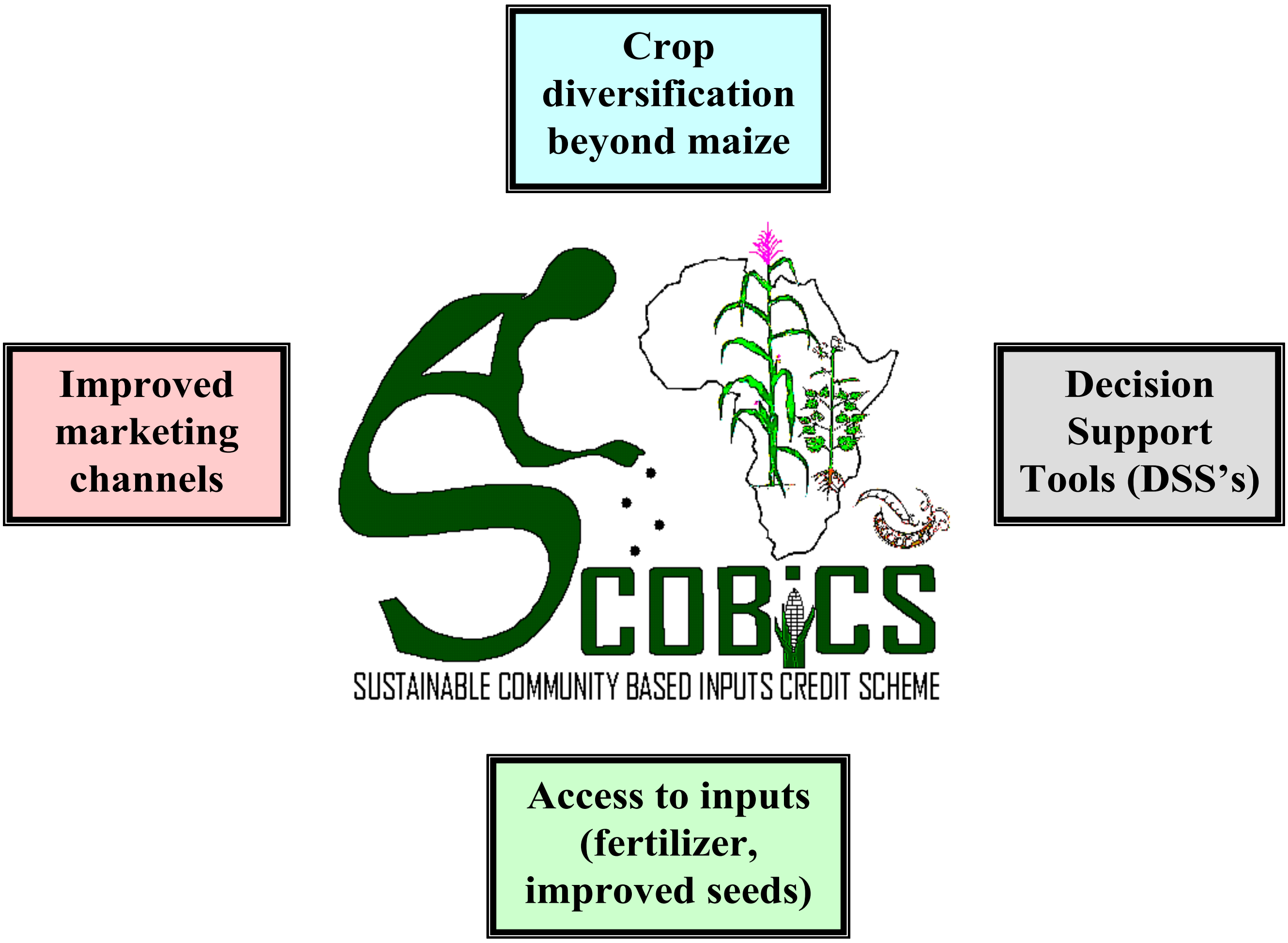


Figure 1: Cornerstones of the Sustainable Community Based Input Credit Scheme (SCOBICS).

Experiences to Date

Provision of technical knowledge to farmers

Provision of technical support to farmers involved understanding farmers' traditional soil fertility management options and cropping patterns, community based testing of improved cropping innovations and varieties, farmer visits to various organization and on-farm trials, provision of information on NRM innovation, capacity building and provision of DSS support materials.

Decision support system and cropping patterns

DSS for nutrient deficiency diagnosis and corrective measure, striga management and control and better land management for improved returns were developed and further refined by farmers and extensioners and have been translated into local languages. The DSS are easy to understand pictorial presentations, which depict farmers' cropping patterns and possible interventions obtained from various research organizations to counter farmers' constraints. Both farmers and extension workers are now being trained as resource person on the use of these DSSs. The DSSs were developed and pre-tested with farmers in 2001 in three sub-locations. Subsequently, in other project areas the DSSs were used as training tools

DSS have also played an important role in influencing farmers cropping patters (Figure 2+3). Farmers have now diversified beyond maize and they can target landuse constraints through better management of soil fertility management options and targeting of the various crops for high returns. Farmers are now growing market-oriented crops for income and at the same time trying to alleviate soil fertility constraints and striga control.

Figure 2. Farmers seasonal cropping system patterns before and during the introduction of DSSs (Decision Support Systems) and participatory farmer designed trials among SCOBICs farmers in Vihiga and Siaya district (n=99)

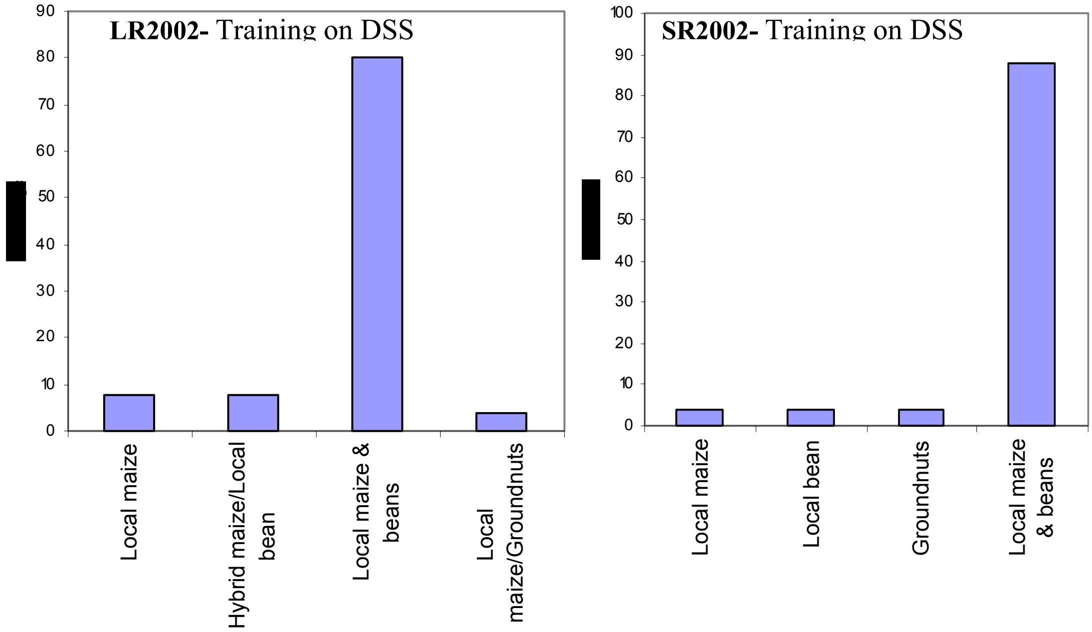
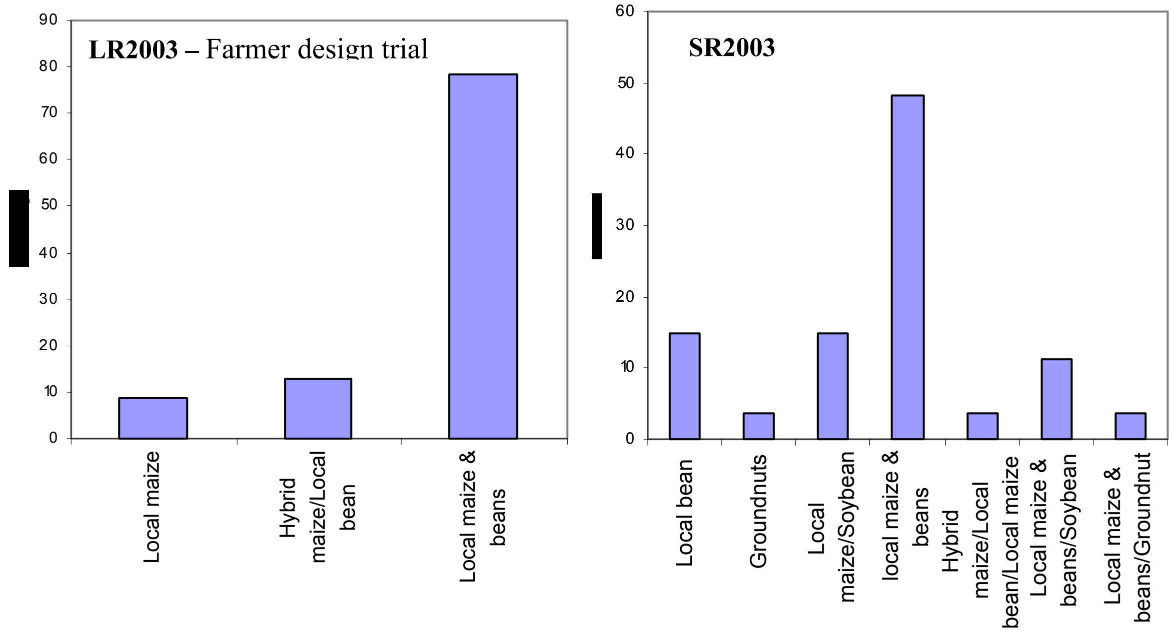


Figure 3. Farmers seasonal cropping system patterns after the introduction of of DSSs and participatory farmer designed trials among SCOBICs farmers on cropping patterns in Vihiga and Siaya district (n=99)



Participatory evaluation of different seed varieties.

Varieties of three crops were tested under farmer-managed trials in the 2003 long rains season, with addition of nitrogen and phosphorous input at recommended rate. These were:

- nine maize varieties obtained from KARI, Kenya Seed Company, Western Seed Company, LAGROTECH Seed Company, CIMMYT and input shops (tested on three farms). Striga IR maize was obtained from CIMMYT.
- two groundnut varieties obtained from KARI (tested on two farms)
- four soyabean varieties obtained from KARI and IITA (tested on three farms).

Depending on the variety, maize yields varied between 1.5 – 2.8 tons/ha on the striga infested farm, 4.1 – 6.2 tons/ha on the farm previously under *Crotalaria grahamiana* fallow and 2.2 to 6.7 tons/ha on the farm previously under natural fallow (Table 1). Soyabean yield varied between 0.8 – 2.0 tons/ha (Table 2) and groundnuts yield varied between 1.0 to 1.6 t/ha, depending on location and variety (Table 3). In addition to getting the potential yield under farmers' conditions, field days were held to get farmers' evaluation of the different maize, soybeans and groundnut varieties. Farmers' evaluation criteria included high yields, resistance to storms, tolerance of striga and maturity period (Table 4). The field days and associated evaluations had a strong influence on the demand for seed under the SCOBICS credit scheme for the 2004 long rains also on farmers' cropping patterns, since they acted as a demonstration and training site. Farmers are now growing more market oriented crops (see below).

Table 1. Yield of different maize varieties (kg/ha) in three farmer managed trial plots in Vihiga and Siaya Districts in long rains 2003

Site/Cropping history/Variety	**Yield data (kg/ha)**		
District and Site	Vihiga District R. Amayi farm	Siaya District J. Nyamas farm	Siaya District Z. Liewa farm
Short rains 2002	Maize + striga	Fallow-crotalaria	Natural fallow
H513	1729	4068	2235
H614	2221	5727	4218
ECAVL	1919	5257	6520
WH904	2373	5644	6733
WH502	2499	6082	5998
KSTP94	2205	5431	4176
Pioneer	2789	5030	2800
Maseno double cobber	2202	5445	2261
Local variety	1494	4496	4072
Mean	**2159**	**5242**	**4335**

Table 2. Yields of different soybean varieties (kg/ha) in three farmer managed trial plots in Vihiga and Siaya Districts in long rains 2003

Site/Cropping history/Variety	**Yield data (kg/ha)**		
District and site	Siaya District Jerim Otieno farm	Siaya District Joseph Oloo farm	Vihiga Districf Richard Amayi farm
Short rain 2002	Fallow-crotalaria	Maize+striga	Maize+striga
Nyala (EM)	1200	Eaten by gazelle	800
Hill (EM)	1600	1600	1400
Gazelle (MM)	1400	**Eaten by gazelle**	1200
TGX1448 2E (LM)	2000	1400	1400
Mean	**1550**	**1500**	**1200**

EM= Early maturing; MM= Medium maturing; LM= Late maturing

Table 3. Yields of different groundnuts varieties (kg/ha) in two farmer managed trial plots in Vihiga and Siaya Districts in long rains 2003

Site/ cropping history Variety	**Yield data (Kg/ha)**	
District and Site	Vihiga District Rinah Muchukah farm	Siaya District Peres Ochillo farm
Short rains 2002	Maize + striga	Maize + striga
ICGVSM 88710 (Virgnina type)	1000	1600
ICGVSM 89749 (Valencia type)	1400	1400
Mean	1200	1500

Table 4. Reasons given by farmers for selecting the best bet varieties of maize, soyabean and groundnuts

Crop	Best bet variety	Reasons given/Farmers evaluation
Maize	WH 502 and WH 904	High yielding, relatively short height withstood storm, weight at harvest was relatively high, good tolerance to striga weed – WH 502 yielded higher compared to other striga tolerant varieties
	KSTP 94	Only advantage was that it matured earlier than western seed varieties. Its tolerance to striga weed was lower than that of WH 502 and this affected yields.
	H614	Only 'undoing' is that it takes longer to mature and its height, but with good agronomic practices it yields highly in a striga free environment.
Soybean	TGX 14482E	Produces a lot of biomass which is good for the soil organic matter content, and also yields higher compared to the other varieties.
	Hill and Nyala	Good alternatives for the TGX 14482E variety especially for the short rain season. Their yields are slightly lower than that of the TGX 14482E variety
Groundnut	Virginia type	High yielding variety compared to 89749 variety (Valencia type), which is also highly susceptible to the groundnut rosette that adversely affects yields. The Virginia type variety of groundnuts also fetches a higher amount of money compared to the Valencia type of groundnuts

Access to Credit by Farmers

Few microfinance institutions in Africa have so far shown interest in providing loans to support smallholder agricultural production, because the seasonal nature of agricultural cash flows does not fit well with their current strategies for ensuring loan repayment. Hence they consider such lending to be too risky (Dorward et Al, 1998; Morduch, 1999). In Kenya, however, both the major microfinance institutions, K-REP (based in Nairobi) and Wedco (based in Kisumu) appreciate the importance of developing loan products for supporting seasonal agriculture if microfinance is to increase its contribution to poverty reduction efforts in the country. SCOBICS seeks to develop an effective and viable model for seasonal lending that can ultimately, if successful[2], be taken on by Wedco as a commercial pilot project.

SCOBICS began with efforts by ICRAF in 1999 to promote the use of rock phosphate fertiliser amongst farmers in pilot villages of Sauri sublocation, Siaya District, through the provision of credit in kind. Under ICRAF management, the pilot credit scheme expanded to take in an additional sublocation (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 current project, its mode of operation changed and the name SCOBICS was born. Since then, the scope of the scheme has expanded further, as follows:

[2] Success will be measured by two main criteria: outreach and loan repayment rate. Discussions with Wedco have suggested that a loan portfolio of KES 2 million with a high repayment rate (90-95%+) would be needed to encourage them to take the scheme on as their own pilot project.

- the range of products supported has been further expanded to include: TSP fertiliser (2002), DAP fertiliser (2003), urea and CAN fertiliser (2004), soyabean and groundnut seed (2004);
- In 2003, two Ministry of Agriculture and Rural Development extension "focal areas" - Ebukhaya and Gongo - joined the scheme;
- In 2004, three further areas – Ebusiloli (Vihiga), Muyafwa (Busia) and Kaplelartet (Kericho) also joined.

The total amount borrowed in 2004 is Kshs. 545,000 (e.g. US$ 7786 equivalent).

Up until 2003 the scheme worked through either village / sublocational or catchment committees and these remain the first point of contact for the scheme, including when expanding into new areas. These committees were originally established to support the promotion of agricultural production technologies, either by a previous ICRAF-run project or by the Ministry of Agriculture and Rural Development. Committee members have played a key role in deciding which farmers may deservedly receive credit and in channelling repayment from these farmers back to KEFRI (formerly to ICRAF). Starting with the 2002 long rains season, each sublocational committee was given an annual credit allocation, based on the previous year's repayment 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, although SCOBICS did specify certain conditions that new borrowers had to fulfil (e.g. having repaid any previous loans, attending the annual Credit Information Day in their area). The compiled requirements were returned to KEFRI-Maseno by the beginning of December and a competitive tender process was instigated to choose a supplier for the products demanded. The winner of this process[3] was contracted to acquire the required inputs, repackage them as necessary[4] and distribute them to a central location within each of the three sublocations. This distribution took place in early February, in good time for planting in the long rains season.

Table 5 shows the expansion of the credit portfolio and the credit repayment performance by sublocation from 2001-2003. The table shows a mixed picture, with consistently good repayment performance amongst Tatro members, good initial performance from Ebukhaya and Gongo, but mediocre or poor performance in Nyamninia and Sauri. In 2003 Sauri, Nyamninia and Tatro were not eligible for credit, as they had not met the repayment conditions from 2002 (Tatro completed its repayments too late for the 2003 tendering process).

[3] For both 2002 and 2003 the winner was Jumbo Agrovet, an input stockist with a store in Luanda. In 2004 the winner was SCOBICS.
[4] Borrowers can order fertiliser in quantities of 10kg, 25kg or 50kg. Seeds are sold in 1kg or 2kg packs.

Table 5. Credit percentage repayment by different sublocations and NALEP focal areas in Vihiga and Siaya Districts

Sublocation / Village	Amount Borrowed 2001	% Loan Recovery 2001	Amount lent in 2002	Total recovery by 14 November 2003	Amount lent in 2003	% Loan Recovery 2003	Total Amount Lent 2001-2003	% Loan Recovery Overall	New Lending in 2004
Sauri									
Sauri	7811	69%	21300	40%	0		29111	48%	
Soso	5343	35%	18652	46%	0		23995	43%	
Nyamninia	2727	36%	16800	2%	0		19527	7%	
Luero	17028	12%	15552	14%	0		32580	13%	
Kosoro	4632	23%	10736	0%	0		15368	7%	
Yala	5735	12%	9510	8%	0		15245	10%	
Sarika	0		14502	0%	0		14502	0%	
Madiri	5938	24%	11436	17%	0		17374	19%	
Total	*49214*	*27%*	*118488*	*19%*	*0*		*167702*	*21%*	*0*
Nyamninia									
Muhanda	10342	86%	40748	66%	0		51090	70%	
Nyamboga	4950	100%	30526	50%	0		35476	58%	
Umiru	550	73%	2764	4%	0		3314	15%	
Ginga	0		6452	12%	0		6452	12%	
Muhoho	2745	65%	22652	43%	0		25397	45%	
Total	*18587*	*86%*	*103142*	*51%*	*0*		*121729*	*57%*	*30000*
Tatro	*24000*	*100%*	*108958*	*100%*	*0*		*132958*	*100%*	*150000*
Gongo					*47040*	*100%*	*47040*	*100%*	*100000*
Ebukhaya									
Emabuye					22119	100%	22119	100%	
Emukunzi					10134	100%	10134	100%	
Musikoye					9494	100%	9494	100%	
Musitoyi					15453	100%	15453	100%	
Total					*57200*	*100%*	*57200*	*100%*	*115000*
Ebusiloli									50000
Kaplelartet									50000
Muyafwa									50000
Total SCOBICS	**91801**	*58%*	**330588**	*56%*	**104240**	*100%*	**526629**	*65%*	**545000**

The main incentive mechanism for ensuring credit repayment under SCOBICS is the linkage between current repayment performance and future credit access. Up till 2003, this mechanism operated at the sublocational level. Thus, a sublocation that failed to achieve 80% repayment performance in a given year was not eligible for credit at all the next year, whereas a sublocation that repaid in excess of 99% of it loan could double the volume of credit that it received the next year. Intermediate repayment rates qualified for intermediate credit volume ratios the following year. By the end of 2003, it was concluded that incentives for repayment were insufficiently strong under this model, for the following reasons:

- Some committees were not as strong as originally hoped;
- In some cases (especially Sauri and Nyamninia), inadequate attention was given to screening. Indeed, in parts of Sauri, the loans were described to potential borrowers as "government money" that would not need to be repaid;
- The general level of awareness about loan repayment is too low and the numbers of borrowers involved is too large for the incentive system to work at sublocational level. Where (as in Sauri and Nyamninia) no one really believed that 80% repayment would be achieved by current borrowers, even those who would have been willing to repay in order to gain access to future loans held back, as repayment would not be rewarded with future credit access under SCOBICS rules.

Therefore, beginning in 2004, SCOBICS moved to a new, small-group-based lending model, with the same mechanism linking current repayment performance and future credit access now operational at the group level[5]. Existing borrowers within the scheme who had repaid all their loans in full, plus new borrowers joining the scheme, were required to organise themselves into groups of 5-10 (who would be judged collectively on their repayment performance) as a precondition for receiving a loan in 2004.

The change was greeted with considerable enthusiasm, both by individuals who now felt freed to repay their loans, unburdened by responsibility for others in their sublocation, and by committee members, who had despaired of persuading a sufficient number of borrowers to repay in order to meet the sublocation-level targets. It was noted that some of the women in these areas already had experience of giving each other loans from Rotating Savings and Credit Associations (ROSCAs) within small groups and that this works fine as long as group members select each other. However, in practice, the few borrowers from Sauri who had repaid their loans and attended the Credit Information Day were unable to agree to form groups together, as they did not trust each other sufficiently to be judged collectively on their repayment performance. Thus, no new loans were extended in Sauri in 2004, although some 2002 borrowers from Nyamninia did re-enter the scheme.

The group-based approach is closer to Wedco's current lending approach than the committee-based approach that was tried previously. However, the SCOBICS incentive structure is different from that operated by Wedco, who use a mutual liability approach originally pioneered by Grameen Bank. Both theory (Stiglitz, 1990) and experience suggest that the Grameen-style approach has shortcomings when applied to rainfed smallholder agriculture (one of the reasons why SCOBICS did not adopt it at the start of the project). The SCOBICS incentive structure, applied at small group level, may have superior incentive properties to the Grameen-style approach in bad years, but these theoretical properties still need to be tested out in practice.

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[5] Regardless of the allocation made to their borrower group, an individual borrower who fails to repay 80% of their outstanding balance by the end of a given year will not be eligible for a further loan the following year. They will, however, be eligible for readmission into the scheme – subject to the consent of their fellow group members – once they have *fully* cleared the balance remaining. Where a group achieves loan repayment of 95% or more, so becomes eligible for an expanded credit allocation, it will be up to group members to decide whether the additional sum should be used to either increase the size of the loans taken by existing members or incorporate additional, trusted borrowers into the group as new members. However, where the addition of new members takes a group above the ceiling of 10 people, the group will be expected to subdivide, with each half forming a group in its own right, with its own contact person and its own repayment incentives.

Meanwhile, experience has also shown the importance of providing training to both individual borrowers and committee members if acceptable repayment levels are to be achieved. Wedco staff were invited to provide training to borrowers in 2003, which appears to have paid dividends.

Accumulated experience has also generated the following guidelines for screening loan applicants in 2004:

- All applicants should be required to work through the relevant DSSs with a resource person before being approved for a loan.
- The need to plant higher value crops should be stressed to all potential borrowers. A simple rule could be that no one is allowed a loan without a clear plan to plant one or more higher value crop(s) intended primarily for sale across the two seasons.
- Borrowers should be encouraged to think carefully about the expected (financial) benefits of taking a loan. If these are not twice the cost or more, then they should not borrow.

Each borrower should be able to suggest two or three plausible ways of repaying their loan *before* they are allowed to borrow. Where two options are crop-based, ideally one should be related to long rains production and one to short rains production. At least one option should be unrelated to crops, in case both long and short rains seasons are bad.

Looking forward, there are grounds for optimism that the small-group-based lending model, plus additional training inputs from Wedco and generally enhanced awareness of the importance of screening loan applicants, will generate good repayment performance in 2004. If so, it is possible that by 2006 the scheme could be close to its target loan portfolio of KES 2 million.

Handing over to a specialist microfinance provider such as Wedco will, however, require changes to scheme operation, even if the basic loan product (seasonal loan, delivered to borrowers organised in groups, with the SCOBICS repayment incentive scheme) is adopted unchanged by Wedco. In particular, it is unlikely that a specialist microfinance provider would be willing to organise the tendering process for input supply that SCOBICS has arranged each year. A possible solution to this problem is the introduction of input vouchers, redeemable at recognised stockists, that is being considered by CNFA, an NGO preparing to work with input stockists in the area.

Linking farmers to markets

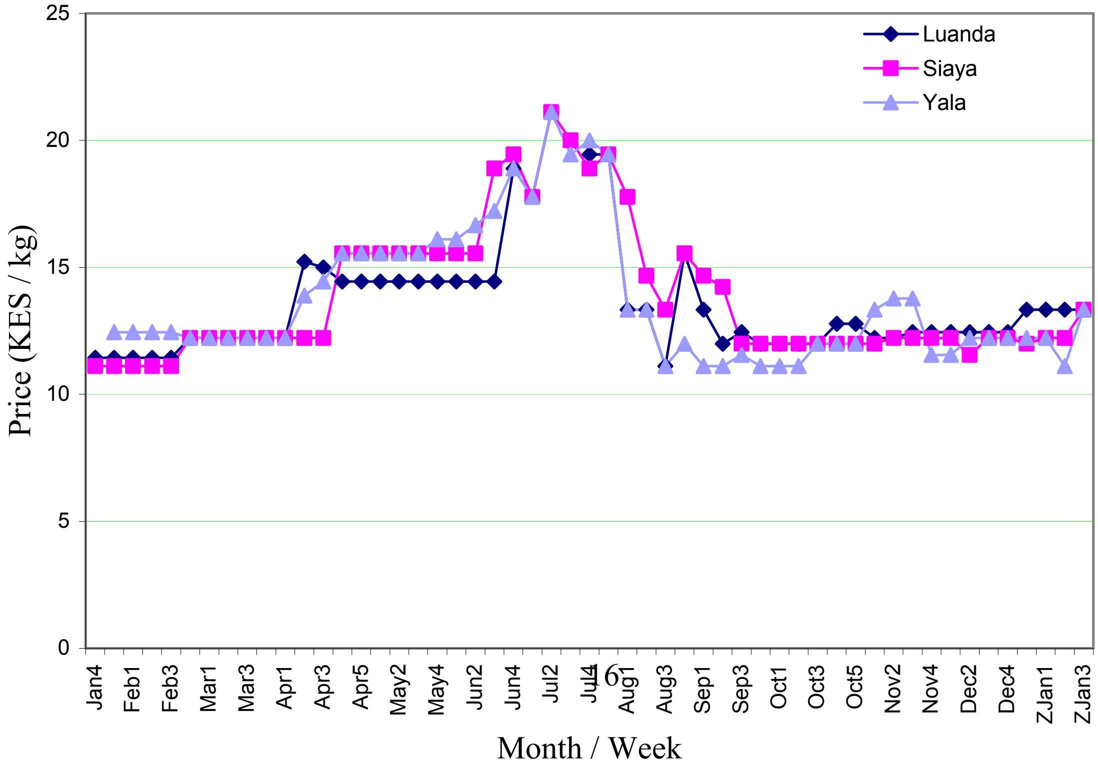
This dimension of the project featured less prominently in the project concept and proposal than the biophysical work (e.g. DSS development) and credit provision and, partly as a result, implementation began later. With the benefit of hindsight, this was a mistake. Having seen the performance of new crops and varieties in their fields, obtained access to input credit and begun to understand the importance of growing higher value crops alongside maize[6], farmers are keen to plant new crops, even though the market prospects for these have yet to be convincingly established.

[6] A project activity not discussed in any detail in this paper is participatory budgeting work, whereby farmers have been encouraged to consider the returns (financial and to labour) that they achieve from different crop and technology mixes. The dominant lesson drawn from these exercises by participating farmers has been that maize production does not pay!

Efforts to link farmers to market began with a series of market research exercises, plus initial efforts to familiarise selected farmer representatives with the major, informal wholesale and retail markets in Kisumu. Having been producing predominantly maize and local beans, and generating insignificant marketed surpluses, many producers in the project areas are only familiar with local markets. As opportunities in these markets were perceived to be limited, it was decided to explore opportunities within Kisumu markets (not too far away, not too demanding in quality terms) as a first step. Market research exercises covered both price monitoring (of crops in local markets, plus price data analysis from Kibuye market in Kisumu) and a survey of traders at Kisumu city markets that aimed to understand the structure and conduct of these markets, given farmers' fears that (as inexperienced outsiders) they could be exploited by traders in these markets, even if they had produce that they could sell profitably at prevailing market prices.

So far, price analysis has only been conducted on three crops: maize, beans and groundnuts (as there have been difficulties establishing reliable unit weights for other commodities in local markets). Figure 4 shows weekly wholesale prices (in KES per kg) for maize in three local markets – Luanda, Yala and Siaya – over a one-year period commencing January 2003. It shows that the highest local price, achieved in mid-July, was around 90% above the lowest, achieved in January-February and September-October. This represents a similar degree of intra-seasonal price variability to that observed in other countries of Sub-Saharan Africa in areas with uni-modal production (Coulter and Onumah, 2002) and a much higher degree of intra-seasonal price variability than is observed locally for beans and groundnuts. It may, therefore, provide one explanation for why most households in Siaya and Vihiga put maize production as their first priority. For local surplus producers, maize marketing between June and early August would fetch the highest prices, after which the prices fall drastically due to widespread harvesting of maize planted in the long rains. The short rains maize harvest between December and early January does not appear to influence local market prices for maize.

Figure 4. Wholesale prices of white Maize in Luanda, Siaya and Yala markets in the year 2003



Similar price series were generated for beans and groundnuts in local markets and also for wholesale buying prices of these three crops in Kibuye (Kisumu) market. Costs of transporting crops to Kibuye were also estimated, then the net price to the farmer from selling into the different markets was compared. To the initial surprise of the project team, in virtually every week in 2003, this showed that producers in the pro. Table 6 shows the annual average prices obtainable in the different markets.

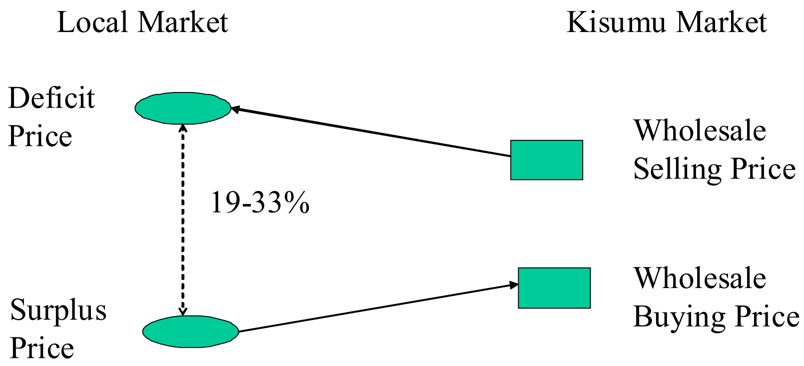
[Table 6 about here]

Table 6. Comparing market options (annual average prices) in local and regional markets

Comodity	Wholesale Buying Price	Local Market Price	Difference	Transport	Final Margin (KSh/kg)
White Maize	13.3	14.0	-0.7	1.9	-2.6
Beans (Wairimu/ Canadian Wonder)	21.7	29.6	-7.9	1.9	-9.8
Groundnut	61.9	70.4	-8.5	1.7	10.2

Three observations flow from this initial analysis. Firstly, it reminds us that the project areas are actually deficit areas in terms of all three commodities. The net flow of produce is into the area from other parts of the country (or, in some cases, Uganda [Uganda is usually believed to supply the Kenyan market which is usually not self sufficient]). Hence, local producers selling at local markets receive a local "import parity price" (the selling price at an external market plus the costs of transporting produce into the area). By contrast, to sell to Kisumu, they would have to accept a local "export parity price" (the buying price at Kibuye minus the costs of transporting produce from the area to Kisumu). As illustrated in Figure 5, the difference between the "import" and "export parity price" in 2003 was 19 – 32% depending on the commodity.

Figure 5. Prices of maize in price surplus and deficit areas in western Kenya



Secondly, whilst this presents a challenge to producers seeking higher prices for their produce to encourage them to intensify their production, the difference between the "import" and "export parity price" gives an indication of the magnitude of the price benefits to local consumers if locals producers do successfully intensify, such that the area realises its natural potential as a surplus area. A fall in the real price of staple foods of 20-30% would represent a major gain for poor households that struggled to participate in the intensification process, so remained net food consumers. Participatory wealth ranking (see below) classes up to two thirds of all local households in the very poor category. Whilst some of these are engaging with project activities, many might realise their main benefit from the project (and from complementary initiatives in the same area) through food price falls if intensification leads to the area becoming net food surplus.

Thirdly, whilst most farmers talk of transport cost as a major hindrance to selling in the regional (Kisumu) market, the difference between the wholesale buying and selling prices[7] of major crops in Kisumu markets is greater than the per kg transport cost incurred by producers in the project area if they seek to sell to Kisumu. This casts the spotlight (for further investigation) on the structure and conduct of Kisumu markets. Certainly, it is widely believed by farmers that restrictive practices by wholesalers are commonplace in these markets.

[7] Information on margins commonly realised by wholesalers and on seasonal variations in these were provided by key informants within Kibuye market.

Meanwhile, the project will seek to analyse prices of other commodities across local and Kisumu markets, to confirm that the findings for the first three crops hold for other crops, too. It will also continue to explore opportunities for selling direct to agro-processing millers and supermarkets in Kisumu. Assuming that some farmers can, in theory, gain by selling to Kisumu, the next step will be to undertake action research to test whether or not farmers *do* actually benefit from doing so, by getting them to try this and seeing what happens.

If no immediate market opportunities open up, the price differential between local and regional markets gives an indication of the extent to which farmers have to increase productivity through their intensification efforts before these efforts provide a financial return. The outcomes of the field trials reported above, plus findings reported below suggest that a productivity increase in excess of 20-30% is indeed achievable.

The seed system and community seed bulking

The typical small scale farmer combines a wide range of crops and varieties to meet their diverse objectives. A major challenge faced by farmers is availability of seed both in quality and quantity. Farmers may identify a promising variety during on-farm trials, but there can then be a long delay before it is commercially available in their area. This is partly due to the restrictive government policies towards seed registration and partly to the inherent lack of coordination between public research and commercial seed producers in bringing new varieties to market.

Availability of good quality seed can, however, lead to increased crop productivity. In the project, certain farmers were nominated by group members to bulk new seed varieties for other farmers. In 2003, informal seed production systems were established with 38 farmers selected in the project area. The seed was later distributed to over 80 farmers and to over 20 farmers in the new project areas. By achieving a successful seed security and multiplication system, the formal seed sector can then initiate commercial seed systems [explain potential success, sustainability, processes used to ensure both]. Farmer seed production was also used for on-farm demonstrations where farmer field visits, field days and training sessions are held with villagers.

Impact of Project Activities

As the previous sections have explained, the full range of coordinated interventions to support production intensification and diversification *beyond* maize have not yet been put in place by the project. Moreover, a formal assessment of the project's impact has yet to be conducted. Here, therefore, we just provide some initial indications of:

- Who has been able to access credit through SCOBICS
- The impact of project activities on maize and bean yields
- The impact of project activities on crop diversification.

Participation in SCOBICS

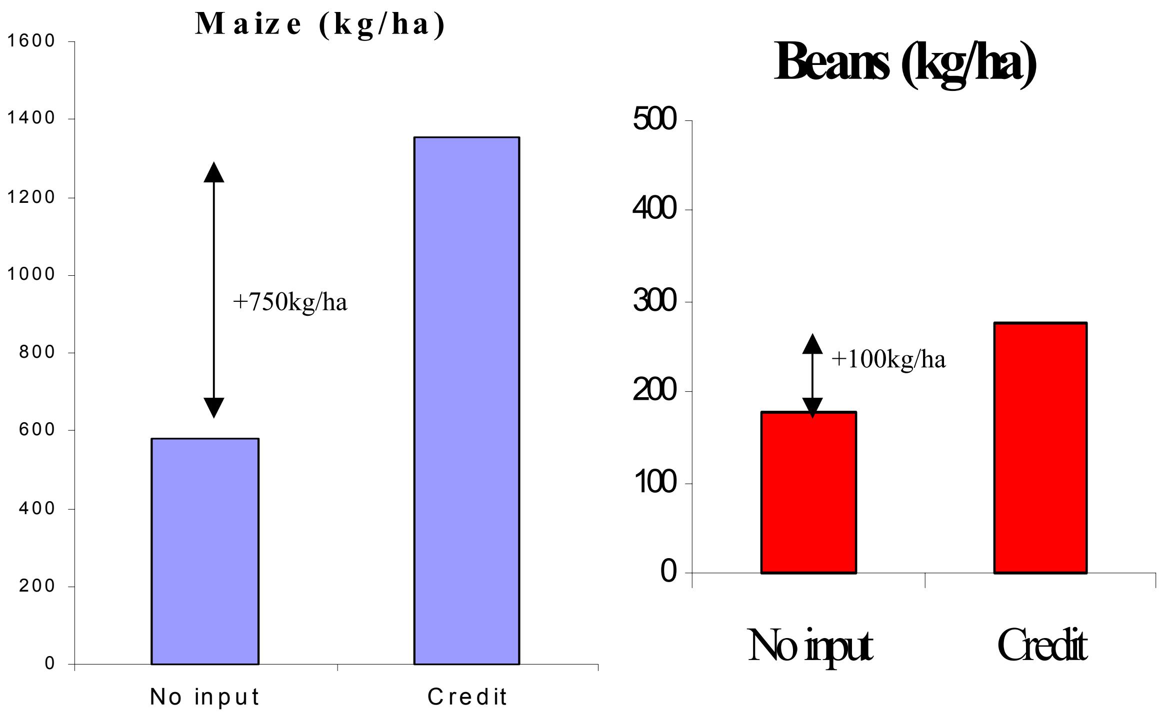
In 2002 a socio-economic survey was conducted to characterize farmers participating in SCOBICS during the 2001 and 2002 seasons. 263 borrower households in the study area were interviewed. Decision makers were both male and female; 58 % of those interviewed were men and 42% were women. Fifty percent of the households were male-headed household monogamous, 16% male-head household polygamous, 4% female headed household absentee husband, 17% female-headed household monogamous window and 11% female-headed household polygamous windows. Decision on whether to acquire input credit were mostly made by household heads. About 10% of the farmers were illiterate while the majority of farmer had acquired primary education.

Wealth ranking exercises were also conducted to gauge community perceptions on the wealth endowment of borrowing households. These in turn were compared with outcomes of previous exercises in the same or adjacent communities that were unrelated to SCOBICS. Key local indicators of wealth endowment included: household farm size; source of income; type of housing; number of meals per day; type of food; employment records; children status in society; whether the household hires on-farm labour or not; the number of local/hybrid cattle that the farmer owns; the level of education of the household head; and whether any household member has non-agricultural employment. Based on these identified indicators of wealth, it was found that about 9% of borrowers were considered to be rich, 47 % average and 45% poor. This compares to figures of 14% rich, 23% average and 63% poor for the area as a whole, showing that average farmers are disproportionately targeted by the credit scheme. Poor households are under-represented in SCOBICS, but not by as much as might be expected or feared.

Impact of project activities on maize and bean yields

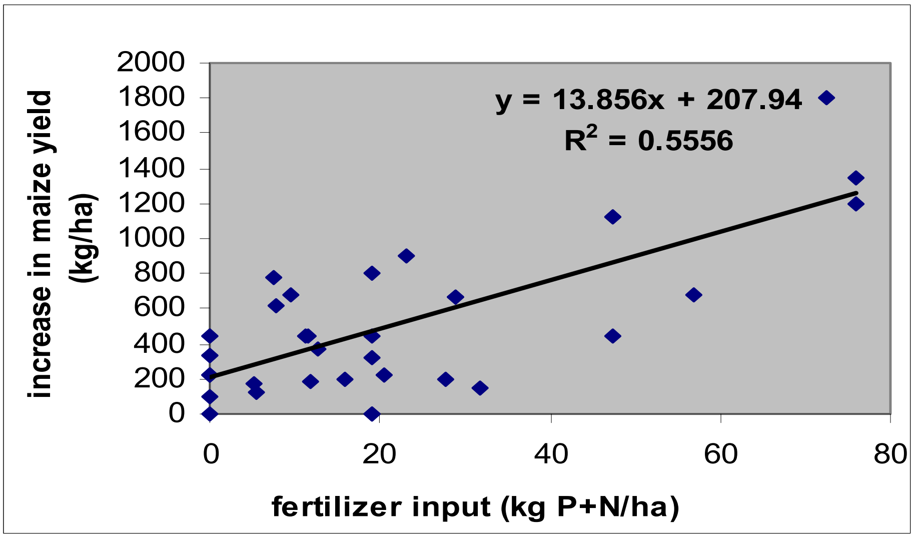
The majority of farmers who got fertilizers on credit applied them on maize. In Gongo and Ebukhaya 33% of the farmers apply phosphorous at the recommended rate of 21 kg P ha^{-1}, but only 10% of the farmers in Nyamninia, Sauri and Tatro applied the recommended rates. The rate of N application among farmers in all the sublocations was found to be below the recommended 60 kgN ha^{-1}. For all farmers. Application of nitrogen ranged from 0-5 kg ha^{-1} for 40 % of the farmers in Nyamninia, Sauri and Tatro. In Gongo and Ebukhaya 33% of the farmers were found to be applying 18 kg N ha^{-1} giving credence to the conclusion that these farmers apply nitrogen only at maize planting and do not meet the short fall at topdressing stage of maize growth. It should however be noted that these figures reflect the application from inorganic sources only. Other sources of N that farmers use include compost and animal manure but a large amount of these are required to meet the shortfall and the poverty levels in the region have limited livestock ownership. In some areas these organic manures are prepared for sale to farmers without livestock further limiting acquisition of these nutrient sources by resource poor farmers. Credit availability increased maize yield by 750 kg ha^{-1} and 100 kg ha^{-1} for bean mainly in Gongo and Ebukhaya sublocations (Figure 6). Low increases were attributed to the often poor fertilizer application rates below the recommended rate.

Figure 6. Effect of credit to crop yield on maize and bean yield in Vihiga and Siaya district **(n=99)**



Maize yields increased apparently linearly with unit application of P+N nutrients for Gongo, Ebukhaya, Tatro and Nyamninia sublocations respectively, although large differences between individual fields were observed (Figure 6). In Gongo and Ebukhaya it was noted that without application of *both* P and N there would be no increase in maize yields. The regression on the other hand estimated that on average 207 kg of maize would be the yield per hectare without application of both nutrients. Overall, it was noted that the yield increase per unit fertilizer was much lower than expected and profitability marginal. This suggests that, apart from the above mention low and poorly balance fertilizer applications, further evaluations on reasons for this poor response is required.

Figure 7. Regression analysis for increase in maize yields (kg ha^{-1}) against unit application of P+N (kg ha^{-1}) in Vihiga and Siaya district



Outlook – or how to coordinate the provision of these services on a sustainable basis

This paper has discussed the challenges entailed in developing a new integrated approach to improving farmers livelihoods that can be used to get farmers out of poverty through increased farm productivity through successful use of DSSs and credit scheme. However, more work is needed particularly on the marketing front before the action research project can say that it has tested its hypothesis about the impact of coordinated service provision on small farm crop management, livelihoods and poverty.

The preliminary findings suggest that provision of coordinated extension services, provision of intergrated soil management options, farmer linkage to markets and credit may provide an avenues to escaping from maize focused poverty traps. So, let's assume that – with access to remunerative markets plus the credit necessary to invest in the fertility of their soils and to obtain improved seeds – farmers are able *both* to increase their maize production *and* to sell other crops for cash, (i.e. to diversify *beyond* maize, as opposed to *out of* maize). How might provision of the necessary coordinated set of services to poor farmers in western Kenya be ensured after the life of the project? A mechanism is needed to bring together output buyers, credit providers and seed suppliers (all from the private sector) with researchers and extension workers (mainly public sector) to support farmers in particular communities or sub-locations to diversify beyond maize. Technology transfer alone are not sufficient to ensure widespread technology adoption. The right institution and coordinated service provision need to be in place to provide local incentives for investment. The COSOFAP consortium of organisations involved in development in western Kenya may be able to encourage the necessary coordination. Alternatively, district development planning processes may be the appropriate mechanism for encouraging such coordination. Our observation is that this is an issue that has yet to receive serious policy consideration. However, it could be central to assisting poor farmers in western Kenya to escape the maize-focused poverty trap in which they currently find themselves.

Government, NGOs, private sector, international organization need to work and development partners need to work effectively with communities recognizing multiple and informal rights and opportunities for strengthening households social capital for collective action of farmers.

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