Small-scale irrigation for food security in sub-Saharan Africa

Report and recommendations of a CTA study visit

Ethiopia, 20–29 January 2003

Mekuria Tafesse

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- Lutheran World Federation
- Ministry of Agriculture
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- Sustainable Agriculture and Environmental Rehabilitation in Amhara Region
- Wonji/Shoa Sugar Factory – Out-grower farms
- World Vision International

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1 Introduction

1.1 General

In Africa, agriculture forms the backbone of most of the continent's economies, providing about 60% of all employment. During the last decade, per capita agricultural production has not kept pace with population growth. Consequently, as per the Food and Agriculture Organization's (FAO's) assessments[1], at the end of the 1990s, 30 countries in Africa had over 20% of their population undernourished, rising to 35% in the 18 worse affected countries. In terms of absolute numbers, between 1997–99, 200 million people were malnourished, with 194 million of these people living in sub-Saharan Africa (SSA). The food gap estimated at 17 million tons in 2000 was filled by imports (14.2 million tons) and food aid (2.8 million tons) at a cost of US$18.7 billion. In 2001, close to 30 million people required food emergencies due to droughts, floods and civil strife.

Development of the agricultural sector in Africa is therefore seen as central to combating hunger, reducing poverty, and generating economic growth (through the reduction of food imports and the boosting of exports). However, progress in the sector can only be achieved if the main constraints (listed below) are successfully addressed:

- Variability in climate
- Limited access to technology
- Low levels of rural infrastructure
- Poor institutional structures.

Other areas that need addressing are the poor political and economic governance, the need to introduce supportive policy and legislation, the need to develop rural entrepreneurship capacity, combat HIV/AIDS, mobilise savings for investment and improve the performance of cash crops.

Although there are various ways in which the above-mentioned issues can be tackled, one key strategy that could contribute to the alleviation of poverty and improvement in food insecurity in SSA is assisting poor farmers to increase the productivity of their farms. Low farm productivity can be addressed through integrated approaches such as increasing the use of organic and mineral fertilizers, using improved seed varieties, applying irrigation techniques and improving the level of mechanisation.

FAO estimates that for the next 30 years, 75% of the projected growth in crop production in SSA could come in the form of crop yield increases (62%) and higher crop intensities (13%), with arable land expansion accounting for the remaining 25%.

[1]FAO, New Partnership for Africa's Development (NEPAD) Comprehensive Africa Agriculture Development Programme, November 2002, (prepared in close collaboration with the NEPAD Secretariat).

However before this can be realised, substantial land and water development will have to take place.

1.2 Why small-scale?

Except for a few countries in northern Africa, Madagascar and South Africa, the potential for irrigation development has not been effectively tapped in Africa. Out of a total arable land of about 874 million hectares (ha), the current area under managed water and land development totals 12.6 million ha, or 3.7 % of the surface area of SSA. In spite of this potential, and the demand for more dependable sources of water, the development of irrigation has not picked up. Furthermore, existing irrigation farms operate at sub-optimal levels.

Until recently, irrigated agriculture was almost exclusively supported by the state. However, government-managed (large- and small-scale) schemes have generally performed far below expectations and most of the time, initial capital costs have not been recouped and the financial returns have not been able to cover operation and maintenance (O&M) costs.

Meanwhile, privately developed and managed (small-scale) irrigation schemes in most of the SSA countries show that there is business potential for private entrepreneur involvement in irrigation. Groups of farmers or water users' associations (WUAs) running parts of irrigation schemes for which responsibility was transferred to them by government, can also be considered as operating private irrigation schemes. Recent developments have shown the increasingly important role of these new operators. However, for private operators to function efficiently, a clear institutional framework is required – in many parts of SSA this framework is not in place.

In addition to the above, small-scale irrigation schemes are also being promoted because of the associated benefits listed below:

- Lower investment costs
- Ease in maintenance
- End-users being able to have more control of the water they need
- The possibility of remote areas (where there are poorer farmers) gaining access to controlled water
- Small-scale irrigation requires very little in terms of enterprise and management capability
- Their potentially less negative environmental impact.

Small-scale irrigation (those schemes under the direct management of smallholders) will also enable farmers (those outside of the major irrigation perimeters and who would

otherwise have to depend on irregular and variable rainfall) to increase crop intensities through double cropping, through supplementary watering during drought, as well as enable crop/forage growth in dry areas (crop expansion). This type of irrigation may take many forms of water control:

- Rainwater harvesting
- Flood recession
- Flood water spreading
- River diversion
- Treadle pumps
- Motor pumps usually combined with sprinkler or drip systems
- Porous jars.

In short, access to small-scale irrigation technology will allow small-scale farmers to improve their production more easily.

Constraints facing irrigation development in SSA

The problems related to irrigation development and management in SSA can be categorised as follows:

- Environmental factors:
  - water scarcity and poor water quality especially as related to sediment concentration;
  - land degradation as a result of poor O&M activities – this is partly related to inefficient water management resulting in water wastage and water logging as well as land-use regulation.
- Capacity of the farmers:
  - lack of know-how in, and access to, the opportunities of irrigation technology;
  - weak economic base of most farmers and the relatively high development costs involved in developing irrigation schemes.
- Government policy; institutional and legal support:
  - limited or no priority given to irrigation development during national and local planning and budgeting;
  - poor management structures in place to support farmers and promote irrigation development. For example, the infrastructure to facilitate agricultural development is underdeveloped;

- a land tenure system that does not encourage farmers to invest in permanent improvements on their plots and make improvements which can be used to obtain credits for further development;
- unclear water rights and their enforcement.

Despite the myriad of problems facing formal small-scale and traditional[2] irrigation WUA or cooperative societies, they can become more efficient and sustainable by:

- Upgrading small-scale irrigation techniques
- Putting in place a management structure responsive to water users
- Access to (innovative) credit schemes
- Good support services.

Government's role in supporting irrigation development is therefore important in terms of the policies and regulations formulated and implemented; the planning undertaken at the macro and micro levels; training and; provision of services to support development of the sector.

1.3 Rationale for the study visit

This study visit is largely the result of discussions held at a seminar on *Private irrigation in sub-Saharan Africa* – Regional seminar on Private sector participation and irrigation expansion in SSA, co-organised by the International Water Management Institute, FAO and CTA in Accra, Ghana, on 22–26 October 2001. These discussions called for smallholder farmers to '…be allowed access to simple and affordable technologies and thus be in a better position to combat poverty and exclusion'. (p 286)

Sixteen experts in the field of irrigation, representing government, small-scale WUAs and non-governmental organisations (NGOs) were selected to attend the workshop. The participants came from six countries: Ethiopia, Ghana, Kenya, Malawi, Tanzania and Zambia. These countries share similar problems in irrigation, and as a consequence, the study visit provided an excellent opportunity for them, to exchange views and learn from each other. Further, the study visit allowed the participants, to see firsthand various types of irrigation schemes in Ethiopia – the successes and problems that they face. The participants also had the opportunity to discuss the various problems they face as well as develop strategies to overcome these challenges.

The participants visited small-scale irrigation sites located in different agro-ecological zones representing arid/semi-arid, highland and lowland areas. The sites depicted

[2] Traditional irrigation refers to those schemes that have been initiated and constructed by farmers using the knowledge and resources available to them. Farms under traditional irrigation are in many instances, characterised by temporary diversions/ structures and channels not built following formal engineering designs and as a consequence, may not contain optimum grades and cross-section.

various support systems and management structures including government-supported, NGO-supported, partnership arrangement and privately-managed schemes. The range of irrigation technologies visited comprised:

- Water abstraction: small reservoirs, gravity diversions and pumped schemes
- Conveyance system: canals with limited lining, and piped conveyance
- Water application: furrow irrigation, flooding, and hose system

The sites visited included:

- Government-supported irrigation schemes: Agulai Improved Traditional, Laelay Wukro, Little Chelekot Improved Traditional, Wedi Cheber Improved Traditional, Kobo/Alluha and Dodicha
- NGO-supported irrigation schemes: Hermata, Kokona, Kemisse and Antsokia
- Out-growers or partnerships and privately-managed irrigation schemes: Ethio-Flora and Wonji/Shoa Sugar Out-growers.

1.4 Objectives of the study visit

The objectives of the study visit were to:

- Promote the exchange of information and discussion between the participants and to promote a network at the regional and sub-regional level, and to exchange knowledge between countries
- Review existing irrigation initiatives for food security operated by private entrepreneurs and/or small-scale WUAs in SSA
- Exchange experience on the challenges and constraints associated with different technologies, management models and production schemes
- Assess institutional and financial constraints, social and environmental impact of small-scale irrigation
- Make recommendations towards the creation of an enabling environment for small-scale irrigation expansion in SSA.

1.5 Study visit programme

The study visit began on January 20, 2003 with a one-day workshop. The workshop was officially opened with statements from CTA and His Excellency Ato Belay Ejigu, Vice Minister, Ministry of Agriculture. There were also presentations and discussions of the papers prepared by the participants.

Between 21–28 January 2003, participants visited small-scale irrigation sites in northern and central Ethiopia. These sites were thought to be representative of the range of support systems and irrigation technologies being used. Early mornings were allotted to the presentation of country reports/case studies followed by discussions. Every evening, participants discussed the lessons learned during the day and developed recommendations for improvement.

On the last day, January 29, participants reviewed the information collected during the presentations and visits, and drew conclusions and recommendations regarding small-scale irrigation expansion in SSA. The participants also came up with proposals for promoting the development of small-scale irrigation in their work and agreed to take advantage of the opportunity provided by the study visit to further interact with each other.

2 Small-scale irrigation in the participating countries

2.1 Overview

The distribution of water-managed areas in Africa is very uneven (FAO – *Irrigation in Africa*, 1995). Five countries (Egypt, Sudan, South Africa, Morocco and Madagascar), which cover 19% of Africa's land surface, hold more than 60% of the water-managed areas. By including Nigeria, Algeria, Libya, Angola and Tunisia, more than 80% of the water-managed area is controlled by ten countries. In contrast, 28 countries, covering more than 30% of the area in Africa, have a mere 5% of water-managed lands.

In most of SSA, water resources are under-managed and the people of these countries suffer from food shortages. For the six countries participating in the study visit – Ethiopia, Ghana, Kenya, Malawi, Tanzania and Zambia – population and land features are given in Table 1.

Table 1: Population and land features

Country	**Population in 1994 (in millions)**	**Total land area (millions of ha)**	**Arable land (% of total land)**	**Irrigation Potential (millions of ha)**
Ethiopia	53.4	110.0	13.2	3.60
Ghana	16.9	23.8	10.0	1.90
Kenya	27.3	58.0	9.9	0.35
Malawi	10.8	11.8	3.6	0.16
Tanzania	28.8	94.5	40.0	0.83
Zambia	9.2	75.0	16.3	0.52

Note: Methods used in estimating irrigation potential vary from country to country.

The following analysis of small-scale irrigation is based on the papers prepared and presented by participants. The countries represented are drawn from East, West and Southern Africa, and give a fair reflection of the current situation of small-scale irrigation in SSA.

Population

The populations in the countries represented range from over 10 million in Zambia and Malawi to over 63 million in Ethiopia. Most of the populations live in rural areas (65–90%) and are dependent on subsistence agriculture.

Climate

The climatic conditions in the six countries range from sub-humid to semi-arid to arid. A wide variety of crops grow where a tropical climate prevails. Rainfall shortages are very common, as well as the resulting crop failures, leaving farmers dependent on food aid. Most areas in these countries receive less than 1000 millimetres (mm) mean annual rainfall. However, the countries are endowed with large land and water resources – high mountains, flat lands, lakes and the East African Rift Valley.

2.2 Small-scale irrigation

Irrigation status

Table 2 shows the total area currently irrigated in each country. Smallholder irrigation in these countries is currently characterised by:

- Low levels of efficiency
- Lack of finance
- Inadequate marketing
- Weak extension services.

Table 2: The area covered by smallholder irrigation in the countries represented

Country	Total irrigation area (ha)	Smallholder irrigation (ha)
Ethiopia	161,790	95,320
Ghana	19,000	12,700
Kenya	91,410	36,190
Malawi	57,040	8,900
Tanzania	150,000	120,000
Zambia	40,000	n.a.

n.a. – not available

Irrigation technology

In Malawi, small-scale irrigation is based on technologies such as pumping (treadle and motorised pumps) river diversion and watering cans. In Zambia and Malawi, smallholders use treadle pumps because they are relatively easy to operate, they are affordable, and above all, the presence of abundant shallow water resources such as lakes and dambos favour treadle pump use. In Zambia, four types of treadle pumps are manufactured – tube well pump, modified well pump, river pump and pressure pump. In Ethiopia, most smallholder irrigation is based on river diversions, small reservoirs and diesel-operated motorised pumps. Private commercial farms in Kenya use modern irrigation technologies like drip and sprinkler irrigation. Some private farms in Ethiopia also apply these technologies. In Tanzania, water harvesting techniques, gabion head works, lined canals, low-pressure sprinklers and drip irrigation are in use.

Production system

In all countries, smallholder schemes are attractive because of the low capital investment required and the demonstrated capacity of the beneficiaries to manage, operate and maintain the systems.

Two model schemes in Ghana showed that improved crop production technologies for rice and vegetables can lead to better opportunities for farmers. In Zambia, crop yields under irrigated agriculture exceeded those under rain-fed agriculture by almost three times. In Ethiopia, irrigated vegetable production in the dry season, particularly in areas close to town centres, is gaining importance in the farming community. In Kenya, given the tremendous potential for improving horticultural crop production, farmers have demonstrated their interest in practicing irrigation by opening schemes through their own efforts. In Tanzania, farmers report that the adoption of soil and water conservation practices have doubled their profits.

Finance

The availability of financial resources for the development of smallholder irrigation is a constraint in almost all the countries represented at the study visit. Local NGOs and agri-business institutions, which promote certain export crops in Zambia, are now financing smallholder irrigation. Recently, the Support to Farmers' Association Project through external financing has created a credit line for small-scale farmers. Lack of financial resources in Kenya is reflected through smallholders' declining share in the volume of exports.

In Ghana, the rehabilitation of public irrigation schemes is programmed under donor funding projects. In Malawi, government schemes are not functioning as efficiently as before, given the government's failure to fund O&M costs. In fact, the government is in the process of handing over these schemes (after they have been rehabilitated) to farmers who are currently using them. The cost of borrowing money in Malawi is high, and this makes it difficult for farmers to borrow and pay back the loans.

In Ethiopia, smallholder community irrigation projects are financed either by the government or by NGOs, although beneficiaries contribute about 10% of the investment cost in the form of labour or by providing local materials such as sand, stone, wood, etc. The beneficiaries also cover minor O&M costs. However, major maintenance works (e.g. pumps, and head works) are carried out with government assistance. There are various programmes supporting traditional irrigation development in Tanzania, which are funded by different financing agencies such as the World Bank, African Development Bank, International Fund for Agricultural Development (IFAD), etc. Donor countries like Denmark, Japan and the Netherlands, through their respective development agencies are collaborating with the government in implementing studies and construction activities geared towards developing irrigation in the country.

Marketing

In almost all of the participating countries, the marketing of produce is one of the most difficult challenges facing smallholder irrigators. In Kenya, however, the Horticulture and Traditional Food Crops Development Project (HTFCDP) has been able to offer better marketing opportunities for farmers. Besides providing food for the population, creating employment and providing raw materials for the processing industry, the country has been able to earn additional foreign exchange. In 2001, Kenya earned a total of 20.2 billion Kenyan shillings from the export of fresh fruits and cut flowers. The main export crops are green beans, snow and snap peas, Asian vegetables (okra, dudhi, karella, aubergines, chillies, valore, etc.), pineapples, mangoes, avocados, pawpaws, passion fruits and cutflowers (carnations, roses, alstromeria, statice, orchids, ornithogalums, etc.). The main importing countries have been the United Kingdom, France, The Netherlands, Germany, Saudi Arabia and South Africa.

Irrigated agriculture is dominated by the estate sector in Malawi, which mainly produces export crops such as tea, coffee, and sugar cane. Local markets are not well organised, and the crops produced by smallholders are sold at low prices. In Zambia, vegetables are produced for local markets in town centres. Efforts have been made to link farmers to the local chain store (Shoprite), but this has met with little success because small-scale produce lacks consistency in both quality and quantity. Rural processing is also not well developed and so market linkages remain the biggest challenge among small-scale irrigators.

In Ethiopia, marketing is a big challenge for smallholder irrigators. Most of the farmers produce vegetables like tomatoes, onions, carrots and cabbages, however, because of the perishable nature of the crops, prices fluctuate frequently and farmers are often forced to sell at low prices. Further, the absence of organised markets has allowed tradesmen to take advantage of the situation. In Tanzania, the Traditional Irrigation Programme (TIP) assists farmers in solving their marketing problems through the promotion of market linkages and training in entrepreneurial (agri-business) skills, in collaboration with other agencies involved in business development and poverty alleviation.

Support system

In Ghana, two model schemes were studied to look at the possibility of introducing a credit scheme in the form of inputs (e.g. fertilizer, agro-chemicals, seeds, etc.). Here the effects of timely application of fertilizer on rice yields were confirmed at the experimental plot. Training sessions were also organised for farmers under the Small-scale Irrigated Agriculture Project. A farmers' bank was then established in 2001 to guide and control the Farming Input Credit service. The farmers repay the loans (with interest) after harvesting (marketing).

There is a plan to distribute 300,000 treadle pumps to farmers in Malawi, on loan to be repaid in three years. The HTFCDP project in Kenya has developed production and marketing extension packages for dissemination to the farmers by the field staff. A front-line extension worker has been assigned to each irrigation scheme for the purpose of training the farmers on all aspects of production, marketing and water management. Training, input supply, and credit service are the major components of the extension service strategy for smallholder farmers in Ethiopia.

Socio-economy and environment

In all countries, the benefit of irrigation development to smallholders is being emphasised. In Kenya, the need to commercialise agriculture has, in the recent past, put a lot of pressure on the existing potential irrigable areas within the country. There is also the threat of deterioration of water quality as a result of a decline in river flow in the Ewaso Ngiro North River Basin of Kenya. In Ghana, the improvement of farmers' income (including female farmers) through irrigation development is encouraging. In Tanzania, (through the TIP programme), taboos hindering women's participation in development activities and access to benefits such as the right to use productive resources (i.e. land, irrigation water, trees, and increased income) have been overcome.

Policy and strategies

According to the Ghana 'Poverty Reduction Strategy 2002–2004', the total area under irrigation is expected to increase by 300% by 2004. Furthermore, the 2002 budget statement mentioned that the importation of rice should be reduced by 30% by 2004. At the 11th consultative group meeting in May 2002, the president stated that '…irrigation should be the key to growing all the rice and other cereals that we currently import'.

The government of Malawi views irrigation as part of the solution to curb food shortfalls and a way of attaining food self-sufficiency. To guide irrigation development strategies, the government has set short- and long-term priorities for irrigation development. The Kenyan government follows a district focus rural development strategy where series of guidelines are formulated on the concept of smallholder irrigation and the important role it plays in rural development. Beneficiary participation is emphasised in all phases of the project development. The guidelines include commercialisation of irrigation, cost sharing, cost recovery, grants for food-based schemes, revolving funds for infrastructure

loans and payment for technical services. In Zambia, attention has shifted away from the challenges of developing large irrigation schemes to those of helping smallholders directly. The emphasis is not so much on technology, but on how to improve the livelihood of the rural poor by providing access to irrigation. This involves irrigation on small plots of land, in which farmers have the major controlling influence and use a level of technology that farmers themselves can effectively operate and maintain.

In Ethiopia, the national development plan is based on a strategy called 'Agricultural Development-Led Industrialization', and aims at boosting agricultural productivity and improving the rural standard of living, which in turn will increase the demand for goods and services and further lead to industrial development. Central to achieving the agricultural policy objective is the promotion of irrigated agriculture and integrated water resource management. In Tanzania, the capacity of the irrigation community (water user group) to mobilise self-help labour and cash contribution for construction and maintenance of irrigation infrastructure is essential.

Water management and institutions

In Malawi, there are not many properly established farmer organisations managing irrigation schemes, yet river diversion and motorised pump-based schemes require that farmers work in groups. This has led to some influential farmers monopolising irrigation facilities that were meant for groups of farmers. In Kenya, a new proposed Water Act recommends the establishment of two distinct bodies namely, Water Resources Management Authority (WRMA) that will be charged with the responsibility of managing the water resources of the country and the Water Supply and Sanitation Board (WSSB) that will be responsible for water development in the country. The HTFCDP and the Horticultural Crops Development Authority are effectively working with smallholder irrigation development.

In Ghana, a computer programme for irrigation water delivery scheduling has been developed and the monitoring system has been improved. A manual for the O&M of irrigation facilities has been prepared and is being used in training courses. Both the Ghana Irrigation Development Authority and farmers' cooperatives have become aware of the importance of water management through the improvement in the plot-base and system-base management.

In Ethiopia, water management and infrastructure maintenance was found to be one of the bottlenecks affecting the sustainability of small-scale irrigation (SSI) development. Consequently, after the construction of an SSI scheme, WUAs will be established. All beneficiaries will be members of the WUA. The WUA will be a legally recognised body responsible for the management of the scheme; it will facilitate water distribution, maintenance and operation of the scheme. Several WUAs could be organised into a larger co-operative association. Finance is the major constraint limiting the capacity of most WUAs.

In Tanzania, TIP has made remarkable achievements in improving and developing traditional irrigation. Through the TIP programme, the adoption and use of various

techniques in water management and the improvement of irrigation infrastructure have resulted in more secure water availability for the members and reduced conflicts over water (e.g., lined canals, low pressure sprinklers and drip irrigation).

2.3 Summary of discussions on country papers

The following is a summary of the discussions held during the presentations on each of the six countries:

Kenya: Here discussions focused on the need to develop demonstration plots on farmers' land aimed at improving production technologies as well as the overall farming system rather than developing them on government-owned plots. The importance of rules and regulations related to upstream and downstream water uses was emphasised. Storage requirements and water rights also need to be considered as well as the issuing of water permits to WUAs for efficient water utilisation. Further, government support is desirable in assisting farmers in the construction of hydraulic structures (intakes, water diversions, etc).

Malawi: Discussions on the Malawi presentation centred around issues such as the rehabilitation of government-owned irrigation schemes and their eventual handing over to the farmers, gender concerns, the use of treadle pump technology, and credit services. The government of Malawi is committed to rehabilitating schemes and handing them over to the beneficiaries. The government will play a limited role in providing extension services, and the idea of viewing irrigation as a business venture is being promoted. The bottom-up approach in (irrigation) development is now adopted.

There are cultural limitations restricting women's involvement in irrigation. However, there is a deliberate move to balance gender concerns at the policy-making level. The use of treadle pump technology for small-scale irrigation development is strongly promoted in Malawi. However, locally manufactured treadle pumps are of poor quality. Credit services are available for farmers, but, re-payment was found to be difficult. Private money lending institutions exert exorbitant interest rates (44–49%/month), and the security requirements for the credit are another constraint facing farmers.

Ghana: The discussions on Ghana were on the operationalisation of the Farmers' Bank, pumped irrigation and irrigated rice cultivation. The Farmers' Bank is a farmers' organisation with an account at a commercial bank which can access credit on behalf of the farmers. The farmers pay interest rates commensurate with the rate being charged by commercial banks, but they have easy access to the credit. Pumped irrigation schemes are very costly to operate, but there is one project that the community is able to operate successfully. The farmers are conversant with rice cultivation and that makes it easier to operate the scheme. There is more money, however, in producing vegetables.

Ethiopia: Topics of discussion touched on gender, agricultural institutions, irrigation efficiency, and farmers' groups. One concern is that women are not participating, as expected, in irrigation activities. This is mainly because women are mainly engaged

(culturally) in household activities such as child rearing, food preparation, water fetching, etc. However, addressing issues relating to gender sensitivity and balance is now a priority in the implementation of community-based projects.

WUAs operate community-based small-scale irrigation schemes, and there are farmers' co-operative organisations in some places providing credit services. Farmers participate in the construction and maintenance of community-based irrigation schemes by contributing labour and locally available materials. The efficiency of community-based irrigation schemes is generally low; although, there are efforts, in some donor-funded projects, to develop demonstration trials aimed at improving efficiency. The highly centralised top-down approach to rural development in the past has had a negative effect on farmers working together as a group. There therefore needs to be a concerted effort to create awareness among farmers' groups as to the benefits of working together – such as better services relating to water distribution, increased bargaining power, access to credit, and improved infrastructure.

Tanzania: The discussions were on the sustainable use of water resources, gender, and the bottom-up approach to development. Improving traditional small-scale schemes can contribute to poverty reduction and food security. However, the rural folk needs to be empowered so as to be able to manage the water resources on a sustainable basis. Women can increase their income levels if they are given equal access to resources in the communities. The bottom-up approach should be used in the development and improvement of traditional systems so that communities can feel some level of ownership.

Zambia: Here discussions focused on marketing and credit facilities. Agriflora Limited, Zambia's largest exporter of fresh produce to markets worldwide has formed a partnership with small-scale farmers for the production of export crops. The farmers have organised themselves into cooperatives to grow export quality vegetables, mainly baby corn, mange tout peas and sugar snap peas. The scheme has recently introduced semi-perishable export crops (washed arabica coffee, paprika and sunn hemp) to stabilise farmers' incomes and reduce crop risk. The scheme acts as a bridge between the farmer and the market. Since the farmers and Agriflora have a contractual arrangement, Agriflora as the contracting firm is obliged to purchase all the produce that the farmers grow, provided this meets the market quality standards. The farmers know the price of the produce well in advance of its production and this in itself is an advantage to the farmers as it gives them a chance to plan their production activities. The credit facilities include input credit on seed and fertilizer, and irrigation loans. Farmers' repayment of the credit is encouraging.

3 Visits to selected sites and findings

3.1 Site visits

Participants were taken around to visit small-scale irrigation sites located in different agro-ecological zones representing arid/semi-arid, highland and lowland areas. These sites depicted various support systems and management structures such as government-supported, NGO-supported, partnership arrangement and privately-managed schemes. The range of irrigation technologies visited comprised:

- Water abstraction: small reservoirs, gravity diversions and pumped schemes
- Conveyance system: canals with limited lining, and piped conveyance
- Water application: furrow irrigation, flooding, and hose system.

The sites visited were:

- Government-supported irrigation schemes:
  - Agulai Improved Traditional;
  - Laelay Wukro;
  - Little Chelekot Improved Traditional;
  - Wedi Cheber Improved Traditional;
  - Kobo/Alluha;
  - Dodicha.
- NGO-supported irrigation schemes:
  - Hermata;
  - Kokona;
  - Kemisse;
  - Antsokia.
- Out-growers or partnerships and privately-managed irrigation schemes:
  - Ethio-Flora;
  - Wonji/Shoa Sugar Out-growers.

Site 1: Agulai improved traditional

Owner: Farmers' association and Tigray Water Resources Development Bureau (TWRDB)

Location: Agulai (Tigray)

Host: TWRDB and Farmers' association

Participants' observations

Technology: The principal form of irrigation is river diversion using an intricate network of both lined and partially lined canals. The perennial mountain stream running along the steep slopes of a severely deforested mountain range has been expertly harnessed to irrigate mountain valleys down below. The financial sources for major constructions (head work, main canal, etc.) have come from the government and donors. Community participation is largely restricted to the beneficiaries who only manage the sub-canals that traverse their quarter hectare plots.

Production systems: Although the farmers seem happy with the current level of production (two croppings per year), the farming system is based on a poor crop production mix, with heavy dependence on local grains (maize, wheat, barley and teff). The extension service is poor and dependent on a largely unmotivated team of government extension workers.

Financial management: A financing mechanism is in place where farmers are allowed seasonal input loans at minimal interest rates of 18% per year. The system of group collateral (involving five members) is used. Defaulters can easily be taken to the local courts for redress.

Marketing: There are local markets to service the surrounding small towns and in the large town of Mekele. However, poor transport and lack of market linkages and information remain limiting factors. Although the site was just a few metres away from a good road, farmers did not know how to take advantage of this good network by creating a collection centre for their produce.

Heavy reliance on maize attracts low prices in certain seasons.

Policy and regulations: Although farmer associations are in place at the Agulai and Wukro sites, their management structure is weak and the participation of women in leadership roles is limited.

Support system: Very little extension (farmer training) service is in place. Farmers have little sense of farming as a business and there is no real intervention from government in terms of agribusiness development.

Social and environmental issues: Farmers generally appreciate improvements made to traditional irrigation. However, there are large numbers of older farmers who are not

willing to change their attitudes (mind-set). Since the site is located in fragile alluvial soils in the mountain valleys, soil erosion and land degradation are a major threat.

Recommendations

Following the visit to the irrigation sites, the participants made these recommendations:

- Train all water users in good irrigation practices to save water
- Set up good demonstration plots to train farmers
- Promote organic farming and use of compost manures
- Encourage farmers' exchange visits
- Explore contact farming and out-grower schemes as a way to stimulate production
- Develop good transport logistics (group marketing)
- Start collecting water user fees to develop group finance
- Register groups in the legal entities
- Improve extension service delivery in participating households
- Work out good erosion control measures and re-afforestation programmes for all catchment areas.

Site 2: Laelay Wukro

Owner: Farmers' association and TWRDB

Location: Wukro (Tigray)

Host: TWRDB and the farmers' association

Participants' observations

Technology: An IFAD-funded holding dam has been constructed and is fully operational. Government and donors carry out all major construction and maintenance works. The lower portion of the site is not well covered by irrigation water due to poor design and shortage of water as a result of the prevailing drought.

Production systems: The crop production mix is poor and there is a heavy dependence on local grains such as maize, wheat, barley, and teff. There was an attempt to put in place a demonstration plot for farmers, but this failed because the extension service has been inadequate. Farmers clearly lack good agronomic practices. Random cropping is still

practised with farmers not really sure of which crops to grow. More research is needed with respect to crop diversification.

Financial management: A financing mechanism is in place where farmers are allowed seasonal input loans at minimal interest rates of 18% per year. The system of group collateral (involving five members) is used. Defaulters can easily be taken to the local courts for redress.

Marketing: There are local markets servicing the smaller towns of Wukro/Adigrat and the large town of Mekele. However, poor transport and lack of market linkages and information are limiting factors.

Policy and regulations: Although farmer associations are in place, the management of services is poor and there is very little done with respect to gender mainstreaming. The ratio of women to men, in participation of leadership roles, is one to seven.

Support system: Very little extension (farmer training) service is in place. Farmers have very little sense of farming as a business and the government plays no role in stimulating agribusiness development.

Social and development issues: Farmers generally appreciate the improved techniques in traditional irrigation. However, there are large numbers of older farmers who are resistant to this. Since the site is located on fragile alluvial soils in the mountain valleys, land degradation and soil erosion are major threats.

Recommendations

The recommendations made for site 2 are the same as for site 1.

Site 3: Little Chelekot improved traditional

Owner: Farmers' association and TWRDB

Location: Chelekot (Tigray)

Host : TWRDB

Host officials' comments

The irrigation scheme is based on the base flow diversion of river water to develop 39 ha in the dry season. More area will be irrigated in the rainy season as river flow/water availability increases. In total, there will be 550 beneficiaries – 310 men and 240 women. The diversion weir on Little Chelekot River was constructed in 2001. The scheme will be operational in 2003.

The major crops being grown in the area are potatoes, maize, and onions. The mean annual rainfall in the project area is 600 mm.

Participants' observations

Technology: The diversion weir has no scouring sluice portion. As a result, water is not fully diverted to the off-take, particularly at low water levels. The upstream impervious apron of more than 1 metre, and the protection work provision was not necessary and it is likely that the weir will be filled with sediments shortly.

Recommendations

- The construction work needs to be completed this year (2003)
- Legal registration of the WUA should start as soon as possible
- Water quality should be checked for salinity hazards
- Drainage construction and maintenance and clearing of canals are required.

Site 4: Wedi Cheber improved traditional

Owner: Farmers' association and TWRDB

Location: Kuiha (Tigray)

Host : TWRDB

Host officials' comments

The scheme is based on water harvesting during the rainy season. Construction started in 1994 and has been operational since 1996. The dam height is 14.5 metres; and the crest length is 620 metres. The gross storage capacity of the reservoir is 1.24 million m^3. There are 194 beneficiaries and 48.6 ha of irrigation development. The mean annual rainfall in the project area is about 560 mm. Cabbages, carrots, onions, potatoes, maize and sorghum are the major crops growing in the area.

Participants' observations

Technology: Drip irrigation system is more appropriate for the scheme than the existing surface water irrigation system because of water shortage in the area. The crossing structure (flume) needs rehabilitation.

Environment: Catchment treatment (watershed management) is very important in the basin for the increased life of the reservoir.

Recommendations

The following recommendations were made:

- Integrate gender mainstreaming in project management activities – educate women farmers
- Implement crop rotation and diversification
- Formalise WUA registration
- Post-harvest technology needs to be considered.

Site 5: Kobo / Alluha

Owner: Farmers' association and Sustainable Agriculture and Environmental Rehabilitation in Amhara Region (SAERAR)

Location: Woldia

Host : Farmers' group

Participants' observations

Technology: The weir diversion system constructed has outlets on both sides of the river, allowing the irrigation of lands along both sides of the riverbank. However, although the construction was completed in 1996, the canals leading to the farmer fields have not been upgraded and as a result there is water spillage / seepage. The government and the farmer beneficiaries are contributing to the maintenance of the irrigation system with the government supporting major repair works while the beneficiaries attend to the minor works. The improvement in the system has led to an increase in the irrigation area from the initial 100 ha to the current 380 ha.

Production system: The cooperative, with the support of the government, has established crop demonstration areas providing guiding support in the production of newly introduced crops – perennial and horticultural crops. The farmers have a mixed agricultural system in place and crop rotation is practiced – this is a positive and sustainable agriculture production system, which contributes to food security. Further, the area has good soils and farmers are able to grow a variety of crops to improve their livelihood. Farmers are currently harvesting two crops a year, with the possibility of a third harvest; they are also able to obtain seedlings through credit from the cooperative plot.

Financial management: The farmers have been organised in groups of ten under the main irrigation cooperative and this has enabled them to access various support services for production and other social activities. Credit facilities for inputs have been made available by the cooperative to the farmers. Such input credits attract an interest rate of

12% on the total cost. Repayment terms are:

- Option 1: 50% down payment and the other 50% after the harvest. In this credit system interest does not accrue if the farmer meets the deadline
- Option 2: Payment of the full 100% of credit after harvest. This type of credit attracts interest.

Marketing: The main road network is near the production fields and farmers are able to transport their products to the market within an appropriate distance. During lean seasons, traders and merchants approach the cooperative to buy the products at quite competitive prices favouring the farmers. In other seasons, farmers identify contact farmers who have access to the market and arrange for bulk selling of the crop on behalf of the cooperative members.

The study visit team also found out that the newly introduced perennial crops might pose a problem to the farmers, because the farmers do not have experience in selling these crops. These problems relate to the transportation and packaging of the produce.

Support systems: The extension services are based on the integrated development approach and are entirely provided by the government. Some of the interventions include agroforestry, land conservation, irrigation utilisation methods, etc. Demonstration plots and a nursery have been established to show farmers how to produce a variety of crops. As a result, farmers have been able to move from producing traditional crops to producing high-value crops. Training in bookkeeping and leadership capacity is also being provided. The nursery has also served a training ground for farmers as well as provided them with early maturing seeds.

Social and environment: Following the introduction of land conservation and agroforestry management practices, the environment is now very rich with vegetation. Farmers have learned good farm management and conservation practices. They have now switched from subsistence-based agriculture to a cash crop-based production system. Further, the farmers are now organised in groups and are able to coordinate and provide support to each other.

Policy and regulations: The farmers' cooperative has bylaws through which the duties and responsibilities of each member are defined. Canal maintenance is planned and implemented in accordance with these bylaws. The credit system is also administered in accordance with the bylaws and farmers who default on their loans are taken to task according to the set rules and court settlement system that are in place.

Recommendations

Although there is a functioning cooperative, there is room for improvement through the introduction of high-value crops. This can only be achieved if government intervenes to encourage farmers to produce quality crops for wider markets. New technology should be introduced to enable the efficient production of crops. Inputs should be made

available at reasonable prices to ensure continuity in crop production and also to make it economically possible to produce crops based on market demand. In line with this, the study visit team made the following recommendations:

- The irrigation system has the capacity to cater to a wider area, and farmers need to explore the maximum utilisation of the system
- The main weir body is damaged and requires urgent repairs to avert costly works
- An assessment of the market is necessary so as to identify new outlets for the new crops that have been introduced. Prices need to include costs of transport and other logistic facilities
- The contact/model farmers system should be adopted to provide extension directly to farmers in the recommended ratio of 1:10 farmers per group to allow maximum training to the beneficiaries. The extension officer should equally be qualified in providing practical training. It is therefore important that extension staff and model farmers attend periodical training programmes for trainers
- Government should play a major role in regulating crop prices to the advantage of small-scale farmers, the present situation seems be monopolised by merchants and marketers. The extension service needs to involve engineers who can develop simple efficient tools to help the farmers. Farmers should be involved in the seed multiplication programme in such a way as to access seeds within the cooperative, thus reducing seed costs.

Site 6: Dodicha

Owner: Community

Location: Ziway

Host: Oromia Irrigation Development Authority (OIDA), Farmers' group

Host officials' comments

The Dodicha lift irrigation system started five years ago. The main sources of funding are Oromia Social Rehabilitation and Development Fund (OSRDF) and the community. The community's contribution accounts for about 10% (cash and labour) of the total cost, and the rest is funded by OSRDF. Project implementation started two years ago, with 147 household beneficiaries – 13 of which are female-headed. The irrigable area is about 67 ha, and maize and horticultural produce are the dominant crops grown.

Participants' observations

Technology: Irrigation water is abstracted from a river by two diesel driven pumps. The canal system is well constructed. Furrow irrigation method is practised.

Production system: Crop diversification is in place. The irrigation intensity ranges from 200–300%. Organic (farm yard) manure is used. There is an improved cropping management system.

Financial management: Credit is available to the farmers and since they are legally registered, farmers can receive loans from the commercial bank. Farmers contribute 12% of their produce sale per season towards operation and management. Credit settlements by the farmers is, however, not satisfactory.

Support system: The district irrigation extension coordinating unit is in place and a development agent has been assigned. The extension service has contributed to the improvement of delivery of services to the farmer.

Market: There is better access to major marketing centres. The farmers have a vegetable producer union in place to promote the sale of their produce. There is price fixing on the part of merchants (wholesalers).

Social and environment: The livelihood of farmers has improved. However, negative environmental impacts such as an increase in soil salinity is anticipated.

Policy and regulations: Strong bylaws exist. There is little government intervention in terms of price regulation.

Recommendations

- Irrigation methods other than furrow should be tried
- Drainage system should be improved
- Technical support in operation and management of the pump should be continued until the farmers are comfortable with it
- A reservoir or storage facility should be constructed
- Integrated pest management should be introduced
- Credit management mainly within cooperatives should be improved
- An export growers' association should be established
- Government should support capacity building in horticulture
- Groundwater levels and salinity build-up in soils need to be monitored
- Government needs to offer technical assistance to farmers in making inter-agreements with investors
- Government should intervene in the regulation of prices
- Government should promote agro-processing.

Site 7: Hermata and Kokona

Owner: Community

Location: North Wollo (Amhara Region)

Host: Lutheran Federation (NGO), Farmers' group

Participants' observations

Technology: The irrigation schemes are based on run-off-the-river water diversion basis. The headwork is constructed for intakes on both sides of the river. The canal system contains desilting basins to reduce siltation. Furrow irrigation is practised here.

Production system: Cropping intensities range from 200–300%. Farmer-based demonstration plots are available. Crops are planted in rows and they are well spaced. Crop diversification is in place (including horticultural crops).

Financial management: Credit service is available to farmer groups, the payment of which is made within two cropping seasons. Interest rates are at 12.5%. The credit service is supported by the NGO.

Support systems: Extension services are provided in the form of training in crop production, water management, agroforestry, animal husbandry, savings, etc. Farmer field demonstrations are in place. Seedlings for horticultural crops are provided to farmers free of charge. Post-harvest technologies have been demonstrated to farmers.

Marketing: Produce is taken directly to the market during peak production and merchants buy from the farm gate during the lean season. Market planning and intelligence are available. The farm roads are in poor condition.

Social and environment: There is an improvement in the lifestyle of the people in the project area. Group organisation has improved. Women are under-represented in most of the project activities. Catchment rehabilitation has improved as a result of land conservation measures and afforestation programmes, and the flooding of fields during heavy rains has reduced. Farmers get training on other methods of income generation, such as carpentry, masonry, etc.

Policy and regulations: Bylaws exist for group cooperatives and are enforced. Defaulters are penalised according to the established bylaws. Maintenance is carried out according to a schedule. Monitoring and evaluation is in place.

Recommendations

The study visit team made the following recommendations for the improvement of the irrigation schemes:

- Field demonstration should include crops that are high in value and have a short growing period. The demonstration plots should be identified and labelled to show the type of crop and planting date
- The credit and paying system needs to be reviewed and clarified to the farmers
- Farm roads should be improved to encourage marketing
- Participation of women should be encouraged, and they should be able to occupy decision-making positions
- Farmers should start paying O&M fees in order to maintain facilities on a sustainable basis.

Site 8: Kemisse and Anstokia

Owner: Community

Location: South Wollo (Amhara Region)

Host: World Vision International (NGO), Farmers' group

Host officials' comments

World Vision International first started intervention in the area in the form of relief assistance. Later on, the NGO realised that relief food assistance alone was not a sustainable solution for the drought problem in the area. Irrigation projects were therefore started in 1991 with the construction of a reservoir. The water abstraction system is diversified to include spring capping for drinking water supply, use of ground water and swamp reclamation. World Vision's intervention has succeeded to a certain extent and when the project comes to an end in 2007, it will be handed over to the community.

Participants' observations

Technology: At Antsokia, structures are constructed to harness spring water, and a piped water supply system is in place. At Kemisse, the main canal was lined and had a 3,000 m^3 capacity night storage.

Production system: Different crops are grown: fruits, vegetables, and cereals. Crop rotation is practised. The crops are grown in rows and are well spaced. Farmyard manure is used and compost is made. Agroforestry is practised to add fertility to the soil. Terracing is

practiced to control soil erosion. It is possible to achieve a cropping intensity of 300% by using early maturing crops such as sorghum.

Financial management: There are higher earnings from selling horticultural produce. Farmers generate sufficient income for their current irrigation operations.

Support system: There are farmer demonstration plots. There is a contact farmer system in place where one farmer services nine others. World Vision International and the Bureau of Agriculture of the Amhara Region provide extension services.

Market: There is a local market, but farmers have pooled together to look for a better market. Fruit juice is locally processed from the farm produce. Transport is identified as a problem at one of the sites. Farmers intend to place a storage facility within their locality.

Social and environmental issues: Farmers transformed themselves from being relief dependent to being self-sufficient. Their living status improved, enabling them to send their children to school. Women have access to land as contact farmers. District water supply coverage reaches 75% of the farmers. The catchment area improved through tree planting and swamp areas have been reclaimed for agricultural development.

Policy regulations and institutions: Bylaws are in place that guide farmers' contribution to O&M activities.

Recommendations

- Introduce drip irrigation to promote the use of irrigation water so that more farmers can benefit
- Arrange farmer-to-farmer exchange visits
- Provide training on record keeping and improving savings to farmer organisations
- Keep separate accounts for O&M costs and cooperative activities
- Introduce a seed multiplication programme with the involvement of the farmers
- Encourage group production and marketing
- Carry out proper environmental impact assessments before reclaiming swamps
- Strengthen farmers' groups with gender mainstreaming.

Site 9: Ethio-Flora

Owner: Ato Tsegaye Abebe (private farm)

Location: Ziway

Host: OIDA

Host officials' comments

Within the irrigation scheme different crops and vegetables for local and external markets are produced. Water is pumped from the Bulbula River, which is an outflow from Lake Ziway. Diesel and electric power are used to run the pumps. The total area of the irrigation project is 46 ha.

Participants' observations

Technology: Irrigation water is supplied by pumping using diesel and electric power-driven pumps. The canal system is well constructed. Furrow irrigation is used.

Production system: Irrigation intensity ranges from 200–300%. There is crop diversification and productivity (volume per hectare) is 7 tons per hectare. An improved cropping management system is in place.

Financial management: Private company – business oriented system is in place.

Support services: Government gives support as required, for example, in the export of produce.

Market: The production of beans for export is encouraging. There is better road access to major marketing centres. Price fixing by external merchants (wholesalers) is a problem.

Social and environmental issues: The project creates employment opportunities for about 200 and 400 persons in the off and peak seasons respectively. Salinity build-up in the irrigated area soils is increasing.

Policy and regulation: Existing government policy encourages private irrigation producers.

Recommendations

- Other more efficient irrigation systems (drip, sprinkler) should be considered so as to increase efficiency and prevent degradation of the environment
- The level of the groundwater should be monitored
- Integrated pest management needs to be introduced
- Improved packaging, and post-harvest technologies should be introduced

- In terms of the environment more attention needs to be paid to hygiene.

Site 10: Wonji/Shoa Sugar out-growers and factory

Owner: Community

Location: Wonji/Shoa

Host: Wonji Sugar Estate/ Farmers' group

Host officials' comments

The sugar cane plantation of Wonji/Shoa factory is located 112 kilometres (km) south east of Addis Ababa and 12 km south of Nazareth. It is a public enterprise engaged in the growing of sugar cane. The area under sugar cane comprises 7,050 ha of which 5,929 ha is under the estate and 1,121 ha is under the out-growers' holdings. The out-grower farms were established with the objective of improving the standard of farmers through full employment, as well as increasing cane supply to the estate.

Participants' observations

Technology: Water is diverted from the Awash River by electrical and diesel pumps and discharged into the reservoirs. From the reservoirs, the water is distributed into various conveyance networks with the help of gravity. The method of irrigation used is furrow irrigation. The main outlet canals are concrete lined, while the field channels are unlined. The irrigation water application is based on applying soil moisture content at intervals. The water distribution system is managed by a group of three farmers:

- One is responsible for opening the water at the outlet distribution valve
- Another is responsible for ensuring the flow of water in the main canals, and
- The third checks the flow of water in the furrows.

The pumps that divert water from the river into the reservoir however, are not sufficient to meet the demand.

Production system: The production system is based on an out-grower system. Land preparation on the plantation is done mechanically. The sugar cane is planted in furrows and later raised to ridges. To ensure continuous supply of cane to the factory, the sugar cane is planted in phases so that harvesting is done throughout the year. The growing period for the sugar cane is between 15–24 months, depending on the variety planted. This means that most of the time there is sugar cane in the farmers' field. There is mainly the large-scale production of sugar cane, and a few vegetable crops are grown.

Financial management: Credit is made available to the farmers from the estate. This credit covers seeds, fertilizers, chemicals, and the maintenance of the pumps. Repayment for

these inputs is made when the farmers receive payment for the sugar cane sold (the state deducts these costs from their income). Due to financial constraints, farmers are unable to purchase a new pump. The farmers are currently in debt due to the flooding of the Awash River, which damaged the crop. However, the income the farmers are receiving now is better than that received in the past two years and they have been able to invest in a hammer mill, cattle water supply and fish production. There is also a credit association assisting farmers. The farmers feel that they can earn more from vegetables than from the sale of sugar cane.

Support system: Farmers receive extension service support in the basic agronomic practices of sugar cane production. There is also training in chemical usage, crop protection and planting. Cane ratoons are also provided. Extension service delivery in other crops is minimal.

Market: The farmers do not have a major problem marketing the sugar cane since it is all taken to the factory. None of the sugar cane is sold on the local market. Transport of the sugar cane to the factory is by a tractor driven trailer.

Environmental and social issues: The government has put in place an environmental protection programme to maintain soil fertility and regulate/control the level of air and water pollution brought about by the factory. The farmers are well organised into groups and carry out all the work on their farms.

Policy and regulations: The Cane Producers Association (CPA), which mainly constitutes the out-grower farmers, is used as a link between the farmers and the factory management. The CPA negotiates on behalf of the farmers for better contractual terms. A review of the contractual agreement is done every three years. The out-growers also have a registered farmers' organisation.

Recommendations

- Government needs to intervene in the procurement of an additional pump
- Government assistance should be sought for debt relief on overdue inputs
- Extension services need to be provided to farmers for the other crops that they are growing
- Policies need to be developed to protect farmers against carrying over debt in times of flood disasters or in the face of other factors leading to crop failure
- The CPA needs to mainstream gender issues in their programme and in all their activities and benefits offered.

3.2 Main findings

- Of all the irrigation sites visited, the Kobo/Alluha community-based irrigation scheme was considered by the participants to have a relatively good management system in place.
- Major structures such as dams, head works, main canals, etc., used in small-scale projects are financed by the government and NGOs. The farmers' contribution, in most cases, is limited to the provision of labour and local materials during construction and minor maintenance of the small canals.
- Participants found that the weak extension system, poor marketing conditions, the lack of an adequate support system are major constraints to the success of smallholders.
- The extension agents themselves lack adequate practical knowledge to train farmers in various irrigation technologies, crop husbandry, and land use practices.
- Credit facilities are not available to smallholders in a number of cases, and where they are available, farmers have difficulty in paying back due to insufficient income generation.
- Finding good prices for the produce is a major problem. Group marketing is not practised in most cases, and this situation favours merchants and traders who fix prices to their advantage.
- Lack of good transportation facilities (access roads) is another obstacle facing farmers. As a result, many farmers cannot take their produce to the market areas.
- Crop diversification is not practised and one of the consequences is that there are often market gluts, which result in low prices. Any improvement of small-scale irrigation should include the application of irrigation technology, market analysis, extension and support systems, etc.
- Constraints facing small-scale irrigators that need to be seriously addressed include:
    - absence of workable cost recovery schemes for major structures (e.g. dam, head work, main canal, etc.);
    - inadequate access to the market, lack of government support in terms of the regulation of the market;
    - poor support systems to most farmers (loans, credits, etc);
    - lack of know-how in, and access to, the opportunities of irrigation technology and design, poor extension services, etc;
    - insecurity of land tenure;
    - recurrent drought conditions and the scarcity of water during the dry season;
    - land degradation, etc.

Tables 3-5 present the summaries of the findings of the study visit in terms of the different ownership patterns in relation to themes such as irrigation technology, production and support systems, financial arrangements, marketing and policy/ regulations and institutions, social and environment.

Table 3: Summary of the site visit findings – government-supported schemes

Theme	**Findings in relation to the theme**
Irrigation technology	Technologies used: • Water abstraction from small reservoirs in ephemeral streams • Gravity diversion in perennial streams • Unlined canals in impermeable strata • Canal lining in permeable soils Constraints: • Droughts reduce irrigated area • Water use efficiency affects area irrigated – inefficient use of water affects the size of the irrigated area Sharing of responsibilities: • Construction of head-works and other major structures funded by government and donors • Importance of timely maintenance – need to include drainage channels to remove excess irrigation water and runoff • Major maintenance is handled by government while minor maintenance is handled by farmers
Production systems	• Opportunity to increase cropping intensity to two or more crops per year • Extension support with demonstration plots encourages farmers to plant more remunerative crops as well as improved agronomic practices such as maximising plant populations
Support systems	• Limited extension/farmer training • Farmers have limited outlook on farming as a business
Financial arrangements	• Farmers can obtain credit for seasonal inputs with an interest rate of 12–18%. • System of group collateral in place (5 – 10 members) • Legal system for redressing defaulters in place
Marketing	• Proximity to markets is overshadowed by poor transport, lack of market linkages, lack of information and lack of collection centres • Heavy reliance on maize attracts low prices in certain seasons • Use of contact farmers for assessing markets and arranging bulk marketing is promising • Introduction of new crop varieties needs to be supported by market information
Policy, regulations/ institutions	Although WUAs exist, they tend to have weak organisational management. Better-organised farmer cooperatives arrange credit and seedlings at a reasonable price
Social and environment	• Women and youth participation in the leadership and activities of farmer organisations is limited • Land degradation along riverbanks is a major threat • Catchment treatment extends life span of storage reservoirs

Table 4: Summary of the site visit findings – NGO-supported irrigation schemes

Theme	Findings in relation to the theme
Irrigation technology	• Water abstraction through gravity diversion and spring development system • Night storage and sediment settling structures • Canals partially lined • Water scheduling through rotation system • Water application through furrow and hose systems
Production systems	• Cropping intensity of 200–300% • Project- and farmer-based demonstration plots • Crops grown in rows and well spaced • Crop diversification in place including horticultural crops
Support systems	• Extension services in place in the form of training in crop production, water management, agroforestry, animal husbandry, savings, etc. • Seedlings for horticultural crops provided to farmers • Post-harvest techniques
Financial arrangements	• Credit available at 12.5 % supported by NGO • Saving mechanism with interest payment (3% based on national Bank's interest rates)
Marketing	• Direct sale at farm gate during lean season • Market planning and intelligence in place
Policy and regulations/ institutions	• Bylaws for WUA • Mechanism for penalising offenders • Scheduling for maintenance • Monitoring and evaluation
Social and environment	• Improvement of lifestyles as a result of irrigation • Reclamation of swamps (with environmental impact assessment), reduced flooding from runoff • Gender mainstreaming through training • Catchment conservation • Energy saving stove • Integrated development such as provision of water supply, and alternative income generation

Table 5: Summary of the site visit findings – Out-growers or partnerships and privately-managed irrigation schemes

Theme	Findings in relation to the theme
Irrigation technology	• Water abstraction using electrical and diesel pumps from water courses • Partially lined canals • Incorporation of drainage • Night storage system • Surface irrigation using furrows • Water application based on soil moisture • Field irrigation conducted with a team composed of three farmers
Production systems	• Planning farm production to suit agro-processing or marketing • Crop diversification, and management • Increased cropping intensity
Support systems	• Soil and water management in place • Training in crop protection and fertilizer usage
Financial arrangements	• Credit availability through out-grower system
Marketing	• Marketing on out-grower farms, therefore there is no need to look for a market • Production plan geared towards local and export markets • Negative impact of market cartels • Packaging and grading facilities available
Policy and regulations/ institutions	• Negotiation skills of farmers improved • Registered farmer organisations
Social and environment	• Gender mainstreaming is still a problem • Impact of disasters on farm management is a threat • Soil salinity hazard in arid/semi-arid areas

4 Lessons learned during site visits

4.1 General findings

NGO-supported schemes are more successful in integrating diverse activities associated with irrigation development than government-supported ones.

4.2 Irrigation technology

- Improving traditional irrigation allows for an increase in the command areas.
- More potentially irrigable land can be placed under irrigation if existing users can use water more efficiently. Likewise, the changing of surface irrigation to drip and sprinklers would alleviate water shortage during droughts, in addition to extending the command areas.
- Irrigation technology needs to be adapted to the specific agro-ecology, for example, taking into account storage in ephemeral streams, gravity diversion in ephemeral streams.
- Out-grower farmers will adopt improved water management techniques from knowledge transferred from partnership arrangements.

4.3 Production systems

- Current systems favour food security crops such as maize, teff, barley and wheat.
- Production systems can be improved if:
  - sustainable production systems are put in place. Presently, there is a lack of consistent use of improved seeds, fertilizers (generally low fertilizer use – both organic and inorganic), etc. Crop protection is not well developed – there is no chemical spraying and integrated pest management is not practised;
  - the number of plant populations is improved;
  - better irrigation agronomy is put in place, for example, flood vs. furrow (furrow would be preferable but was not practised everywhere).
- Agroforestry: donor- or NGO-supported projects tend to promote agroforestry more than government-supported schemes.
- There is good use of root crops (onions, carrots). The tomato/potato mix favoured by farmers needs close monitoring because of the danger of leaf blight outbreak.

- Too much variety in farmers' fields prevents them from more effectively marketing their produce. On the other hand, too little variety leads to deteriorating prices during the high season. A good balance needs to be found.
- Commercial growers tend to concentrate on a single crop production system, often ignoring soil salinity concerns. Instead, salt tolerant crops during fallow periods need to be grown and measures put in place to control soil salinity.
- Commercial out-grower scheme exposed small-scale farmers to high-risk crops (i.e. sugar cane damaged by flood). A better balance should be maintained (such as including vegetables) to spread risks (Ethio-Flora).
- Scheme level production plan assists group marketing.

4.4 Support systems

- Training, capacity building and motivating extension workers are essential if they are to effectively support farmers.
- The promotion of agribusiness development interventions by extension services enhances farm productivity.

4.5 Financial arrangements

- The group collateral system can be an effective means of providing credit to farmers.
- Farmers' income can increase substantially from the sale of vegetables and fruits.
- The effectiveness of farmers' organisations and performance of irrigation schemes can improve with good record keeping and having separate accounts for O&M activities.
- Farmers' incomes improve as a result of out-grower arrangements.

4.6 Marketing

- Proactive marketing support in the form of information, improved roads, transport means, packaging and collection centres (cooled/ventilated) can help farmers to perform better.
- Poorly constructed and maintained roads affect marketing.
- Farmers face problems of market access due to the existence of cartels of traders.

4.7 Policy and regulations / institutions

General

- Having effective policy and regulation in place can help avert the degradation of riverine lands.
- Regular payment of water charges leads to an improvement in maintenance operations.

Country paper / case study presentations

- The majority of the producers are small-scale farmers. Their contribution to national production is lower than their share in the population, thus, for food security to improve, more attention will have to be paid to these small-scale farmers.
- Many existing irrigation projects are not working properly and need to be rehabilitated. In the presentations, it became clear that there are inadequate policies to support small-scale farmers – implementing appropriate policies and strategies will ensure proper functioning in the future.
- The creation of an enabling environment for private participation is needed.
- Building up the capacity of beneficiaries to take over effective control of the projects is needed.

4.8 Social and environment

Social

- Gender: Women are marginalised in irrigation activities and have limited leadership roles in irrigation management. An effort needs to be made to tackle these gender issues.
- Lease conditions for small-scale farmers with powerful private entrepreneurs (Ethio-Flora) can be unfavourable, limiting farmers' ability to make production decisions (e.g. growing vegetables instead of sugar cane).

Environment

- There is extensive land degradation within the catchment area, hence the massive siltation in irrigation schemes. This can be attributed in part to the cultivation on steep slopes and marginal areas consequent on population pressure and the shortage of fuel wood.

- Poor sanitation can easily result in water-borne diseases.
- Increasing the use of organic manure can result in an increase in production and is less harmful to the environment.
- Soil salinity build-up in some areas is due to a lack of drainage systems. Water quality and ground water level monitoring would assist in understanding its impact on crops and soils.
- Land conservation and afforestation measures can protect catchment areas.

4.9 Conclusions from field visits

- Government needs to improve its support to the sector.
- There are no clear policy guidelines on the division of responsibilities at the sites, for example, are the repairs which are required minor or major. Who is supposed to do what? Responsibilities need to be clearly defined.
- Marketing limitations; no linkages and infrastructural support.
- There is a need for training and capacity building (NGO-supported projects cover these areas better than government-supported projects). There is need for training in the whole range of issues, not just in the technology required for O&M, but also in marketing, and in all other relevant areas.

5 Recommendations of the study visit

All of the participants agreed that smallholder irrigation is important to agricultural development and to food security. To be successful, the smallholder irrigation system should be based on the wide participation of the farmers using the bottom-up approach to planning. Gender mainstreaming is important at all levels of the development process; women should be able to own land, participate at the leadership level, share in the economic benefits, etc.

Farmers should organise themselves into co-operatives. These co-operatives should provide credit facilities at reasonable interest rates, draft by-laws, search for group market places, maintain accounting systems, open bank accounts, etc. Organising farmers into groups will help them acquire a better negotiation potential for selling their products.

Government and NGOs should assist farmers in providing extension services in water-saving technologies, better agronomic practices, environmental conservation, marketing, etc. Government should also assist farmers in regulating prices during periods of high fluctuations, being a business partner, finding an export market, etc. Policy and regulations in water abstractions, water tariffs, land tenure and land lease issues should be favourable for irrigation development as well as promoting environmental conservation.

In the light of this, the participants made the following recommendations to improve small-scale irrigation in SSA.

5.1 General

- Irrigation projects with the general objective of enhancing food security need to be planned, developed and managed within the context of a clearer programme of capacity building, and with a longer timeframe given to farmers to attain financial sustainability, compared with irrigation programmes for commercial purposes targeted at farmers with some asset base.
- Government-supported projects consistently ranked last in the effectiveness of their support to small-scale irrigation, after NGOs, donors and commercial farmers. It might now be time for government to hand over the responsibility of managing such schemes to other development agents (NGOs, churches, etc.). Donors should also channel their money to these other organisations rather than through government agencies, with government maintaining its planning and regulatory roles.
- Farmers need to be supported with more adaptive and applied research on water use efficiency, improved marketing, etc. It should not be assumed that farmers can access the information they require on their own.

5.2 Irrigation technology

Development approach

- A stepwise approach to development is required. Farmers need assistance to be able to move from one level to a higher level (they cannot be expected to do it themselves). Do not start with 'high-tech' approaches especially in places where there was nothing before.

Water-saving technologies

- As water is the limiting factor in the expansion of irrigated areas, participants recommended that the promotion of water-saving technologies could include (based on site specific conditions) sprinklers, mulching, drip irrigation, lining of canals, etc.

Simple pumping technologies

- Promoting simple pumping technologies such as treadle pumps which facilitate the exploitation of vast shallow groundwater resources (where available) for irrigation. Treadle pumps also allow the promotion of individual development in irrigation farming. As a consequence, farmers do not have to rely on communal/cooperative schemes.

Motorised pumps

- In some cases where motorised pumps are the only option for small-scale irrigation development, provision should be made to support farmers to the point where they are economically stable and can run the motorised scheme on their own.

Silt load in rivers

- Design of headwork for river diversion should aim to minimise the sediment getting into the irrigation system.
- In high, sediment laden rivers, provision should be made for the easy removal of sediment at the headwork (e. g. Hermata and Kokona schemes).

Salinity problem

- Salinity problems need to be given due consideration during project design.
- Extension staff and farmers should be trained in ways to prevent soil salinity, such as using water-efficient systems (e.g. drip irrigation instead of surface irrigation), leaching

using fresh (rain) water, and putting in place a drainage and salinity build-up monitoring system.

Seepage losses in unlined canals

- Unlined canals were observed in most of the irrigation schemes visited, with the likelihood of high seepage losses, especially over sandy soils. This problem can be addressed by lining the canals, and if this is not possible, construction material of low permeability (clay soils) should be used in the construction of the canals.

Training

- Farmers need to be properly instructed in irrigation technology and encouraged to regularly contribute money and communal labour for O&M of irrigation schemes.

5.3 Production systems

- Farmers need to adopt an agri-business approach to their operations and be prepared to practise crop rotation and diversification.
- Farmers' organisations should be involved in seed multiplication programmes to enable access to good seeds as well as reduce seed costs.

Recommended production system

- Improve the systems currently in use to the "new diversified small-scale model". This includes producing cereal/food grains for food security, and root crops for soil pest control and improving market access.
- Food legumes, currently absent from farming systems, should be included as they are useful in livestock production, promoting soil fertility, nutrition and food security.
- Farming systems should be well researched to include some cash crops for income generation.
- Government and donors should develop a proactive, long-term productivity policy on production systems; and not only develop policies focusing on drought and famine (long-term policies, not short-term solutions).

5.4 Support systems

General

- Extension service delivery to participating households needs to be improved and strengthened through:
  - training in irrigation water applications;
  - setting up demonstration plots;
  - promoting organic farming and use of compost manures;
  - farmer exchange visits;
  - improving access to better farming techniques (less laborious) and post-harvest technology.
- The contact/model farmers system should be adopted to provide extension directly to farmers in the recommended ratio of 1:10 farmer per group to allow maximum training to the beneficiaries. Training to update knowledge of a new technology of crop production should be provided to both extension staff and contact farmers.
- Demonstration fields should include short duration and high-value crops. The plots should be identified and labelled to show the type of crop and planting date.

Government support

The government has a critical role to play in supporting farmers to realise their potential. The points listed below all relate to what the government needs to do.

- Monitor all small-scale development programmes to ensure that the intended support reaches the targeted beneficiaries.
- Provide infrastructure support to cooperatives such as storage sheds, equipment, etc, and provide training in management and maintenance of the infrastructure as well as new extension requirements.
- Ensure that the extension service provides:
  - new, cost-effective techniques in the utilisation of the irrigation equipment, e.g. salinity control through leaching with rainwater, etc;
  - expert advice on, for example, the maintenance of irrigation equipment (pump maintenance etc) and the drawing up of legal instruments (e.g., agreements between small-scale farmers and private entrepreneurs);
  - service to small-scale farmers involved in out-grower schemes;
  - business skills such as negotiating skills to the farmers' cooperatives;

  - a demonstration site network for all schemes.

- Provide community natural resource management training e.g., agroforestry.
- Provide extension incentives such as payment of salaries on time and at a good level to ensure the proper delivery of extension services.
- Encourage and strengthen women in agricultural programmes.
- Provide support to NGO-operated programmes to facilitate efficient attainment of intended sustainable food security targets.
- Strengthen extension service trainers' programmes (build capacities of extension agents).
- Strengthen irrigation extension capacity by increasing the number of capable development agents (contact farmers).
- Support extension staff attached to private companies.

NGO support

- Technical staff should extend their knowledge to government extension staff as an ongoing process (training of trainers).
- Exit strategies of NGO-supported projects should be to the benefit of the community and not government (hand over projects to the communities, not to the government).
- Government staff should actively participate in project exit strategies and should take up part of the responsibility for maintenance together with the community.
- NGOs should provide continuous backstopping support for those projects/programmes that have been handed over to the community.
- Provide technical support to any project which lacks the capacity to manage in, for example, times of natural disasters such as floods or droughts.

Private company support

- Provide adequate extension services to contact farmers for quality production.
- Companies should request extension support from government (in the form of an attachment/secondment) and provide incentives for attached extension staff. There was some discussion around this issue, and the following questions were raised – How does one balance the provision of extension support to farmers attached to private companies and those that are not? If the private company tops up the salary of the extension agents, then will those not attached to the project lose out?

Donor support

- Conduct extensive monitoring and evaluation of supported projects.
- Intended objectives of the projects should be achieved and targeted beneficiaries should be reached.
- Projects should be designed in such a way that the activities yield positive results.
- Donors should be approached especially in situations requiring additional funding (natural disasters such as floods and droughts).

Farmer support

- Farmers should pass on their knowledge to other farmers who have not received training/advice.
- Exchange visits should be encouraged between cooperatives to exchange ideas and experiences. Government and NGOs should support these exchange visits.
- The contact/model farmer system should be strengthened and encouraged and introduced in areas where it is not present.

5.5 Financial arrangements

- Financial systems in the different schemes should be in place so as to solicit funds to support sustained development activity. Funding sources could come from irrigation water annual fees, membership fees and fines for the violation of by-laws. This should also have the effect of encouraging farmers to use the water efficiently.
- Assistance should be extended to farmers setting up registered cooperatives so that they can access credit from commercial banks at favourable rates, and open savings accounts, etc.
- Farmers should be informed earlier that they will eventually be expected to contribute to the irrigation scheme, so that they can prepare for this.
- Farmers in communities which have suffered famine and drought in the recent past first need to be able to recreate their asset base before taking over financial responsibilities.
- Provision should be made for financial assistance (from the government) in disaster cases such as flooding and drought. Timely assistance is cheaper than emergency relief.
- Market-oriented agriculture should be promoted to enable farmers to raise funds.

5.6 Marketing

Small-scale communal irrigation schemes

- Synchronise production with marketing. Assess market demand before production. Market assessments and surveys carried out by the government and supporting NGOs should be coordinated.
- Focus on the production of high-quality produce so as to be able to compete with other produce – employ good agricultural practices, for example, use high quality seeds, manure, etc.
- Form/strengthen WUA/farmer cooperatives and marketing organisations. Plan as a group as this increases the bargaining power.
- Farming should be approached as a business – there is a need to develop marketing skills.
- Diversify. Explore the possibility of growing other crops that are high in demand.
- Contract growing with buyers, possibly for export – this provides an assured market. Explore other markets.
- Access roads need to be upgraded and maintained; government and donors have a critical role to play here.
- Collection centres are needed within the communities. These centres can also be used as a meeting place for the community.
- Exchange visits for farmers should be arranged within the country and outside – so as to expose them to other practices and models.

Commercial farming enterprises

- Proper post-harvest practices need to be put in place (Ethio-Flora) – packaging, grading, cold chain storage, etc.
- Develop an all year round production system with a more diverse crop mix. Include out-growers in the production plan.
- Form an export growers association (this reduces freight costs, better negotiation on prices). Visit other developing countries that have successful associations of this type (e.g., Zambia; Kenya).
- High quality produce is needed to be able to compete in international markets. More attention needs to be paid to the quality of the product.

Government interventions (general)

- Market information and intelligence is needed to monitor prices and take note of fluctuations in demand and supply. This information needs to be passed on to producers to better plan what they need to plant so as to respond to existing market demands. This information can be passed on to the farmers via market bulletins and the media (e.g., newspaper, radio).
- The local processing industry should be developed to take care of gluts. This should have the effect of increasing the shelf life of products, and expand markets (by overcoming transport problems).
- Place cold storage/cooling structures at strategic sites (e.g. marketing centres; airports).
- Put a marketing body in place for different types of crops to promote the marketing of each produce. Marketing bodies are generally able to better regulate prices and reduce the influence of cartels and unscrupulous middlemen.

5.7 Policy, regulations and institutions

- WUAs should be registered as legal entities, and be strengthened for effective management transfer, acquisition of credit, O&M and group marketing.
- Government should support farmers through price regulation and by providing improved post-harvest technology, quality control, and hygienic standards.

Government

- Governments should initiate, source funding and set targets for the promotion of irrigation development as key to achieving food security.
- Government and development partners should formulate proposals that address the complete spectrum of project development and practice for sustainability.
- Adequate legislation from governments should be established for the protection of both investors and landowners to address the issues of land tenure and water rights.
- Policies and legislation should be institutionalised to attract private investors to the sub-sector to encourage increased production.
- Government should elaborate on policies related to gender mainstreaming, and disaster mitigation such as flooding.

Beneficiaries

- Farmer-based organisations, community-based organisations, WUA, etc., should be established at all irrigation projects with clearly defined roles and responsibilities for government/donor and beneficiaries.
- The organisations must be registered so as to establish their legal status with constitution and bylaws that will adequately address the management and the O&M of the project.
- Improve marketing linkages/infrastructure and involve private sector participation as a way of increasing support to the farmers.
- Gender issues – women should be encouraged to participate in the process and given leadership roles. Ways of doing this include promoting the formation of women's groups to carry out income generation projects involving processing, storage, post-harvest technologies and marketing.

5.8 Social and environment

- A thorough participatory rural appraisal and an environmental impact assessment should be conducted prior to any irrigation development.
- Women's participation in irrigation development and management should be sought in all irrigation activities e.g., WUA – women could play a role in the leadership and decision-making process.
- Extension workers should be clear on what approaches they should use in gender inclusiveness (gender analysis).
- Extension workers should adapt gender performance indicators in monitoring and evaluation programmes.
- Unfavourable taboos with regard to women's participation should be discussed and where possible eliminated.
- Irrigation policies should include the gender dimension and be part of all projects and activities.
- Soil and water conservation measures should be incorporated into irrigation activities, e.g., organic manure, agroforestry, legumes, etc.
- Government should provide good water supply for domestic use (boreholes, etc).
- Government should intensify tree-planting programmes and provide alternative sources of fuel to support the energy gaps.
- Environmental policies should take into account the sustainability of the environment.

- Soil surveys and analysis should be conducted at all irrigation schemes in order to identify appropriate crops and cropping techniques for the specific situation.
- Government should assist farmers to negotiate favourable lease contracts with private entrepreneurs (also covered under policy etc. with respect to land tenure issues).

6 Study visit impact activities

During the study visit, the participants prepared a list of activities that they would undertake upon returning home, which would promote small-scale irrigation. These impact activities are summarised as follows:

- Arrange workshops/training sessions to promote gender perspectives within farmers' organisations (Tanzania).
- Strengthen farmers' marketing capabilities through group actions (Tanzania).
- Identify best practices and collaborate with institutions to chart institutional roles for development programmes (Zambia).
- Organise workshops and field days to promote efficient irrigation water use (Kenya).
- Promote improved quality in the construction of irrigation structures and catchment improvement through field visits and assessments (Kenya).
- Improve the market information system through the adoption of best practices (Tanzania).
- Improve irrigation performance through training in water management and improved design of irrigation structures (Ethiopia).
- Promote, through training, the efficient use of water to address water shortages and encourage farmers to relate production plans with market prospects (Ethiopia).
- Visit and assess the constraints of selected WUAs with a view to strengthening their performance (Malawi).
- Include in ongoing training programmes, activities for effective O&M of irrigation schemes (Ghana).
- Include training in water use efficiency with a view to increasing cropping intensity (Ghana).
- Improve four traditional river diversion structures and two spring sources (Malawi).
- Arrange for stakeholders to lobby for increased productivity and efficiency of public sector-supported irrigation schemes (Zambia).
- Improve market information systems with respect to quality and market demand through workshops (Zambia).

Annexes

Speeches at the opening and closing ceremonies

Welcome address

Mekuria Tafesse, Metaferia Consulting Engineers (MCE)

Your Excellency Ato Belay Ejigu,
Vice Minister, Ministry of Agriculture,
Invited Guests,
Study Tour Participants:

It is an honour to welcome you to the opening session of the CTA sponsored study visit on 'Small-scale irrigation for food security in SSA', which will be held from 20–29 January 2003.

I understand that a number of the study visit participants who came from abroad arrived during the night and I hope that you have had time to rest a bit. I also hope that the morning weather is not too cool for most of you, rest assured that it will warm up, becoming more pleasant during course of the day.

My name is Mekuria Tafesse and I am the technical consultant for the programme. I will be chairing the opening session, which consists of opening statements, an official opening by our guest of honour, and a *Background paper*, which will I present. After the official opening we will have a group photograph, followed by a coffee/tea break.

The objective of the study visit is, in a nutshell, to exchange experiences and views over food security in SSA and more specifically, the role and contribution of SSI for food security. A number of questions have been asked as to why there has been a relatively low rate of irrigation development in SSA in spite of the demand for food, fodder, fibre or cash crops, in areas where the water and land resources are available.

Some studies point to:

- Relatively high cost of development
- Inadequate physical infrastructure and markets
- Poor investments in irrigation
- Lack of access to improved irrigation technologies

- Lack of cheap and readily available water supplies
- Inadequate policies, regulations and institutional capacity.

These are some of the issues that the participants will ponder on for the next ten days. They have come with their own experiences and we hope that they will be able to share them with their fellow participants. They will visit SSI sites in northern and central Ethiopia, learn of the Ethiopian experiences of irrigation development under variable agro-ecological conditions, and different management styles. They will also be able to exchange views with farmers, development agents and sponsors.

As active development workers, the participants are interested in acquiring additional knowledge and experience in developing and managing successful SSI schemes, and at same time, boosting food security.

We have with us 15 participants from six countries: i.e. Zambia, Tanzania, Malawi, Ghana, Kenya and Ethiopia giving us a fair representation of SSA.

The programme starts here in Addis Ababa with this opening session and will include visits to 13 small-scale irrigation schemes in three regions in northern and central Ethiopia, covering over 1,800 km. The participants will meet again here at Ghion Hotel on the last day January 29, to summarise their findings, and make recommendations which will promote SSI development.

This study visit was made possible with CTA sponsorship. In addition, a number of regional bodies, NGOs and private farms have assisted in the identification and hosting of the study visits at their project sites. Travel Ethiopia is handling all the logistics and administrative matters. I would like to take this opportunity to thank them for their supportive role, time and effort in making these arrangements.

With these introductory remarks I would now like to invite His Excellency Mr Belay Ejigu, Vice Minister of Agriculture to make the opening statement.

Opening statement

His Excellency Mr Belay Ejigu, Vice Minister of Agriculture, Ethiopia.

Honourable Guests,
Participants of the Study Visit on Small-Scale Irrigation,
Ladies and Gentlemen:

I feel honoured and privileged to be in the midst of this august audience to present the opening statement for the study visit on 'Small-scale irrigation for food security in SSA', which is being held in Ethiopia.

Allow me, first of all, to express my appreciation on behalf of the Ministry of Agriculture of the Federal Republic of Ethiopia and myself for the opportunity to host this study visit. I sincerely hope that those of you visiting Ethiopia for the first time will find the environment conducive to work in and that you will be able to participate effectively.

I have been informed that the main objective of the study visit is to discuss and exchange experiences in the field of small-scale irrigation for food security, to highlight roles of various actors in irrigation development, assess constraints and discuss solutions. The visit will also offer participants the opportunity to familiarise themselves with the challenges and constraints in irrigation development in Ethiopia. Further, it is expected that the study visit will provide an opportunity for establishing and strengthening professional linkages among the participants.

Disasters such as droughts, floods and storms have in recent years devastated large tracts of land in Africa, resulting in food shortages – an almost annual occurrence in many countries. Drought has affected a large number of people in many African countries including Ethiopia.

Water is a fundamental input to agricultural production. Indeed, there can be no food security without water. Other inputs such as seeds, fertilizers, pesticides and over all crop management are meaningless, without sufficient supply of water/moisture in the soil. Water is also critical to livestock production. Hence, the availability of water should be guaranteed to increase the success of good harvests and good animal breeding. Small-scale irrigation needs to be expanded to increase food security in drought prone areas.

It is not possible to address issues such as poverty, environmental protection or food security without putting in place mechanisms to use water resources exhaustively and efficiently. These measures include:

- Securing adequate financial resources for building irrigation schemes which extends up to various related operations

- Organising farmers in associations so as to enable them have access to get credit
- Organising and strengthening WUAs
- Expanding infrastructure
- Encouraging farmers to produce marketable products by making use of irrigated lands and introducing modern irrigation equipment
- Strengthening agricultural extension, training programmes
- Creating an environment conducive to the development of appropriate policies for the sector.

Where there is suitable infrastructure, private investors are often expected to be involved in developing irrigated agriculture in a sustainable way – given the business potential for private entrepreneurs in this sector.

It is evident that by encouraging the participation of privately developed and managed irrigation schemes, we can decrease the involvement of government in irrigated agriculture.

Addressing issues surrounding the development of small-scale irrigation is timely and crucial giving the prevailing drought conditions in many parts of Africa. I wish to thank CTA for organising this important study visit.

It now remains for me to wish you success in your deliberations and to declare this function officially open.

Thank you!

Keynote address

Gesa Wesseler, CTA

CTA and what it is?

- The ACP-EU Technical Centre for Agricultural and Rural Cooperation.
- Founded in 1983 under the Lomé Convention.
- Since 2000 operates under the framework of the ACP-EU Cotonou Agreement (successor agreement to Lomé).
- Headquarters in Wageningen, the Netherlands.
- 40 members of staff.

CTA's niche

- Geographic: ACP regions (Africa, Caribbean, Pacific).
- Overall objectives: Poverty alleviation, food security, sustainable management of natural resources, sustained and equitable growth.
- Thematic/sectoral: Information and Communication Management (ICM) for agricultural and rural development.
- Strategic: Provision of information services and strengthening of ICM capacities.

CTA's new structure

There are three main programmes:

- Information Products and Services: to improve the availability of information and to increase the awareness of information sources on agriculture, on the rural sector and on their development.

  Main activities: Publications, *Spore*, Publication Distribution Service.

- Communication Channels and Services: to support the integrated use of communication channels and to help intensify contacts and information exchange among concerned ACP stakeholders on agricultural and rural matters.

  Main activities:

  - provide support to regional networks;

- seminars, conferences;
- study visits, SSP;
- websites, portals and gateways.

- ICM Skills and Systems: to facilitate and support ACP actors/stakeholders' capacity to generate and manage agricultural information and to develop information communication management strategies and models.

CTA and food security

- Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. (World Food Summit).
- One of the broad objectives of the Cotonou Agreement.
- Cross-cutting issue in all of CTA's programmes.
- Some specific activities: publications; workshops.

CTA and irrigation

- Ways of water
- Runoff irrigation in the Sahel zone
- In land we trust
- Sustaining the soil
- Water management in SSA
- Towards sustainable land use
- Water harvesting and soil moisture retention
- Rainwater harvesting
- Private irrigation in SSA.

The Cordoba seminar

'Fair, efficient and sustainable management of water for the agricultural and rural development of sub-Saharan Africa and of the Caribbean.' Cordoba, Spain, 20–25 September 1999.

The Accra Seminar

Co-seminar 2001, 'Private sector participation and irrigation expansion in sub-Saharan Africa, Accra, Ghana, 22–26 October 2001 (FAO, the International Water Management Institute (IWMI), CTA) – focus on the potential of the private sector (NGOs; local private firms; individuals) in promoting irrigation.

Some conclusions

- Clear need for expansion of irrigation for food security.
- Declining public investment => more private sector initiative needed.
- Issues and constraints – marketing, equipment, financing, gender issues, etc.
- Need to exchange information and experience on different management models.

Role of irrigation in food security

- Large-scale vs. small-scale irrigation.
- Who is food-insecure? Community level; household level.
- Can small-scale irrigation help?
- What are the pre-conditions?
- What are the constraints?
- What can we do?

Let's go and see …

Let's discuss …

Thank you!

Concluding remarks

Gesa Wesseler

I have been asked to make a few concluding remarks on behalf of CTA and myself.

First of all, I would like to say that I have enjoyed this study visit very much. This was my first trip to Ethiopia, and I hope that I will have a chance to come again in the future to visit those places that we missed on this trip. Personally, I have learned a number of important lessons (and the following is just a personal selection of issues that I have picked up; many of these, and many others have been mentioned earlier today).

It has been said that Ethiopia is a microcosm of Africa, with several dozen agro-ecological zones that cover the full range from desert to snow-covered mountain peaks to tropical forests. While we may not have seen these extremes, we have certainly seen quite a range of different agro-ecosystems and environments, and within these environments we have seen many different types of irrigation schemes and projects.

This brings me to the **first lesson** that I have learned as somebody who is not an expert in irrigation (although to most of you this might be quite obvious). The technical approaches to irrigation are very much dependent on the agro-ecological conditions under which the project is being implemented. Obviously, if there is no surface water, diversion will not be possible. If the groundwater table is too low, pumping will be difficult, and treadle pumps will be useless (incidentally, we didn't see any treadle pumps on our trip). But although it is so obvious, I still believe it is important to make this point, to avoid generalisations and over-simplification. Each case is different and we have to be specific in diagnosing problems and recommending solutions.

The **second lesson** I have learned is that small-scale irrigation for food security is more than just technology. All the other issues that we have discussed throughout the last ten days – production, marketing, financing, social, environmental and institutional issues, are at least as important as the technology used for water lifting and distribution. In practical terms, this has at least three implications:

- The first one is that the design and implementation of an irrigation project needs an interdisciplinary team of experts, so that all of these issues can be taken on board
- The second implication is that the farmers, who will ultimately manage the scheme, will need skills in all of these fields, and that capacity building is essential in all of these areas to exploit the full potential of an irrigation project
- The third implication is that the farming community will have to be involved in the planning, design, construction and management of the scheme from the beginning, in a participatory and transparent way, to ensure local ownership, appropriateness and

sustainability of the project. Participation increases the chance that potential problems or constraints of whatever nature are identified at an early stage and can be avoided.

The participation of farming communities in the project raises another issue, namely that of gender. We have talked a lot about gender, but we have still failed to address it in an important way. Gender issues in small-scale irrigation do not only relate to the sex of the household head, and how many female-headed households benefit from the project. Gender issues also relate to the impact of the irrigation project on men and women within the same household. We have not addressed these issues at all. In male-headed households, who was farming the land before it was irrigated? Who is now providing the bulk of the labour? Who is making decisions regarding the irrigated plots? Who receives the money? How is the money used? Do men and women have different preferences regarding the crops to be grown on the irrigated plots? How has irrigation affected the nutritional status of household members? These are just some of the questions that need to be addressed to fully understand gender issues in irrigated agriculture. Unfortunately, in most cases there weren't many women present, and if there were, they were not too eager to speak. We might need another study visit to address these issues.

Another problem that came out very strongly during this trip was the issue of sustainability in small-scale irrigation projects. Because of high operation, maintenance and replacement costs, irrigation is a risky business for many small-scale farmers. In some cases, the irrigation projects had developed out of relief and rehabilitation programmes for communities that had suffered under famine conditions. In such cases, it is useful to remember the costs to the government and the international donor community of not having an irrigation project, which might include another relief operation, not to mention the aspects of human suffering under such a scenario. Handing over the project to the farmers, who might have just recovered from the last famine and are still building up their asset base, should therefore not be hurried too much. I think this came out as an important lesson from this study visit.

Finally, we need to keep things in perspective. Small-scale irrigation certainly has a big potential to increase and stabilise yields, to expand the area under cultivation (at least in the dry season) and increase incomes. However, at the moment only about 5.1 million ha are irrigated in SSA, mostly in Madagascar, South Africa and Sudan. This corresponds to only 2.4% of the total area under cultivation. The irrigation potential in Africa, based on land suitability and water availability, has been estimated at 42.5 million ha for the whole continent, which would be about 20% of the total area under cultivation. Even if the irrigated area could be expanded by 5% per year until 2025, to reach a total of over 17 million ha (a very unlikely scenario if we look at the current expansion rate of less than 1% per year), this would still represent just a small contribution to the required increase in food production over the next 20 years. Thus, production increases are needed on rainfed areas as well, and we have seen the very low level of input use in agriculture, both on irrigated and rainfed lands. There is certainly room for improvement.

I am not saying this to discourage you, but rather to stress the point that food security is a complex issue that cannot be solved by any one single approach. Food security is

determined not only by food production, but also by income from other, non-farm sources, trade in food products among countries and regions (and also within a country), population growth, health, sanitation, education and intra-household distribution of food, to name just a few. Irrigation can help, but it cannot solve the whole problem.

Despite the big differences in the environments in which you work, I hope that all of you have found some useful piece of information that you can take home and apply in your own work.

In terms of next steps, a report of this study visit will be produced and circulated to you comments. I will then see in which form CTA can publish the report.

With these remarks, I would like to close, but before I do that, I would like to thank Ato Mekuria for the excellent preparation of this study visit; Ato Kedir and Travel Ethiopia for solving all the logistical problems that arise during such an event, and you all for your active and relentless participation in this study visit, sometimes until late in the evenings. It has been a pleasure to travel with all of you and I hope that we will stay in touch.

Thank you and have a safe trip home!

Small-scale irrigation in selected areas of northern and central Ethiopia

Mekuria Tafesse

History

The development of modern irrigation has a relatively recent history in Ethiopia, whereas traditional irrigation has been in existence for longer periods. Private concessionaires who operated farms for commercial cotton, sugar cane and horticultural crops started the first formal large and medium irrigation schemes in the Awash Valley.

Formal SSI was started in the early 1980s by the central government following the widespread drought that affected the country. Traditional irrigation, on the other hand, was initiated by farmers through gravity diversion from perennial sources/springs for growing cereals, fruits, and vegetables.

After 1991, major institutional reorganisation and decentralisation was carried out in Ethiopia with the establishment of regional governments. These governments had greater autonomy and took up the responsibility to plan, construct and transfer the management of SSI schemes to farmers.

Definition

SSI in the Ethiopian context refers to smallholder farms with the size of scheme amounting to less than 200 ha. Medium-scale is defined as between 200–3,000ha, and schemes above 3,000 ha are considered to be large-scale.

Institutions involved in the development, management and support of SSI

A large number of organisations are involved in the development and management of SSI schemes. The main ones comprise:

- Government at the federal and regional levels
- NGOs
- Traditional farmers' groups
- Private sector partnerships
- Private farms.

Each SSI scheme has a different management system, due partly to historical reasons and partly as a result of new initiatives, which have taken place. These are described under the following sub-themes:

Irrigation technology

- Suitability to agro-ecology
- Sustainability
- Spread of appropriate techniques
- Cost-reducing techniques
- Upgrading SSI schemes (traditional and formal)

Production systems

- Traditional food crops
- Horticulture
- Effectiveness
- Level of mechanisation
- Input usage

Financial arrangements

- Access to credit
- Effect of the level of organisation on access to credit
- Innovative finance schemes

Marketing

- Existence of information system
- Produce storage, packing, quality control
- Access roads and other infrastructure

Policy, regulations and institutions

- Irrigation policy
- Regulations
- WUA
- Level of state interference
- Impact of private incentives
- Security of tenure

Environment

- Water-borne diseases
- Catchment protection and sediment control
- Fuel wood

Public sector-supported schemes

Both federal and regional bodies are involved in the development, management and support of SSI. Federal organisations include the Ministry of Agriculture and the Ministry of Water Resources Development (MOWR). The Ministry of Agriculture is involved in overall policy formulation, capacity building and training of regional bureaus. MOWR is responsible for policy and strategy in the water sector as well as preparation of river basin master plans. The Ministry also coordinates irrigation projects that involve a number of regions. The MOWR has issued the Integrated Water Resources Management Policy (irrigation included), and water resources development strategy and programmes for the next 15 years.

At the regional level, the main organisations involved in the development of SSI schemes include OIDA, SAERAR, South Nations Sustainable Agriculture and Environmental

Rehabilitation and TWRDB. These organisations were established after 1993 when the government adopted the federal system and decentralised its operations. Since their formation, these organisations have been involved in capacity building and the rehabilitation as well as the implementation of new SSI schemes.

Irrigation technology

The irrigation system commonly used is surface irrigation through furrow, basin or flooding. The gravity system is however, preferred in view of the costs involved. Water abstraction is dependent on the agro-ecology of the area under consideration. Where there are perennial sources, gravity diversion structures are constructed. These have been constructed in Oromia, Amhara and other regions. Where there are no perennial sources, small reservoirs are constructed to hold on the average 1.0 million m^3 of water thereby irrigating 100–150 ha. These reservoirs can be found in the arid and semi-arid areas of Tigray and Amhara regions. The conveyance and distribution systems comprise mostly unlined channels with associated masonry or concrete structures. Land levelling and in-farm works are often left to the farmer. Farmers participate in the construction works, providing local materials and labour.

The cost of irrigation works tends to be high especially for the schemes associated with storage works, ranging from about to US$ 1,000–7,000 per ha.

Production systems

Traditional food crops such as maize and teff are grown during the rainy season followed by mixed crops comprising traditional crops and vegetable crops such as onions, tomatoes, cabbages, and carrots during the irrigated season. Land tilling is by ox-pulled plough, indicating that there is scope for improved land tilling techniques. Fertilizers and seeds are used at varying levels. Seeds for horticultural crops tend to be in short supply.

Financial arrangements

The government started SSI programmes in the early eighties consequent on the recurrent droughts that affected a large part of the country. Implementation of these schemes commences following farmer sensitisation programmes and scheme development agreements between the sponsoring organisations and farmers' groups. The sponsoring organisations then proceed to undertake surveys, investigation, design and construction. Construction is generally undertaken through on-force account, with the farmers contributing some labour and locally available materials. Once construction is completed, irrigation management transfer (IMT) is done after farmers have obtained training. However, where head-works or some structures tend to be large, IMT has been slow.

Although credit facilities are available to farmers; the coverage is generally low and for limited purposes such as the acquisition of inputs such as fertilizers.

Marketing

Farmers generally receive extension support in irrigation agronomy. However, the level of support is not strengthened with market information, storage, and sorting/packing/cooling facilities. In addition, some of the irrigation schemes do not have access roads or the means to enable them to take their produce to nearby markets.

Policy and regulation

Irrigation policy was issued during the period 1998/99. The policy states that irrigation development is a means to achieving food security, employment generation and provision of raw materials for agro-industry. SSI has been given priority, and it is envisaged that it will bring social equity, that it will be economically/financially viable, technically feasible and environmentally sustainable. The participatory approach is stressed with special attention to rural women.

Regulations have yet to be effectively in place for issuing water rights and the issue of security of tenure needs to be addressed. Regions such as Amhara and Tigray have promulgated the provisions for acquiring security of tenure. However, it is not known if the process has been put into operation.

WUA or groups may be organised and registered under the Cooperatives' Promotion Bureau in each region.

Environment

The need to undertake environmentally sustainable development has been stressed in the irrigation policy. The spread of water-borne diseases are to be minimised through the avoidance of standing water in the fields or canals, as well as through the construction of drains. Catchment conservation is also used as a mechanism for ensuring sustainability. Along this line, watershed treatment and river training form important considerations. Fuel wood is an important demand, and projects need to address this issue in their locality.

NGO-supported irrigation schemes

Among the numerous NGOs operating in Ethiopia, few are actively involved in irrigation development. Some of the major ones include Lutheran Federation, World Vision International and CARE. Their involvement is related to their efforts to address poverty alleviation and food security. Organisations such as Lutheran Federation and World Vision International have integrated programmes that address those different facets of the farmers' way of life. The NGOs are coordinated through a central organisation and from the government side – the Disaster Prevention and Preparedness Commission. The NGOs also coordinate their work with the Government Sector Offices.

Irrigation technology

The irrigation technology commonly adopted by NGOs is the use of gravity diversion structures, to supply water to earthen commonly unlined conveyance and distribution system. Furrow, basin and boarder strip method of surface irrigation water application is practised depending on the soil and crop type. In some areas, water is pumped into canals using centrifugal pumps. However, this is practised in limited areas in view of the relatively high operating costs. Irrigation development costs in NGO projects tend to be lower than government-supported schemes where there are no storage works.

Production systems

As in government-supported schemes, traditional food crops such as maize and teff are grown during the rainy season followed by mixed crops comprising traditional crops, onions, tomatoes, cabbages, carrots and other vegetable crops grown under irrigation. In some schemes, perennial crops are being introduced. Land tilling is done by ox-pulled plough. Fertilizers and improved seeds are encouraged, though to varying levels. Local production of seeds is integrated in some of the irrigation schemes.

Financial arrangements

NGOs and parallel government organisations alike have embarked on irrigation works following negotiation that they should also be involved in development tasks as much as relief works. The approach adopted by NGOs is similar to government bodies, but in a more intense way. After farmer sensitisation programmes and scheme development agreements between the sponsoring organisations and the farmers' groups, define the responsibilities of each party, implementation proceeds. The sponsoring organisations then undertake surveys, investigation design and construction. Construction is generally undertaken through on-force account. The farmers generally contribute some labour and locally available materials. Once construction is completed, management transfer is organised after farmers have obtained training. However, where head-works or pump-fed schemes are used, IMT has been slow. No cost recovery mechanism has been attempted to date in view of the inability of the farmers to pay back the investment costs. Farmers generally agree to take over the O&M aspects after capacity building both in know-how and financial resources. However, this has taken more time than originally envisaged due to a large extent, to the low income of farmers.

Generally limited credit is available through the NGOs, although farmers can use other existing credit facilities.

Marketing

NGOs generally have strong support programmes. The support programmes consist of direct in-farm water management, irrigation agronomy and integrated programmes in seed acquisition, marketing, diversification, and conservation works. In some instances, farmers have been trained as masons and carpenters in an effort to supplement their

incomes. In view of the relatively low level of marketing for horticultural products, farmers also have to struggle to get their produce to market.

Policy and regulation

NGOs have expressed concern at the low level of uptake of irrigation technology. Some feel that the lack of security of tenure has been the main obstacle. Security of tenure would encourage farmers to invest in the irrigation works as well as in conservation activities. Further, the mechanism for administering water rights has not been fully operational, although this is provided for in the 'Integrated Water Resources Policy'.

Environment

NGO programmes generally integrate environmental works in the irrigation development. In some of the schemes, together with farmer groups, they have managed to close off degraded catchment areas, riparian areas, and steep slopes and this has allowed the areas to regenerate. Farmers have been allowed to cut and carry forage from their allotted conservation areas. The farmers have been trained in environmental health to prevent water-borne diseases through the construction of drains to remove excess irrigation water or runoff. The conservation programmes therefore address not only the soil and water conservation needs but also fuel wood and forage requirements.

Traditional farmers' groups

Irrigation technology

Farmers have traditionally irrigated mainly from perennial sources. In total, the traditional irrigation schemes in the country are estimated at about 64,000 ha. Water is diverted to the plots using annually reconstructed barriers across the water sources. These barriers are formed from conglomerates, soil and wood, which tend to leak and get washed away during floods. At the end of the rainy season, farmers through their water committee get together and reconstruct the diversion structures and excavate conveyance channels.

The channels are open ditches that follow the contours of the fields. They tend to leak at granular sites causing loss of water. Crossing gullies is ingeniously achieved at times through locally constructed wooden flumes. Water is applied generally through flooding which causes uneven distribution of water and soil erosion. No water measurements are undertaken and water application is done on a regular basis, supervised by the water bailiff locally referred as "Yewha Abat", "Abo Mai", etc.

It is possible to improve traditional irrigation schemes through the construction of permanent diversion structures, properly aligned conveyance and distribution channels, lining of channels passing over granular soils, and land levelling or grading of plots. Such improvements will increase irrigation efficiency and enable the watering of more lands.

The irrigation efficiency is estimated to be between 25–30%.

Production systems

Farmers grow traditional food crops during the rainy season followed by mixed crop production during irrigation campaigns. Vegetable crops are grown for the market. There is limited use of inputs and a low level of mechanisation.

Financial arrangements

Farmers generally undertake the construction of the diversion and conveyance systems without external assistance. However, NGOs and government bodies have now embarked on programmes to improve these irrigation works. When farmers construct the civil works, they contribute in the form of labour and some materials. They sometimes hire skilled labour, and if the skilled worker is a member of the group, (s)he will not be paid. Credit available is to be used to acquire inputs with no other credit facility being made available for the advanced farm enterprise.

Marketing

The marketing system is generally the same as in the government/NGO-supported schemes. In fact, due to a lack of access roads to these schemes, the marketing of produce is exacerbated, resulting in most of the food produced being used for subsistence.

Policy and regulation

Farmers do not actively get involved in conservation works when they do not have security of tenure. Government needs to be active here, addressing land distribution and taking the initiative to give farmers certificates of land ownership.

Environment

Environmental protection is limited. In fact, where the water application system is through flooding, the risk of exposing the land to erosive flows is high. Catchment protection is not visibly included in the functions of the water committee. Fortunately, there is limited standing water in most cases and irrigation is conducted by rotation. Fuel wood is another constraint in these areas and farmers are not encouraged to plant trees/shrubs around their perimeters partly for fear of losing them, in the event of land re-distribution.

Privately-managed schemes

Formal irrigation expanded in Ethiopia initially through private farms established mainly in the Awash River Valley as well as in other parts of the country, albeit on a relatively small-scale. These farms were producing cotton, sugar, and horticultural crops for the

local and export markets. With the advent of socialism in the mid-1970s, all private farms were nationalised. Their owners were expropriated, with compensation paid to very few farmers. After the re-introduction of the free-market policy, there has been no dramatic uptake by the private sector, partly because of past experiences and the non-conducive environment for private sector investment with respect to access to land, lack of a mechanism for valuating land-based investments and the inability to use land as collateral for bank loans.

Following a partial IMT by the government, some farmers have attempted to operate irrigation plots. The current status is however, not clearly known, but it is believed that due to abrupt transfers, a number of the farms have been disused and some farmers have opted to sublet their plots.

Irrigation technology

On privately-managed farms, the type of irrigation has been mainly gravity diversion and water is supplied through pumping. Surface irrigation methods are either through furrow or basin irrigation with unlined canals and limited drain construction. Canals are not lined, and some farms do not construct drains. These farms set the pace for irrigation development, creating employment opportunities and some export markets.

In some of the farms, water management practices are poor and there tends to be over irrigation with few drainage outlets. There is soil salinisation on some farms.

Some private farms have now started using sprinklers and to a limited extent drip irrigation.

Production systems

The private farms have always been producing cash crops and limited food crops for workers. These included sugar cane, cotton, fruits, vegetables and some cut flowers. Farms are mechanised with extensive use of tractors and implements as well as inputs.

Financial arrangements

Private farms have been established based on a combination of personal finance and bank credit, with the farm venture being used as collateral.

Marketing

Private developers have taken the responsibility to identify markets for their products. There is no established marketing information system for irrigated crops. Export crops are transported through nearby ports for bulk items such as cotton, and air cargo for vegetables and fruits. However, problems related to (cold) storage and some irregularities of air cargo services are known to exist.

Policy and regulation

Though the Water Resources Management Policy has been developed to encourage private sector irrigation development, the mechanism for effective participation has not been fully developed. Further, solutions to problems relating to the acquisition of land and water rights, security of tenure and property rights remain elusive and still need to be urgently addressed.

The extension department of the Ministry of Agriculture does not have programmes to support privately operated farms.

Environment

Unfortunately, with the abandonment of private farms during the period when the economy was centrally planned, experience gained prior to that, in managing concession farms through provision of water rights and operating a system of regular monitoring of the use of water as well as of the wastewater release from these farms has been lost to a large extent.

The study visit

The study visit follows on from a seminar on *Private irrigation in sub-Saharan Africa* – Regional seminar on Private sector participation and irrigation expansion in Africa, a joint initiative of the African Regional Office of the FAO, IWMI, and CTA, held October 22–26, 2001 in Accra, Ghana.

Core issues of the CTA study visit on irrigation for smallholder agriculture were to determine:

- Strengths and weaknesses of small-scale and traditional irrigation
- Sustainability of SSI
- Agro-ecological specific productive and sustainable techniques with emphasis on reducing food insecurity, spread of appropriate techniques and cost-reducing techniques
- Required institutional arrangements: regulations at regional/district level *versus* WUA, what degree of state interference is desirable, impact of private incentives and empowerment of (male and female) farmers?
- Financial arrangements, access to credit, and innovative finance schemes.

Objectives

- To promote the exchange of information and discussion between the participants and to promote a network at the regional and sub-regional level as well as exchange knowledge among countries.
- To review existing irrigation initiatives for food security operated by private entrepreneurs and/or small-scale WUAs in SSA.
- To exchange experience on the challenges and constraints associated with different technologies, management models and production schemes.
- To assess institutional and financial constraints, social and environmental impact of small-scale irrigation.
- To make recommendations as regards an enabling environment for small-scale irrigation expansion in SSA.

Participants

Participants were selected on a competitive basis. Participants played an active role by presenting country reports/case studies.

There were 15 participants from the six African countries, representing small-scale WUAs, NGOs, extension agents and government officials.

Logistical arrangements

The study visit started with a one-day workshop, which involved presentations and discussions at the Ghion Hotel in Addis Ababa, Ethiopia. The next eight days were allotted to the study visit, involving visits to irrigation schemes, presentations and discussions. Both vehicular and air transport were used.

Expected results

On the last day, participants reviewed the information collected from presentations and visits, and came up with conclusions and recommendations regarding small-scale irrigation expansion in SSA. The participants also came up with proposals for enhancing SSI in their work.

Proposed study visit impact activities

At the end of the field visit, each participant was expected to present a study visit impact activity based on the lessons learned either from the site visit or discussions, see outline below:

Participant:	**Mr Bekele Abaire**
Position:	Water and Sanitation Project Officer
Country:	Ethiopia
Objective:	To ensure sufficient water supply and promote its efficient use for irrigation.
Description:	Putting in place systems to promote the efficient use of water. Understanding the role marketing plays in the production process among farmers.
Expected output:	Use of various water sources and efficient use for irrigation promoted. Farmers gain knowledge in marketing and production.
Strategy for evaluation of output:	Support study on the availability of water. Extensive training on the efficient use of water and the importance of marketing. Experience sharing with other farmers. Strengthening WUAs through extension activities.

Participant:	**Mr Tefera Berhe**
Position:	Design Engineer and Team Leader
Country:	Ethiopia
Objective:	Effective and efficient way of designing irrigation structures.
Description:	Improvement of off-takes and scour sluice design. Up-grade water management through training.
Expected output:	Up-graded water efficiency. Reduction of project cost.
Strategy for evaluation of output:	Training in water management to water users in the project site. Preparing regular monitoring reports. Site visits.

Participant:	**Mr Jemal Kuru**
Position:	Irrigation Expert
Country:	Ethiopia
Objective:	To investigate existing SSI development constraints and recommend solutions.
Description:	Hold discussions with colleagues and farmers and present reports and recommendations.
Expected output:	Proposed solutions for better promotion and sustainability of SSI.
Strategy for evaluation of output:	Following up the performance of SSI schemes through monitoring and evaluation.

Participant:	**Mr Busia Nambu Dawuni**
Position:	Agricultural Engineer
Country:	Ghana
Objective:	To increase water use efficiency in two SSI projects in Ghana.
Description:	Training and extension will be carried out in farmers' fields (farmer field schools)
Expected output:	Increase in the availability of water for all year cropping and increasing cropping intensity from 100% to 200–300%.
Strategy for evaluation of output:	Annual project reports, interviews of farmers and site visits.

Participant:	**Mr Akagbor Sammy Mensah**
Position:	Director/Soil Agronomist
Country:	Ghana
Objective:	To promote the strengthening of farmer cooperation in the organisation and management of projects.
Description:	Make adequate preparation from lessons learned from the farmers training programme under SSI.
Expected output:	Farmers appreciating their responsibilities and following the action plans drawn up.

Strategy for evaluation of output:	Systematic visit to project sites to confirm activities in relation to other activities on the farms.

Participant:	**Mr Philip Gichuki**
Position:	Senior Water Engineer
Country:	Kenya
Objective:	To promote the efficient use of the scarce water resources in irrigation schemes.
Description:	Create awareness on efficient water use. Develop with other agencies incentives for wise use of water.
Expected output:	Organise awareness creation forums (workshops and field days). Preparation of technical papers on water use policy.
Strategy for evaluation of output:	Number of workshop/field days organised for awareness creation. Number of published technical papers. Progress reports.

Participant:	**Ms Rebecca M. Wahome**
Position:	Acting Project Coordinator
Country:	Kenya
Objective:	Improved irrigation technology and environmental conservation. To have well designed irrigation systems and high quality construction work done together with a well conserved environment (catchment approach) in the SSI and soil conservation in the farms.
Description:	In Kenya, for the most part, contractors do not use the appropriate materials for construction, hence poor quality weirs, pumping, etc. Designs may not be proper and catchments not well conserved.
Expected output:	Sustainable irrigation schemes with a continuous supply of water. Night storage reservoirs for more water and efficient use.
Strategy for evaluation of output:	Field visits/assessment/site visits. Supervision during construction. Train farmers on soil and water conservation. Well-protected catchments and proper soil conservation measures. All farmers within the schemes have access to water. Quality of irrigation civil works meet standards that ensure long usage as planned.

Participant:	**Mr Winston M. Sataya**
Position:	Senior Irrigation Officer
Country:	Malawi
Objective:	To analyse the performance of WUAs/cooperatives in selected irrigation schemes.
Description:	Two or three irrigation schemes will be visited to find out the general performance of their associations/cooperatives.
Expected output:	Constraints affecting farmers' organisations in the irrigation schemes identified. Proposal on the promotion of farmers' organisations developed.
Strategy for evaluation of output:	Periodic visits to the schemes/contact with individual associations/cooperatives.

Participant:	**Mr Adrian Tembo**
Position:	Senior Irrigation Officer
Country:	Malawi
Objective:	To improve on traditional river diversion schemes and to construct spring source irrigation schemes.
Description:	Traditional irrigation to be improved by constructing permanent head works and canals. Schemes will be constructed using spring water.
Expected output:	Four traditional schemes improved. Two spring source irrigation schemes constructed.
Strategy for evaluation of output:	Reports on the number of sites constructed. Field visits (supervising visits).

Participant:	**Ms Shangwe L. Kiluma**
Position:	Organisation, Development and Gender Mainstream and Training Officer
Country:	Tanzania
Objective:	To improve the organisational status of SSI in terms of its sustainability.

Description:	Through workshops and training sessions – using video, role-plays, etc., highlighting the gender perspective.
Expected output:	Knowledge and skills dissemination acquired for development of SSI in a sustainable manner.
Strategy for evaluation of output:	Reports (field visit reports, training reports).

Participant:	**Mr Rumishaeli J. Masuki**
Position:	Executive Irrigation Engineer
Country:	Tanzania
Objective:	Improve small-scale irrigation schemes through the lessons learned from the visited schemes (e.g. marketing).
Description:	Experiences captured from different country reports and from site visits, and comparing them to the existing situation in Tanzania with a view to improving the situation.
Expected output:	Come up with proper approach and method of irrigation intervention to improve food security.
Strategy for evaluation of output:	Improve marketing information systems in four schemes.

Participant:	**Mr Vincent H.J. Urassa**
Position:	Key-Farmer
Country:	Tanzania
Objective:	Farmers co-operation for improved marketing
Description:	Mobilise farmers through discussion and village meetings.
Expected output:	That one day SSI farmers will attain food security and experience improved marketing opportunities.
Strategy for evaluation of output:	Constant monitoring of technology adoption, improved financing and environmental protection.

Participant:	**Mr Peter Manda**
Position:	Special Projects Manager, Agronomist
Country:	Zambia
Objective:	Improve the food security situation among small-scale irrigators and increase irrigation efficiency.
Description:	Reshape emphasis from irrigation scheme sustainability and cost sharing to more productive and efficient systems.
Expected output:	Public-supported irrigation schemes positively contributing to the food security of the country.
Strategy for evaluation of output:	Stakeholders' seminar.

Participant:	**Ms Mwiinga Mukwiti**
Position:	Agricultural Economist Management Trainee
Country:	Zambia
Objective:	To improve the market information and marketing system among the small-scale farmers with regard to product quality and market demand.
Description:	There is a need for agricultural institutions (government organisations, NGOs, etc.) to play a major role in the marketing of the small-scale farmer products.
Expected output:	Increased income of small-scale farmers and a more focused, meaningful and planned production system.
Strategy for evaluation of output:	Workshops or seminars with the stakeholders.

Participant:	**Mr Joseph Tembo**
Position:	Management Information Systems Officer
Country:	Zambia
Objective:	To introduce farming methods suited to SSI facilities and support interventions through identified institutions.
Description:	Conduct SSI programme visits to interact with different SSI programming and support institutions.

Expected output:	Identified best SSI implementation practices, collaborating institutions, and government role in the development programmes.
Strategy for evaluation of output:	Conduct farmer group discussions and participatory meetings with concerned institutions and farmers' groups.

Evaluation of the study visit

1	ADMINISTRATION AND LOGISTICS	RESPONSES
1.1	When was the study visit announced to you?	Number of participants
	-November 2002	6
	-December 2002	7
	-January 2002	2
1.2	How and by whom were you informed?	
	-How were you informed?	Mostly by e-mail and fax
	-By whom? (CTA, others, etc.)	CTA (most of the participants)
1.3	Was the communication announcing the study visit clear? If not, why?	Yes => 13 participants
		No => 2 participants
1.4	How do you evaluate the logistics of the study visit?	Mean rating[3]
	-Information made available before visit	4
	-Daily information during visit	4
	-Airport reception	5
	-Travel within Ethiopia	4
	-Hotel accommodation: in Addis Ababa	5
	" " during field trip	4
	-Restaurant/meals: in Addis Ababa	4
	during field trip	3
	-Secretariat	4

[3] Mean rating: 1 = very unsatisfactory; 2 = unsatisfactory; 3 = average; 4 = good; 5 = very good

2	EVALUATION OF INSTRUCTIONS	RESPONSES
2.1	When did you submit the required country paper?	Number of participants
	-Before 1st January 2003	3
	-First week of January 2003	6
	-After first week of January 2003	5
2.2	How did you evaluate the site visits?	Mean rating
	-Summary site description	4
	-Briefing by host officials	4
	-Discussions / conclusions	4
2.3	Was the time allocated to the various study visit activities insufficient (I), sufficient (S) or too long (L)?	
	-Briefing by host official	S
	-Field visit	S
	-Travel to the interior	S
	-Discussions	S
	-Conclusions / recommendations	S
3	TECHNICAL EVALUATIONS	RESPONSES
3.1	How do you evaluate the information you received during the course of the visit?	Mean rating
	Theme 1: Technology	
	-Irrigation method	4
	-O&M	4
	-Construction method / capacity	4
	-Cost	4
	-Training	4

Theme 2: Production systems	
-Traditional food crops	4
-Horticulture	3
-Water use efficiency	3
-Level of mechanisation	3
-Input usage	4
Theme 3: Finance	
-Marketing	3
-Credit	4
-Cost recovery	3
-O&M coverage	3
Theme 4: Marketing	
-Existence of Information System	3
-Produce storage, packing, quality control	2
-Access roads and other infrastructure	3
Theme 5: Institutions, policy and regulations	
-Security of tenure	3
-Cost recovery/subsidy	3
-Irrigation policy	3
-Water right	3
-WUAs	4
Theme 6: Social and environment	
-Gender sensitivity/mainstreaming	2
-Sustainability	3
-Environmental impact (salinity, water logging, erosion, etc)	3

3.2	Do you think that community-based SSI plays a major role in attaining food security? Why?	Yes (13 participants)
3.3	Which themes do you consider to be the most constraining factor to the success of SSI? (in priority order):	
	-Theme 4: Marketing	6 participants
	-Theme 1: Technology	3 participants
	-Theme 3: Finance	2 participants
	Why?	Reasons were very varied
3.4	What are the positive impacts of small-scale irrigation?	Very varied
3.5	What is your recommendation for the success of SSI to mitigate drought or the food security problem?	Very varied
4	EVALUATION OF THE IMPACT OF THE VISIT	
4.1	On the whole, did the lessons learned meet your expectation?	Yes => 14 participants No => 1 participant
4.2	Will the lessons of the visit be useful in accomplishing your present tasks?	Yes (all participants)
4.3	Following the visit, which activities do you consider appropriate and useful to your country situation?	
	Marketing, Technology and Finance were emphasised	
4.4	Would you be able to disseminate the information acquired in the course of the visit?	
	-Who (target group)? *Staff members, farmers*	All participants
	-When? *Soon after return*	12 participants
	-How? *Training, seminars, workshops, guideline reports*	All participants
4.5	Would it be convenient for you to send a report to CTA on the outcome of the visit?	Yes (all participants)

4.6	Would you like to maintain regular contact with other participants?	Yes (all participants)
	-If yes, why? *Exchange of information*	All participants
	-If no, why?	
5	APPRECIATION OF ACTIVITIES OF CTA	
5.1	Did you know CTA before the organisation of the visit?	Yes => 7 participants
		No => 8 participant
	-If yes, how?	Varied
5.2	Do you receive the publication titled "Spore"?	Yes => 4 participants
		No => 11 participants
6	ANY OTHER COMMENTS	
	-Commended CTA for a good job done and recommended more of such study visits on a regular basis.	
	-The need of getting *Spore* publication was emphasised.	
	-Sustainable contact between the participants and CTA was recommended.	

Study visit programme

SESSION 1	**OPENING CEREMONY**
January 20, 2003	**Monday**
Chairperson	Mekuria Tafesse
08:30–9:30	Registration and seating of participants and invited guests
09:30	Introductory remarks by the chairperson and CTA
9:45	Opening statement by Guest of Honour from the Ministry of Agriculture
10:00	Presentation: *Background Paper*
10:30	Group photograph

SESSION 2	**PRESENTATIONS**
Chairperson	Sammy Akagbor
Rapporteur	Philip Gichuki
11:30–12:30	Presentation and discussion
14:00–15:45	Presentation and discussion
16:20–17:30	Conclusion and recommendations
18:30–20:00	Reception

SESSION 3	**STUDY VISIT**
January 21, 2003	**Tuesday**
Chaiperson	Adrian Tembo
Rapporteur	Peter Manda
06:00	Trip to Airport
07:00	Fly to Mekele

10:00–11:00	Travel to Agulai
11:00–12:30	Agulai Traditional Irrigation (host TWRDB, Farmers' group)
14:30–16:00	Wukro Irrigation (host TWRDB)
16:00–17:30	Return to Mekele
19:30- 20:30	Dinner – (Discussion and conclusions)

January 22, 2003 **Wednesday**

Chairperson	Rebecca Wahome
Rapporteur:	Tefera Berhe
08:00–08:30	Presentation and discussion
08:45–10:00	Travel to Chelekot
10:00–11:30	Little Chelekot (Traditional) Irrigation (host TWRDB, Farmers' group)
11:30–12:30	Return to Mekele
14:00–14:30	Travel to Wedi Cheber Irrigation
14:30–16:00	Wedi Cheber Irrigation (host TWRDB)
16:00–16:30	Return trip
17:00–18:00	Discussion and conclusions
19:00–20:30	Dinner

January 23, 2003 **Thursday**

Chairperson	Winston Sataya
Rapporteur	Joseph Tembo
07:30–08:00	Presentation
08:00–12:00	Travel to Kobo/Alluha
12:00–13:00	Packed lunch

14:00–16:00	Kobo / Alluha Irrigation (host SAERAR)
16:00–17:00	Travel to Woldia
19:30–20:30	Discussion and conclusions (after dinner)

January 24, 2003	**Friday**
Chairperson:	Shangwe Kiluvia
Rapporteur:	Busia Dawuni
07:30–08:00	Presentation
08:00–09:00	Travel to Hermata and Kokona sites
09:00–11:30	Visit Hermata and Kokona Irrigation (NGO Lutheran Federation)
11:30–12:30	Visit Gotu Irrigation (host SAERAR)
14:00–17:30	Travel to Kombolcha with stop over at Dessie, Ambassel Hotel
19:30–20:30	Discussion and conclusion

January 25, 2003	**Saturday**
Chairperson:	Philip Gichuki,
*Rapporteur***:**	Bekele Abaire
07:00–07:30	Presentation
07:30–08:30	Travel to Kemisse
08:30–11:30	Kemisse and Antsokia Irrigation (host NGO World Vision International)
12:30–13:00	Discussion and conclusions
13:00–18:00	Trip to Addis Ababa

January 26, 2003	**Sunday**
Morning	Free
Afternoon	City tour (optional)

January 27, 2003	**Monday**
Chairperson	Bampoe Opoku
Rapporteur	Winston Sataya
08:00–10:30	Presentation
10:30–12:00	Travel to Ziway
13:30–17:00	Dodicha Cooperative, Ethio-Flora Farms (hosts Farmers' group, OIDA and private farm)
17:00–18:00	Travel to Nazareth
January 28, 2003	**Tuesday**
07:30–08:00	Presentation
08:00–08:30	Travel to Wonji
08:30–11:00	Visit Wonji Sugar Partnership/partnership (host Wonji Sugar Estate)
11:30–12:00	Return to Nazareth
14:00–15:30	Trip to Addis Ababa
16:00–18:00	Rapporteurs' compilation

SESSION 4 : RECOMMENDATIONS AND EVALUATION

January 29, 2003	**Wednesday**
09:15–10:15	Findings and recommendations (work in small groups)
10:15–11:15	Presentation of recommendations and adoption
11:30–12:00	Finalisation of reports (papers/rapporteurs' reports)
12:00–12:30	Evaluation of study visit

SESSION 5: CLOSING CEREMONY

12:30–14:00	Introductory remarks by Technical Consultant
	Statement by CTA
	Vote of thanks on behalf of participants

List of participants

ETHIOPIA

Abaire, Bekele (Mr)
Water and Sanitation Project Officer,
Catholic Relief Services
P.O.Box: 1201 Code: 1110
Addis Ababa, Ethiopia
Tel.: 251-1-450034
Fax: 251-1-654450
E-mail: bekeleab@crsthiopia.org

Berhe, Tefera (Mr)
Design Engineer & Team Leader,
COSEARAR
P.O.Box: 678
Bahir Dar, Ethiopia
Tel.: 251-8-201704
Fax: 251-8-202040

Kuru, Jemal (Mr)
Irrigation Expert,
OIDA
P.O.Box: 24489
Addis Ababa, Ethiopia
Tel.: 251-1-551386, 251-1-560697
Fax: 251-1-550858
E-mail: bekeleab@crsethiopia.org

GHANA

Dawuni, Busia N. (Mr)
Agricultural Engineer,
Ghana Irrigation Development Authority
P.O.Box: 273
Ashaiman, Ghana
Tel.: 233-21-662050, 233-21-668661
Fax: 233-21-668642
E-mail: bnambu@yahoo.co.uk

Mensah, Akagbor S. (Mr)
Director/ Soil Agronomist
P.O.Box: M154
Accra, Ghana
Tel.: 233-21-662050, 233-21-668661
Fax: 233-21-668642
E-mail: gbclub2000@yahoo.com

KENYA

Gichuki, Philip (Mr)
Senior Water Engineer,
Ewaso Ngiro North Dev. Authority
P.O.Box: 203
Isiolo, Kenya
Tel.: 254-1-652002
Fax: 254-1-652507
E-mail: ennda@kenyaweb.com (office)

Wahome, Rebecca M. (Ms)
Acting Project Coordinator;
Horticulture and Traditional Food Crops Development Project, Ministry of Agriculture and Livestock Development
P.O.Box: 14784 Nairobi 00100, Kenya
Tel.: 254-2-719013/718870 Ext. 48046
Fax: 254-2-711150
E-mail: beckymw2002@yahoo.com

MALAWI

Sataya, Winston M. (Mr)
Senior Irrigation Officer,
Department of Irrigation, Ministry of Agriculture & Irrigation
P. Bag: 30797
Lilongwe 3, Malawi
Tel.: 265-1-752122/8899117
Fax: 265-1-751459
E-mail: irrigation@sdnp.org.mw

Tembo, Adrian (Mr)
Senior Irrigation Officer,
Ministry of Agriculture & Irrigation
P. Bag: 28,
Kasungu, Malawi
Tel.: 251-1-253253 (wk), 265-8-855126 (cell)
Fax: 265-1-253253
E-mail: ciokadd@sdnp.org.mw

TANZANIA

Kiluva, Shangwe.L (Ms)
Organisation, Dev. & Gender Mainst. & Training Officer; Traditional Irrigation & Environment & Dev. Organisation
P.O.Box: 8909 Moshi TIP HQ,
Kilimanjaro, Tanzania
Tel.: 255-2-753025
Fax: 255-2-751124
E-mail: tip@eoltz.com

Masuki, Rumishaeli J. (Mr)
Executive Irrigation Engineer
P.O.Box: 3575
Mbeya, Tanzania
Tel.: 255-25-2503485 or 255-744-380745
Fax: 255-25-2502242

Urassa, Vincent H.J. (Mr)
Key-Farmer, Cooperative
P.O.Box: 46 Usa-River
Arusha, Tanzania
Tel.: 255-748-392618

ZAMBIA

Manda, Peter (Mr)
Special Projects Manager, Agronomist
International Development Enterprises
P.O.Box: 350040
Chilanga, Zambia
Tel.: 260-239001 or 260-97-845766
Fax: 260-239001
E-mail: idezambia@zamnet.zm

Mukwiti, Mwiinga (Ms)
Agricultural Economist Management Trainee
Agriflora Water Fall Farm
D199 Police Camp Chelstone
Agriflora CH 43 LSK, Zambia
Tel.: 260-95-701334 or 260-97-786403
Fax: 260-95-701334
E-mail: agrismall@zamtel.zm
mukwiti@yahoo.com

Tembo, Joseph (Mr)
Management Information Systems Officer,
Support to Farmer Associations Project
P.O.Box: 30395
Lusaka, Zambia
Tel.: 260-1-262636
Fax: 260-1-262950
E-mail: josept@sfag.org.zm

Wesseler, Gesa (Dr)
Planning and Corporate Services
CTA – Technical Centre for Agricultural
and Rural Cooperation (ACP-EU)
Postbus 380, NL 6700 AJ
Wageningen, The Netherlands
Tel: 31-317-467100
Fax: 31-317-460067
E-mail: wesseler@cta.int

Organising team

Kemal, Kedir (Mr)
Travel Ethiopia
Tel: 251 1 508870
Fax: 251 1 510200
E-mail: travelethiopia@telecom.net.et

Tafesse, Mekuria (Mr)
Director
Metaferia Consulting Engineers
P. O. Box 3192
Addis Ababa, Ethiopia
Fax: 251 1 514466
Tel: 251 1 517420
E-mail: mekuriat@telecom.net.et

Acronyms and abbreviations

ACP	African, Caribbean, and Pacific Group of States
CPA	Cane Producers Association
CTA	Technical Centre for Agricultural and Rural Cooperation
FAO	Food and Agriculture Organization of the United Nations
ha	hectares
HTFCDP	Horticulture and Traditional Food Crop Development Project (Kenya)
IFAD	International Fund for Agricultural Development
IMT	Irrigation Management Transfer
IWMI	International Water Management Institute
km	kilometres
MCE	Metaferia Consulting Engineers
mm	millimetres
MOWR	Ministry of Water Resources Development
O&M	operation and maintenance
OIDA	Oromia Irrigation Development Authority
OSRDF	Oromia Social Rehabilitation and Development Fund
SAERAR	Sustainable Agriculture and Environmental Rehabilitation in Amhara Region
SSA	sub-Saharan Africa
SSI	small-scale irrigation
TIP	Traditional Irrigation Programme (Tanzania)
TWRDB	Tigray Water Resources Development Bureau
WRMA	Water Resources Management Authority (Kenya)
WSSB	Water Supply and Sanitation Board (Kenya)
WUA	water users' association