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THE TIGRAY EXPERIENCE

A Success Story in Sustainable Agriculture

Hailu Araya and

Sue Edwards

TWN
Third World Network

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Contents

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CHAPTER ONE

INTRODUCTION

1.1 Background of the project

The Sustainable Development and Ecological Land Management with Farming Communities Projects in Tigray, Ethiopia, — often referred to as the 'Tigray Project' — is a broad-based open-ended experiment by farmers and local experts.

The main aim of the project is to find out if a community-based approach to rehabilitating the land and improving crop production based on ecological principles can improve the livelihoods of poor smallholder farmers. It also includes helping communities to develop their own bylaws to protect their interests and improvements.

Administratively, Ethiopia is divided into nine Regional States and two City Administrations, which are further divided into zones and then *'woredas*'. *Woredas* are made up of parishes called 'tabias' in Tigray, 'kebeles' in other regions.

Since its inception in 1996, the Project has been run by the Bureau of Agriculture and Rural Development (BoARD) then known as the Bureau of Agriculture and Natural Resources (BoANR) of Tigray Regional State and the Institute for Sustainable Development (ISD) in collaboration with the *woreda* administrations and experts, and their local communities.

Now the Project also collaborates with the Tigray component of the Land Rehabilitation Project of the Environmental Protection Authority (EPA) in Addis Ababa.

In 2005, ISD was working with the BoARD *woreda* experts and development agents (DAs) to implement sustainable agriculture activities in 42 communities (see Table 1). The majority of the communities are in the moisture-stressed areas of the Central and Eastern Zones of the region.

Table 1: **List of communities working in the Tigray Project in Tigray region in 2005**

Zone	Woreda	Tabia	Communities
Southern Tigray Alamata	Ofla	Hashenge	Adi Abo Mossa (O)
		Lemat	Adi Abo Golgi (2)
		Timuga	Timuga (4)
Eastern Tigray	Sa'esi'e Tsada	Sendeda	Tsebela (2)
	Amba	Mai Megelta	Ziban Sas (O)
		Agamat	Gu'emse (O)
	Wukro	Mai Weyni	Sherafo (2)
		Abreha We Atsbeha	Adikulala (4)
	Atsbi-Wonberta	Hayelom	Gergera (2)
			Enda Maino (2)
			Gundifru (4)
Central Tigray	Tahtai Maichew	Mai Berazio	Adi Nifas (O)
			Rahwa (4a)
		Ferima	Tsa'eda Walka (4)
			Menteto (4a)
		Akab Se'at	Adi Gua'edad (2)
			Haleka (4a)
		Ruba Shewit	Adeke Haftu (4)
			Adi Senbeto (4a)
		Mai Siye	Mai Tsa'eda (4)
			Mai Zagra (4a)

		Hawesta	Dembeba(4)
		Kewanit	Hagere Selam (4)
		Adi Guara	Tselielo (4)
			Baila (4a)
		Adi Hutsa	Kenef (2)
			Mihdar Teza (4a)
		Hadush Adi	Hadush Adi (4)
		Debre Bonkol	Mai Seble (4)
		Chila	Tsa'eda Neto (4)
			Shimana (4a)
		Mirena	Mirena (4)
			Adi Seguet (4a)
		Bete Semaeti	Bete Sema'eti (4a)
		Ma'ekel	Afgume (4)
		Mai Atsmi	Anakule (4)
			Laiso (4a)
	Kolla Tembien	Guroro	Shimarwa (2)
		Miwtsa'e Worki	Adi Reiso (4)
	Wer'e Lekhe	Edaga Hamus	Enda Meskel (4)
		Hibret	Enda Selassie (4)
Western Tigray	Tahitay Adyabo	Adi Aw'ala	Adi Aw'ala (2)
Total	9	30	42

Key:
(O) refers to the four communities where work started in 1996/7;
(2) refers to the nine communities where work started in 2002;
(4) refers to the 18 communities where work started in 2004;
(4a) are 11 adjacent communities incorporated with the main communities in 2004 but strengthened by 2005

Over half of these communities are from Tahtai Maichew *Woreda* where an exercise in upscaling the project to all communities in the *woreda* is taking place. However, from the beginning, a few better-endowed areas in the Southern and Western Zones were also

included because of the negative environmental impacts of prolonged use of artificial fertiliser, and the negative economic impact of increased costs of Urea and diammonium phosphate (DAP).

The main activities done are: training and follow-up on compost making and use throughout Tigray and in some communities outside Tigray; water and soil conservation activities particularly treating gullies and catchments; making community ponds; promoting and encouraging innovator farmers in water harvesting; supporting poor women-headed families (they are the poorest of the poor); skill training for unemployed girls who completed formal schooling; supplying seeds and seedlings for nurseries and far-mers; experience sharing through exchange visits; and supporting the use of new and easy technologies such as treadle pumps.

In 2004 and 2005, the work was expanded to two areas outside Tigray: 10 kebeles in Masha of Meqdella *Woreda* in South Wollo Zone of Amhara Regional State, and two farming communities, one each in Chefe Donsa and Ejere *Woredas* in East Shewa Zone of Oromiya Regional State. The expansion and upscaling activities were carried out in close collaboration with the Land Rehabilitation Project of the EPA.

1.2 Challenges for Ethiopia

Ethiopia is a landlocked country in the northeast of Africa in what is often referred to as the 'Horn of Africa' 32°42' - 48°12' East longitude and 3°24' - 14°53' North latitude (Teklu, 2005) with an area of 1.13 million km2 (Mulugeta, 2004). Its topography is very diverse, encompassing mountains over 4,000 m above sea level, high plateaus around 2000 m above sea level, deep gorges cut by rivers and arid lowlands including the Dallol Depression going to 110 m below sea level in the Afar Triangle within the Great African Rift Valley (Yohannes, 1999; EMA, 1988).

Based on an extrapolation of the 1994 population and housing census the total population of Ethiopia in the year 2002 was 67.22 million, of which 56.9 million (84.7%) were rural (EPA, 2003). By 2005, it was estimated to have exceeded 73 million and could reach 94.5 million by 2015 (Mekonnen, 2003).

The population has an average age of just 21.8 years, with 44% under 15 years old. More than 49% of the country's population lives in the highlands above 2,200 m altitude; 11% lives below 1,400 m and 40% in between 1,400 and 2,200 m altitude. Human and animal pressure is high in the highlands. About 85% of the human population lives within 45% of the highlands and 75% of the animal population lives above 1,500 m altitude (Assefa, 2003; EPA, 2003; FAO, 1986).

The South Westerly Monsoon is the most important of the country's three moisture-bearing wind systems (FAO, 1986). Originating from the Atlantic Ocean, it brings the greatest amount of moisture during the main rainy season (May/June–August/September). The small rains (February-April) originate from the Indian Ocean and fall on to the central and eastern highland areas (EMA, 1988; Daniel, 1977).

The mean annual rainfall is highest (above 2,700 mm) in the south-western highlands, gradually decreasing to 100 mm or less in the north-eastern lowlands. The mean temperature varies from 45°C (April–September) in the Afar lowlands (Dallol Depression) to less than 0°C at night in the highlands (November-February) (EPA, 2003; FAO, 1986).

The country currently faces a number of environmental challenges resulting directly or indirectly from human activities, exacerbated by rapid population growth and the consequent increase in the need to exploit the natural resources (Asseffa, 2005) unsustainably.

Estimates of the annual soil loss range from 400 t/ha in the cultivated highlands; through 100 t/ha in the arable lowlands. The total removal is calculated as 1.5-1.9 billion tonnes of top soil annually with an average productivity loss from crop land of 1.8% (FAO, 1986). The forced misuse of natural resources includes burning animal dung as fuel instead of using it as a soil conditioner. Losses to crop production from burning dung and soil erosion are estimated at over 600,000 tonnes annually, or twice the average yearly requests for food-aid.

Ethiopia is a country of mixed farming and diverse cropping. People have cultivated crops (seasonal and perennial) for at least 5000 years, and the country is recognised as one of the world's eight centres of crop genetic diversity due to its wealth of agro-biodiversity (Engels et al, 1991).

Agriculture continues to provide the base for all economic and social development (EPA, 2003). The main crops are the cereals (barley, finger millet, maize, oats, sorghum, teff and wheat), root crops (enset, potatoes [Irish, sweet and indigenous], taro, yams), pulses (chickpea, faba bean, fenugreek, field pea, haricot bean, grass pea and lentil), oil crops (groundnut, linseed, niger seed, rapeseed, safflower, sesame and sunflower), vegetables (cabbage, garlic, kale, hot pepper, onion, pumpkin, and tomato) and many herbs and spices.

The major cash and industrial crops are avocado, banana, chat (also called mira), citrus, Arabica coffee, cotton, mango, oil seeds, papaya, pulses, sisal, spices, sugar cane, tea, tobacco, and vegetables. Amongst these are several crops of endemic origin in Ethiopia including Arabica coffee and teff.

Although the reasons for poverty are complex, those behind the poverty of rural Ethiopia have mainly arisen from total neglect by previous governments with the land being mined to feed an emerging urban population and trade. These pressures and deliberate

interference have led to the collapse of traditional land management systems for maintaining environmental integrity in general and soil fertility in particular. Due to such problems, the total area under food crop production, mainly cereals, has increased while grain production per unit area has remained generally low, less than one tonne a hectare (Assefa, 2003).

The *Human Development Report* of UNDP (2004) classifies Ethiopia as one of the least developed countries in the world. Agriculture accounts for more than 75% of total exports, over 85% of employment; and about 45% of the GDP (gross domestic product). Coffee alone makes up more than 87% of the total agricultural exports. Hides and skins are the next most important export items, as raw, processed or manufactured goods (EPA, 2003).

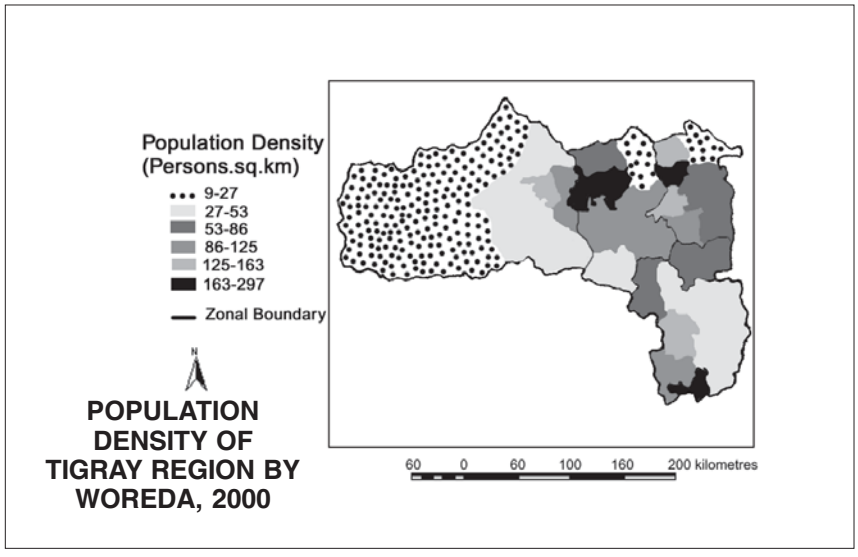
The Government's Sustainable Development and Poverty Reduction Programme has identified agriculture as the key sector in which to devote efforts for accelerating socio-economic development and reducing poverty (MoFED, 2002). However, the interventions for agriculture must be ecologically, economically and socially sustainable if the people are to realise a way out of poverty that supports improved human welfare and basic rights.

1.3 Conditions in Tigray

Tigray region is found in northern Ethiopia and is generally regarded as the most degraded part of the country. Most of the region is highland, but the eastern part includes the escarpment facing the Great East African Rift Valley. As of July 2003 the population was above four million, occupying an area of 50,078.64 $km^{2.}$

The average population density of the region is 80 persons/ km^2 with high concentrations in the Eastern, Southern and Central zones of 131, 122 and 115 persons/ km^2 respectively (CSA, 2002). This is shown in the population map by Assefa (2003) (Figure 1). The

Figure 1: **Population Density of Tigray Region by *woreda***



average cultivated land per household in these areas is generally less than one hectare.

Average annual rainfall in Tigray is 1,000 mm in the highlands of the south dropping to only 200 mm in the extreme east. The precipitation occurs mostly during a short summer (end of June to mid-September) rainy season, often falling as intense storms (FAO, 1986; Hunting, 1976). Except in some remote areas and around churches the natural dryland forest and woodland vegetation of Tigray region has been destroyed. This is because of overgrazing, the progressive increase in demand for fuel wood, extra land for cultivation and recently also urbanisation (Hailu and Hailemariam, 2006).

Serious soil erosion and yield reduction have occurred for at least the last 100 years (Hunting, 1976). However, since the 1980s, many areas of natural forest and woodland have reappeared following

agreements by local communities to restrict access by people and grazing animals to these areas.

1.4 Problems of chemical inputs

The use of chemical fertiliser is recent in Ethiopia, i.e., it started in the late 1960s along with the launching of integrated agricultural programmes and projects (EPA, 2003). For millennia, farmers have been using traditional systems of fallowing, crop rotations and some manure to maintain soil fertility and their crop yields.

The Sasakawa Global 2000 (SG-2000) programme started in 1993 and, in 1995, it was superseded by the National Extension Intervention Programme of the Ministry of Agriculture. The aim is to boost food crop production through a focused campaign to get farmers to use chemical fertiliser along with high yielding varieties (HYVs) and pesticides. However, the programme mainly gave strong support to the adoption of fertiliser through credit schemes and subsidised prices.

Since 1998, the subsidy on chemical fertiliser has been withdrawn while the price has risen. Despite that, by 2001, around 5% of the smallholder farmers of the country, particularly those growing maize, had become accustomed to using chemical fertiliser. But that year, the price dropped out of the bottom of the maize market and the retail price fell to the lowest it had been since 1994/95, well below the cost of production. The retail price in Nekemt in May 2001 was Birr 31 (around USD 4) for 100 kg. This was 41% below the market price in the same month in 1995 (Alemu, 2001). At the same time, the farm gate price of maize in western Ethiopia was reported to have fallen to Birr 18 (USD 2.2) for 100 kg.

In 2002, many parts of the country were hit by drought with the result that yields declined, or crops failed completely and the government requested food aid for more than 14 million people, nearly

20% of the total population. However, the long-term problem is the large number of rural families facing chronic food insecurity who cannot recover even in a good growing season.

Due to the crop failure caused by the drought many farmers were heavily in debt and the next harvest they withdrew from the fertiliser schemes especially in moisture-stressed areas of the country. According to farmers chemical fertiliser contributes to crop failure in moisture-stressed areas because the crops 'burn' in the field. It also causes soil salinisation, change of soil structure, and destruction of smaller organisms living in the soil.

Under the extension programme, farmers are allowed to select and use the best of their own local varieties rather than buy seed of HYVs. Smallholder farmers use their own saved seed for over 90% of the total seed used in the country (Hailu, 2003). However, by 2004, the Ethiopian Seed Agency was promoting and distributing seed of higher yielding crop varieties to be grown either for local food processing or for export, and rapid erosion of farmers' varieties was taking place in better endowed areas (Bayush Tsegaye, 2005).

Very little use of pesticides has developed except for dealing with migratory pests, particularly armyworm, and local swarms such as Pachnoda beetles on sorghum and the endemic Wello Bush Cricket on cereals. The biggest users of agro-chemicals are the few large-scale state-operated farms, particularly cotton farms. However, expanding smallholder horticultural production from small-scale irrigation systems is making increasing use of chemical inputs. The introduction of the higher yielding varieties is also attracting pests and chemical control is being made available to farmers. This use is often with little or no understanding of either how to handle those chemicals safely, or how to use them correctly.

The misuse of pesticides and fertilisers is damaging human health and polluting the surrounding environment. For example, a survey by the local Safe Environment Association and PAN-UK (Pesticides Action Network, UK) found malathion being sprayed on the leaves of the local stimulant, chat (Catha edulis), in order to make them shiny and more attractive to purchasers. Another group of farmers had been using DDT to control insect pests on chat until they associated increasing stomach problems with the use of the chemical. (SEG, 2000)

Nonetheless, an experiment in sustainable development and ecological land management conducted with farmers in Tigray demonstrates that sustainable agricultural practices can succeed and bring benefits to farmers, without recourse to harmful and expensive chemicals (Tewolde Berhan et al, 2004). Among the benefits demonstrated are increased yields and overall biomass productivity, soil and water conservation, pest and disease control, improved soil fertility, rehabilitation of degraded lands and increase in farmers' incomes.

Chapter Two

THE TIGRAY PROJECT

2.1 Working with farming communities

'Is there sufficient biomass to make adequate quantities of compost?' This is the question most often raised whenever there is any suggestion that Ethiopia could use an organic system to increase crop yield.

In 1995, Dr Tewolde Berhan Gebre Egziabher, then in charge of developing a conservation strategy for Ethiopia, was asked by some government officials to design a project that could be promoted with farmers of poor and marginal areas in order to improve the productivity of their land and rehabilitate their environments. Some officials in Tigray region expressed an interest in the project and a workshop was held in 1995 to launch it and identify local stakeholders.

The project was called 'Sustainable Development and Ecological Land Management with Farming Communities in Tigray', commonly referred to as 'The Tigray Project', or 'Sustainable Agriculture/Development Project' (by the local authorities). Activities started in 1996 under the supervision of the Bureau of Agriculture and Rural Development (BoARD) of Tigray then called Bureau of Agriculture and Natural Resources. The other partners in the project are the local communities, their local development agents, experts and administration, and Mekelle University.

The first four communities were Adi Nifas in densely populated Central Zone west of the ancient town of Axum, Adi Abo Mossa in Southern Zone in the valley that encloses Lake Hashenge, and Gu'emse and Ziban Sas in Eastern Zone, generally regarded as the driest and most degraded part of the region. The work started with an experienced senior extension officer of the BoARD, Arefayne Asmelash, consulting the communities about the problems with their environment, and discussing possible solutions, all of which did not require high external inputs but commitment from the community members. The suggested technologies (basket of choices) were designed to build on their own traditional systems of farming and land management.

The farmers were stimulated to select from a 'basket of choices' made up from suggestions put forward by ISD, BoARD and the farmers. The key components of the project were as follows.

- Making and using compost
- Restricting grazing and/or encouraging cut and carry to feed their animals
- Making trench bunds for catching both water and soil
- Planting small multipurpose trees — particularly Sesbania sesban — and local grasses
- Halting and rehabilitating gullies
- Making ponds
- Making and using bylaws to control access to and use of local biological resources including the restrictions for grazing animals

Each of the four original communities chose a different entry point for the project.

Adi Nifas had two gullies eating away the farmers' fields and the farmers agreed to try the other components in the project if the gullies could be stopped. The gullies were treated successfully and Adi Nifas became the model community demonstrating how all

the components reinforced each other to improve the lifestyles of the farmers. By 2001, a permanent spring had reappeared and farmers below the project site started a small irrigation scheme because of the changes.

Ziban Sas had had its grazing area of 13.5 ha destroyed by sheet erosion, and the water table had dropped below 12 m, so the farmers, particularly the women, focused first on rehabilitating their grazing land, and then became interested in the other components. With grazing animals kept off the land, the local grasses and other herbs soon reappeared, and check dams and trench bunds led to better infiltration of water. But of greater significance for the women was the raising of the water table so that they were able to use their local well again.

Gu'emse also had a very large gully eating away the farmers' fields and flooding that brought deposits of silt onto their fields. Attempts to control this gully were not successful until 2005 and this somewhat discouraged the farmers although a core of about 45 households continued making and using compost and also initiated making a communal pond to catch the flood water. Reclaiming the gully has reversed the communities' attitude to the project; they have made a bylaw for its use and protection and planted many trees and grasses.

Adi Abo Mossa is a relatively well-endowed area with good rainfall in a valley with a landlocked lake. The farmers were using increasing amounts of chemical fertiliser, so the organisers of the project wanted to encourage the farmers to adopt composting in order to reduce the threat of eutrophication in Lake Hashenge. The farmers make very good quality compost in large quantities and most have been able to give up using chemical fertiliser. But this is the only component of the project adopted by these farmers.

In all four communities, in one or two growing seasons, the farmers quickly saw the impact of compost on crop yields and the im-

proved water regime of their fields. In May 1998, representatives of the farmers and their development agents from the four communities made exchange visits to each other's areas ending up with a two-day discussion and general evaluation of what they had seen of the project's activities. This encouraged all the communities, except in Adi Abo Mossa, to adopt all the components of the project. This is because this site is well endowed with natural resources especially high quality grazing in the valley floor.

The Gu'emse community was the focus of the annual farmers' field day in October 1998, and this encouraged the senior members of the BoARD to promote the 'sustainable agriculture package' as part of the programme to improve food security for the region. This was the start of scaling up of the project's activities.

By 2005, ISD and BoARD were working together implementing the project in 42 communities while the Bureau was promoting the 'sustainable agriculture package' of compost-making together with trench bunding and planting multipurpose trees, particularly Sesbania, throughout the region.

These activities have increased the biomass in the farms and their surroundings. Therefore, policy makers have come to realise that the answer to the question 'Is there sufficient biomass to make adequate compost?; is 'If farmers want they can make enough compost, especially at the end of the growing season.'

2.2 The impact of compost on crop yields

The first exercise in getting yield data from the use of compost was in 1998. The data showed that using compost gave similar yield increases as the use of chemical fertiliser. In November 2001, these results were presented at a workshop in Axum where representatives from all regions as well key government offices in Addis Ababa were also present. The data were published as an annex to a booklet on Natural Fertilizer (Sue Edwards, 2003). ISD was urged by

the senior staff of the Bureau to continue monitoring the impact of compost on crop yields, and this has been done each year since 2002.

The method used to obtain the yield data is based on the crop sampling system of FAO. Three one-metre square plots are cut from the field. These are placed to reflect the range of conditions of the crop in the field, i.e., both well grown and not so well grown areas are selected from the centre and towards the edge of the field. The cut crop is then threshed and the grain and straw are weighed separately. The plot data are recorded along with the name of the farmer, the crop and the treatment as well as the location and the date. The farmer keeps the straw and grain. The straw is important because it is the main source of animal feed during the dry season.

Each figure is the average from several fields of the same crop in the same area given the same treatment. 'Check' means the field received no treatment, although it may have received compost in one or more of the previous years. 'Compost' is for fields treated with mature compost. The rates of compost application range from around 5 t/ha in poorly endowed areas, such as the dry Eastern Zone of the region (Ziban Sas and Gu'emse), to around 15 t/ha in the moister Southern Zone (Adi Abo Mossa). 'Chemical fertiliser' is for fields treated with DAP (diammonium phosphate) and urea. The recommended rates are 100 kg/ha of DAP, and 50 kg/ha of Urea.

The yields are converted to kg/ha for comparison. It should, however, be remembered that farmers' fields are very small, often less than a quarter of a hectare, and that the total cultivated area of most farmers is less than one hectare.

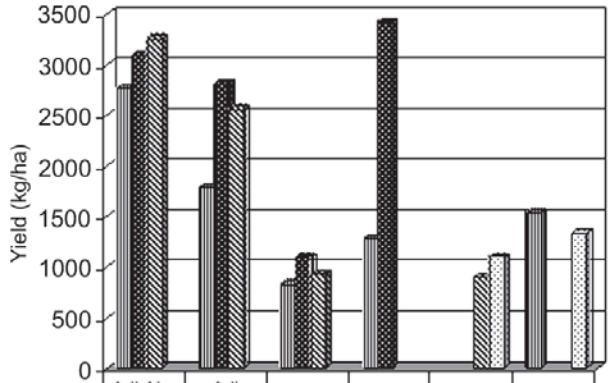
An important feature of the Tigray Project is that it is to a large extent led by the farmers. They choose which crops or land to treat with compost and which with chemical fertiliser — some also com-

pare the use of manure, and others combine compost and chemical fertiliser.

2.2.1 Crop yields in 2002

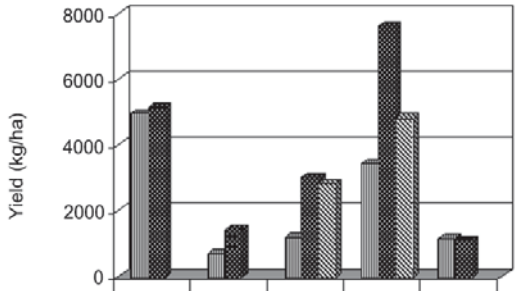
The year 2002 had poor rainfall in most parts of Tigray and only a few farmers got grain from their fields. However, it was a very good demonstration of the effect of compost on the moisture-holding capacity of the soil. The drought was very severe in western Tigray, but a farmer in Adi' Aw'ala applied compost to his field of sorghum and got a grain yield equivalent to 2 t/ha and a straw yield of 3 t/ha; an untreated field gave only the equivalent of 0.8 t/ha of grain and 1.5 t/ha of straw. He also grew maize with compost doubling the yield of the check — see Figure 3.

Figure 2: **Barley yields in 6 communities in 2002 (kg/ha)**



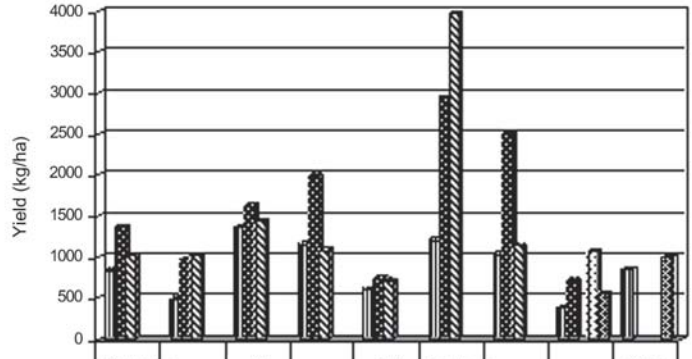
	Adi Abo Mossa	Adi Gua'edad	Adi Nifas	Gergera	Ziban Sas	Guemse
Check	2765	1782	833	1283		1535
Compost	3090	2808	1100	3420		
Chemical fertiliser	3263	2562	933		900	
Manure					1100	1333

Figure 3: **Maize yields in 5 communities in 2002 (kg/ha)**



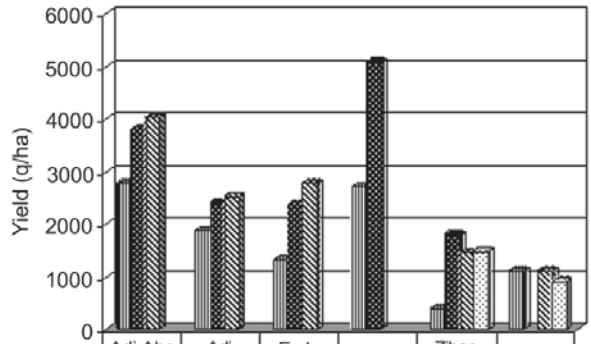
	Adi Abo Mossa	Adi' Aw 'ala	Guroro	Kenef	Adi Nifas
Check	4948	700	1218	3460	1150
Compost	5130	1416	2994	7583	1136
Chemical Fertiliser			2830	4800	

Figure 4: **Teff yields in 9 communities in 2002 (kg/ha)**



	Selam Bikalsi	Guroro	Adi Gua'edad	Kenef	Adi Nifas	Enda Maino	Gergera	Sherafo	Adibo Gulji
Check	829	+86	1365	1160	605	1201	1033	383	842
Compost	136+	966	1620	1986	734	2943	2500	700	
Chemical Fertiliser	1015	1016	1+32	1083	706	3960	1133		
Dung + Compost								1067	
Dung								558	995

Figure 5: **Wheat yields in 6 communities in year 2002 (kg/ha)**



	Adi Abo Mossa	Adi Gua'edad	Enda Mano	Gergera	Ziban Sas	Gu'ernse
Check	2783	1882	1333	2716	400	1113
Compost	3820	2402	2376	5083	1800	
Chemical Fertiliser	4030	2522	2783		1450	1110
Dung					1500	925

Figures 2-5 give the yields for barley, maize, teff and wheat from 14 communities. Only four of the communities, Adi Abo Mossa, Adi Gua'edad, Adi Nifas and Gergera, had yields from three of the four crops. Teff is the fastest maturing of the crops, and yields were obtained from nine of the communities, the best being 3.9 t/ha from a chemically treated crop in Enda Maino where the compost treatment gave 2.9 t/ha. But, overall the composted fields gave higher yields than those treated with chemical fertilisers.

It is interesting to see that the yields from the checks in Adi Abo Mossa and Adi Nifas are close to those from the composted and chemically fertilised fields. These two communities have been making and using compost since 1996, and its residual effect in the soil is clearly seen. This is confirmed in Figure 6 for pulse crops. The very low yields for all crops in Adi Nifas in 2002 are the result of the drought. More normal yields are given in Table 2.

Figure 6: **Yields (kg/ha) for faba bean, field pea and finger millet in 4 sites; 1998 compared with 2002**

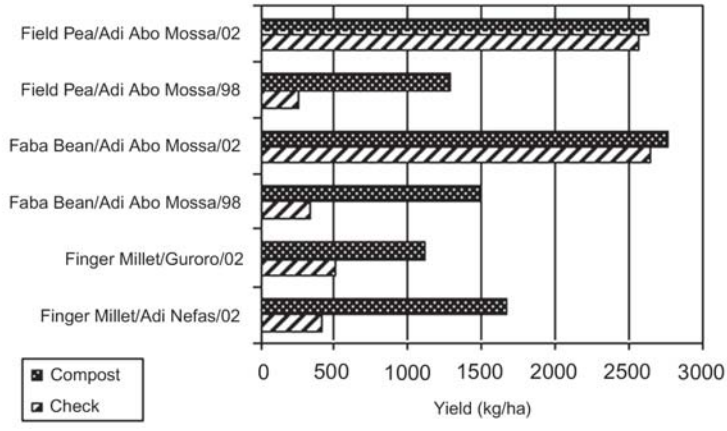


Figure 6 gives the yields for faba bean, field pea and finger millet for 2002 with yields for faba bean and field pea from 1998 for Adi Abo Mossa included for comparison.

In Figure 6, above, the yield difference between the compost and the check plots for finger millet in Adi Nifas and Guroro shows that the soil needs improvement to increase yield. The faba bean and field pea yields in Adi Abo Mossa in 1998 show that at that time the soils were poor but after four years of using compost the yield had increased and the differences between check plots and compost were small (Tewolde Berhan et al., 2004). This indicates that the compost had helped restore the normal fertility of the soil. Farmers rarely use chemical fertiliser for legume crops but these results show that compost can increase yields much above untreated (check) fields.

The increased yields of composted legumes bean are important for the farmers as these crops have high market values. They are

also important components of the normal diet where very little meat is consumed. The farmers of Adi Abo Mossa apply the highest rates of compost to their fields. By 2004, they were complaining of lodging in their compost fields. There also seemed to be a levelling off in improved yields.

2.2.2 Crop yields in 2003/4

The rainy season was better in 2003 and yields were generally higher than in 2002. The communities of Adi Nifas and Adi Gua'edad are close to each other and it was considered useful to compare the use of compost and chemical fertiliser by the two communities, and also give an indication of the value of the crops, and the expense of using chemical fertiliser. The recommended rate of fertiliser application for one hectare of land is one quintal of DAP (Birr 270) and half quintal of Urea (Birr 107). Thus the total cost for applying these to one hectare in 2003 was Birr 377 in cash or Birr 433.55 in credit including 15% interest.

Average grain prices per 100 kg in the local market in 2003 in Tigray were Birr 225 for teff, Birr 155 for maize, Birr 200 for faba bean, Birr 170 for barley, Birr 170 for wheat, and Birr 145 for finger millet. The averages were calculated from prices collected from different markets in the region.

It can be argued that the opportunity cost for making compost should also be included. However, the opportunities for off-farm work are not high and all the materials for making compost are freely available locally, so the net income does reflect what the farmer can expect to get from his crops.

The Adi Nifas farmers had been using compost for seven years while those of Adi Gua'edad had only used compost for two years. The yields are shown in Tables 2 and 3.

Table 2: **Grain yields in kg/ha, expenses and returns in Birr for Adi Nifas (2003)**

Crop	Input	Yield	Gross income	Fertiliser cost	Net income
Faba bean	**Compost**	**4,3911**	**3,173**	**-**	**13,173**
	Check	2,287	6,861	-	6,861
Finger millet	**Compost**	**2,650**	**4,505**	**-**	**4,505**
	Check	833	1,416	-	1,416
Maize	**Compost**	**5,480**	**8,768**	**-**	**8,768**
	Check	708	1,133	-	1,133
Teff	**Compost**	**1,384**	**3,875**	**-**	**3,875**
	Chemical fertiliser	1,033	2,892	377	2,515
	Check	739	2,069	-	2,069
Wheat	**Compost**	**2,250**	**5,625**	**-**	**5,625**
	Chemical fertiliser	1,480	3,700	377	3,323
	Check	842	2,105	-	2,105
Barley	**Compost**	**1,633**	**3,266**	**-**	**3,266**
	Check	859	1,718	-	1,718

**Birr 10 = 1 Euro, or Birr 8.5 = USD 1*

In Adi Nifas only one farmer used chemical fertiliser for his teff, and the yield was less than what he got from his composted field. But in Adi Gua'edad, all the farmers used chemical fertiliser, even on their faba bean. However, the yield of the faba bean was less than half the yield from using compost, and the economic return from the composted crop much higher.

These results from the two communities are a reflection of what has happened in all the areas where the farmers have learnt how to make and apply compost. In the first year or two, they continue to use chemical fertiliser, but as they gain confidence in making compost and also see its residual effects in restoring soil fertility, they stop using chemical fertiliser. It is interesting to note that after farmers stop using chemical fertiliser, no reduction in yields has

Table 3: **Grain yields in kg/ha, expenses and returns in Birr* for Adi Gua'edad (2003)**

Crop	Input	Yield	Gross income	Fertiliser cost	Net income
Faba bean	**Compost**	**2,900**	**8,700**	**-**	**8,700**
	Chemical fertiliser	1,100	3,300	377	2,923
	Check	766	2,298	-	2,298
Finger millet	**Compost**	**2,000**	**3,400**	**-**	**3,400**
	Chemical fertiliser	1,433	2,436	377	2,059
	Check	500	850	-	850
Maize	**Compost**	**2,000**	**3,200**	**-**	**3,200**
	Chemical fertiliser	1,133	1,813	377	1,436
	Check	680	1,088	-	1,088
Barley	**Compost**	**2,193**	**4,386**	**-**	**4,386**
	Chemical fertiliser	1,283	2,566	377	2,189
	Check	900	1,800	-	1,800
Wheat	**Compost**	**1,020**	**2,550**	**-**	**2,550**
	Chemical fertiliser	1,617	4,043	377	3,666
	Check	590	1,475	-	1,475
Teff	**Compost**	**1,650**	**4,620**	**-**	**4,620**
	Chemical fertiliser	1,150	3,220	377	2,843
	Check	390	1,092	-	1,092

**Birr 10= 1 Euro, or Birr 8.5 = USD 1*

been recorded as they 'convert' to using only compost. This is probably because the use of fertiliser is relatively recent, i.e., only since 1995 or even later.

2.3 Economic and social impacts of using compost

There have been many positive impacts on the lifestyles of farmers who have taken to using compost. Several farmers, including women-headed families, have improved their houses, bought additional animals such as chickens and milking cows, and beehives.

Many farmers have diversified their crop production. One interesting innovation now widely taken up by other farmers is that of a farmer who intercropped tomato and chilli pepper in his teff field. Scattering other crops such as cress and oil seed cabbage into teff fields is a traditional practice. These crops grow up after the rains finish and do not compete with the teff. This is also the case with the tomato and chilli pepper. There is a high demand for these vegetables, particularly at the end of the rainy season before the irrigated vegetable areas have started to produce. The farmer claimed to get more from selling his vegetables than from the teff.

One farmer in Ofla had to share crop his land because he did not have plough oxen. He heard about the use of compost and convinced his share-cropping partner to use it. When the harvest was sold, the farmer got sufficient income to buy one ox. The next year he was able to buy a second ox and give up share cropping.

A very poor widow with five children was unable to send them to school or even join in social functions because the children did not have clothes and she had nothing to contribute to the communal meal. She then grew the spice coriander instead of a food crop. This is a high value crop – Birr 40 per kg or Birr 4,000 /100 kg. After the harvest she got sufficient income to send her children to school and participate in social functions because she could buy the food she needed with the income from the spice.

2.4 The special needs of women

Tigray has a high number of women-headed families because of the long years of civil war. Much effort has been made to include households headed by women in the project because these are generally among the poorest of the poor in their villages. Traditionally, women should not handle plough oxen and they therefore have to wait to have their land ploughed by a male relative or a neighbour. This puts the single woman at a double disadvantage.

Her fields are planted later, and each day's delay in sowing reduces the final yield. Then, at harvest time, the woman has to share part of the harvest with the farmer who ploughs her field. Such households never have enough food and are often unable to join in social activities or send their children to school because of lack of adequate clothing. A few women have taken up ploughing their own fields, but this has generally been at considerable social cost with ridicule and ostracism levelled at them by their neighbours and relatives. They have even had their animals poisoned or mutilated. ISD and the local officials try to make sure that the poor women in the communities are included in all activities and their achievements are recognised.

In 2003, ISD suggested that the long season crops finger millet, sorghum and maize could be raised as seedlings in nursery beds and then planted out when the main rains started. This has been readily adopted by women, particularly for finger millet, as they can plant seedlings, rather than seed, when their fields are ploughed and thus overcome the disadvantage of late planting. The first woman to try transplanting got the equivalent of over 7.8 t/ha from the part of her field she had composted and planted with transplanted finger millet seedlings. Direct sowing into the other part of her composted field gave 2.8 t/ha. In 2005, 95 farmers used transplanted finger millet, most of them getting good yields.

In 1998, ISD decided to find out if supplying women with seed of spices, which are high value crops, could help poor women break out of their poverty trap. This has been the case and there is now a high demand from women each year for seed of spices. These women grow and sell the spices and get sufficient income to buy food and clothing for their families.

Many women find it difficult to prepare compost, mainly because they cannot dig the pits. ISD sometimes provides support for labour to dig these pits. However, during compost workshops, poor

women-headed households are deliberately chosen to have pits dug and filled by the workshop participants, including themselves, so that they can get a boost to start making and using compost.

The other main constraint to making compost is the need for water. Collecting water for her household can take a woman around three hours for each trip. Often she has to make this trip twice a day. It is, therefore, not possible for a woman to also collect water for making compost or growing fruits and vegetables but she can use waste water from her household activities. Many local innovators have explored ways to dig shallow wells of around 12-15 metres deep and have developed innovative ways of lifting the water out of these wells. ISD has provided support for these innovators to dig shallow wells for poor women-headed households, and then encouraged the women to grow fruits and vegetables. This again has helped such women and their families get out of the poverty trap. Since the second year of the project (1998) 50-60 women have been supported each year; in 2005 117 women were given this special support.

The community of Adi Abo Mossa used another approach to compost making that ensured women could also be included. Groups of around ten households make their compost in large communal pits. This makes it possible for the women to be included because they help with providing composting materials, and then with taking the compost to the fields. But this is the only community with such a pooled compost-making system.

The Agriculture and Rural Development officer and the Tahtai Maichew *Woreda* Administrator asked for poor women-headed families to be provided with small animals (sheep or goats). Elsewhere in the region, this has been found to be one way of helping women get an income to improve their livelihoods. In all, 13 women (six from the town and seven from the villages) were each given four female and one male goat or sheep. This was on the basis of a revolving fund as each woman will return one female animal to be

given for other poor women or men. Although almost all the women got at least one new lamb, the women in the town faced a problem of finding feed for their animals in the town. One woman said she was planning to move back to her village with her sheep as she could find feed more easily in her village area.

In 2004, leaders in Tahtai Maichew *Woreda* selected 30 girls and young women who had completed 10th grade for skill training in basketry and traditional food preparation. Half of them were trained in traditional food preparation and the rest in basketry and embroidery. With the skills that they had acquired the participants displayed very high standards in what they had produced. Food items were snapped up by the local people who had come for the ceremony.

The head of the Tahtai Maichew *Woreda* women's affairs office has indicated that the young women would be encouraged to form a cooperative and apply for micro-credit to develop their own businesses.

2.5 The challenges

The communities that have taken up the Sustainable Agriculture/ Development Project are neighbourhood groups of between 15 and 90 households. Each community belongs to a tabia of 300 to over 500 households. The tabia with its baito is the lowest level of official administration. Baitos are the community council elected by the people and are responsible for the administrative and socio-economic functions within the community's jurisdiction. Thus, the baito plays a decisive role in local governance. Local collective decisions are codified in bylaws established by the baitos. Legal affairs are adjudicated by a social court.

The *woreda* is the next level of administration. Each *woreda* has its own administration consisting of an administrator and a cabinet of five experts and advisors. All the main sectors of the govern-

ment are represented in the *woreda* by experts with local coordinators and development agents in day-to-day contact with the farmers. It has been very important from the beginning that the *woreda* officials and the Rural Development experts understand and support the aims of the Project.

At the technical level with the farmers, the improvements in livelihoods from the Sustainable Agriculture/Development Project have been readily appreciated. However, these improvements, particularly the management of the natural resources in the catchments, are bringing challenges because a small community can develop and apply its own local bylaw only to its own members, but in order to resolve conflicts and problems with neighbouring communities, the local bylaw needs recognition and support from the baito of the tabia, as well as at the *woreda* level.

Local community-level bylaws have established local committees to oversee the implementation of the project. These committees meet regularly to discuss and make decisions for local management. They have also set up a system of penalties for farmers who let their animals graze in protected areas and the unauthorised cutting of grasses.

2.5.1 Restricted grazing

The most challenging aspect of the project to implement has been restricting the grazing of cattle, sheep and goats. Traditionally, only plough oxen, milking cows and young stock get special feeding treatment; all other domestic animals have to find food for themselves. The animals are turned out in the morning and are guided and guarded by children, including being driven to communal drinking places. In most parts of Tigray, there has been a drastic reduction in the areas of common grazing land as the demands for cultivated fields have increased with the increasing numbers of farming households.

Traditionally, after the harvest is collected, the animals range freely over fields and patches of natural vegetation, while crop residues are kept in special compounds for feeding special animals. This system of free-range grazing means that animals trample on more than they graze, destroy seedlings of woody plants and break down structures for soil and water conservation, thereby adding significantly to the deterioration of the environment.

It was, therefore, seen as essential that animal grazing be restricted if attempts to increase local biomass and allow hillsides to be revegetated were to succeed. In fact, in the 1980s the regional Government of Tigray had already instituted a system whereby communities identified hillside areas as enclosures keeping out grazing animals as well as people, and the local trees and grasses have re-established themselves in many of these areas.

But, up to 2005, neither the region nor the *woredas* had developed a system or systems for the sustained use of the biomass of the enclosures. Hence farmers changing from free-range grazing to cut and carry for their animals have not always found it easy to find fodder for their animals.

One unexpected positive aspect of changing the grazing management has been the opportunity for children to go to school. ISD has heard that children who are required to stay out of school to herd animals resent this and it can cause division in families. Changing grazing management for families without children is also a major problem as the parents are often elderly and do not have the time or energy to cut and carry feed for their animals. Traditionally these families have depended on the custom of collective grazing to take care of their animals.

The problem of restricted grazing was raised in a meeting in Tahtai Maichew in August 2005 and again in a compost training workshop in September 2005. The first was a meeting of around 40 farmers who had expressed their dislike of the Sustainable Agriculture/

Development Project. Most of these farmers were better off and had larger herds of animals than their poorer neighbours. They had only seen the project in terms of restrictions and had not realised the positive environmental impacts of controlling grazing on improvements to the general productivity of their areas, and particularly the improvements to the local hydrology. After a long and intense discussion lasting half a day, the farmers agreed that they would try and cooperate with the aims of the project and control the movements of their animals.

The discussion in the compost training workshop in September emphasised the importance of having cooperation among farmers. The farmers stated their awareness of the importance of controlling the grazing of animals, but they pointed out that their neighbours do not restrict the movements of their animals, and the local authorities, the baito committees and social courts, do not uphold the bylaws of the communities and help in penalising the farmers that break the grazing rules. Therefore, they were not all prepared to control the grazing of their animals unless this could be enforced throughout their communities, i.e., by the baito.

However, the advantage of restricting grazing and using cut and carry is gradually being seen by many farmers, and the BoARD is urging farmers to restrict the grazing of their animals. This has brought a new challenge — the need for improved and easily available forage. Sesbania is popular and some areas have introduced pigeon pea on the bunds, while elephant grass is being widely planted in rehabilitated gullies. But the demands for seed and planting material are much higher than the ability of local institutions to provide these.

2.5.2 Forests

Traditionally local communities usually have some form of common law (unwritten understandings and systems) for using their natural resources, particularly water resources and trees. But these

common laws are not written and it has sometimes been difficult to have them recognised by the formal legal system of the country. Until the development of the system of enclosures, the best protected areas of natural vegetation were the small patches of sacred forests around churches and monasteries, in Muslim burial grounds and around holy springs. These areas have been protected by the strong beliefs of local people, not through official guarding.

The other forest/woody areas are 'community forests', mostly Eucalyptus planted during the time of the military government of the 1980s or early 1990s after the change in government, and the hillside enclosures with indigenous species, particularly acacias.

One of the major challenges for the government is the increasing number of landless people who need alternative sources of income. There is also a strong push from the government to bring the farmers into the monetised economy through the development of markets. Local communities are being supported to build roads, and areas by these roads are being given to landless families to form small settlements, build houses and set up shops and markets. This is increasing the demand for wood to build houses. Often arrangements are made for the new home owners to buy and build their houses using Eucalyptus. However, the demand for wood, particularly good quality wood which is durable and termite-proof, is very high. The preferred timber is juniper and olive. The only places where juniper and olive trees are still found growing are in sacred forests. Despite the strong religious taboos, reports of old olive trees being cut to make new houses were brought to the attention of ISD and the local authorities during the evaluation workshop in August 2005 in Tahtai Maichew. It was decided to follow up these reports and hold a workshop to discuss the issue together with the Department of Natural Resources and Environmental Protection of the BoARD.

The threat to sacred forests was surveyed during December and it was found that there are many pressures being used by different

local people to get access to the valuable timber in these forests. Although the BoARD, particularly the Department for Natural Resources and Environmental Protection, has developed guidelines for protecting forests, these are not being implemented. The workshop recommended that the bylaws developed by local communities and tabias need to be strengthened, and a better understanding on the role of these bylaws in protecting the environment should be developed by the local judiciary and administration at both tabia and *woreda* levels.

2.6 Farmers' experiences in the project

At the beginning of the work in 1996, the local communities came up with their priority problems and local solutions. For example, before the start of the project, Adi Nifas was losing fertile land through two gullies that started from a neighbouring hillside. The senior extension officer assigned to the Project from the BoARD guided the farmers in building a series of check dams in the gullies. In just one year, sufficient soil had been captured for grasses and tree saplings to grow on it. By 1999, a permanent spring had appeared: the stream below the hillside now holds water all year round. Farmers below the project site started a small irrigation scheme during the dry season because of the changes. By 2005, several farmers downstream had developed irrigated vegetable production after harvesting their grain crops. They are now able to regularly harvest at least two crops a year.

At the start of the project, farmers were reluctant to plant trees around their farms, thinking that they would attract birds and shade their crops. But after they saw the impact on the health of their animals of having more forage available, particularly the small multipurpose legume Sesbania, and that the trench bunds and check dams stabilised the land, they readily planted more trees. Many farmers have started to also plant fruit trees, both around their homesteads and in rehabilitated gullies. There is now a steady

demand for fruit trees from the farmers and a new nursery is being developed to meet this demand.

Farmers have diversified their production since the quality of their land has improved. For example, as described above, one farmer in Adi Nifas now regularly plants vegetables, particularly tomato and chilli pepper, in his teff field. Another farmer reintroduced a special free-threshing barley called 'demhaye', which is used to make a popular snack of roasted grain called 'qolo'. Overall, the diversity of most crops has increased in all the communities in the project.

In Ziban Sas, after the grazing area had been restored in 1998, the farmers asked for other improvements, particularly a pond for watering their animals as the community is on a small plateau and the animals have to be taken several kilometres down into the valley below to get water. They also needed water for making compost. The farmers were encouraged to ask for help to build a pond because there had been a dramatic rise in the water table after they had put in trench bunds and check dams. Constructing the pond was interrupted because the war with Eritrea in 1998 disrupted the leadership of the community when the local chairman and other lead farmers were called up to fight. The work to make the pond started in 2002 when the leaders returned. The first attempt was only moderately successful because there was no lining to the pond and it did not hold much water. Starting in 2004, a much larger pond was constructed and provided with a cement lining. It was completed in 2005.

Farmers, development agents and experts, local administration and ISD staff have identified the following as the positive effects of the Sustainable Agriculture/Development Project:

- Yields are as good as and often better than those obtained using chemical fertiliser.

- Agro-biodiversity is maintained and improved — for example, the farmers of Ziban Sas were growing only a durum wheat-barley mixture called 'Karka'eta' and a little teff, but now other crops such as maize and faba bean are also grown.
- Weeds are reduced in composted fields – weed seeds, pathogens and insect pests are killed by the high temperature in the compost pits, but earthworms and other useful soil organisms establish well. Weeds that do well on poor soils, such as wild oats (*Avena vaviloviana*), are much reduced in composted soil.
- Increased moisture retention capacity of a soil — if rain stops early, crops grown on composted soil resist wilting for about two weeks longer compared to fields treated with chemical fertiliser. This is crucial during times of drought, which remains a problem in many parts of Ethiopia.
- Plants grown with compost are more resistant to pests and diseases than crops treated with chemical fertiliser.
- Residual effect of compost — the positive effects of compost can remain for up to four years. The farmers have realised that, in contrast to chemical fertilisers, they do not need to apply compost each year and those who have used adequate amounts of compost for two can obtain high yields from their crops the next year without applying compost afresh.
- Farmers have been able to get out of debt from buying chemical fertiliser — the economic returns are positive as farmers have been able to stop buying chemical fertiliser, but they get even higher yields.
- Foods made from composted grain are said to have a better flavour than foods made from crops treated with chemical fertiliser.

Each project site has its distinctive features and problems, and the outcomes achieved are also distinctive. However, in general for all project sites, the environment has been rehabilitated, food and feed production greatly improved, tree and grass cover returned and ground cover increased.

CHAPTER THREE

POLICIES FOR SUSTAINABLE AGRICULTURE

3.1 Taking care of the environment

In 2002, the Ethiopian government issued a new policy guideline on Rural Development and set up a supra-ministry, the Ministry of Agriculture and Rural Development, to coordinate activities. The Rural Development policy guideline regards environmental rehabilitation as an essential factor in increasing productivity (MOI, 2001). It emphasises the need to improve local marketing infrastructure, and also to develop agricultural products to diversify the economic base of the country.

The Environmental Policy of Ethiopia also has incorporated a basic principle similar to the one adopted on organic agriculture: 'Ensure that essential ecological processes and life support systems are sustained, biological diversity is preserved and renewable natural resources are used in such a way that their regenerative and productive capabilities are maintained, and, where possible, enhanced...; where this capacity is already impaired to seek through appropriate interventions a restoration of that capability' (FDRE, 1989 EC/1997 GC).

Key elements of the Environmental Policy cover soil husbandry and sustainable agriculture, and can support the development of more specific policy and regulations for organic agriculture. They recognise the importance and need for agriculture to be environmentally and ecologically sustainable.

In 2005, the Ministry of Agriculture and Rural Development produced a Guideline on 'Community-based Participatory Watershed Development' plus an Annex. These are comprehensive documents incorporating the experience of many practitioners. Participation is central to the Planning, Implementation, Monitoring and Evaluation of watershed development. The documents include information cards on the technologies that can be used, including one for compost making. Although ISD is not mentioned specifically, its experiences in Tigray have helped in shaping the policy behind this document.

In 2006, environmental issues were incorporated into the revised second phase of Ethiopia's Poverty Reduction Strategy Programme (PRSP). The PRSP is taken as the guideline for all development interventions by the donor community in Ethiopia. One of the biggest programmes being launched by the government is the 'Productive Safety-Net Programme', which is channelling funds directly to *woredas* for use in public works activities as well as environmental rehabilitation focusing on watersheds.

3.2 Organic production for Ethiopia

Spurred by the successes of the Tigray Project, the Ethiopian government has stated its interest to increase the capacity of farmers to use organic methods of crop production.

In 2003, it announced that it would support the development of organic agriculture, and a task force was established to draw up an Ethiopian Organic Agriculture Regulation, which can become law, and a Regulation for Organic Agricultural Products to describe how organic products are defined, and what may or may not be used in their growing and processing. The documents cover crop and animal production, as well as food processing and marketing, with the second document providing a basis for a local organic certification scheme.

The international trade in organic products is an expanding niche market that Ethiopia is geographically well situated to exploit. Already, some communities in the south and southwest regions have started to develop and export Arabica coffee with an organic and fair trade label. This has enabled farmers to obtain prices similar to those in 1966 when the international coffee prices started to collapse.

There is an increasing awareness of the importance of producing healthy fruits and vegetables for the expanding educated middle-class and expatriate market in Addis Ababa. For example, Genesis Farm started five years ago and production now covers over 40 ha. The farm combines dairy and poultry production with growing vegetables, fruits and ornamental plants. It is almost totally organic and sells certified products on the export market. However, there is also a fast expanding local market and it is interesting to note that none of the items sold by Genesis are more expensive than other locally produced items, and several are even cheaper. Local workers are able to buy their vegetables from the farm shop.

3.3 Scaling up the Tigray Project

Since it started in 1996, the Tigray Project has been accepted as part of the activities of the Bureau of Agriculture and Rural Development, and the Project Officer was an experienced extension officer employed by the Bureau. In 2002, the Project Officer was retired from the Bureau and became a full-time staff member of ISD, but with his working base still in the Bureau. ISD has deliberately not set up a separate system to implement activities. Instead, the staff members work with the local administrators, experts, development agents and farmers through facilitating some inputs, giving advice and running workshops.

3.3.1 Steps in the scaling-up process

The first scaling up took place in 1998/99, when the regional government adopted key elements of the project as part of the food security development plan for the region. Efforts were made to extend activities to 90 communities and have 2000 farmers making compost. This was only partly successful mainly because local experts and development agents lacked any training in compost making.

As part of the scaling-up process, in 2002, ISD published a booklet on compost making written in Tigrinya (the local language of Tigray) by Arefayne Asmelash (1994 EC/2002 GC). Although this guidebook was distributed widely, farmers, development agents and local experts needed to have the booklet supported by practical training and visiting to feel confident that they could make and use compost effectively.

The next major event in the scaling-up process was a workshop held in Axum hosted jointly by ISD and the BoARD with the Innovative Soil and Water Conservation Project of Mekele University. This took place in November 2001 and representatives from all regions of Ethiopia were invited as well as NGOs working with farmers in Tigray. Over 40 farmers were also present, including six from communities near Addis Ababa. The papers presented included the first set of yield data from the use of compost in farmers' fields.

The workshop also included field visits to the farmers in Adi Nifas and innovator farmers including one who had developed an ingenious lifting device to get water from a well 12 metres deep. He used the water to develop a fruit and vegetable garden. This workshop stimulated experts from the Environmental Protection Authority (EPA) to develop a project for land rehabilitation with support from UNDP under the Country Cooperation Framework (CCF2) Programme.

The Land Rehabilitation Project was launched in a workshop in Axum in October 2003. The aims of the projects and the steps to achieve these were discussed and a field visit was carried out to Adi Nifas. The plan was to have communities from three *woredas* from each region, except Addis Ababa, start to implement the principles of the Tigray Project, but adapted to the local situation. By 2005, this project was being implemented in 69 communities in all of the regions.

For Tigray, the Land Rehabilitation Project included communities in the *woreda* of Tahtai Maichew, and the *woreda* administration approached ISD and EPA to help bring all the *woreda* into the Sustainable Agriculture/Development Project. The scaling up started in July 2004 with a four-day workshop involving over 200 farmers. Each of the local experts introduced an aspect of the project, and was then followed by two farmers describing how the activities had improved their livelihoods. The activities were expanded into 11 new communities in 2004, and 11 adjacent communities joined voluntarily.

By 2005, 26 communities were participating in the Project with 830 (5% of the total) farmers making and using compost. The approach is still to focus activities on neighbourhoods, but leading farmers are being trained and encouraged to train other farmers in their neighbourhood, so that there can be a rapid increase in the numbers implementing the activities of the project, particularly making and using compost.

The spread into Meqdela *Woreda* of South Wollo Zone in Amhara region came about in 2004. Meqdela is the home area of one of the staff of ISD, and he had talked about the Tigray Project when he had visited his family in Masha, the capital of Meqdela. In February 2004, six farmers, two local experts and two representatives from the local administration visited the Tigray communities, and four more participants came to a compost workshop in Axum in August 2004. When they returned to Masha, the local administra-

tor encouraged the farmers to become local trainers with the aim of having the 28,000 farmers in ten kebeles (parishes) in the area making and using compost by the next growing season in 2005.

Meqdela *Woreda* was visited in November 2005 and the impact of applying sustainable agricultural practices was striking. As well as making compost, the farmers had started water harvesting, growing vegetables, and protecting hillsides from grazing. The local administration also changed a tree nursery into a nursery for producing fruit trees and forage plants. In 2005, Meqdela *Woreda* was awarded a prize by Amhara region because of its efforts to rehabilitate its environment and improve the lifestyles of its farmers.

Scaling up has also been started in Gembichu and Ejere *Woredas* of East Shewa Zone of Oromiyar. Two farmers had taken part in the big workshop in Axum in November 2001, and had been applying compost and fermented dung to their fields since. They had also wanted follow-up, but ISD did not have the capacity for this. In September 2004, the farmers were invited to a workshop on seed where they challenged ISD to work with them. Two one-day compost workshops were held in October 2004 and one of the farmers in Gembichu *Woreda* formed a local neighbourhood group of 20 farmers committed to making compost. This group is also a Crop Conservation Association mandated to produce elite seed of farmers' varieties.

In 2005, the Administrator and experts of Gembichu *Woreda* requested ISD and EPA to include the *woreda* in their programme. An introductory workshop was held October 2005, and representatives from the *woreda*, including the administrator, came on the exchange visit to Meqdela *Woreda* in November 2005. Work is just starting to get the whole *woreda* into an organic system of production.

This move from working mostly at a personal level with the farmers in only a few communities to support of the local *woreda* has brought a rapid change in the way of working for ISD. Previously,

ISD focused on the farmers, their development agents and local coordinators, but now there is also partnership with the local administration. The challenge for ISD is to keep contact with the farmers and continue to monitor and evaluate the process of the project.

3.3.2 Workshops and exchange visits

The best person to convince a farmer to take up compost making is another farmer, and similarly, the best person to convince an expert or administrator of the value of the Sustainable Agriculture Project, is another person already involved in the project at the same level. For farmers, it is seeing that is believing, but this is also true for trained professionals. ISD has, therefore, invested time, energy and funds into developing good workshops and taking representatives from all levels in a *woreda* to meet their counterparts in a *woreda* where the Project is being implemented. These are referred to as exchange visits.

The development agents and local experts gain confidence through these workshops and exchange visits to help the farmers make good compost and the relationship between them and the farmers changes from one of coercion to support and advice. All stakeholders also actively participate in evaluating the effectiveness of the activities of the project.

The first comprehensive compost training workshop was held in August 2002. The 80 participants included farmers, development agents and experts from seven *woredas*. Although the focus of the workshop was compost, other topics connected to sustainable agriculture were also raised and discussed.

Compost workshops are now held regularly at the end of the growing season, i.e., from late August to early October. Typically they last for three days and include a field visit as well as practical training and discussions so the numbers are kept below 50 and the practical work is done in groups of 10-15. Everyone is expected to physi-

cally contribute to filling a compost pit. The discussions raise issues of what constitutes sustainable agriculture and any special challenges faced by the farmers. Through these workshop opportunities, ISD has been able to discuss farmers' views on food security and sustainable agriculture, traditions in selecting and keeping seed for sowing, and preferred indigenous trees for animal feed. The workshops bring together farmers and local experts from different areas and there can often be a vigorous exchange of views and experiences.

Because of the rapid turnover of development agents and local experts, compost workshops are required every year, and ISD has evolved a combination of discussions, field visits and practical work which enables all levels from farmers to experts to be fully involved in the workshops. Follow-up field visits confirm that this approach ensures that the farmers are able to make and use good quality mature compost on their fields.

Now the farmers are being encouraged to become their own trainers so the technology can spread fast throughout a community. This is done by farmers committing themselves to train at least ten of their neighbours, and those trained also commit themselves to train other farmers. This can initiate a training chain so that all the farmers within one area make and use compost.

In November 2005, Meqdela *Woreda* invited ISD and groups from other *woredas*, including from Tigray, to visit and see the impacts of the Sustainable Agriculture Project. An officer from the Natural Resources and Environmental Protection Department of South Wollo Zone was included in the visit. He was so impressed that he arranged for representatives from the 50 *woredas* in the eastern part of Amhara region to visit Meqdela in December 2005. At the end of the exchange visit, most of the representatives from the *woredas* stated their intention of implementing the Sustainable Agriculture Project.

Chapter Four

CONCLUSION

The experience in Tigray from the Sustainable Agriculture/Development Project has been very positive, both in terms of helping farmers improve their livelihoods as well as showing local experts, administrators and policy makers that environmental rehabilitation is basic to improving productivity of crops and livestock. Use of ecologically sound organic principles can have very quick positive impacts on the productivity and well-being of smallholder farmers so that they do not necessarily have to face a conversion period of reduced yields as they change from chemical to organic production.

Most farmers, particularly those in marginal areas, are not able to afford external inputs, so for them an organic production management system offers a real and affordable means to break out of poverty and obtain food security.

It is important to bear in mind that although it may be external market interests that initially stimulate the development of a policy environment for organic agriculture, the benefits should be available to all members of the local society to build a healthy and food-secure future for Ethiopia.

While challenges undoubtedly still lie ahead, the positive Tigray experiences in sustainable and organic agriculture practices provide hope for Ethiopian farmers of the future.

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TOP: *Training farmers to prepare compost.*

LEFT: *Composted maize (left) compared with non-composted maize (right).*

Non-composted faba bean in Akab Se'at, 2003.

Composted faba bean in Akab Se'at, 2003.

Degraded and eroded Adi Nifas in 1997.

Rehabilitated Adi Nifas in 2003.

THE TIGRAY EXPERIENCE: A SUCCESS STORY IN SUSTAINABLE AGRICULTURE

This paper documents the results of an experiment in sustainable development and ecological land management in the Tigray region of Ethiopia. The Tigray Project, as it is often referred to, demonstrates that sustainable agricultural practices such as composting, harvesting of water and soil, and crop diversification, can succeed and bring benefits to poor farmers and communities, particularly to women-headed families. Among the benefits demonstrated are increased yields and productivity of crops, improved hydrology with raised water tables and permanent springs, improved soil fertility, rehabilitation of degraded lands and increased incomes. The project is farmer-led, and builds on the local technologies and knowledge of the farming communities. Local communities have been empowered, developing legally-recognised bylaws to govern their land and other natural resource management activities. The successes of the project have led to its expansion to include many more communities in Tigray and in other parts of the country. The government has now adopted the approach used by the project as its main strategy for combating land degradation and poverty in Ethiopia.

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The data from the Tigray project were collected by Arefaine Asmelash and Hailu Araya, and analysed and compiled by Hailu Araya.

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