Ecological Agriculture with Smallholder Farmers in Ethiopia

Background

The Ethiopian population is about 85% rural. Poverty in rural Ethiopia is mainly caused by land degradation and a consequent fall in agricultural production.

The Institute for Sustainable Development (ISD) was born from a workshop in May 1995 on the environmental problems of Tigray Region in Northern Ethiopia. The Third World Network (TWN), a Malaysian-based NGO, financially supported it. ISD joined forces with the Bureau of Agriculture and Natural Resources (BoANR) of Tigray and started work with the aim of building on local technologies for the poor rural communities to improve their physical environment and soil fertility. This would raise crop yields without making them dependent on expensive external inputs.

The farmers were stimulated to select from a 'basket of choices' consisting of their own systems of organic farming and land management together with some ideas novel to them. The key components were:

- prevention of soil erosion through biological and physical means,
- discontinuation of free range grazing by their domestic animals,
- making and using compost,
- harvesting both soil and water.

This increased the biomass in the farm and its surroundings. All this was made through community empowerment. The empowerment was achieved through suggesting that the communities themselves develop bylaws to govern their land and other natural resources management activities, and obtaining recognition of the bylaws by government administrative and law enforcement agencies.

Four project sites (Adi Nifas, Adibo Mossa, Gu'emse and Ziban Sas) were established in 1996/7. The number has now increased. ISD and BoANR are working together implementing the project in 15 communities while BoANR on its own is working with over 90 communities throughout Tigray. Encouraged by this experience, the Federal Environmental Protection Authority has adopted the approach as its main strategy for combating land degradation and poverty throughout the country. In 2004, it started to implement the strategy in 69 pilot communities in all the regions of the country.

The Main Activities of the Sustainable Development Program

The activities carried out so far have included promoting organic agriculture through composting, physical and biological soil and water conservation including gully treatment,

water and soil harvesting, catchment protection, crop diversification, forage development and special support to women headed families.

Farmers, development agents and local experts have been trained in various skills and now actively participate in evaluating the effectiveness of the activities of the project. Farmers in all the project sites have made their own by-laws and are enforcing them.

Examples of Outcomes of the Project

On the whole, each site has its distinctive features. Consequently, the problems tackled by each community and the outcomes achieved are also distinctive. All in all, however, the environment has been rehabilitated, food and feed production greatly improved, tree and grass cover returned and ground water increased.

For example, before the start of the project, Adi Nifas, was loosing fertile land through a gully that started from the neighbouring hillside. The farmers built a series of check dams in the gully. In one year, sufficient soil had been captured for grasses and tree saplings to grow on it. By 2001, a permanent spring had reappeared and farmers below the project site started a small irrigation scheme because of the changes. An impression of the changes can be obtained by comparing the photographs of Adi Nefas in 1997 when the project had just started, and in 2003. The photos are of the same view.

At the start of the project, farmers were reluctant to plant trees around their farms thinking that they will attract birds and shade crops. But after they saw that *Sesbania* was a small tree and it gave forage for feeding cattle and helped stabilize the trench bunds and check dams, they readily planted more of these trees. Similarly, the Ziban Sas project site, particularly its grazing area, has been transformed. In 1996, it was bare and covered by soil wash. Now, after putting in trench bunds and halting the erosion, the grasses and other herbs have grown back. There has also been a significant rise in the water table.

The use of compost has increased yields without the debts incurred in buying chemical fertilizer. The farmers have realized that, in contrast to chemical fertilizer, the positive effect of compost is still present in later years – see the graph. When rain stops early, crops grown with compost resist wilting for at least two weeks after those grown with chemical fertilizer. Women comment that the cereal grains from composted fields are denser and the food has a better flavour.

The yields are higher from fields where compost has been applied as can be seen from the tables. Adi Nifas joined the project in 1996. Therefore, virtually all the fields have had compost applied to them at least in some of the years since then. Therefore, even the checks have residual impacts from compost. The field where finger millet was sown, however, had not had a previous compost application. Farmers also apply compost to their pulse fields; crops that are not normally given much attention. The farmers of Adi Nefas have mostly given up using chemical fertilizer, see table 1.

Adi Gua'dad joined the project only in the 2002/3 cropping season. Therefore, the checks have not benefited from the residual effect of compost. For the same reason, the farmers

still use chemical fertilizer as well. That makes it possible to compare the impacts of both compost and chemical fertilizer, see table 2.

The total cost of the recommended chemical fertilizer (DAP and Urea) for one hectare of land in the summer of 2003 was 377 Birr in cash or 433.55 Birr on credit. The average market prices per 100 kg for grains and pulses in 2003/4 were: teff – 280, maize – 160, faba bean – 300, barley – 200, wheat – 250, finger millet – 170.

Table 1. Grain yields (in kg/ha), expenses and returns (in Birr) for Adi Nefas in 2003/4

Crop	Input	Yield	Gross income	Fertilizer cost	Net income
Faba Bean	Compost	**4,391**	13,173	-	13,173.00
Check	2,287	6,861	-	6,861.00	
Finger Millet	Compost	**2,650**	4,505	-	4,505.00
Check	8,33	1,416	-	1,416.10	
Maize	Compost	**5,480**	8,768	-	8,768.00
Check	7,08	1,132	-	1,132.80	
Teff	Compost	**1,384**	3,875	-	3,875.20
Chemical fertilizer	1,033	2,892	377	2,515.40	
Check	7,39	2,069	-	2,069.20	
Wheat	Compost	**2,250**	5,625	-	5,625.00
Chemical fertilizer	1,480	3,700	377	3,323.00	
Check	8,42	2,105	-	2,105.00	
Barley	Compost	**1,633**	3,266	-	3,266.00
Check	8,59	1,718	-	1,718.00	

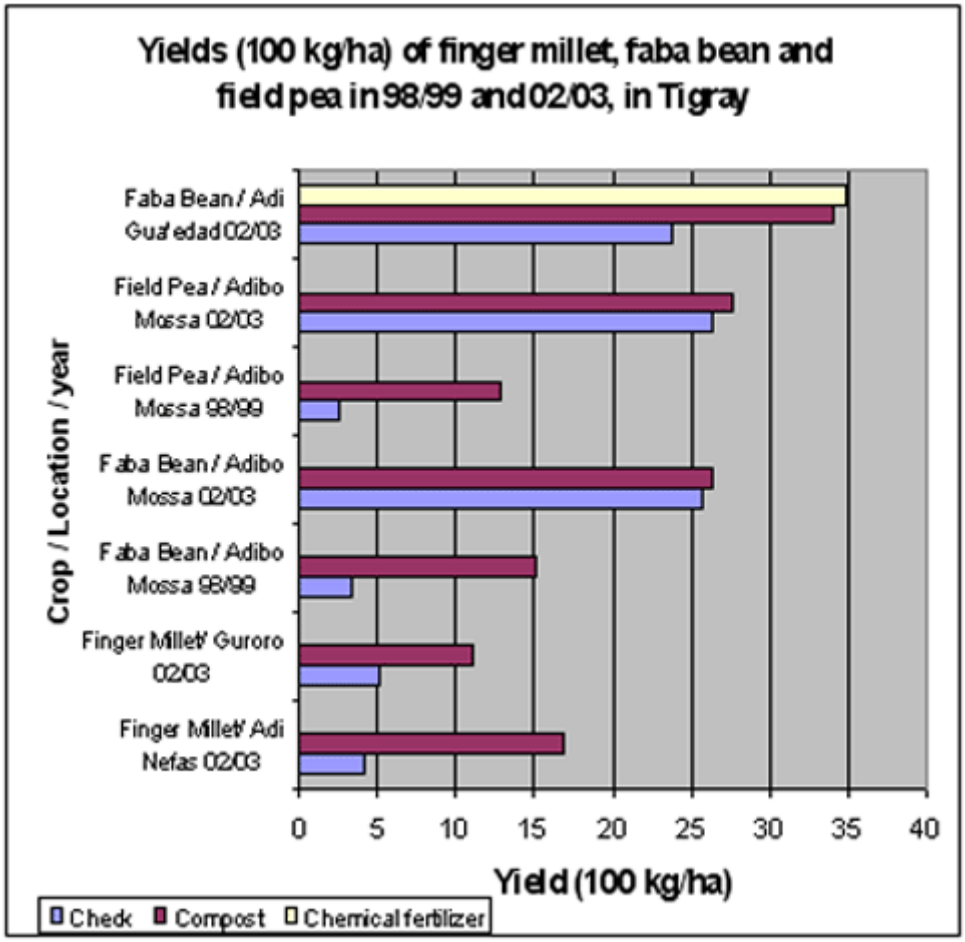
10 Birr is equivalent to 1 Euro, or 8.5 Birr equals 1 USD.

Crop cultivation is often vulnerable to weather fluctuations. With global warming and climate change, these fluctuations have become more common and more intense. Often rain comes late and stops early, which leads to crop failures.

In 2003, irrigated seedbeds of sorghum and finger millet were prepared at an experimental scale and the seedlings were transplanted when the rains started. The transplanted sorghum matured but was eaten by birds while the other fields sown conventionally when the rains started failed to mature. The yield of finger millet conventionally sown on composted land was 2,800 kg per hectare, while that transplanted onto composted land was 7,830 kg per hectare. The contrast can be seen in the photographs.

Table 2. Grain yields (in kg/ha), expenses and returns (in Birr) for Adi Gua'edad in 2003/4

Crop	Input	Yield	Gross income	Fertilizer cost	Net income
Faba Bean	Compost	**2,900**	8,700.00	-	8,700.00
Chemical Fertilizer	1,100	3,300.00	377.00	2,923.00	
Check	766	2,298.00	-	2,298.00	
Finger Millet	Compost	**2,000**	3,400.00	-	3,400.00
Chemical Fertilizer	1,433	2,436.10	377.00	2,059.10	
Check	500	850.00	-	850.00	
Maize	Compost	**2,000**	3,200.00	-	3,200.00
Chemical Fertilizer	1,133	1,812.80	377.00	1,435.80	
Check	680	1,088.00	-	1,088.00	
Barley	Compost	**2,193**	4,386.00	-	4,386.00
Chemical Fertilizer	1,283	2,566.00	377.00	2,189.00	
Check	900	1,800.00	-	1,800.00	
Wheat	Compost	1,020	2,550.00	-	2,550.00
Chemical Fertilizer	**1,617**	4,042.50	377.00	3,665.50	
Check	590	1,475.00	-	1,475.00	
Teff	Compost	**1,650**	4,620.00	-	4,620.00
Chemical Fertilizer	1,150	3,220.00	377.00	2,843.00	
Check	390	1,092.00	-	1,092.00	



The graph above compares the yields of faba bean and field pea in 1998/99 and 2002/03 from Adibo Mossa, by Lake Hashenge of Southern Tigray. It also shows the yield of faba bean from the new site of Adi Gua'edad, and the non-transplanted finger millet yields.

Only the farmers in Adi Gua'edad used fertilizer. The rehabilitation of the soil in Adibo Mossa is shown by the marked increase in the yields of the 'check' in 2002/03 compared with those of 1998/99. By 2002/03 the yield from the 'check' fields was almost as good as those treated with compost. This shows that after the consistent use of compost for only a few years, the fertility of the soil is markedly improved.

The project has given much emphasis to promoting and training in compost preparation and use. In 2002, a handbook on compost making was published in Tigrinya and there is now an English version. An Amharic version is being finalized.

Training involves both male and female farmers as well as local development agents and experts, as the photograph below shows.

Indicators of Sustainability

- Maintaining or increasing agricultural biodiversity: for example, Ziban Sas was growing only wheat and barley mixed together and a little teff, but now other crops e.g. maize and faba bean, are also grown.
- Reduced weeds: 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.
- Increased moisture retention capacity of the soil: if rain stops early, crops grown on composted soil resist wilting for about two weeks longer than those grown on soil treated with chemical fertilizer.
- Disease and pest resistance: as seen through the problem of shoot fly on teff and root borer on faba bean in Tahitai Maichew and La'elai Maichew respectively, crops are more disease and pest resistant.
- Residual effect: farmers who have used compost for one or two years can obtain high yields from their crops the next year without applying compost afresh.
- Economic returns: farmers have been able to stop buying chemical fertilizer, but they still get even higher yields.
- Flavour: food is said to taste better.

This work was done by ISD as a partnership between the farmers of Tigray, the BoANR of Tigray and ISD.

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