Strategies for Systems Intensification

AHI brief

November 2003 • No. A1 • **African Highlands Initiative** • Empowering Communities to Regenerate Livelihoods and Landscapes

Restoring Soil Fertility in the Highlands of East Africa through Participatory Research

A collaborative effort between AHI, EARO and TSBF in Areka, Ethiopia, is looking into the rehabilitation of degraded arable lands on the verge of falling out of production.

Land degradation is the principal environmental factor behind declining per capita food production in sub-Saharan Africa. Causes include nutrient mining, soil erosion, poor land management and lack of resources. Rising population pressure often obliges farmers to utilize vulnerable, sloping land, thereby aggravating erosion and degradation (Fig. 1).

A major concern of many stakeholders in highland areas, besides maintaining the fertility of lands that are still productive, is how to rehabilitate degraded arable lands that are on the verge of going out of production. The Tropical Soils Biology & Fertility Institute of CIAT (TSBF) and the African Highlands Initiative (AHI), working together with the Ethiopian Agricultural Research Organization (EARO) in an action research approach with farmer research groups, has shown that the following methods are effective in implementing integrated soil fertility management in the Areka area of southern Ethiopia.

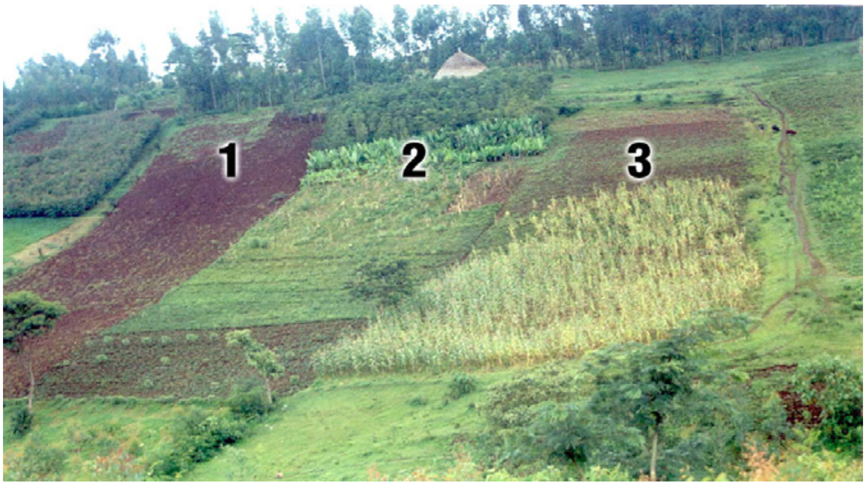

Figure 1. Three farms on steeply sloping land in southern Ethiopia with good (2) and poor (1, 3) management. Household no. 2 resides on the farm, while others reside off-farm.

Step 1. Gaining the confidence of farmer experimenters

We started by bringing together interested farming communities and a team of local researchers and extension staff. Farmers outlined their problems and experiences, researchers explained some results that they thought could help address the farmers' needs, and a farmer research group decided what they wished to test in the first season. Invariably, they asked to evaluate new varieties of the crops they knew because—as they later explained—they thought this the surest way to get something out of a relationship that experience taught them could be a short-term one!

After a couple of seasons, these farmers were multiplying seed of some new varieties they had selected, passing seed on to others, and had visited more distant research and demonstration sites to select other technologies for testing. By this time, the participants were discussing ideas for tackling their more serious, long-term problem—declining soil fertility.

Step 2. Implementing integrated soil/water conservation measures

Research results from the soil conservation research program (SCRP) in southern Ethiopia showed that runoff on crop land with a slope of at least 14% was reduced by more than 80% where soil bunds or grass strips were used. More farmers adopted these measures when fast growing, drought resistant forages such as Pennisetum species were used for stabilizing the soil bunds. Farmers were attracted by the extra benefit of the grassed bunds in producing dry season feed; the grass also serves as a trap crop for maize stalk borer.

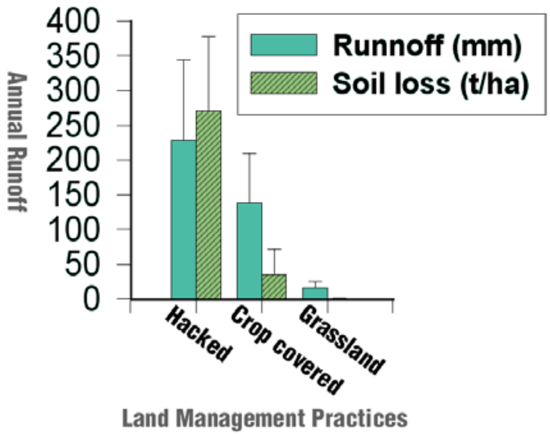

Figure 2. Effects of three land management practices (hacked vs crop covered, both on 16% slope, and grassland on 40% slope) on runoff and soil loss in the southern Ethiopian highlands (SCRP, 1996).

The solid grass cover reduced soil losses, improved the availability of organic inputs for soil improvement, and offered animal feed and consequent increase in cash income.

Step 3. Increase soil organic matter by integrating more legumes into the system

Current organic matter inputs in Eastern Africa are insufficient for maintaining soil organic matter. Conventional sources of organic matter (manure, crop rotation and weedy fallows) are becoming scarce as livestock numbers decline on smaller farms and due to competing demands on their use. Our project evaluated an alternative option of integrating legumes into the cropping systems. We offered farmers a range of options and legumes, and found that their decisions varied according to the agroecological niches available on their farms and their socioeconomic situations.

A farmer who needs a fast growing legume cover crop for short-term fallow periods finds that Crotalaria and Vetch are the best options. On the other hand, a farmer wishing to improve his land with a medium-term fallow fares best with Tephrosia or Crotalaria. We found that, as farmers are usually attracted by short-term benefits, the inclusion of field peas and faba beans, multipurpose legumes having a low N harvest index, increased levels of adoption. The use of good rotations cannot be over-emphasized.

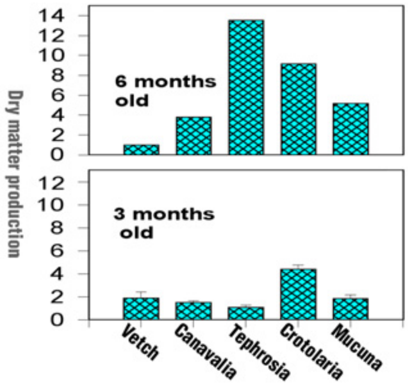

Figure 3. Dry matter production of cover crops in short- (3-month) and medium-term (6 -month) fallow in the southern Ethiopian Highlands

Step 4. Improve soil nutrient status through judicious application of mineral fertilizers

Organic fertilizers cannot fully cover nutrient demands and therefore need to be supplemented by mineral fertilizers. Nutrients other than nitrogen and phosphorus could be in deficit in organic inputs, so supplementation by mineral fertilizers is required. In some calcareous soils, addition of 5 kg/ha zinc can give significantly higher yield than 100 kg/ha of N or P (Marschner, 1995). Moreover, current blanket fertilizer recommendations should be adjusted to specific soils, crops and agroecologies so as to improve the use efficiency of these amendments.

Figure 4. A well-managed farm in southern Ethiopia with integration of soil conservation measures, trees and high-value crops.

Conclusion

Soil fertility management is a continuous process. Besides addressing current nutrient deficiencies, other measures are also needed to ensure sustainable soil productivity. The farmers collaborating in this pilot project have now gone on to innovate more confidently on their own account.

—Tilahun Amede

For further information contact:

The International Center for Tropical Agriculture (CIAT)
c/o ILRI
P.O. Box 5689
Addis Ababa
Ethiopia

African Highlands Initiative
P.O. Box 26416
Kampala, Uganda

tel:
256-41-220607
256-41-220602

fax:
256-41-223242

e-mail:
ahikamp@ infocom.co.ug

Key partners in this work have been research specialists from AHI's NARI collaborators (EARO, DRD, FOFIFA, FIFAManor, KARI, NARO), the IARCs (CIAT, TSBF, ICRAF, CIMMYT, CIP, IITA), and various NGOs and government extension officers.

We gratefully acknowledge donor support from SDC; Netherlands, Norwegian and Italian governments; IDRC; DFID; and the Rockefeller Foundation.