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SIMLESA
Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa

ETHIOPIAN INSTITUTE OF AGRICULTURAL RESEARCH

Australian Government
Australian Centre for International Agricultural Research

COUNTRY POLICY BRIEF

ENHANCING AGRICULTURAL RESILIENCE AND SUSTAINABILITY IN ETHIOPIA

Conservation Agriculture-based Sustainable Intensification: Minimal tillage saves resources, improves yields on Ethiopian farms

Summary and key facts

Minimum tillage and intercropping maize and legumes produced 44% and 47% additional yields of soybean and maize, respectively in low rainfall season in sub-humid agroecologies

The combination of minimum tillage and residue retention had 31% and 79% more soil water at sub-humid and Central Rift Valley (CRV) areas of Ethiopia, respectively

The soil moisture retained through reduced tillage and residue retention resulted in 28% and 29% more maize grain and stover yields, respectively when maize and common bean were intercropped

Minimum tillage reduces labor required for plowing by 41% compared to the conventional tillage - reducing drudgery and providing more time for other activities

What is the problem?

Conventional tillage accelerates surface soil erosion as well as soil moisture loss

Most farm households rely on family resources, especially human labor and animal (mainly ox) traction to prepare land and help with weeding. Conventional tillage practice for maize production in Ethiopia involves plowing a field three to four times when preparing seedbeds. This takes place over 2-3 months prior to planting coinciding with high and intense rainfall leading to high soil erosion. High soil erosion results in increased soil acidity, and low soil fertility and productivity. Frequent tillage combined with removal or burning of crop residues increases evaporation of moisture from the soil surface increasing vulnerability of crop to drought and dry spells. This makes smallholder farmers' livelihood highly vulnerable to climate variability.

What solutions were identified from research?

CASI practices had good impacts on soil moisture, reduced erosion and increased yields

In 2010, the Sustainable Intensification of Maize-Legume Cropping systems for Food Security in Eastern and Southern Africa (SIMLESA) project were introduced in Ethiopia. The project's objective was to increase smallholders' food and nutrition security, and income levels by integrating sustainable intensification practices to increase productivity and protecting the environment at the same time.

SIMLESA research involved trialing a paradigm shift towards Conservation Agriculture-based Sustainable Intensification (CASI). CASI technologies and practices combine the principles of conservation agriculture and principles of improving agricultural productivity with less use of resources and pressure on the environment, resulting in the increase of productivity and sustainability. This involved promoting practices that emphasized minimizing tillage, crop rotations and intercrops, and maintaining soil cover using crop residues. Along with using inputs such as improved seed varieties, fertilizer and agricultural machinery.

Minimum tillage as part of a package of practices increased yield and reduced downside risks.

The major components of CASI practices include reduced tillage, residue retention, and crop association (rotation or intercropping of legume and maize). The highest maize yields under CASI practice obtained was 5.76 t ha-1 in the central rift valley and 7.0 t ha-1 in the sub humid and north-western Ethiopia. The combination of major CASI practices increased maize and legume productivity yield, thus improving household food security and income generation.

7.0t ha-1

The highest maize yields under CASI practice

Minimum tillage improves rainwater productivity for crops.

Higher soil moisture content in all soil horizons was recorded in the minimum tillage-based common bean-maize rotation plot followed by minimum tillage-based sole maize at both planting and harvesting times in CRV of Ethiopia. Rainwater productivity of maize was significantly improved in plots under minimum tillage and residue retention compared to the usual repeated tillage and residue removal during low rainfall years. The highest rainfall productivity (10 kg mm-1 ha-1) was obtained from common bean-maize rotation followed by maize common bean rotation (9.2 kg mm-1 ha-1) and sole maize (8.2 kg mm-1 ha-1) grown under minimum tillage compared to the average value of 7.4 kg mm-1 RP recorded under CP in CRV Ethiopia.

10 kg mm-1 ha-1

The highest rainfall productivity was obtained from common bean-maize rotation

Minimum tillage and SI practices increased soil moisture and reduced soil erosion.

Growing common bean-maize rotation under CASI retained higher moisture consistently in all soil horizons. For CASI compared with conventional tillage practice, the was an increase to soil water by 31% atl sub-humid environments and 79% more at CRV of Ethiopia. Soil water at the 1m soil depth at Melkassa during grain filling was affected by the main effect of tillage and the tillage by cropping system interaction. Reduced soil loss in the range of 34–65% compared to that of farmer's sole maize production practice under traditional tillage. The highest soil loss was recorded under sole maize in conventional/repeated tillage.

31%

increase to soil water under CASI practice

What are the opportunities for policy action?

Invest in CASI training and market development for machinery and new fodder crops

Alternative livestock feed supply and feeding arrangements

New arrangements in free grazing or incentives for minimum herd size needs to be designed to encourage residue retention in fields.

Promote appropriate mechanization to encourage minimal till

The policy makers at ministry level should design ways of locally producing and making available labor-saving CASI implements and machineries (Rippers, Jab planters etc.) to smallholder farmers for better and fast adoption of reduced tillage practices.

Produce CASI training manuals for extension services

Governments and extension services providers should prepare concise user guide manuals for how to do and implement reduced tillage practices using the labor-saving CASI implements and machineries. They should also train farmers on the practices, use, and advantages of reduced tillage practices for better environment, food production and adaptation to climate variability and change

Why act now?

Soil degradation remains a threat to food security and economic development in Ethiopia. Scaling and promoting CASI practices such as reduced tillage by Ethiopian Ministry of Agriculture and other institutions will help to restore the degraded soils of agricultural lands, increase crop productivity, improve the livelihoods of the farmers, and contribute to the efforts of mitigating and adapting to varying and changing climatic factors. The new practices and principles of CA should be considered in the basket of options for stemming soil degradation.

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