The Issues

Information gathering and baseline surveying identified key issues:

• Agronomic practices like monocropping, residue removal, and heavy, repeated plowing deplete soil productivity;
• Economic realities prevent adoption of alternative practices, purchase of conservation agriculture equipment, or fallowing land for cover crops;
• Market structures and policies discourage innovation such as crop rotations, cover crops, or implementation of other CA practices.

Agronomic Practices

Objectives: Evaluate CAPS tillage, rotation, and cover-crop practices.

Tangible versus intangible effects: Many tangible effects of status quo practices are positive, while invisible, effects are negative:

Residue is valuable as firewood, fodder, and building material, but left in place builds soil productivity.

Cover crops take up valuable space needed for food crops, but they build soils and can increase yield.

Moldboard plows are paid for, rarely break, are easy to repair, are easy to transport and handle behind a team, and they create a mellow, weed-free seedbed. But they also accelerate loss of soil organic matter, compaction, and eliminate almost all soil cover. Adoptable minimum-tillage implementations must retain advantages of moldboard plows.

Economic Realities

Objectives: Evaluate economic and socio-cultural performance of CAPS and economic tradeoffs necessary to improve soil fertility.

Constraints:

Farmers can’t afford to sacrifice short-term yield for long-term sustainability, so CAPS must generate income at least equal to current practices immediately upon adoption;
Crop residues have value off the field, so CAPS must allow some removal and demonstrate the value of soil building;
Space is too precious to be occupied by cover crops, so CAPS must demonstrate yield increases that allow soil-building space without sacrifice;
Gender roles and labor allocation inhibit changes in the timing or amount of work, so CAPS must be developed with close involvement of all stakeholders.

Market Constraints

Objectives: To provide bases for policy review, revision, and development of marketing systems that encourage adoption of CAPS.

Constraints to agricultural and market innovation:

Policy and regulatory environments discourage small farm innovation;
Lack of technology prevents sensing innovative or emerging markets;
Logistical bottlenecks prevent sales of crops or purchase of inputs;
Gender roles and labor allocation inhibit changes in the timing or amount of work;
Inadequate storage infrastructure can cause high post-harvest losses;
Obligations or debt can restrict ability to create or exploit new opportunities.

Activities and Progress

Study areas: two upland and two lowland areas in Mt. Elgon region of Kenya-Uganda border: Kapchorwa and Tororo Uganda; Trans Nzoia and Bungoma, Kenya.

CAPS experiment: one on-station and four on-farm factorial tillage x cropping system trials in each area. Focus groups, baseline surveys and advisory groups for co-design of CAPS trials in each study area.

Data collection:

Soil fertility and carbon stores, including stable and labile pools and density fractions of soil organic matter;
Trace gas emissions and mineral nitrogen for soil carbon flux modeling;
Rainfall and temperature;
Crop growth and yield parameters.

Tools for Conservation Agriculture

We believe that adoption of CAPS will depend largely on identifying or developing tools that accomplish soil preparation and weeding while reducing both soil disturbance and labor. As field trials progress, we work with farmer cooperators to develop and/or evaluate hand, animal-drawn, and tractor-drawn implements designed to retain residue cover.

Prototype tiller designed for easy manufacture and repair, and to compete with the oxplow with respect to handling, turning space, and ease of transport among fields.