



# Integrated Soil Fertility Management



Soil fertility depletion is a major constraint to food security in sub-Saharan Africa (SSA)<sup>1</sup> and Central America. To achieve sustainable investments in soil fertility management, CIAT has adopted a paradigm known as “integrated soil fertility management (ISFM)”. This is defined as:

*A set of soil fertility management practices that necessarily include the use of fertilizer, organic inputs, and improved germplasm, combined with knowledge on how to adapt these practices to local conditions, and aiming to maximize agronomic use efficiency of the applied nutrients and thus crop productivity. All inputs are managed, using sound agronomic principles.*

During recent years, CIAT research has improved livelihoods of rural families in targeted impact zones by developing ISFM-based crop production systems. These systems are profitable, socially just, nutrient-dense, and resilient. Researchers have also created the environment to enable their adoption.

## Outputs and impact

- ISFM interventions have been developed for maize, sorghum, and cassava-based systems in the major impact zones. Yield increases were over 100%, even as soil fertility status improved. Activities are now directed towards achieving the same successes with rice- and banana-based systems. Conservation agricultural practices are also being developed.
- A holistically evaluated set of profitable, socially just, nutrient-dense, and resilient ISFM practices are being promoted for legume-cereal-based systems in the West African Sahel and the savanna impact zones in western, eastern, and southern Africa. These practices are adapted to prevalent farming conditions and their intrinsic variability.
- A set of ISFM practices has been assembled for:
  - Cassava- and rice-based systems in the West and Central African humid forests.
  - Banana-based systems in the impact zones of the Central and East African mid-altitudes.
  - Conservation agriculture systems in the impact zone of Central American hillsides.
- Local and international NGOs are disseminating ISFM practices in SSA.

- The three-tier approach is being used to facilitate the adoption of soybean in East Africa, involving all major value chain partners.
- Over 40 MSc and PhD students have been trained in the past 3 years. At least 500 NGO partners and farmer representatives participated in group training events on ISFM topics.

## Main activities and projects

The major impact zones of SSA, with target cropping systems, are:

- Millet and sorghum-based systems in the West African drylands.
- Cereal-legume intercropping/rotation systems in the moist savannas of West, East, and southern Africa.
- Cassava-based systems in humid areas of West and Central Africa.
- Upland rice-based systems in West and Central Africa.
- Banana-based systems in East and Central African highlands.
- In Central America, crop-livestock systems are being targeted in Honduras and Nicaragua.

## Partners and collaborators in national programs

**Benin:** INRAB • **Brazil:** Embrapa • **Burkina Faso:** INERA • **DR Congo:** CRSN; INERA; UCB;

1. For an explanation of acronyms and abbreviations see [www.ciat.cgiar.org/newsroom/pdf/acronyms\\_syntheses.pdf](http://www.ciat.cgiar.org/newsroom/pdf/acronyms_syntheses.pdf)

UNIKIN • **Ghana:** CRI; SRI; UG • **Honduras:** DICTA • **Kenya:** JKUAT; KARI; KEFRI; KU–Kenya; Moi University; NMK; UoN • **Madagascar:** FOFIFA; UA • **Malawi:** Bunda College; DARS • **Mali:** IER • **Mozambique:** IIAM; UCM; UEM • **Nicaragua:** INTA • **Niger:** INRAN • **Rwanda:** ISAR; UNR • **Tanzania:** ARI; SUA • **Togo:** ITRA • **Uganda:** MUK; NARO • **USA:** MSU • **Zambia:** UNZA; ZARI • **Zimbabwe:** ARES; UZ

#### Advanced research institutes

BOKU (Austria) • CIMMYT • CIP • CIRAD • Cornell University • ETH–Zürich (Switzerland) • FAO–Honduras • Humboldt University (Germany) • ICIPE • ICRAF • ICRISAT • IFDC • IITA • ILRI • IPU • IRD • ITC • JIRCAS • Kyoto University • KU–Leuven • MSU • OSU • Purdue University • SLU (Sweden) • UEx (UK) • University of Illinois • UB • UGent (Belgium) • University of California–Davis • WUR (Netherlands)

#### Regional consortia

AfNet • African Highlands • Consorcio MIS • SOFECSA • Sub-Saharan Africa Challenge Program

#### Nongovernmental organizations

CARE • CNFA–Kenya • CNFA–Tanzania • CRS/BDD (DR Congo) • Diobass • FHI • FIPS–Africa • Heiffer (USA) • ROP (Kenya) • RWARRI • Technoserve (Kenya) • VACID Africa • World Vision–Rwanda

#### Private companies

Agrodealers (DR Congo, Kenya, Tanzania) • Bidco Industries (Kenya) • Leldet Ltd (Kenya) • Western Seed (Kenya)

#### Donors

ADA (Austria) • AGRA (Kenya) • Bill & Melinda Gates Foundation • CTA • DGDC (Belgium) • IDRC • Kilimo (Uganda) • Rockefeller Foundation • USAID • WOTRO (Netherlands)

#### Team members

- **Bernard Vanlauwe**, Soil Scientist and Program Leader ([b.vanlauwe@cgiar.org](mailto:b.vanlauwe@cgiar.org))
- **Eliud Birachi**, Market Economist ([e.birachi@cgiar.org](mailto:e.birachi@cgiar.org))
- **Jonas Chianu**, Socioeconomist ([j.chianu@cgiar.org](mailto:j.chianu@cgiar.org))
- **Marc Corbeels**, Soil Scientist and Modeler ([m.corbeels@cgiar.org](mailto:m.corbeels@cgiar.org))
- **Laetitia Hermann**, Biotechnologist ([l.hermann@cgiar.org](mailto:l.hermann@cgiar.org))
- **Jeroen Huising**, GIS Scientist ([j.huising@cgiar.org](mailto:j.huising@cgiar.org))
- **Joyce Jefwa**, Microbiologist ([j.jefwa@cgiar.org](mailto:j.jefwa@cgiar.org))
- **Wanjiku Kiragu**, Administrator ([w.kiragu@cgiar.org](mailto:w.kiragu@cgiar.org))
- **Saidou Koala**, Soil Scientist and African Network Coordinator ([s.koala@cgiar.org](mailto:s.koala@cgiar.org))
- **Patrick Lavelle**, Soil Ecologist ([p.lavelle@cgiar.org](mailto:p.lavelle@cgiar.org))
- **Didier Lesueur**, Microbiologist ([d.lesueur@cgiar.org](mailto:d.lesueur@cgiar.org))
- **Brigitte Maass**, Forage Agronomist ([b.maass@cgiar.org](mailto:b.maass@cgiar.org))
- **Martha Nyagaya**, Human Nutritionist ([m.nyagaya@cgiar.org](mailto:m.nyagaya@cgiar.org))
- **Peter Okoth**, Extension Specialist ([p.okoth@cgiar.org](mailto:p.okoth@cgiar.org))
- **Pieter Pypers**, Soil Scientist ([p.pypers@cgiar.org](mailto:p.pypers@cgiar.org))
- **Idupulapati Rao**, Plant Physiologist ([i.rao@cgiar.org](mailto:i.rao@cgiar.org))
- **Kristina Roing de Nowina**, Agronomist ([k.roing@cgiar.org](mailto:k.roing@cgiar.org))
- **Nteranya Sanginga**, Soil Microbiologist ([n.sanginga@cgiar.org](mailto:n.sanginga@cgiar.org))
- **Jerome Tondoh**, Soil Ecologist ([j.tondoh@cgiar.org](mailto:j.tondoh@cgiar.org))
- **Shamie Zingore**, Soil Scientist ([s.zingore@cgiar.org](mailto:s.zingore@cgiar.org))

#### Contact: Deborah Bossio

Tropical Soils Research Area Director  
([d.bossio@cgiar.org](mailto:d.bossio@cgiar.org))