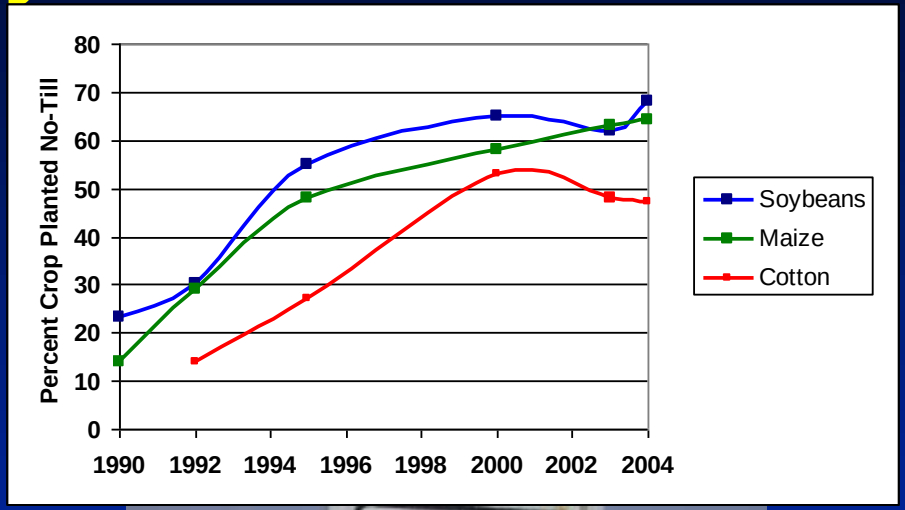
Developing Sustainable Conservation Agriculture Systems for Smallholders in Southern Africa: Lesotho & Mozambique

It Takes a Team

- University of Tennessee
  - Neal Eash, Forbes Walker, Dayton Lambert, Michael Wilcox
- Tennessee State
- National Uni. of Lesotho
  - Mokoala Marake
  - Mampiti Matete
- CIMMYT – Zimbabwe
  - Pat Wall
- Lesotho Min of Agri
  - Martin Ranthemane
- NGO's – Growing Nations,
- Others:
  - University of Free State?

No-Till Research and Education at the University of Tennessee

- Started in the 1960s
- Major efforts in 1980's and 1990's
- Research Station at Milan, west Tennessee – all no-till since 1982
- Adopted by majority of farmers > 80 % all crop land



Background

- World Congress of Conservation Agriculture – Nairobi, 2005
- "Development of No-Till in Tennessee"
- August Basson to TN, 7 / 06
- UT team to Lesotho, 3 / 07
- Signed MOU with National University of Lesotho - Sept. 30, 2007
- Grants:
  - UT ~ $5k (2007)
  - USDA ~ $100k (2008-11)
  - SANREM (2010-14)

Lesotho

- **"Kingdom in the Sky"**
- **Over 80% of the country lies above 5,900 ft**
- **Population 2,3 million (81% rural)**
- **11,720 square miles**
- **Economy: water & electricity, agriculture, livestock, & labor**

Study Site

- Maphutseng Valley
- Lowlands
- Very Badly affected by gully erosion

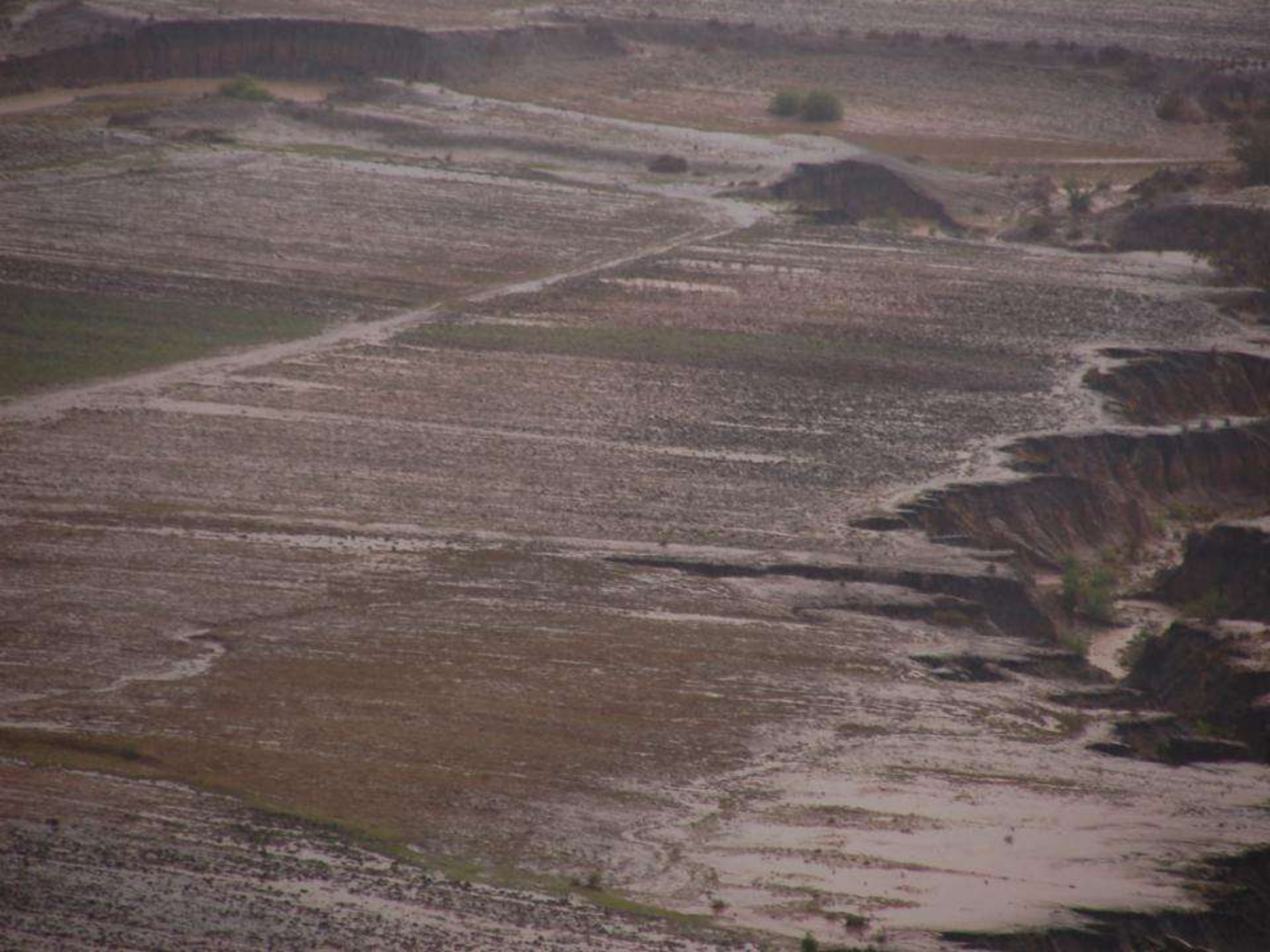
Agriculture

- Small farms: 5 acres per family
- 86% of resident population involved
- Mostly women (35% men in SA)
- Produces 15 to 30 percent of food needs
- Corn, sorghum, wheat, beans, peas
- Cattle, sheep

Issues

- Gender: tractors, weeding and inputs
- HIV / AIDS: labor, access to inputs
- CA system that appears to work – no data!
- Lack of a functioning R & D program and recommendations
- Different soils, climate, high erosion rates
- Influence of South Africa
- Economics
  - Tractors vs household labor
  - Scaling up issues
  - Gender


KUBOTA



Costs/benefits of Likoti

Benefits

- Better control over plant populations and fertilizer applications
- More efficient fertilizer use
- Soil improvement
- Better moisture penetration

Costs

- Higher than conventional when farmer uses own plough, planter, and own animals
- Cheaper with herbicide assistance and when planting is contracted
- Labor constraints and weeding

Maphutseng: 2007 - 2008

- Planted early
- Increased plant populations
- Fertilizer use
- Managed weeds
- Yields similar to Tennessee (from 7 to 95 bushels)
- Village exported food for 1st time in 30 years

No-till benefits for Small Scale Farmers in Lesotho

- More timely planting
  - Increased yield potential (4 week delay = 50% lower yield?)
- Labor:
  - Prepare fields prior to rain
  - Weeding
- Reduction in soil erosion losses
- Improvements in soil organic matter
  - Soil structure improved – more infiltration, better soil moisture, soils nutrients etc.
  - Depends on residue cover management

Challenges for Small-Scale Farmers

- Community Meeting at Tebellong, Lesotho - March 23, 2007
- 1 to 5 years experience with Conservation Agriculture
- Challenges
  - Animals
  - Weeding
  - Residue cover

Animals

- Grazing of animals on residue during dry season
- Should they be excluded??
- Local laws needed to protect the residue
  - Enforcement?

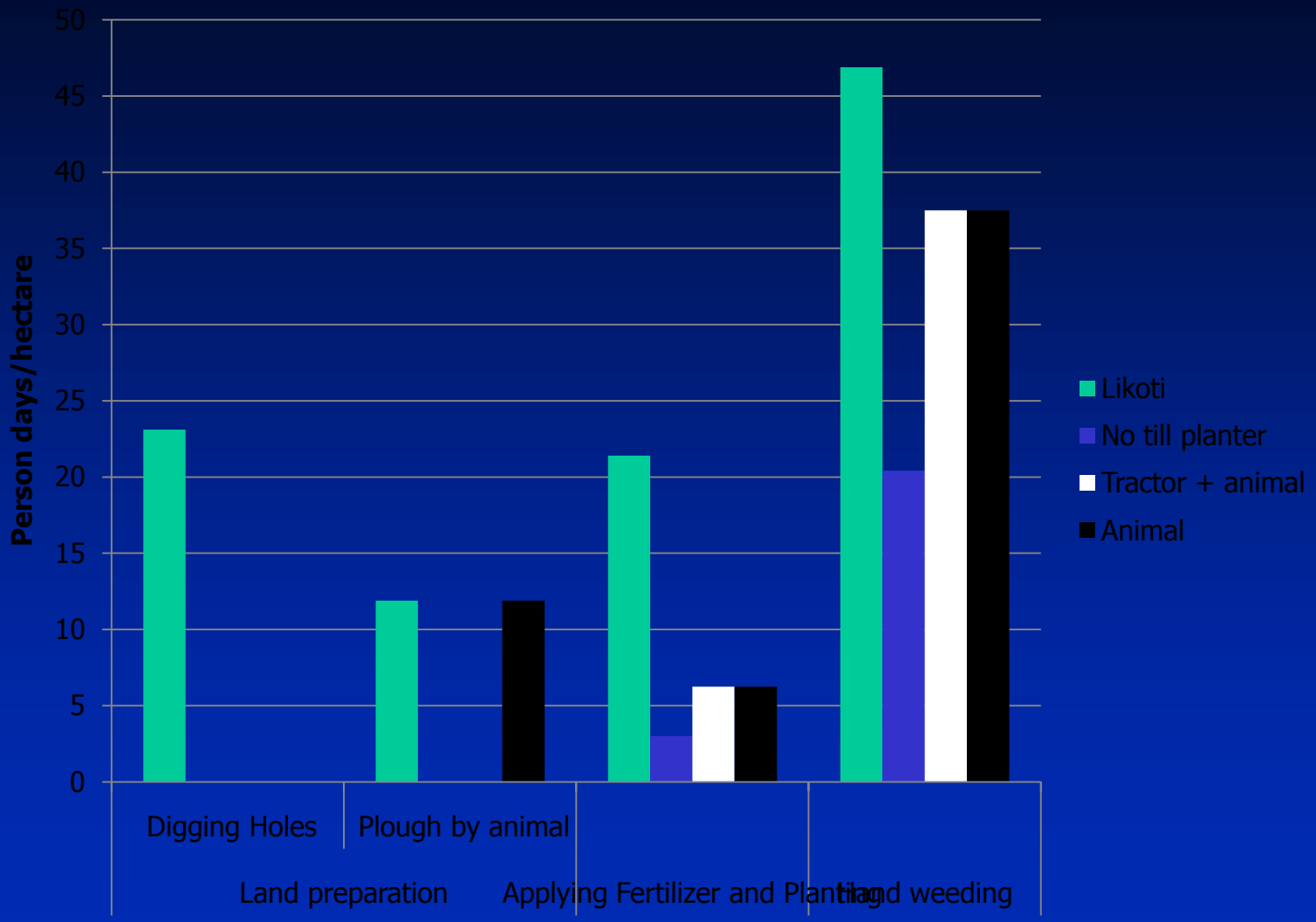
Weeding

- Hand-weeding more labor intensive
  - Scaling-up ?
- Gender issue – mostly done by women
- Use of herbicides to reduce labor?
  - Much cheaper!
- Cover crops!

Residue

- First years can be a challenge
  - Bring in residue from outside?
  - More cover as residue builds-up from previous crops
- Conversion from plowing to no-till may take 3 to 4 years
- Livestock interactions
- Agroforestry
- Cover crops

Person days/hectare and cultivation activities



Preliminary numbers, 2009 – 2010 growing season

	Break-even yield	Person days/hectare
Conservation agriculture:		
No-till	1.9	59
Likoti	2.6	117
Conventional:		
Tractor and animals	2.6	80
Animal	2.2	92

Lessons Learned

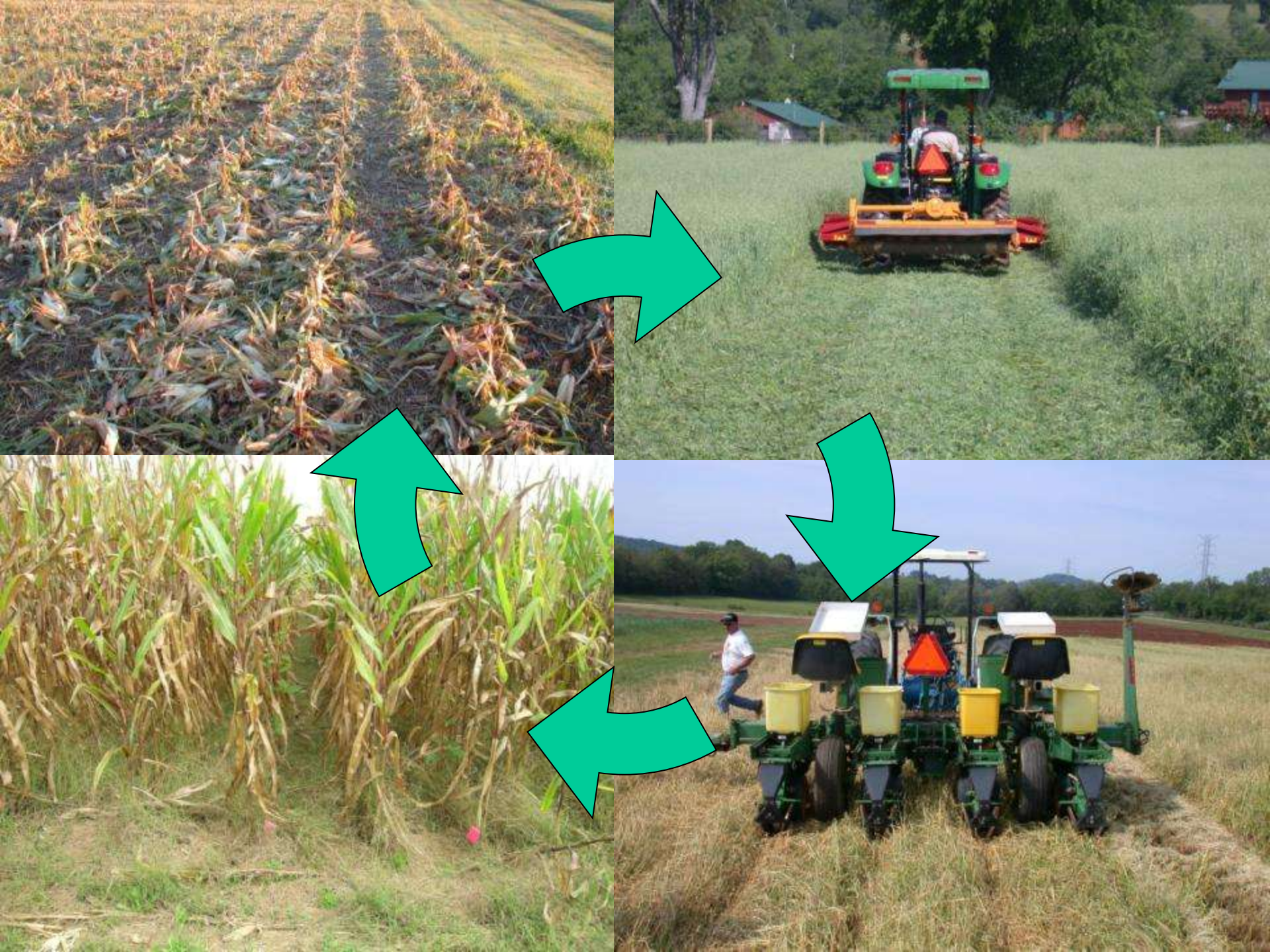
- Need a System and Data
  - CA is not a belief system!
- NGOs need close monitoring
  - CA is not a belief system!
- Pests happen (be prepared!)
  - Army worm
  - Stalkborer
  - Pollen beetles
- Variety selection
- Weeding is important
  - Even during Christmas!
- Involve the tractor guys

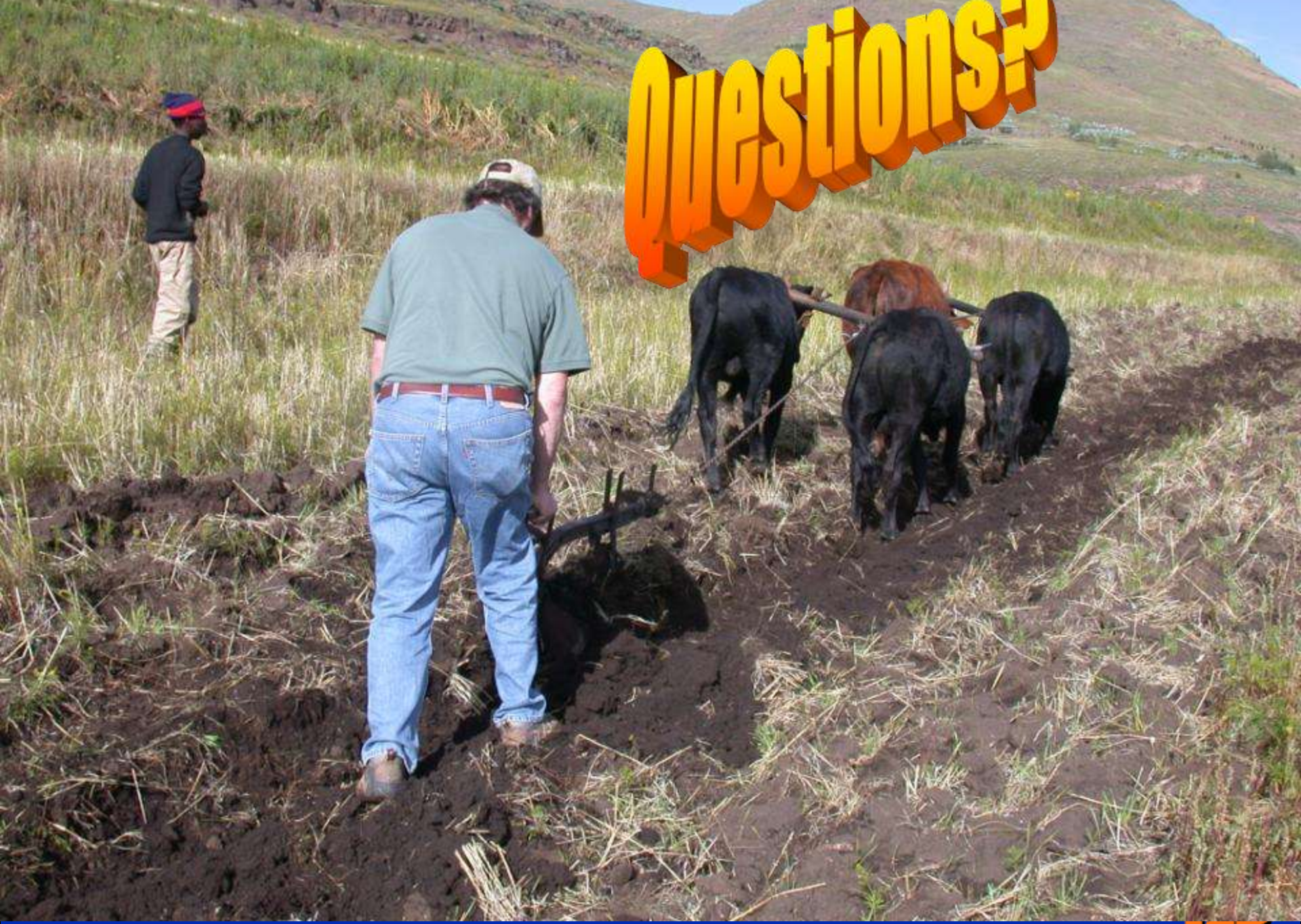
Approach

- Baseline and follow-up surveys
- Communities / systems that have CA: Lesotho (UT) & Mozambique (CIMMYT / UT)
  - What works?
  - What does not?
- Continue to develop CA system that works
- Iterative research
  - Replicated "on-station"
  - Farmer – yes / no
- Participatory methods
- Field days / demonstrations
- Training / curricula development
- Environmental data
  - Carbon

Bowen's Ratio Energy Balance

- Less sensitive but real data
- Measures:
  - Evapotranspiration
  - Net radiation
  - Soil heat flux
  - Infrared CO_2 analyzer
  - Dry and wet bulb T




Questions?