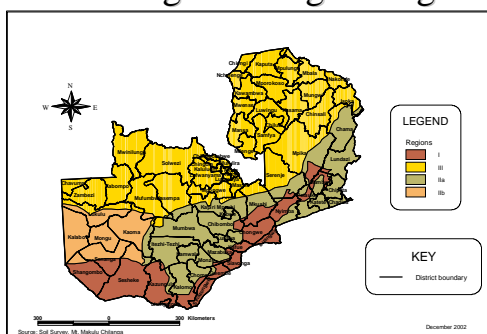


Lessons Learned from Zambian Experience with Conservation Farming

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Suitable agro-ecological regions



Zambian CF package developed for:

- Southern agro-ecological zones: AEZ 1 and 2a
- Low rainfall regions: under 1,000 mm rainfall
- Clay or loamy soils

Outline

1. Zambia's CF technology
2. Origins
3. Farm-level impact
4. Adoption
5. Conclusions

1. Zambia's CF technology package

- Minimum tillage (basins or rip lines)
- Dry season land preparation
- Crop residue retention (no burning!)
- Crop rotations with legumes
- Reduced-but-precise mineral fertilizer application

Minimum tillage

- Hand hoe CF
- Animal traction CF

Minimum tillage: hand hoe



Minimum tillage: hand hoe

- Precise grid of 15,850 basins per hectare
- 60 cm by 90 cm grid
- Basins 15 cm x 30 cm
- Depth = below hoe pan

Minimum tillage: ripper



Minimum tillage: ripper



Minimum tillage: ripper



Dry Season Land Preparation



Crop residue retention



Crop rotations with legumes



Crop rotations with legumes



Crop rotations with legumes



Crop rotations with legumes



Reduced-but-precise mineral fertilizer application



1. Zambia's CF technology package

- Minimum tillage (basins or rip lines)
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Agronomic Gains from CF

CF Technology Package	Impact
Minimum tillage	Saves energy (fuel) Breaks pans Reduces soil compaction Water harvesting
Dry season land preparation	Avoid peak-season labor bottlenecks Early planting (1-2% yield gain per day)
Crop residue retention	Build up organic matter Improve soil structure Improve water retention Moderate soil temperature
Crop rotation with legumes	Improve fertility
Reduced-but-precise mineral fertilizer application	Improve fertility

Water retention due to:

- Basins and rip lines harvest water
- Soil organic matter build-up in basins and rip lines
- Minimum tillage favors water penetration in basins and rip lines
- Mulches from crop residues

Gains from early planting



Gains from early planting



Gains from early planting



Planted December 20

Planted November 11



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2. Origins of CF in Zambia

- Commercial farmers experiment with minimum tillage technologies (mid 1980's)
- ZNFU establishes CFU to develop hand hoe CF package for small farmers (**1996**)
- Animal traction model developed at GART (**mid-1990's**)
- Early extension efforts (**1996-2006**): Dunavant Cotton, CLUSA, others
- Large-scale extension (**2007 onwards**)

Motivation for CF in Zambia

- Declining soil fertility
 - Acidity build-up
 - Soil erosion
 - Soil hard pans (Plowing, Hand hoe, Compaction)
- Moisture stress due to drought
- Rising fertilizer prices (subsidy removal)
- Rising fuel prices (devaluation)

Plow-pan damaged land



Early extension efforts



Unique features

- Technology diffusion from large to small farmers
- Strong private sector role: national farmers' union, cotton companies

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3. Farm-level impact

- Hand hoe CF farmers
- Animal traction CF farmers

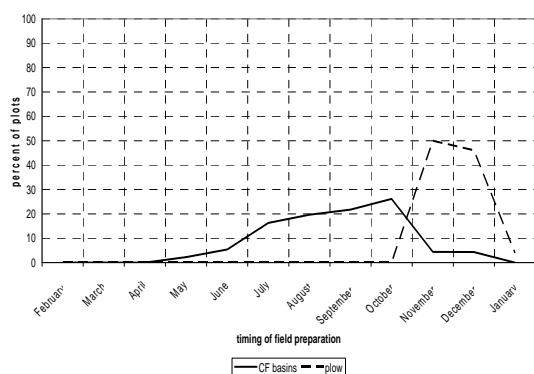
Impact of hand hoe CF farming

- **Higher yields** (early planting, water harvesting, improved soil structure raise yields 50% to over 100%)
- **Higher returns** (returns to peak season labor +60%)
- **Change in agricultural calendar**
- **Higher weeding labor initially**

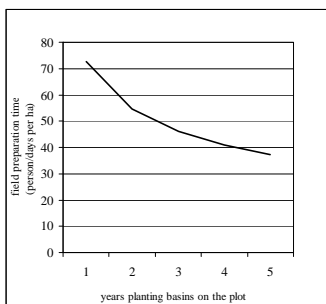
Sources of higher yields

	Yield (kg/ha)	
	Cotton	Maize
Conventional plowing	820	1,350
Conservation farming basins	1,280	3,000
Sources of difference		
higher input use	90	500
early planting*	40	400
water harvesting in basins*	330	750
total difference	460	1,650

Requires changing agricultural calendar



Higher weeding labor
 Lower total peak season labor
 Land preparation labor subsides over time



Better management

- earlier planting, 14 days
- input precision
- water harvesting



Impact of animal traction CF

Maize, Eastern Province

	Ripper	Conventional
Planting date	3-4 weeks early	
Yield	2,350	1,479
Returns to land	\$202	\$86

Cotton, Eastern Province

	Ripper	Conventional
Planting date	3-4 weeks early	
Yield	1,015	880
Returns to land	\$99	\$90

Source: Donovan and Tembo (2006)

Impact of animal traction CF

Maize, Southern Province

	Ripper	Conventional
Planting date	same	
Yield	1,224	1,122
Returns to land	\$56	\$36

Cotton, Southern Province

	Ripper	Conventional
Planting date	same	
Yield	780	697
Returns to land	\$81	\$61

Source: Donovan and Tembo (2006)

Impact summary

- Yield gains: 50% to 100%
- Higher returns to land and peak season labor
- Impact variable from year-to-year
- Benefits accrue over time

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4. Adoption: early indications

- Geographically clustered
- Self-selection by farmers with personal characteristics favoring precision farming
- Cotton farmers twice as likely to adopt CF as other farmers
- Incremental adoption
- Disadoption occurs among some farmers and promotional institutions

Geographic clustering

District – farmer type	% adopting CF basins
Nangoma – cotton farmers	27%
Keembe – cotton farmers	24%
Mulendema – cotton farmers	20%
Zambia average – cotton farmers	15%
Zambia average – all farmers	8%
Sinezongwe - cotton	0%

Incremental Adoption

HH experience with CF	Area under Cotton	CF Maize
1 year	1%	11%
2-3 years	22%	25%
4 + years	44%	31%

Adoption guesstimates

Year	Estimated adopters
1995	0
2001	40,000
2002	100,000
2003	50,000
2007	150,000*

Factors favoring adoption

- Location
 - Erratic rainfall
 - Cotton zone
- Household
 - Few cattle
 - Female
 - Disciplined
- Group leader's example
- Personal characteristics
 - Disciplined
 - Organized
 - Good planning skills

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5. Conclusions

- Unusual technology transfer: commercial to small farms; strong private sector role
- Very recent innovation (began 1996, big push from 2007)
- Solid agronomic benefits from Zambia's CF
- Early evidence suggests that CF out-performs conventional methods (higher productivity, higher income, soil fertility maintenance)
- But requires major changes in cropping calendar and management timetable

5. Conclusions (cont.)

- Extension support necessary
- Knowledge-intensive management practices require more extension efforts than new seed varieties
- Full benefits likely to be achieved over time
- Principles can work in Mozambique; packages would need to be tailored to local soils and agricultural calendars