Conservation Farming Unit

Two issues to be addressed

The perception that CF is labour intensive

The perception that adoption is low among SSF’s
The issue of labour

To answer this question we have to:

1. Define what CF is and what it is not
2. Understand how it is done
3. Understand what farmers were doing before
The key principles of CF as we know it today were pioneered in the USA in the aftermath of the Dust Bowl

- Minimise soil disturbance to the extent possible
- Maximise soil cover to the extent possible
- Diversify cropping patterns to the extent possible
What CF is: CF/CA Definitions in Zambia

**Improved Reduced Tillage (IRT)**
Inadequate residues either grazed off by communal livestock or burnt off intentionally or unintentionally as a result of uncontrolled bush fires, insufficient or no rotations with legumes. Correctly spaced **permanent planting basins or ox/mechanised rip lines** established across the slope before the rains. Early planting of all crops.
Conservation Tillage (CT)
Inadequate or no crop rotations, residues retained with more or less 30% cover. Correctly spaced permanent planting basins or rip lines established across the slope before the rains. Early planting of all crops.
Conservation Farming (CF)
As above with about 30% of cropped land occupied by legumes.

Farmers will shift between the above definitions depending on prices, market opportunities, exchange rates, government subsidies and many other factors that influence the proportion of crops they grow.
Conservation Agriculture (CA)
CF + the establishment and survival of a minimum of 50 *Faidherbia albida* trees per hectare.
What CF/CA is Not

There seems to be a lack of understanding that foundation of CF is **Minimum Tillage**

The definition CA appears to encompass just about everything and therefore nothing.

Pit farming, manuring, composting, fallow cropping and agro-forestry applied individually or collectively cannot qualify as CF/CA if MT is not observed.
What CF/CA is Not
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Maize/Tephrosia Intercrop based on ridge splitting is not CF
CF is extremely flexible

It can accommodate a wide range of planting configurations.

Many different crops and cropping systems, including rotations, inter-crops, relays, agro-forestry trees etc.

It can accommodate non-organic and organic supplements or combinations of these.

However if any of these systems involve excessive soil disturbance or overall tillage they are something other than CF/CA
Conventional Hoe Tillage and CF Hoe Tillage

Labour Inputs

Annual Dry season Ridge Splitting

- Annual soil movement: 300 tons/ha
- Total in Malawi: > 540 million tons

Common in Eastern Province and universal in Malawi. Labour input: 30 to 35 SPD’s/ha
Breeched Ridges after storm Flow - Malawi
This practice is less common in Zambia. Usually confined to 0.25ha or less. Labour requirement **100 to 116 SPD’s/ha**
Dry Season Overall Hoeing

For hoe farmers overall digging is universal. Labour 50 to 70 SPD’s/ha
‘Jembe Scheme’ on cleared upland forest reserve Nyaharuru where landless farmers are allowed to cultivate for 2 to 3 years in exchange for establishing and tending tree seedlings. This area of hoed land is 150ha+. Over 150,000 tons of soil inverted by hand!

Hoeing denser Zambian soils to a depth of only 10cms as above equates to inverting 1,520 tons/ha
Wet Season Traditional Min Till – Gardens

Normally confined to homestead gardens. Mainly women

Small areas 1 lima or below

Holes dug haphazardly & Maize planted to be consumed early

Ash or organic refuse may be used

Gaps filled with Pumpkins, Okra, Indeterminate Cowpeas etc
Wet Season Overall Hoeing Zambia

Moderately common. SPD’s 25 to 35 SPD/ha
CF Dry Season Hoe Tillage

Zambia: Basins 12 x 30 x 20cms deep

Year 1 40 to 55 SPD/ha. Year 2 onwards 30 to 35 SPD’s/ha. Disturbed area < 10%. Soil Movement 80 tons/ha

Work can commence in May/June.

Labour spread over several months
Conclusions

Compared with practically all Conventional Hoe Tillage practices, CF Min-Till does not demand more labour.
Any form of conventional dry season tillage cannot confer weed control advantage of CF Hoe MT
Wet Season overall digging followed by planting
Kafue 27th November 2009

Wet Season MT planting to be followed by weeding
Dry season Hoe CF land prep. Situation after emergence of crop
Conclusions

Dry Season Hoe MT does not increase weed pressure or labour inputs compared with any conventional tillage practice applied before or after the onset of the rains.

Weeds are a problem for everybody. In Zambia families spend between 40 and 60 million days hoe weeding each year.
Conventional Ploughing and MT Ripping - Comparisons

**September:** Residues raked up and burnt. Soil totally exposed to early storms and sheet erosion.
September: The atmosphere is full of colloids and Zambia can hardly be seen from the air even at low altitude.
AFRICA – ACTIVE FIRE DETECTIONS  FEBRUARY AND AUGUST 2004
Conventional Ploughing and MT Ripping Comparisons

Ox Owner 40,000 to 50,000

Time to Plough 1 ha is 14 hours. Weed suppression 10 to 14 days
Ploughing and soil erosion

Zambia

November: The results of storm flow
Poor Crop Stand after Ploughing
Ploughing and Compaction

Compact layer at about 12-14cms
Skim Ploughing Degraded Land
Conventional Tillage Systems increase Climatic Risks

In Drier Seasons Panned soils stunt root development causing severe moisture stress.

Rainfall cannot infiltrate the soil and washes away
Conventional Tillage Systems increase Climatic Risks

In Wetter Seasons. Compacted soils cause water logging from impeded drainage
Field abandoned to Couch Grass Kapinga

Continuous ploughing and land degradation encourages Kapinga
Land degradation occurs gradually and we seldom notice the early symptoms.

Here it is too late. 10cms or **1,000** tons of top soil per hectare has been lost. Even the toughest weeds struggle to grow.
When soils are exhausted farmers **migrate** and encroach primary or rejuvenated woodland to exploit accumulated fertility. 

**Deforestation – Zambia 4th highest per capita in world?**
Waiting to plough with ‘Hired Oxen’ results in Late Planting

In Zambia many thousands of farmers have lost their oxen to Denkete Corridor Disease.

These farmers queue up to hire or borrow animals to plough.

The cost of hiring oxen to plough is between ZMK 225,000 to ZMK 275,000 per hectare

Our farmers are locked into systems that guarantee failure year after year.– Yield Zero. Weed inversion benefit Zero
Failure - Year after Year

31st March 2006

2005/6 was a perfect season but this lady like thousands of others failed
Ox Min-Till CF

Ripping cost 40% of ploughing
1ha 4 hrs. Ploughing 14 hrs

Dry Season Ripping with Magoye Ripper. Ripping Window 6 months. Contracting opportunities. Ploughing window 2 weeks?
Early April Ripping through physiologically mature Soya Beans
Ox Min-Till CF

Only 10% of the soil is disturbed. Weeds will emerge with crop. However we have not heard of many complaints regarding weed pressure.
Benefits of ripping

• Cheaper and faster than ploughing

• Ideal business for service providers

• Soil less exposed to erosion

• More accurate fertilisation and seeding possible

• More even crop emergence

• Some rainwater harvesting achieved

• Customers can plant with first rains – critical

• Much more efficient use of scarce oxen
In general farmers who say CF is too labour intensive are those who have lost their oxen and converted to hoe CF.

i.e. from the plough to the hoe
60 years of research shows on each hectare, mature trees supply the equivalent of 300kg of complete fertiliser and 250kg of lime.
Faidherbia trees at GART in Zambia: CF + FA = CA
Small-scale CA. Re-filling gaps always necessary to get full stand

Young *Faidherbia* trees on smallholder farm
2008/9 Season 40 Trials – Management Excellent

All plots Zero Fertiliser

Outside tree

Under tree
## Results of CFU Trials Under Mature *Faidherbia albida*, 2008/9 season 40 trials

<table>
<thead>
<tr>
<th>Region</th>
<th>Maize Yield (mt/ha)</th>
<th>Cotton Yield (mt/ha)</th>
<th>G’nut Yield (mt/ha)</th>
<th>Soya Yield (mt/ha)</th>
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<tbody>
<tr>
<td></td>
<td>Under</td>
<td>Out</td>
<td>Sign</td>
<td>Under</td>
</tr>
<tr>
<td>Central</td>
<td>4.85</td>
<td>2.07</td>
<td>*</td>
<td>0.87</td>
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<td>5.68</td>
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<td>South</td>
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<td>2.79</td>
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<td>Overall</td>
<td><strong>5.12</strong></td>
<td><strong>2.65</strong></td>
<td>*</td>
<td><strong>1.30</strong></td>
</tr>
</tbody>
</table>

**Notes:**
- Sign refers to significance of t-test at 0.05 level of significance
- * indicates significant difference between mean yields at 0.05 level of significance
- ns = no significant differences between mean yields at 0.05 level of significance
- Overall = across the various regions
Issue 2: The perception that adoption is low among SSF’s
Most of Agro-ecological Region IIa and small part of Ilb.
Mainly Zambia’s Maize & Cotton belts
The question is who is promoting CF on the ground with farmers in Zambia or elsewhere.

In Zambia it is being promoted in 17 Districts out of 73 occupied by 38% of the population. The CAP is the largest CF programme in Africa but Zambia families farming 1.2 million

157,000 farmers trained 4 times a year through a lead farmer system.

Adoption within IRT – CA envelope 180,000 on portions of land including 2006/7 baseline of 93,000.

Zambia Farming population 1.2 million

Zimbabwe 50,000 beneficiaries with adoption at about 30,000

Elsewhere in East Central and Southern Africa promotion is negligible.

Major lack of consistency. NGO’s become involved after drought years linking CF to food relief and delivery of input packs. After crisis is over they depart. Training poor, input packs not always delivered etc.