Ernährungssicherheit und Bodenmanagement: Illusion und Realität

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A bit about everything

- Conservation Agriculture
- Agro-ecology / Organic Farming

Conservation Agriculture
FAO definition:
1. Continuous minimum mechanical soil disturbance.
2. Permanent organic soil cover.
3. Diversification of crop species grown in sequences and/or associations.

What will Conservation Agriculture do?

- Carbon sequestration?
- Effect on yield or yield reliability?
- Impact on soil structure – less compaction!
- Slight increase in Plant Available Water (where is the increase?)
  + SOC +12% ~ 3.4 mm/10 cm soil
- Increase in infiltration rates – reduced erosion
- ... and some not so positive effects ...
Differences in organic carbon stocks (Mg/ha) with tillage, stubble management and nitrogen application for the 0-10 cm depth at the Hermitage trial, 2008 (LSD=0.6).

SB = stubble burnt
SR = stubble retained
N = nitrogen rates
Meta-analysis based on data from 69 paired-experiments indicated:

- Conventional tillage (CT) and no-tillage (NT) resulted in comparable soil C loss comparing with adjacent natural soils.
- In most cases, adopting NT did not increase the total C in the soil profile.
- Climatic conditions and fertilization did not significantly regulate the response of soil C to the adoption of NT.
- Double cropping systems (intercropping), total $C_{NT} > C_{CT}$
- Single cropping systems (mono-cropping), total $C_{CT} > C_{NT}$

**Soil C sequestration - Between Myth and Reality**

Adoption of Conservation Agriculture

- CA has been widely adopted by farmers in North and South America, and in parts of Asia.
- Much less success with smallholders in Africa despite > 2 decades of research and development investments.
- Farming: business or ‘subsistence’?

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**Adoption of Conservation Agriculture**

<table>
<thead>
<tr>
<th>Country</th>
<th>CA in 1000 ha</th>
<th>CA % of cropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>19719</td>
<td>58.9</td>
</tr>
<tr>
<td>Brazil</td>
<td>26500</td>
<td>38.3</td>
</tr>
<tr>
<td>Australia</td>
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<td>26.9</td>
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<td>Canada</td>
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<td>USA</td>
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<td>South Africa</td>
<td>368</td>
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<td>China</td>
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<td>0.8</td>
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<td>0.2</td>
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<tr>
<td>Morocco</td>
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</table>

Problems with Conservation Agriculture

Generally related to maintaining biomass on the ground and the reason why to cultivate!

- Pest and disease management

Roundup resistance

After Preston 2012.

Herbicide resistance is potentially a major threat for ongoing use of CA
Use of "occasional" tillage!

Stratification of nutrients and organic carbon

Strategic/occasional tillage

What is it - when to apply?

Depending on objective:
- Post harves - early fallow, Prior to weed flowering
- Blades, discs, tines, plough...
- Pest and disease management, nutrient stratification, stubble management, weed control
- Generally shallow cultivation, but for nematodes 45 cm
- 1 – 3 times per year???
The Conservation Agriculture ‘push’ in Africa [or ‘putsch’?]

- ‘Push’ of Conservation Agriculture in Sub-Saharan Africa as a means to overcome continuing poor profitability, food insecurity and soil degradation on smallholder farms
  - FAO, Worldbank
  - Several donors: SIDA, Norway, USAID, DFID, AFD, ...
  - Several NGOs: CARE international, Worldvision, foundations for Farming, ...
  - Research institutes such as CIMMYT, ICRISAT, CIARD and CIRAD
  - Governments in southern and eastern Africa have endorsed CA as a pathway to food security

- Often promoted as a “panacea” or “silver bullet”

In Zambia, conservation agriculture has helped vulnerable households pull through drought and livestock epidemics. In the 2000-2001 drought, farmers who used conservation agriculture managed to harvest one crop, others farming with conventional methods faced total crop failure. — FAO news release October 4, 2005

Conservation Agriculture

- Benefits:
  - Reduced labour/cost ...
  - Reduced erosion
  - Yield ...
  - Cost effective

- Problems:
  - Livestock interactions
  - Herbicide resistance
  - Disease control
  - Yield gap – soil dependent?
  - C-sequestration? – probably NOT!

CA is and probably will remain, for the foreseeable future, a method for sustainable intensification

BUT let’s not spoil its potential by promoting a wholesale push for adoption!
For some, reduced tillage and maintaining ground cover = CA

Beware of the limits where ground cover can stop erosion!

If land is too steep, soil management may not control erosion and land use may need to change.

Agro-ecology

Forum for Food Sovereignty in Sélingué, Mali, 27th Feb 2007

⇒ Declaration of Nyéléni

New 'push' for Agroecology with FAO meetings in 2015

1. Latin America - Brasilia, Brazil in June
2. Africa – Dakar, Senegal in November
3. Asia-Pacific – Bangkok, Thailand in November
After Michel Griffon, 2013. Qu'est-ce que l'agriculture écologiquement intensive?

Sustainable intensification / Agro-ecological intensification

Is it the same?

Definition of agro-ecology

An ecological approach to agriculture that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices

What are agro-ecology practices - are they consistent, ambiguous, realistic, where can they applied?

Ecologically sustainable management of rural land

- Generates its own nutrients
- Does not rely on fossil fuels
- Has high energy/output ratio
- Has high species diversity
- Has high resilience
- Has a built-in means of controlling pests and weed
- Is integrating with native ecosystems

Food/fibre production components

- Agroforestry
- Alley farming
- Conservation Agriculture (CA)
- System of Rice Intensification (SRI)
- Integrated Pest Management (IPM)
- Permaculture
- Vermiculture
- Composting
- Organic Farming
  - Compost teas
  - Biochar
  - NO Genetically modified organism (GMO)
- ...

Organic Farming

No use of agro-chemicals:
- pesticides, fertiliser, herbicides, growth hormones

More:
- Uses ecological processes,
- Promote fair relationships,
- Organic certification, bio-d

Common knowledge about artificial fertiliser:

Quotes from farmers:

- The food is unhealthy, tastes bad.
- If you use chemical fertiliser, our women will become infertile (Ethiopia)
- It poisons the ground and makes it sour (PNG)
- It is the Suanggi (West Papua)
- Biological transmutation (Ca + e = K)
- Microbes will make nutrients
Where do these powerful messages come from?

- non-reviewed internet sites => accessible everywhere!
- Free-online journals, pay to publish and the push to publish!
- NGOs who lack technical expertise => who are the volunteers?
- extremists @ where faith is more important than fact!
- EU ?
  - What is the real reason why organic farming is promoted and so successful in the EU?
  - Waste management!

Back of the envelop calculation

- Global cereal grain production
  - 2015/16 forecast: 2.529 million tonnes (FAO)
  - Total N content of the cereal grain @ 1-2% => ~50 million t N
- Global area under legume grain production
  - 2006-2008: 62 million ha (CGIAR)
  - Total N fixation @ 100 kg N/ha (GRDC) => ~6 million t N fixed
  - Total manure output 10-30 (20) kg N/beast
    - 30 kg N/beast from ~30 million t manure

Nutrient accumulators and emitters (resource relocation)

- Urban areas ← Rural regions
- Organic waste recycling/reuse
  - Plant material
  - Animal Waste
  - Human Waste

This calculation is very rough and only shows orders of magnitude, but the numbers do not add up without mineral fertilizer
Do we learn from the past?