Alternatives to Open Burning:

Conservation Agriculture – the Climate-Smart Agriculture in Global Practice.

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Global Conservation Agriculture Network and Government of Alberta

Content.
➢ Why burn?
➢ What is Conservation Agriculture, CA?
➢ Drivers for adoption?
➢ Global policy examples
➢ Climate smart
➢ Future opportunities and levers.
Why Burn?

- Clearing land
- Diseases, pests
- Physical impediment of residue
- "Cheap"

Conventional agriculture

- Erosion – water, wind
- Soil degradation
- High operating costs
- Environmental costs
Conservation Agriculture

- No Till
  - Less C oxidation, nutrient cycling
- Keep the land covered
  - Residue, cover crops
- Diverse crops
  - Rooting, decay, nutrients
Grassland Species

Relative rooting depth of some crop plants

Pea  Corn  ½ Potato  S. Wheat  W. Wheat  Alfalfa
CA drivers for adoption

- Farmers – self organized
- Institutions – barriers and bright lights
- Industry – innovation, leadership
- Policy – government programs, incentives, R&D, supportive frameworks
- Public – private policy development and traits (government issues)

Catalysts for CA adoption

- Education – extension,
- Leadership – farmers, organizations
- Research – answers
- Systems thinking
- Linkages
- Government support – R&D, Aid
- Private policy, service providers

Goddard et al. 2019
From 0.58% to 1.74% SOC →

✓ 160 .... to 37 kgN/ha
(4X savings)
✓ 19 – to –104 kg wheat/kg N fert
(+4.5X efficiency)

(Carvalho, 2012. Portugal)

Farmer Field Schools, Arusha, Tanzania (Owenya, 2011)

**Conventional**
plough 2X,
Maize +P.Pea +beans +pumpkin
Total Yields = 3.01 t/ha

**CA**
Maize + P.Pea or Lablab

<table>
<thead>
<tr>
<th></th>
<th>M+PP</th>
<th>M+Lablab</th>
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</thead>
<tbody>
<tr>
<td>No Rip</td>
<td>-9</td>
<td>50</td>
</tr>
<tr>
<td>Rip</td>
<td>37</td>
<td>78</td>
</tr>
</tbody>
</table>

Land preparation, seeding, weeding

CA required 35% of time and 50% of labour of Conventional
Haryana, India: CA rice-wheat–(mungbean), 4 yr. (Jat, 2018)
✓ Improved soil properties and nutrients
✓ 30% N fertilizer savings
✓ 50%+ K fertilizer savings

(Boincean, 2014. Moldova) - Crop Yield - % change

<table>
<thead>
<tr>
<th></th>
<th>UnFert. delta %</th>
<th>Fert. delta %</th>
<th>Fertilization delta %</th>
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<tbody>
<tr>
<td>W. Wheat</td>
<td>Cont.</td>
<td>--</td>
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<tr>
<td>W. Wheat</td>
<td>Rotation</td>
<td>143</td>
<td>82</td>
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<td>S. Beets</td>
<td>Cont.</td>
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<td>--</td>
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<tr>
<td>S. Beets</td>
<td>Rotation</td>
<td>281</td>
<td>153</td>
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<tr>
<td>Maize</td>
<td>Cont.</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Maize</td>
<td>Rotation</td>
<td>43</td>
<td>7</td>
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</tbody>
</table>

“Across environmental zones, overall CONV had consistent **negative** effects on soil functions whereas CA and its component practices had overall **positive** effects on soil functions.”

(Ghaley, 2018. pan EU)

(5 soil functions: productivity, carbon, water, nutrients, habitat)
Global adoption

Global uptake of CA

+89% in last decade

+17 times since 1990

Kassam et al. 2018
<table>
<thead>
<tr>
<th>Policies Used</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>equipment subsidy</td>
<td>Argentina</td>
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<tr>
<td>tax stimulus</td>
<td>Argentina</td>
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<tr>
<td>cooperative research workshops, think-tanks</td>
<td>Argentina</td>
</tr>
<tr>
<td>multinational policy</td>
<td>Brazil</td>
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<tr>
<td>national Gov support</td>
<td>Brazil</td>
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<tr>
<td>local Gov support</td>
<td>Brazil</td>
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<tr>
<td>foreign aid agencies</td>
<td>Paraguay</td>
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<tr>
<td>specific CA agencies</td>
<td>Paraguay</td>
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<tr>
<td>cross compliance</td>
<td>Paraguay</td>
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<tr>
<td>farmer groups</td>
<td>Paraguay</td>
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</tbody>
</table>

**PUBLIC POLICY**

- **Regulatory**
  - Command and control
  - Flexible, market based

- **Non Regulatory**
  - government
  - farmer focus

- **Infrastructure**
  - government agency
  - research organization
  - Institutions

- **Education**
- **Finance**
- **Social linkages**

**PRIVATE POLICY**

- Self organized - farmer
- Farmer-industry collaboration
- Industry/corporate policy

Goddard et al. 2017
Climate Smart Agriculture, CSA

... “is an integrated approach to managing landscapes—cropland, livestock, forests and fisheries—that address the interlinked challenges of food security and climate change.” World Bank.

CA –
✓ Reduces - erosivity, erodibility, erosion, evaporation, temperature stress
✓ Increases carbon storage, lowers GHG emissions
✓ Improves - soil health, fertility, pests, yield and variance, profit

Conclusions
✓ Rapid increase in CA
✓ Soil system change
✓ Cropping system change
✓ Future ≠ past

Paradigm Shift?

• Rotation effect ↔ yield increase of 7% - 150%
• Fertilizer reduction ↔ 30% - 75% less N = same yield
• Insects on CA landscapes ↔ gains 24% of the yield gap

Better research? Farmer experience (‘citizen science’)? Better information, education?
Future?
- levers and opportunities

- Governments –
  - climate policy, SDGs, sustainability metrics,
  - Agriculture policy, research policy

- Farmers –
  - equipment investments, inputs, yield risks, sustainability metrics

- Industry –
  - New equipment markets, tech, service providers

- Public –
  - Awareness, concerns, food safety, environment

- IOE –
  - R&D beyond institutions, citizen science, service providers

Change is complex
Scales of
✓ time,
✓ space,
✓ politics,
✓ geography

Government
Farmer organizations
Private Sector
Key players
- Research/Education
NGOs
Media

(Lalani, 2017)
The END

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