Revival of Conservation Agriculture GPP

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Conservation Agriculture

- **Conservation Agriculture**: a promising and widely-adaptable form of sustainable agricultural intensification
- The term generally used for a diverse array of crop management practices that involve minimal disturbance of the soil, retention of residue mulch on the soil surface and use of economically viable crop rotations
- About 110 million hectares around the world, of which 50% found in non-OECD
Conservation Agriculture Impacts

- Reduces soil erosion, improves moisture conservation, and builds organic matter
- Saves labor, fuel and reduces turn-around time in multiple cropping systems
- Recently adopted on 2 million ha in Indo-Gangetic Plains and 300,000 ha in sub-Saharan Africa
R4D in Conservation Agriculture

- Research on soil and crop management
- Adaptation to farming systems in a manner that provides immediate, easily perceivable economic benefits to farmers
- Sustainable management of agro-ecosystem productivity and diversity, while minimizing unfavorable environmental impacts
Direct seeding, Conservation tillage, Residue retention, Drip Irrigation
Average wheat grain yield of various crop managements in a rain-fed, annual crop production system from 1996 to 2004

Returns over variable costs in Mexican peso - LSD at 0.05 = 352 Pesos
Impacts in the Indo-Ganges (and relating to climate change)

- Net savings of 50 liters of diesel per hectare, significantly reduced labor and water use, and lower CO2 emissions
- Reduced tillage can offset water shortage
- Better soil cover, moderate soil temperatures, and lowering evaporation of irrigation water
Knowledge Sharing and Capacity building

IARCs’ Core Programs

Systems Research Coordinated by RWC

Participatory validation and refinements of technologies

Research programs

Participatory needs assessment by NARS/Extension/NGOs

Technology Dissemination

Farmers

Private input/Service providers
Results in the field – Zimbabwe

Zimuto - Effect of CA on Maize Yield on Farmers' Fields

- Very sandy soils – 93% sand
- Apparent cumulative effect over the 3 seasons is an effect of rainfall
- Rip-line seeding very variable
- Direct seeding significantly better ($P < 0.05$)

Mr. Makwara’s Field - Zimuto

Direct seeded Farmer’s Check
Zimbabwe: working with and through partners

A farmer group organized by the NGO Total Land Care’s Chia Project at their conservation agriculture demonstration plot. For them it is a demonstration, for the researchers it is a replication of a multi-site on-farm trial.

Participants from the national research and extension program try out an animal traction direct seeder during a conservation agriculture course in Zambia.
Is strategic research possible if the techniques are site-specific?

- Yes! The principles are widely adapted
- Component technologies often have fairly large, distinct, but overlapping, recommendation domains.
  - Equipment
  - Fertilizer strategies
  - Crop rotations
  - Weed control measures
Use of crop residues, cereal yields and cropping risk levels

- Northern Europe
  - Bajio (Mexico)
- Indo Gangetic Plains
- Southern Brazil
- Balaka Malawi
- Lowland Bolivia
- Shamva
- Northern Kazakhstan
- Zimuto
- Southwestern Zimbabwe

Use of residues (for animal feed)
Potential biofuel feedstock from intensive cropping systems

- After tractor-shredding, Punjabi farmers burn annually rice straw (about 13 million t)

Straw burnt in India (million t yr⁻¹)
Source: B.S. Pathak, ICAR, India, 2005

<table>
<thead>
<tr>
<th>Crop residue</th>
<th>Total waste</th>
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<tbody>
<tr>
<td>Rice straw</td>
<td>13.1</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>15.4</td>
</tr>
<tr>
<td>Sugarcane trash</td>
<td>21.6</td>
</tr>
<tr>
<td>Groundnut haulm</td>
<td>3.3</td>
</tr>
<tr>
<td>Mustard stalk</td>
<td>4.5</td>
</tr>
<tr>
<td>Cotton stalk</td>
<td>11.8</td>
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</tbody>
</table>
Crop residues and biofuel feedstock in dry lands

- Removal of crop residues contributes to water runoff, soil erosion and, through loss of soil organic matter, long-term degradation.

- Agronomists need to define the minimum thresholds of crop residues for sustainable production in particular farming systems, especially in low-yield rainfed systems.

Source: Rachid Mrabet, INRA, Morocco
Building on early successes: Conservation agriculture

• The program shall catalyze innovation systems in “R4D” partnerships with conservation agriculture networks and farmers’ associations

• The program therefore will act as integrator (rather than solely as technology provider) to address issues emerging within the new, better, intensive, diverse, sustainable and more profitable agro-ecosystem
Increasing the productivity, sustainability, equity, and water use efficiency of dry-land agriculture, while protecting downstream water users in Yellow River Basin.
Soil and water runoff collectors at the base of the erosion plots (L) versus zero-till flax with residue from previous millet crop in erosion plots (R)
The linear research and extension model

- Research and Extension Systems in the developing countries generally follow a linear model of knowledge development and flow.

Researchers conducting formal research in established institutions → Researchers Extension agents → Farmers

Basic research → Strategic research → Applied research

Technology transfer

Adoption

Knowledge flow
Participatory research and extension systems: knowledge - remodeling

For complex technology options, multi-agent *innovation systems* are required

Participation of stakeholders is essential

A simplified example of an innovation system – the role and importance of different players may change over time
Revival of Conservation Agriculture GPP

• **Purpose:** A global network to build capacity of selected NARS and draw international public goods from coordinated conservation agriculture innovation and learning hubs

• **Proposal:** A joint GFAR-led proposal for the establishment of a global conservation agriculture lesson learning network to establish and strengthen innovation and learning hubs
Conservation Agriculture Platforms

- Climate change adaptation
- Genotype x cropping system
- Impact-innovation system
- Capacity building

Hub research (NARS)

Strategic science research
Next steps

- Workshop of key stakeholders to identify key science knowledge gaps for conservation agriculture constraints to sharing, existing and new locations for research, and formulate the proposal
- **Participants:** About 15 to 20 scientists and stakeholders
- **When? Where? Who?:** First half of 2008, with participation and venue to be determined through consultation.
- **Output:** A workshop report identifying critical conservation agriculture research and knowledge development areas.
- **Resources:** GFAR will provide resources for formulation and CIMMYT to assist in-kind with staff who will facilitate the consultative process and proposal development
- **CIMMYT contact point:** John Dixon