CONSERVATION AGRICULTURE AS A CLIMATE CHANGE RESILIENT OPTION
– CASE STUDIES IN ASIA AND AFRICA

Yuji Niino

Food and Agriculture Organization of the United Nations,
Regional Office for Asia and the Pacific
39 Phra Atit Road, Bangkok Thailand 10200 Thailand

Yuji Niino holds a Ph.D. degree in Soil Science from Texas A&M University (USA) and is a Land Management Officer of the Food and Agriculture Organization of the United Nations (UN-FAO) Regional Office for Asia and the Pacific (RAP). He is in charge of promoting sustainable land use and management, soil and water conservation and soil productivity improvement.
ABSTRACTS

Natural ecosystems, in their altered states, have always been relied upon to support continuity of agriculture production and ecosystem services such as flood and erosion control, mediation of water quality, stream flow regulation, microclimate regulation, and biodiversity in its various forms. Improper agricultural practices can reduce the ability of ecosystems to provide food and other services. But efforts to promote food security and environmental sustainability can often reinforce each other and enable all farmers to adapt to and mitigate the impact of climate change and other stresses. Some of these efforts would be based on appropriate technologies such as Conservation Agriculture (CA) and practices that restore natural ecosystems and improve the resiliency of farming systems, thus enhancing food security.

CA principles translate into a number of locally-devised and applied practices that work simultaneously through contextualized crop-soil-water-nutrient-pest-ecosystem management at a variety of scales. According to FAO (2008, 2012), the adoption of CA has resulted in savings in machinery, energy use and carbon emissions, a rise in soil organic matter content and biotic activity, less erosion, increased crop-water availability and thus resilience to drought, improved recharge of aquifers and reduced impact of the variability in weather associated with climate change (drought, floods, heat, cold).

In Asia and the Pacific region, the rate of increase in crop yields has slowed and yield gains are becoming difficult to maintain because of the degradation of land and water resources upon which agriculture is depends. In the region, agriculture in general has been changing from traditional subsistence farming to ‘modern’ commercial farming at different rates in different nations. This has led to specialization in commercialized farming with mechanization, intensive tillage and increased agrochemical use, leading to destruction of soil health and soil ecosystem functions. The use of high levels of external inputs and labour-saving technologies has resulted, in some cases, to abandoning some of the important ecologically-based practices such as crop rotation and diversified cropping (Kassam et al. 2014).

The agro-ecosystems in Africa are facing increasing pressures as a result of rapid population growth, agricultural and livestock intensification characterised by progressive reduction in farm sizes, and unsustainable land use and management practices. The land and freshwater resource base, associated biodiversity and populations whose livelihoods and food security depend on those resources, are threatened by land degradation, declining productive capacity of croplands and rangelands, deforestation and encroachment of agriculture into wetlands. Climate change and variability aggravates these threats.

KEYWORDS
Conservation Agriculture, Land Degradation, Climate Change, Sustainable Land Management, Sustainable Crop Production Intensification

REFERENCES


Session A

Conservation Agriculture as a climate change resilient option

Yuji Niino
FAO Regional Office for Asia and the Pacific

Outline

- Sustainable crop production intensification
  - Focus on soil and ecosystem functions
- Conservation Agriculture
  - The concept
  - Impacts of CA
  - CA – the wider picture
- History and development
  - FAO’s role
  - Issues around CA adoption and scaling
- Conclusions

Extreme weather

Observed changes

- Increase in extreme weather events

Impact on the food system

Climate change is a challenge for food & agriculture systems

The most vulnerable
- Regions already food insecure, particularly smallholders in South Asia, Africa...
- In dry and tropical regions, agriculture productivity is projected to decrease
- Small-island States, drylands, mountainous areas etc.

Summary of Observed Impacts of Climate Change on the Agriculture Sector in Southeast Asia

Increase in hot days and nights
- Intense and devastating heat waves
- Extreme atmospheric phenomena
- Higher temperatures
- Increased frequency of droughts, floods, and tropical cyclones
- Crop growth
- Extreme weather events
- Crop yields
- Soil degradation

Source: FAO, 2009

... extended drought periods

Extreme precipitation...
A “triple win” with climate-smart agriculture?

Climate-smart agriculture: definition

CSA - an agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances achievement of national food security and development goals.

Sustainable Crop Production Intensification

Focus on soil and ecosystem functions:

Healthy soil is base for sustainable crop production

Soil tillage > degradation/erosion > natural soil formation = NOT sustainable

“Dirt – the erosion of civilizations” by David R. Montgomery

Soil is a fragile thin skin around the world

Soil formation is very slow, degradation very fast. Even with conservation tillage, soil erosion by winds or rains is orders of magnitudes higher than soil formation

The decline of important human civilizations can be related to erosion events and soil degradation (Greek, Roman etc.)

Conservation Agriculture

The Concept:

• CA involves core components, which are necessary, to make “no-till” sustainable

• CA in practice is characterized by three linked principles, namely:

Conservation Agriculture

Drivers for adoption:

• Erosion: North America, Brazil, China

• Drought: China, Australia, Kazakhstan, Zambia

• Cost of production: global

• Ecosystem services: global
Conservation Agriculture
Impacts:
• Increase of yields and production
• Less fertilizer use (~50%)
• Less pesticides
• Less machinery and labour cost (~70%)
• Higher profit
• More stable yields – lower impact of climate
  (drought, floods, heat, cold)
• Lower environmental cost (water, infrastructure)

Creating drought-resistant soil

History and Development
Global CA area (million ha)

Timor-Leste
Enhancing Food and Nutrition Security and Reducing Disaster Risk through the Promotion of Conservation Agriculture (2013–)
**History and Development**

**Issues around CA adoption and scaling:**
- CA is a concept – no blueprint
- Local adaptation works best in a farmer discovery/learning process – participation of private sector/input suppliers is crucial for uptake
- CA works through synergy – hence all three components are important (to some degree)
- Understanding of the concept is important for practice solutions for CA – in some cases “gradual” approaches work, in others full adoption is better

**Issues around CA adoption: Common perceptions**
- No-till needs more herbicides: tillage conserves seeds; multiplies micomes; CA has non chemical options for weed management
- No-till soils compact: compaction comes from traffic; no-till CA soil with mulch compacts less; biological tillage/SOM to “repair”
- Residues vs. livestock: CA produces over time more biomass; better IC-LS options/double purpose cover crops
- Residues tie nitrogen: only when soil and straw is mixed
- Residues carry pests and diseases: they also host beneficial fauna and flora; crop rotation is key
- Root crops and CA: no problem for most; some adaptation in harvest or cultivation

**Action Areas for Scaling-up CA**

- **Increase investments in sustainable agricultural practices**
  - public and private investment
  - policies and regulations – land tenure over multiple seasons; market guarantees
- **Enhance research, learning and knowledge sharing**
  - identify practices and technologies affordable to small-scale farmers (limited income, market access, inputs)

**Action Areas for Scaling-up CA**

- **Diversify agricultural mechanization and improve access to inputs**
  - regular supply of reduced-tillage equipment and seed stock for cover crops
  - manufacture of CA equipment locally
  - identify and market multifunctional seed stock
- **Establish new market opportunities**
  - niche and “green” markets
  - establishing GAP or organic certification processes
  - carbon sequestration compensation mechanisms

**Policy and Institutional Support for Conservation Agriculture in the Asia-Pacific Region**

Conservation Agriculture Alliance for Asia and the Pacific (CAAAP) established

http://www.caap.org/index.html
Conclusions

- CA addresses the core problem for sustainable agriculture with the deepest environmental footprint: soil tillage
- For SCPI and climate resilient agriculture, there is no “alternative” to CA
- CA has many local adaptations and there are different routes to adoption

“CA - there is no better way to farm”


Join the CA-CoP!