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Perspectives and experiences on Conservation Agriculture for Sustainable Intensification in Southeast Asia

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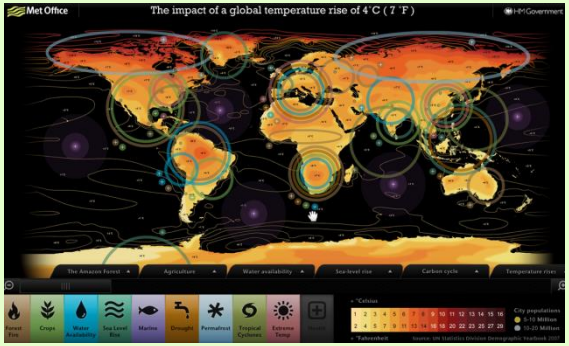
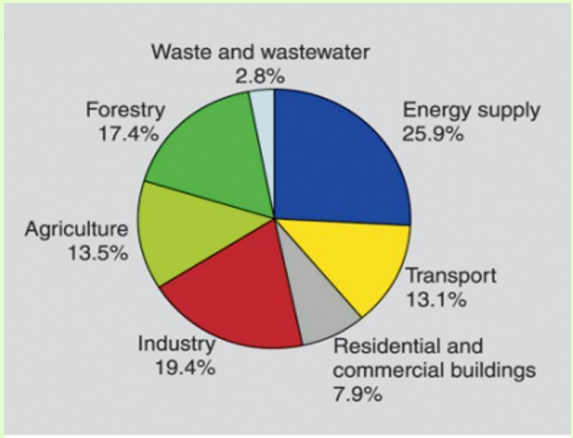
A triple Challenge for agriculture





- More food, in quantity, quality and diversity, everywhere for everyone

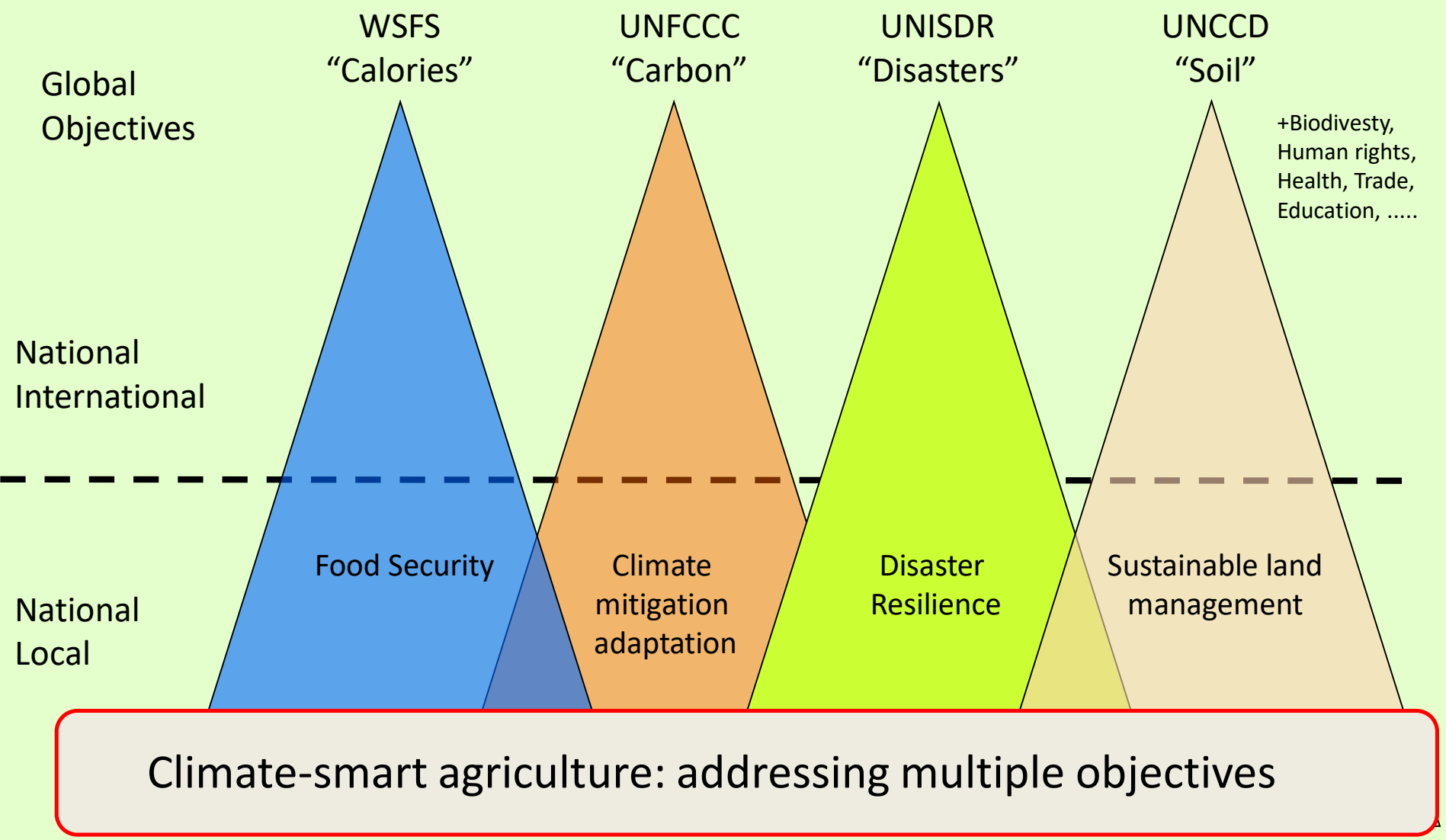
  (availability, acessibility, utilisation, stability)

- Adapt to Climate Change

- Contribute to mitigate Climate Change

  - Agriculture and Land use = 30% of emissions
  - Needs to be part of the solution ...

Overlaps, Synergies and Trade-offs



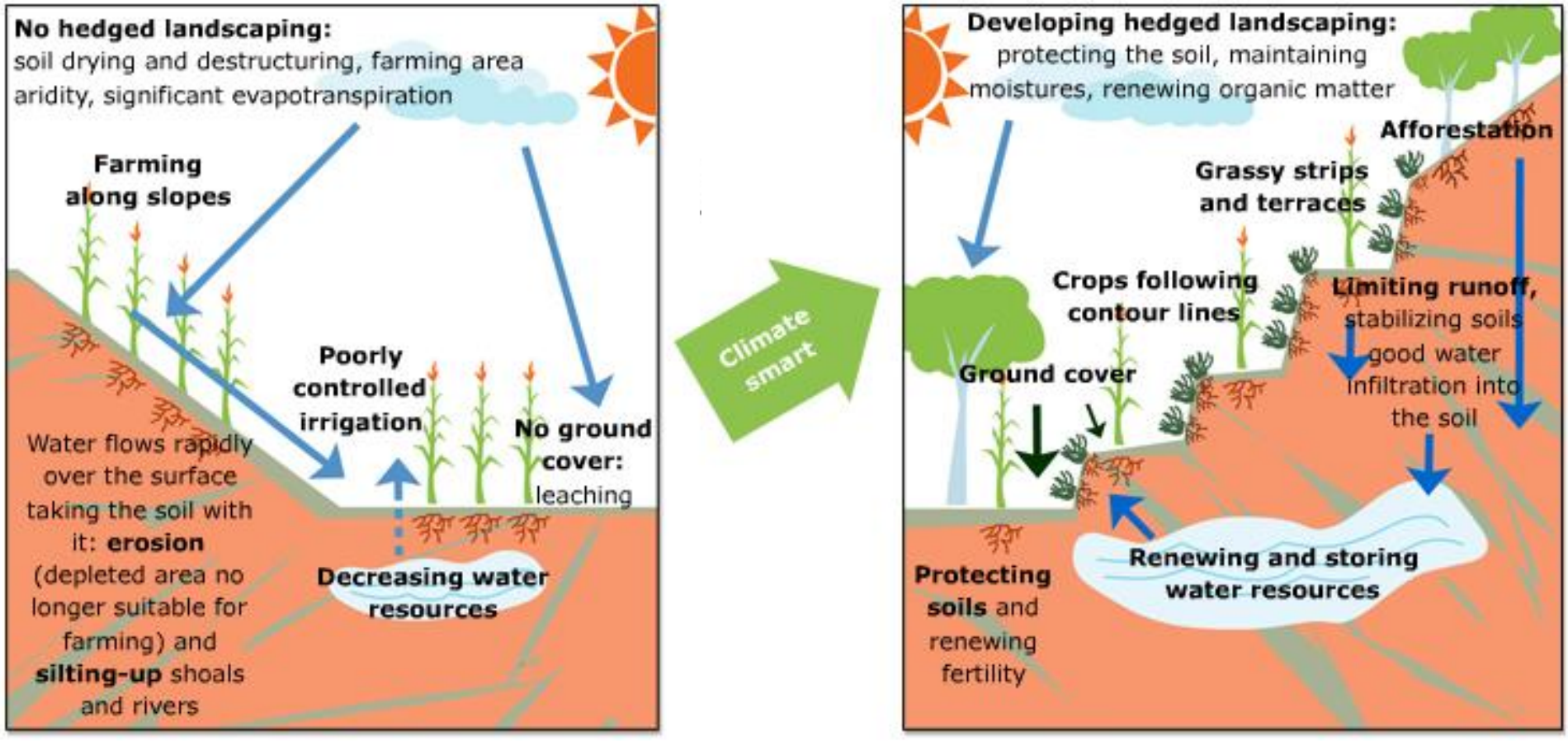
What means Climate-Smart Agriculture?

Transform agriculture to enhance the achievement of national food security and development goals in the light of global challenges

ww.fao.org/climatechange/climatesmart

Towards climate-smart agricultural landscapes

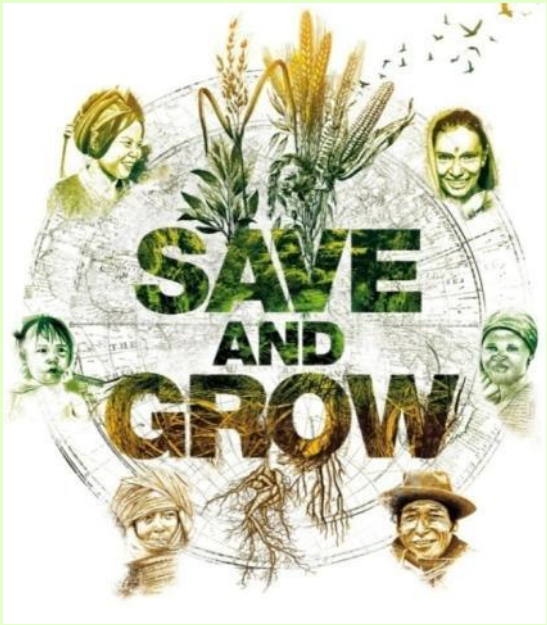
Practices + Policies and institutions + Financing



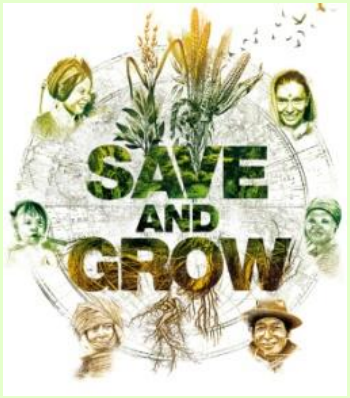
Agricultural Sector or Sub-sector and Practices	Adaptation	Mitigation	Climate smart agriculture
Crop			
Conservation agriculture	x	x	x
Integrated pest management	x	x	x
System for rice intensification	x	x	x
Livestock			
Improved pasture management	x	x	x
Improved grazing management	x	x	x
Improved manure management	x	x	x
Forestry			
Agroforestry	x	x	x
Sustainable forest management	x	x	x
Afforestation, reforestation and forest restoration		x	
Fishery			
Decreased use of fish meal and fish oil feeds		x	
Reduce excessive fishing capacity		x	
Diversification of species	x		
Land management			
Sustainable land management	x	x	x
Improve crop and grass land management	x	x	x
Restoration of degraded lands and organic soils	x	x	x
Water management			
Irrigation modernization	x	x	x
Wet-and-dry irrigation in paddy fields	x	x	x
Rainwater harvesting	x	x	x
Cross-sector			
Efficient energy use	x	x	x
Reduced post-harvest losses and waste recycling	x	x	x
Disaster risk management	x		
Breeding of new crop, plant and animal varieties	x		

Sustainable Crop Production Intensification

- Highest possible production
- Environmental footprint < recovery capacity



Technical objectives



- Agricultural **land productivity**
- Natural capital and flow of **ecosystems services**

Simultaneously!

- Enhanced input-use **efficiency**
- Use of biodiversity – natural and managed (and carbon) to build farming system **resilience**
- Contribute to multiple outcome objectives at farm, community & landscape scales – food and agriculture system
- Rehabilitation of degraded agricultural land and agro-ecosystems

But how?

Soil & Ecosystem Health

Agriculture must, literally, *return to its roots* by rediscovering the importance of healthy soil, and rehabilitating its ecosystem services.

A healthy productive soil is a *living system* to be managed as a 'complex' biological system.

Mobilize the whole ecosystem rather than fight or degrade it, and enhance natural capital and the flow of ecosystem services.

No *single* solution but all solutions in agricultural lands need to be based on Conservation Agriculture principles and locally formulated practices.

3 Principles of ecological sustainability

Empirical and scientific evidence internationally shows ....

- **No or minimum mechanical soil disturbance by** – seeding or planting directly into untilled soil
- **Enhance and maintain organic matter cover on the soil surface** – using crop residues and cover crops to protect & feed soil life
- **Diversification of species** -- both annuals and perennials - in associations, sequences and rotations

Conservation Agriculture,
together with other good practices

Sustainable Land Preparation

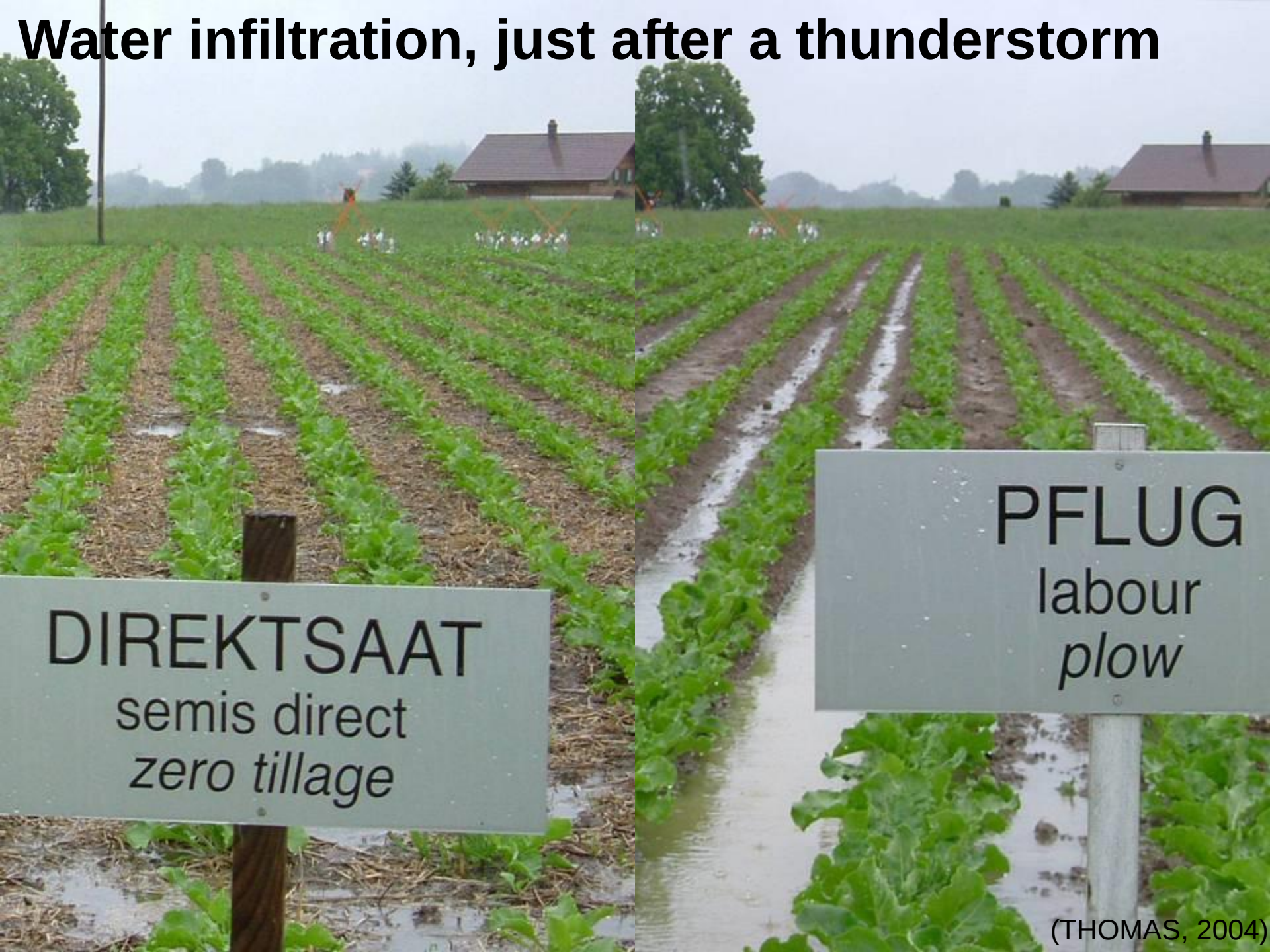
Planting holes, ripping or mulching, direct drill

Once soil brought to good condition, avoid its unnecessary disturbance, and plant seeds through the mulch

'Plantio Direto' = Direct Drilling of soya immediately after wheat harvest. *Source: 'O Meio Ambiente e o Plantio Direto', p.27*

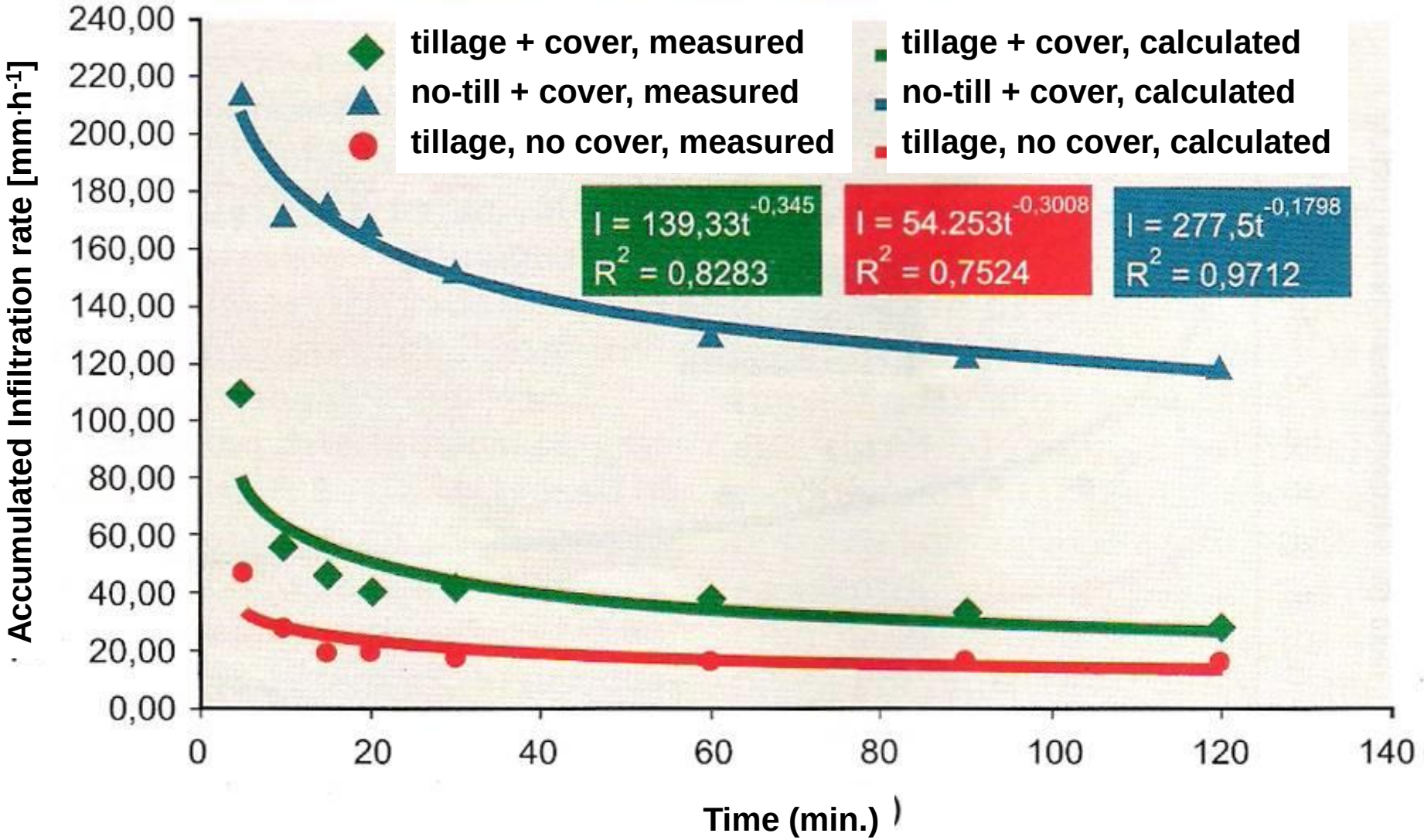
Residue retention distinguishes Conservation Agriculture from conventional farming systems, which are characterized by leaving the soil bare and unprotected, exposed to climatic agents.

Water infiltration, just after a thunderstorm



(THOMAS, 2004)

Gains in Rainfall Infiltration Rate with CA
Less flooding – improved water cycle



COMPARISON

A FARMER'S TRIAL – CLODS OF TOPSOIL FROM ADJACENT PLOTS, PARANÁ, BRAZIL (Shaxson 2007)

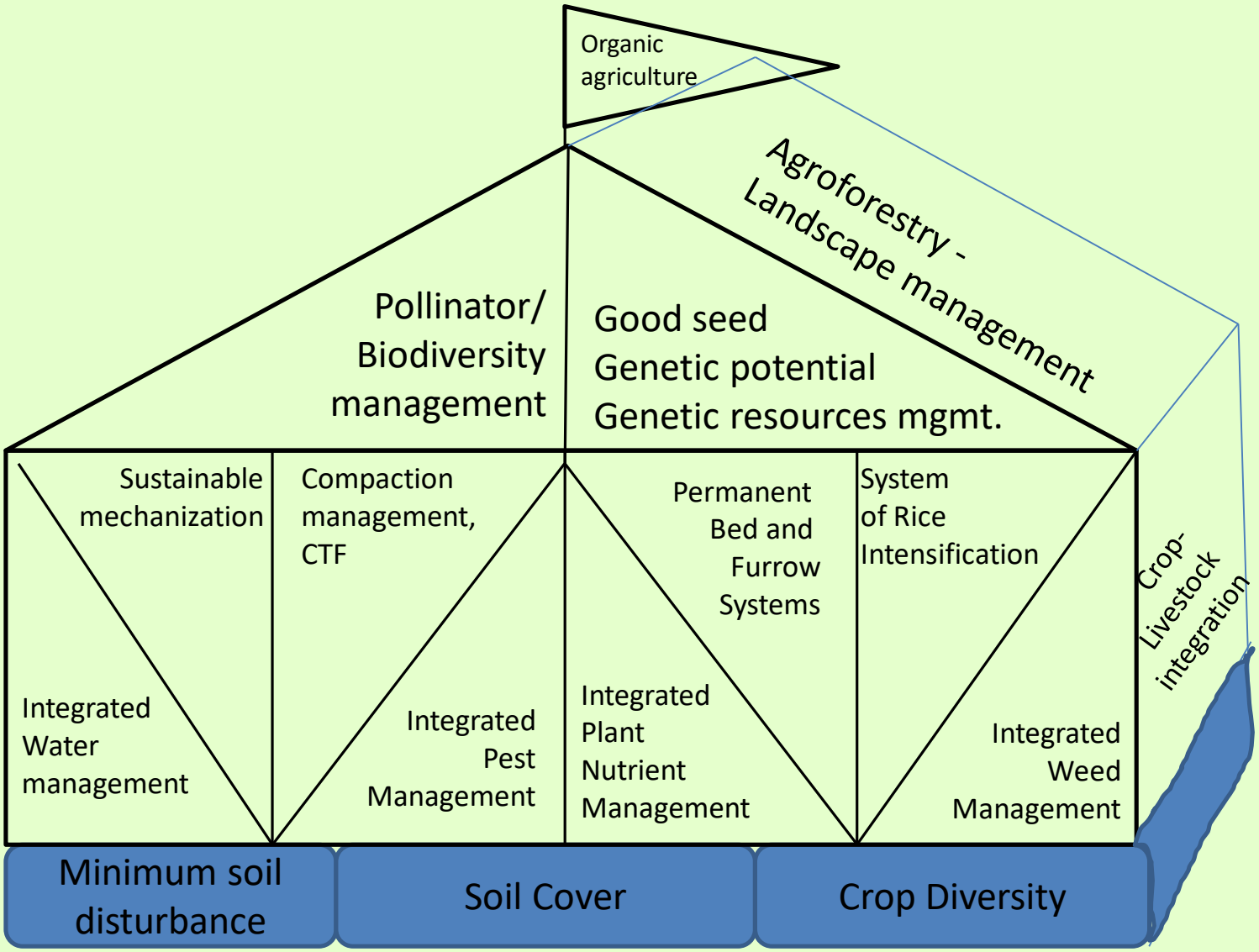
PRO-BIOTIC ▲

Topsoil after 5 years with retention of crop residues and no-till seeding.

ANTI-BIOTIC ▲

Topsoil after regularly-repeated disk tillage, without retention of residues

Ecological Base of CA



Conservation Agriculture

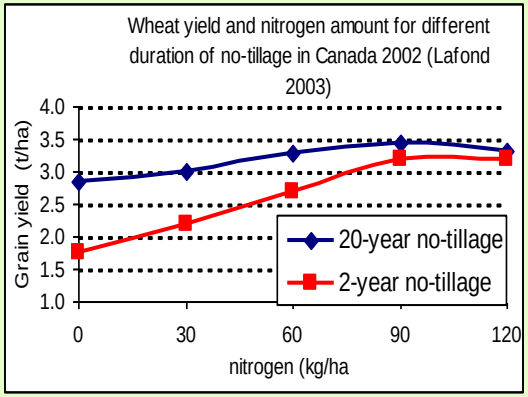
Drivers for adoption:

- **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)**

Documented benefits of CA for food security and environment

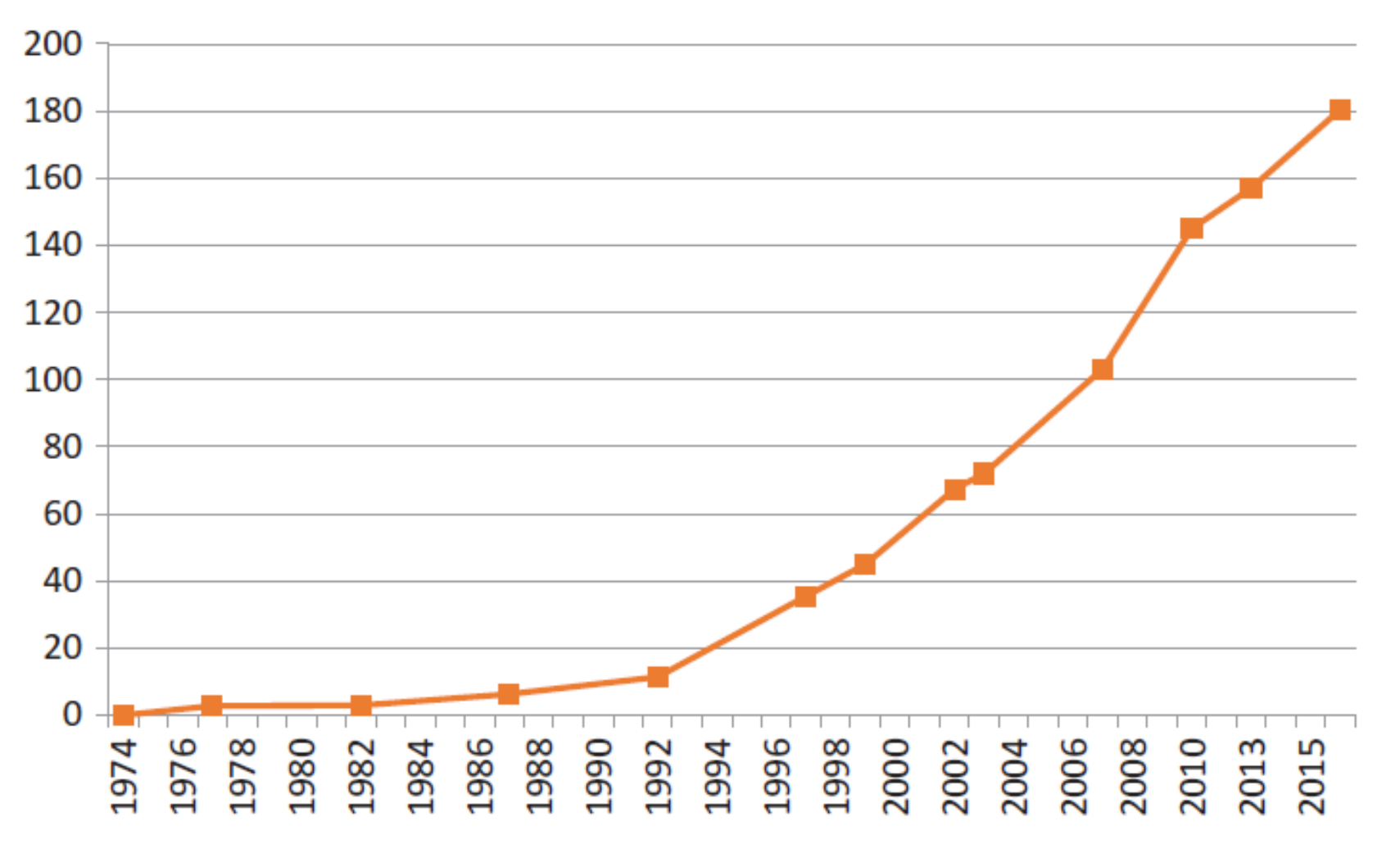
Small scale -- Paraguay, Tanzania, Lesotho, Zimbabwe

Large scale – Canada, Brazil, Australia, Argentina .....

publications

Global CA area (million ha) over time

History and Development



CA area in Asia over time

Extent of CA adoption ('000 ha) in Asia in 2008/09, 2013/14 and 2015/16

Country	CA area 2008/09	CA area 2013/14	CA area 2015/16
China	1,330.00	6,670.00	9,000.00
Kazakhstan	1,300.00	2,000.00	2,500.00
India	–	1,500.00	1,500.00#
Kyrgyzstan	–	0.70	50.00
Turkey	–	45.00	45.00
Syria	–	30.00	30.00#
Korea, DPR	–	23.00	23.00#
Iraq	–	15.00	15.00#
Uzbekistan	–	2.45	10.00
Azerbaijan	–	1.30	1.30#
Lebanon	–	1.20	1.20#
Pakistan	–	–	600.00
Iran	–	–	150.00
Bangladesh	–	–	1.50
Tajikistan	–	–	1.20
Vietnam	–	–	1.00
Cambodia	–	–	0.50
Laos	–	–	0.50
Total	2630.00	10,288.65	13,930.20
% difference		291.2 since 2008/09	429.7 since 2008/09 35.4 since 2013/14

#from 2013/14.

Experiences in Asia:

- *China promotes CA officially as means against drought, dust storms, erosion; subsidies for equipment*
- *Kazakhstan promotes CA in wheat growing areas in the North*
- *DPR Korea promotes CA to fight hunger*
- *Special challenge: convert paddy rice to CA*
- *India, Bangladesh und Pakistan experiment with components of CA*
- *Growing interest in CA in SE Asia (Cambodia, Laos)*


Pakistan/India

Surface mulching with zero till – wheat, Pakistan

No-till in Kazakhstan

(Wall, 2008)

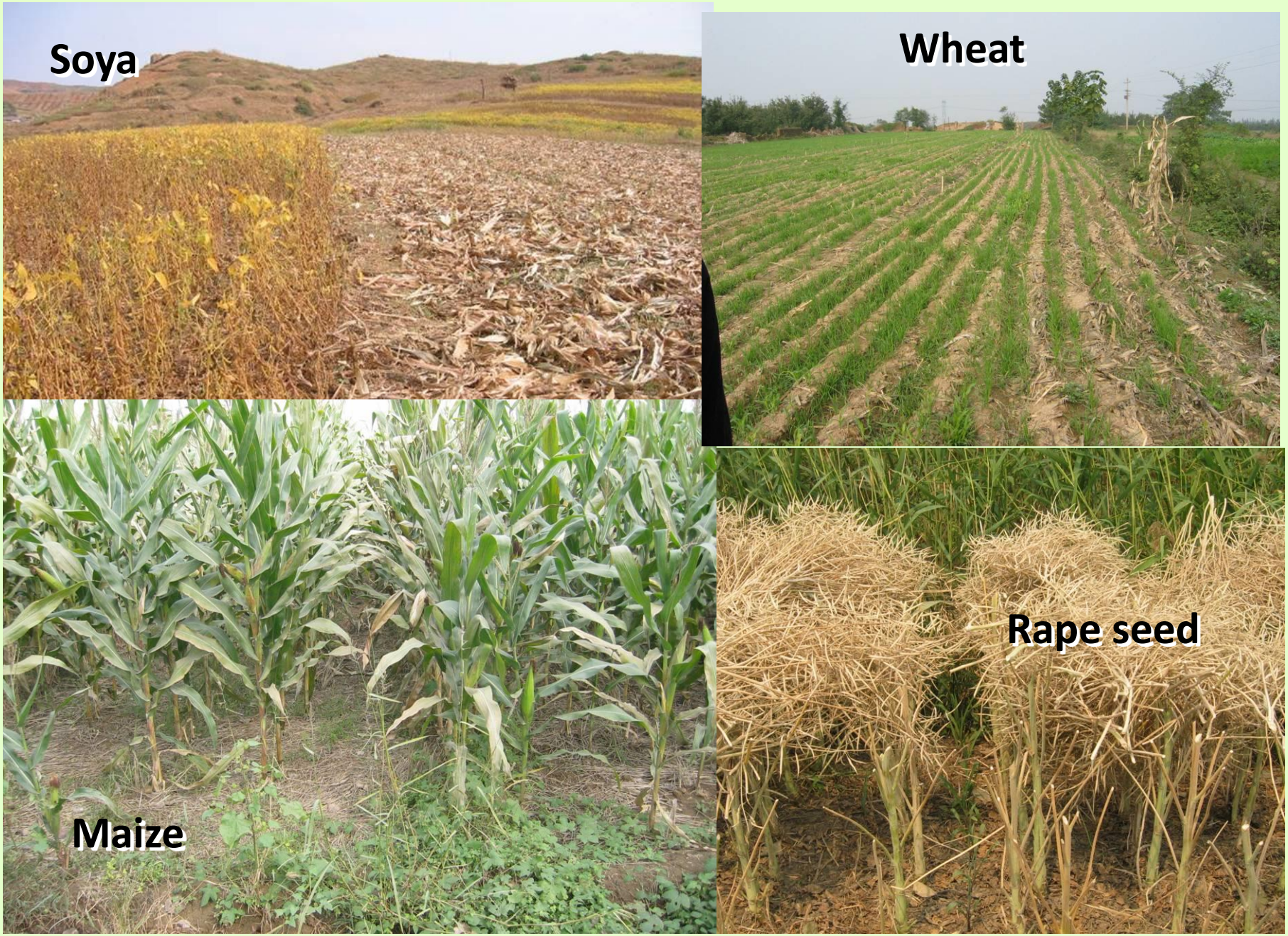
Kazakhstan

Experiences in China

Example #3

No-till in China
Wheat No-tilled into maize stubble

(McGarry, 2006)


Soya
Wheat
Maize
Rape seed

CHINA: innovation with raised-bed, zero-till SRI field; measured yield 13.4 t/ha; Liu's 2001 yield (16 t/ha) set provincial yield record and persuaded Prof. Yuan Longping

North Korea

Rice:

- no puddling
- no flooding
- less CH_4
- less N_2O
- less water

All crops can be seeded in No-till systems

Potatoes under No-till after rice in North Korea

(Friedrich, 2006)

Iterative approach with smallholders

using local species

Equipments

More complex systems

Southeast Asia

Alternatives

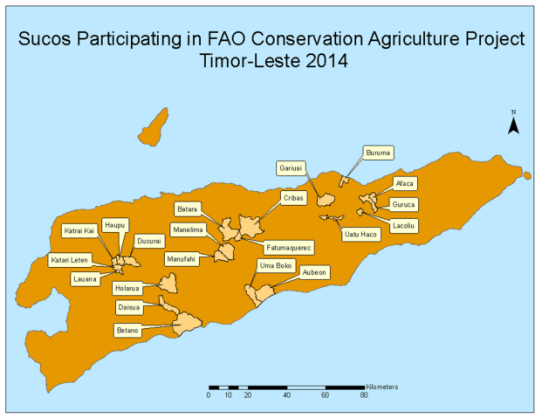
- intensive commercial agricultural systems based on high chemical input
- solution to restore soil fertility and degraded environment (acidic or salty or polluted soils)
- erosion control both at plot and landscape levels
- Intensification and diversification of agriculture in mountainous areas

Timor-Leste https://vimeo.com/103779391

Lao PDR https://vimeo.com/117622628

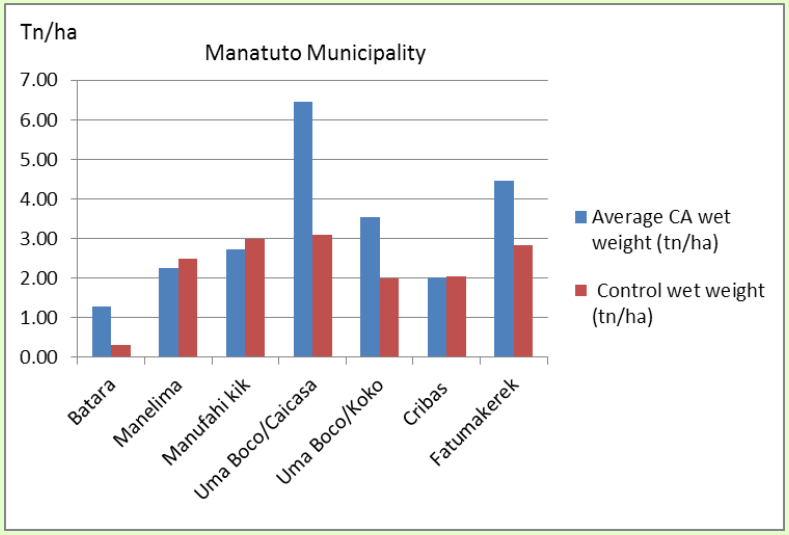
Timor-Leste

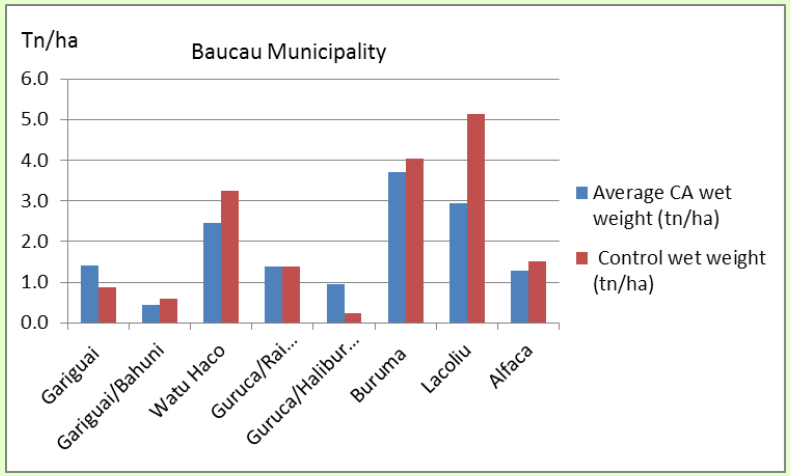
Enhancing Food and Nutrition Security and Reducing Disaster Risk through the Promotion of Conservation Agriculture (2013~)

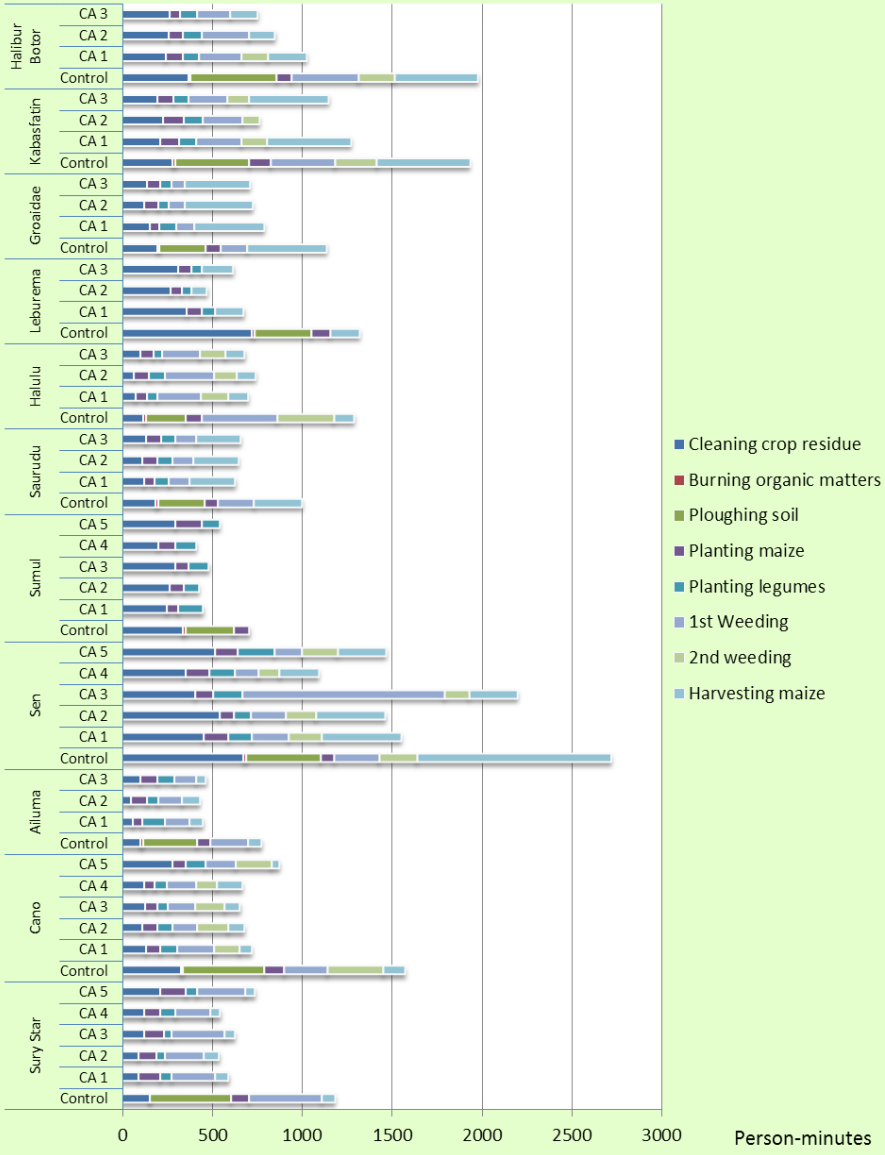


https://www.usaid.gov/timor-leste/project-descriptions/enhancing-food-and-nutrition-security-and-reducing-disaster-risk-through-promotion-conservation

Timor-Leste



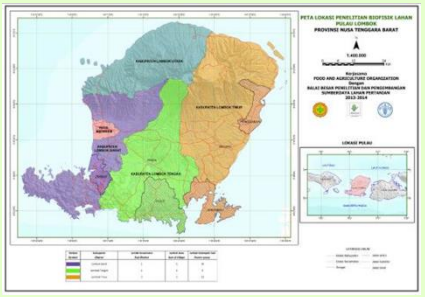


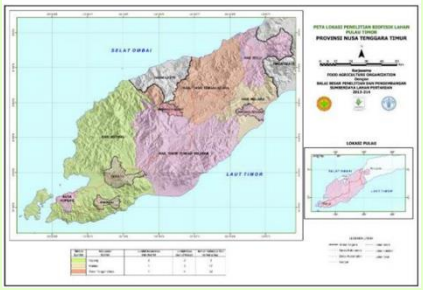


https://www.youtube.com/watch?v=nbOXwXeqKvg

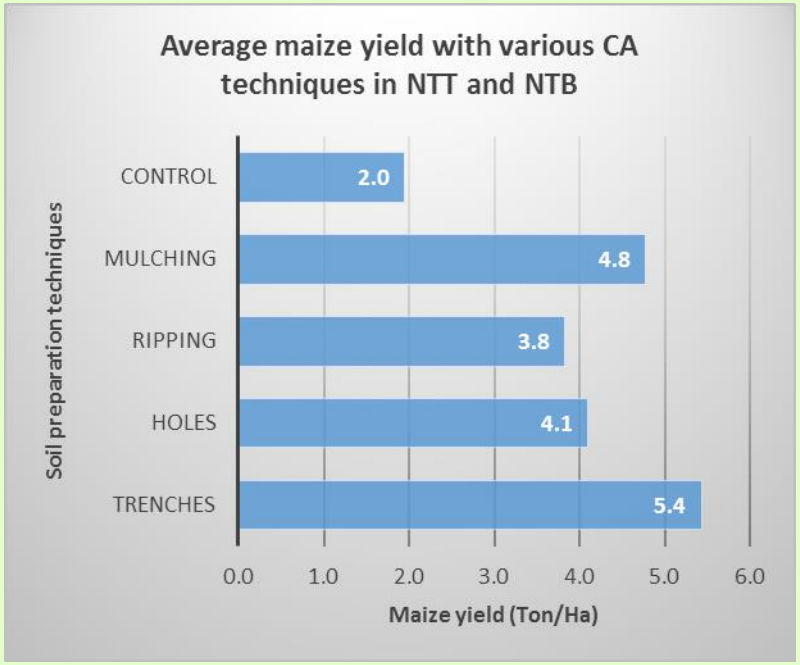
Indonesia

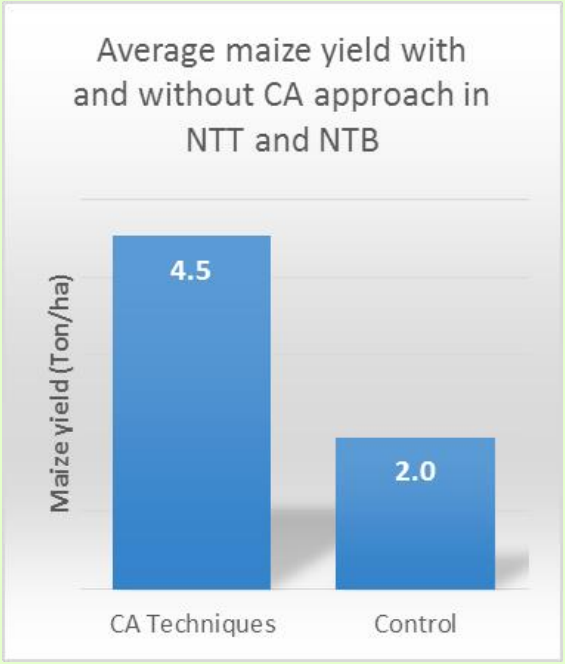
Reducing Disaster Risks Caused by Changing Climate in Nusa Tenggara Barat and Nusa Tenggara Timur Provinces in Indonesia (2013~)





Indonesia


Average maize yield with various CA techniques in NTT and NTB
Soil preparation techniques
CONTROL
MULCHING
RIPPING
HOLES
TRENCHES
2.0
4.8
3.8
4.1
5.4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Maize yield (Ton/Ha)


Average maize yield with and without CA approach in NTT and NTB
Maize yield (Ton/ha)
4.5
2.0
CA Techniques
Control

History and Development

FAO's role: Support to member countries:

- Policies and Institutions:
  - policy support for upscaling CA; coherent policies (mechanization/CA, extension)
  - institutions, supporting infrastructure: education/training, science/technology, commercial infrastructure (input supply)
- Field level: farmer-groups/associations; proof of concept and field evidence with farmer learning processes (FFS, earthworm clubs...)
- FAO DRR/M uses CA as concept

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

Conclusions

- CA addresses the core problem for sustainable agriculture with the deepest environmental footprint: *soil tillage*
- For SCPI there is no “alternative” to CA
- CA has many local adaptations and there are different routes to adoption
- FAO therefore mainstream CA as approach to cropping

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

Action Areas for Scaling-up CA

- develop institutional framework and national roadmap
- Integrate and coordinate initiatives among policy-makers, financial institutions, private sector, administrators, research institutions, advisory and knowledge exchange bodies, with the farmers
- STRONG ADVOCACY!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