Conservation Agriculture

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Land degradation has caused substantial decline in agricultural productivity::

- 16% of arable land in developing countries is "degraded"

Examples of % agricultural lands seriously degraded *:

- 75% of Central America
- 20% of Africa
- 11% of Asia

(* Sarah Scherr, 1999).

4 “sources” of the problems:
- to be replaced, or at least modified

- Conventional tillage

- particularly routine ploughing (inversion)
- soil tillage (rotavators, chisels, rippers, discs, etc)

- Removal / incorporation of crop residues

- *via* ploughing, cultivation, in-field burning, cattle feed, household fuel

- Crop monoculture - no rotations

- Random in-field trafficking of equipment

- tractors, harvesters, trailers, etc.

Result::
Wide range - environmental problems

- Land, environment, health and socio-economics:

1) surface-water quality and quantity (nutrients, herbicides, siltation)
2) soil organic carbon (decline in amount and sequestration, soil structure)
3) ground water quality (contamination and declining levels),
4) air quality (soil particles and farm chemicals)
5) global warming (CO_2 from tractor engines)
6) wildlife habitat and ecological diversity (tree and crop residue removal, river siltation, etc)

How are these redressed??

Conservation Agriculture

A Change in the Paradigm of Resource Conservation

Represents:

"a shift in our philosophy towards the land"

"do not beat the land into submission
- rather work in harmony with it"

What is Conservation Agriculture ?

The four principles of CA are:

1. **Stop (or reduce) mechanical soil disturbance by tillage – No-tillage**
2. **Maintain soil cover with plant residues**
3. **Use of crop rotations and cover crops**
4. **Precise placement of in-field traffic**

Promotion of conservation agriculture using permanent raised beds in irrigated cropping in the Hexi Corridor, Gansu, PRC

- Demonstrate the effectiveness of permanent raised beds in improving crop, nutrient, residue and water management in wheat / maize systems of the Hexi corridor.

- Develop and test conservation agriculture machinery designed around the 20hp tractors to mechanise PRB in wheat/maize systems.

- Assess the cost benefit of PRB farming systems.

- Extend conservation agriculture using PRB technology across the Hexi Corridor.


Sites
Jiuquan
Shandan
Zhangye
Liang Zhou
Wuwei
Lanzhou
Xi'an

Conventional tillage

Fresh raised bed (FRB)

Bed width: 100cm
Height: 20cm
Wheel track: 30cm

Zero tillage control traffic (ZT)

Bed width: 100cm
Wheel track: 30cm

Permanent raised Bed (PRB) with 20cm standing stubble

Bed width: 100cm
Height: 20cm
Wheel track: 30cm


CT
PRB


Chiu-ch'üan
Jiuquan


CT
PRB
30 7:01AM


PRB
固定道保护性耕作区
试验作物：小麦
品　　种：2014
播种机具：2BLF-5型施肥播种机
ZT
传统耕作区
试验作物：小麦
品　　种：2014
播种机具：2BF-7型分层施肥播种机
CT

Zhangye Yield

Effect of different options on yield component in 2006				
treatment	FRB	PRB	CT	ZT
emergence (%)	65	66	85	78
spike/mu)	306800	318200	397700	326300
wt/1000 grains (g)	42.4	41.8	40.3	43.5
grains/spike	33	39	37	31

Effect of different options on yield component in 2007				
treatment	FRB	PRB	CT	ZT
emergence (%)	73	74	85	75
spike/mu	474100	370400	406600	368900
wt/1000 grains (g)	40.9	43.0	39.3	41.5
grains/spike	27	34	31	33

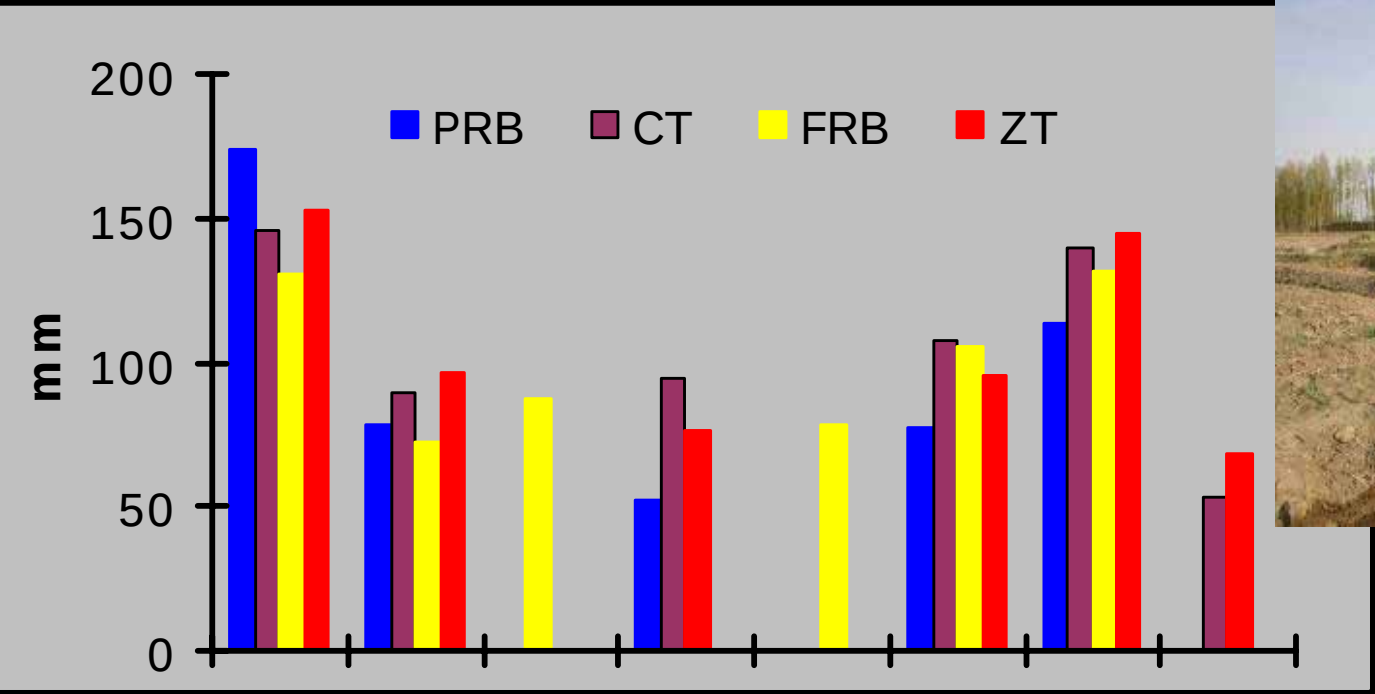
Zhangye Yield

Analysis of yield results(2006))		
treatment	Yield (kg/ha)	F 0.05
CT	6088.58	a
PRB	5575.87	ab
ZT	5420.32	b
FRB	5306.17	b

Analysis of yield results (2007)		
treatment	Yield (kg/ha)	F 0.05
PRB	7132.20	a
FRB	6651.75	b
CT	6458.85	b
ZT	6356.40	b

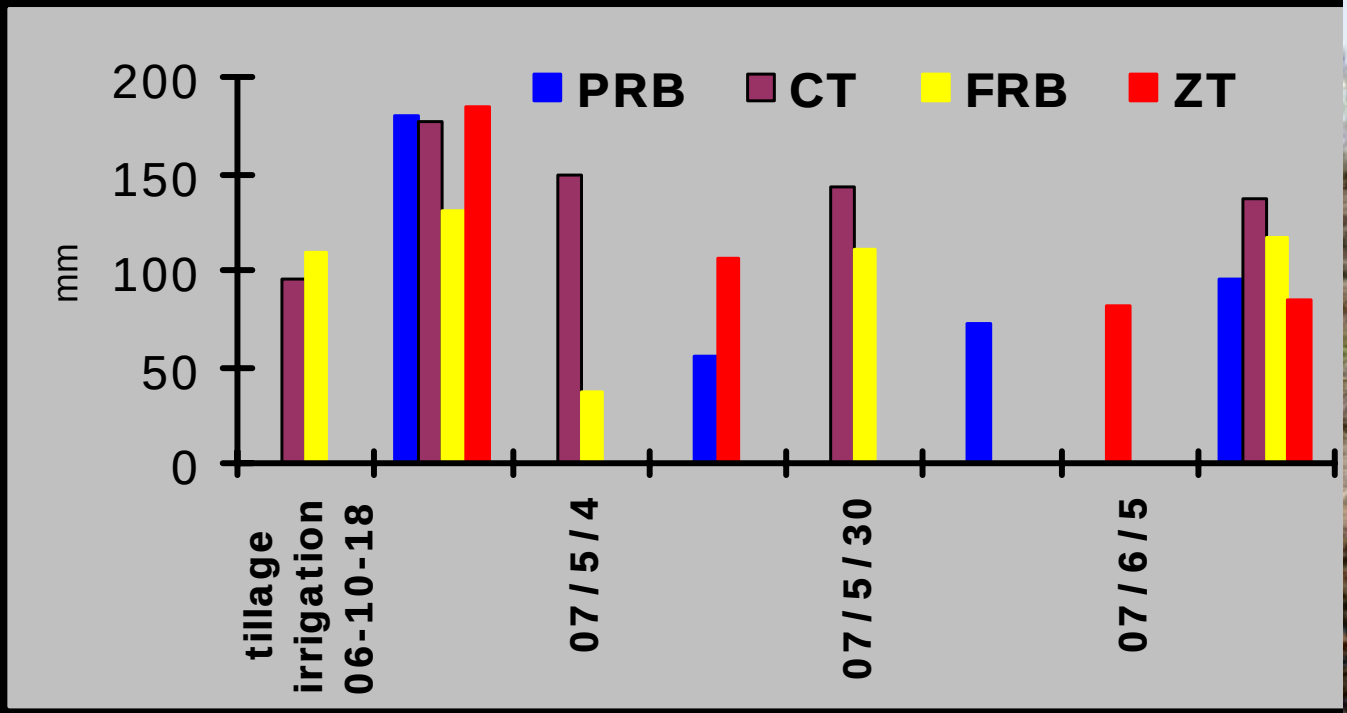
Average yield (kg/ha)

Year	FRB	PRB	CT	ZT
2006	5306.17	5575.87	6088.57	5420.32
2007	6651.75	7132.20	6458.85	6356.40
Average	5978.96	6354.04	6273.71	5888.36



Zhangye Irrigation 2006

treatments	water consumption (mm)	yield (kg/ha)	WUE (kg/mm/ha)
FRB	553	5306	9.6
PRB	393	5576	14.2
CT	572	6089	10.7
ZT	560	5420	9.7



Zhangye Irrigation 2007

Treatments	water consumption (mm)	yield (kg/ha)	WUE (kg/mm/ha)
FRB	485	6652	13.7
PRB	447	7132	16.0
CT	626	6459	10.3
ZT	480	6356	13.2

Shandan 2006

Treatment	Emergence (%)	Yield (kg/ha)	Irrigation (mm)	Cost (Yuan/mu)
PRB	76	5033	439	392
ZT	83	5223	456	364
CT	86	5161	489	414

Shandan 2007

Treatment	Emergence (%)	Yield (kg/ha)	Irrigation (mm)	Cost (Yuan/mu)
PRB	90	7314	214	345
ZT	81	7624	321	358
CT	91	7104	333	414

Jiuquan 2007

Treatment	Emergence (%)	Yield (kg/ha)	Irrigation (mm)	Cost (Yuan/mu)
PRB	82	6645	455	385
ZT	76	6405	536	369
CT	85	6975	585	388