

W05L03: Soil Health

Dr. Mahesh K. Gathala

Sr. Systems Agronomist, CIMMYT, Bangladesh

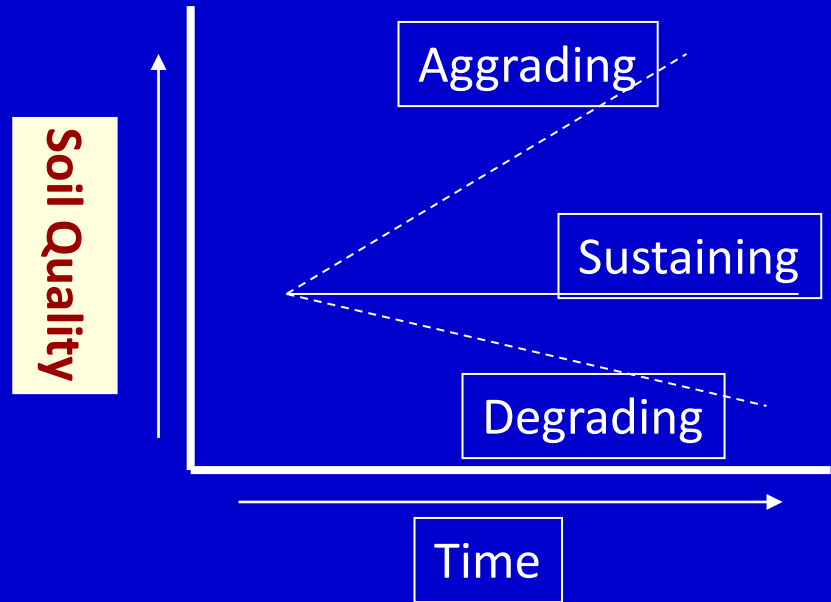
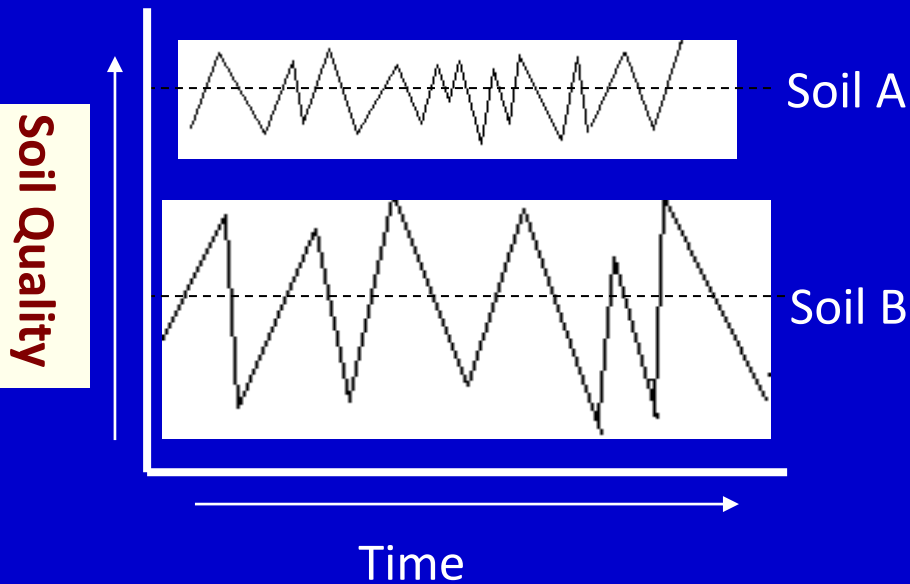


Soil Health

- ➔ **Basic and simple – we understand and feel but difficult to define**
- ➔ **It is like human health but assessment is more complex**
- ➔ **We have vast knowledge but need to distil/integrate in a simple and usable form**
- ➔ **Soil quality not directly measurable but Infer from measurable soil properties**
- ➔ **Best indicator of soil quality in crop production: Ability to produce good yields**
- ➔ **Therefore, soil properties that relates to yield: Indicators of soil quality**

Inherent Soil Quality

Dynamic Soil Quality

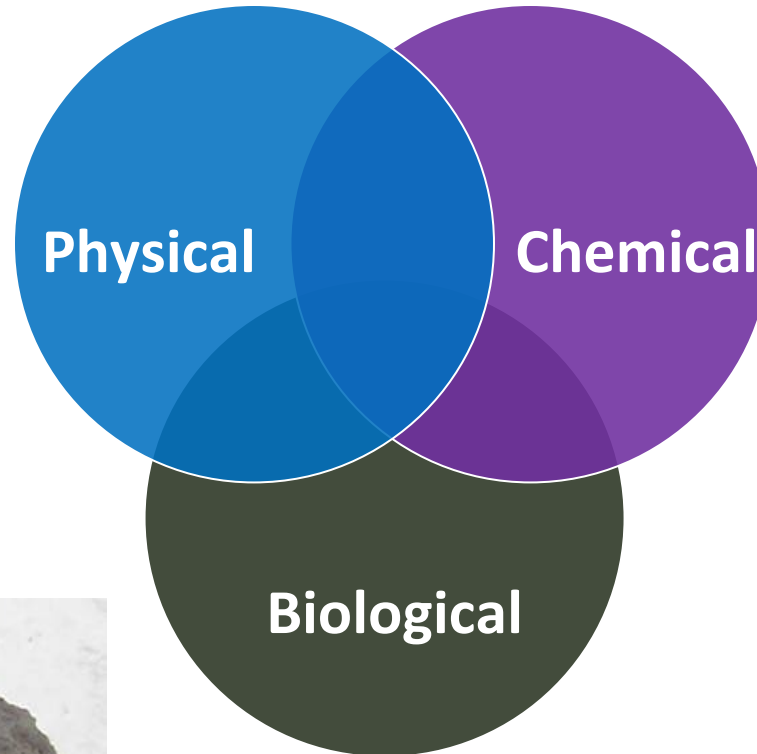


- **Inherent** - reflects basic soil forming factors
- **Climate, parent material, time,**
- **Topography, and vegetation**
(Reflected in Land Capability Classifications)

- **Dynamic** - describes soil status or condition
- **Reflects management decisions**
- **Current or past land uses**
(Reflects sustainability & conservation goals)

Soil quality in relation to soil process

- Physical support for plants
- Soil water retention and movement
- Soil erosion
- Soil Hardness



- Nutrient retention and release
- Soil reaction
- Energy (C) storage

Biological

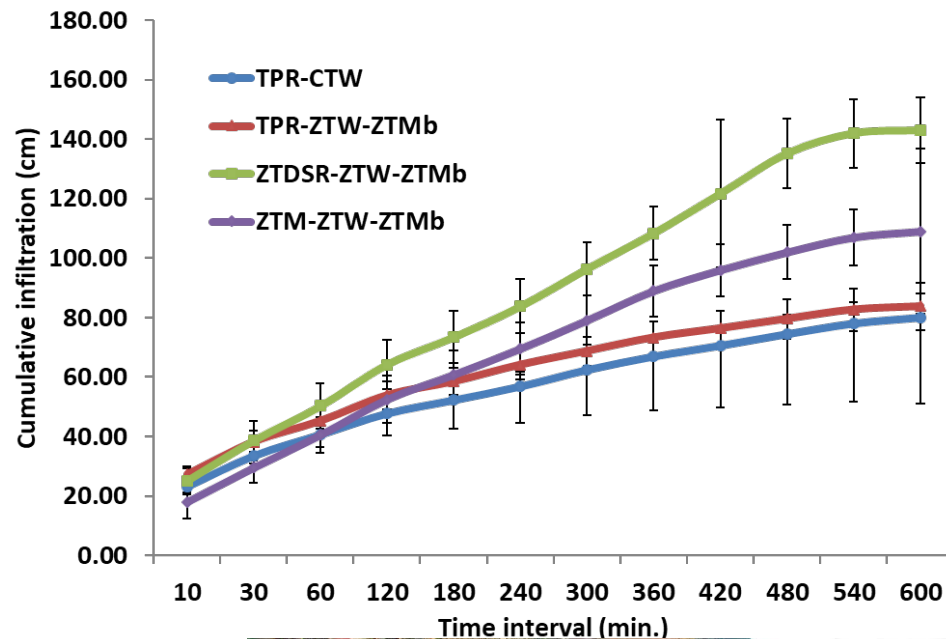
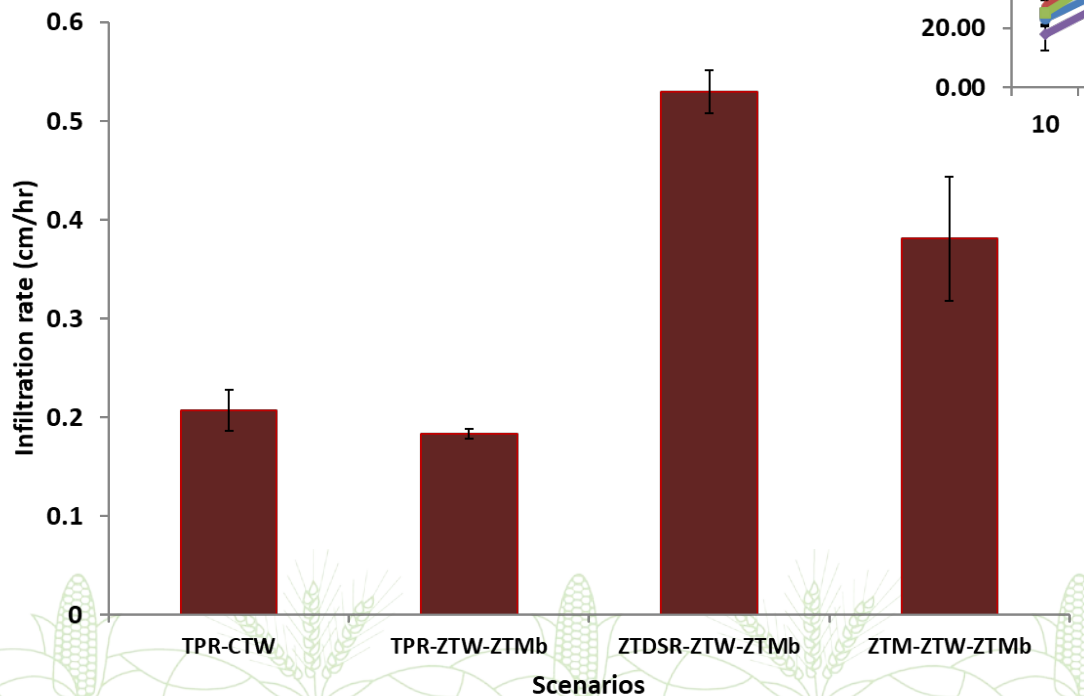
- Weed & Pest suppression
- Microbial biomass
- N mineralization
- OM decomposition



Soil physical properties under CA

Infiltration under CA after 8 yrs

Increase soil infiltration and rate which helps for waterlogging sensitive crops and recharge aquifers



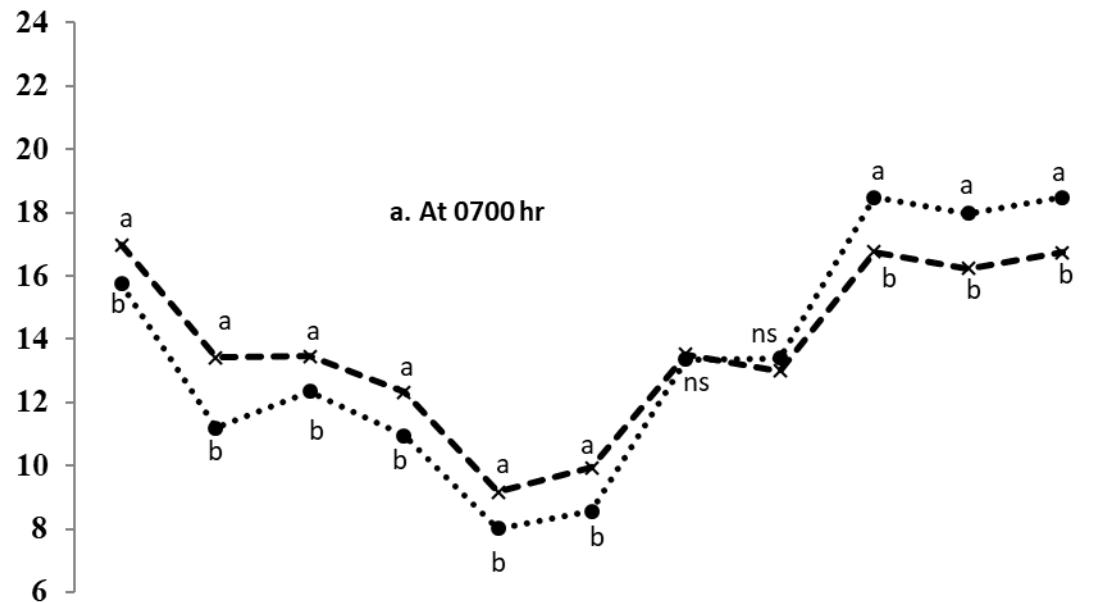
Moderation of surface soil temperature by surface mulching

Moderate soil temperature in extreme weather conditions by 4-5 °C

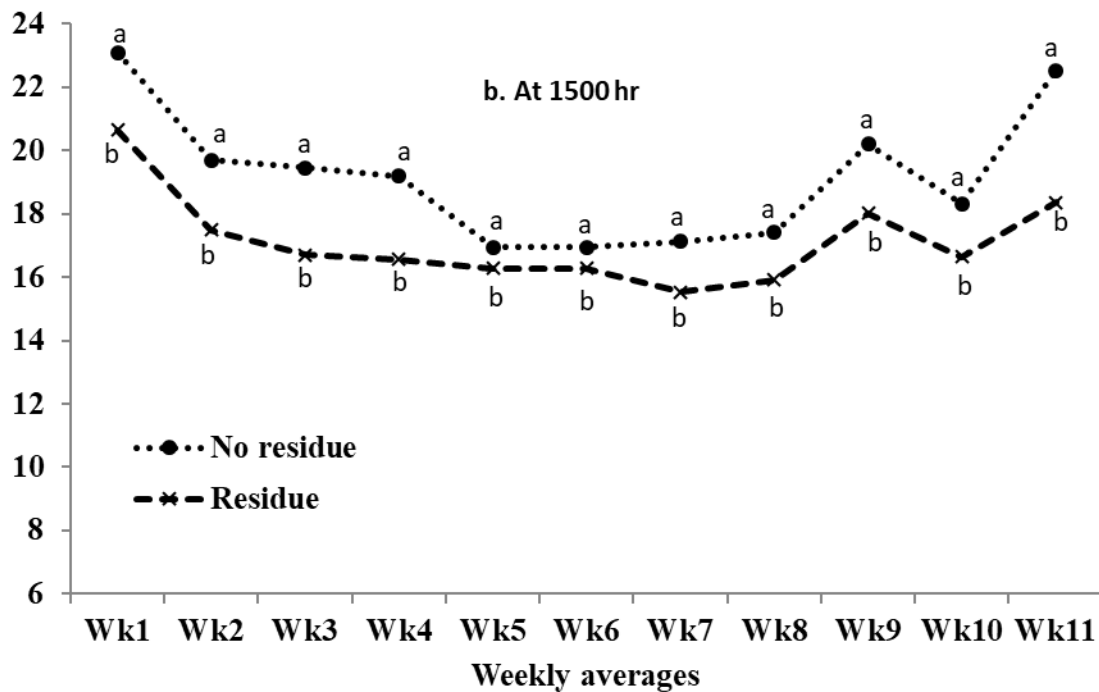


Gathala et al., 2017

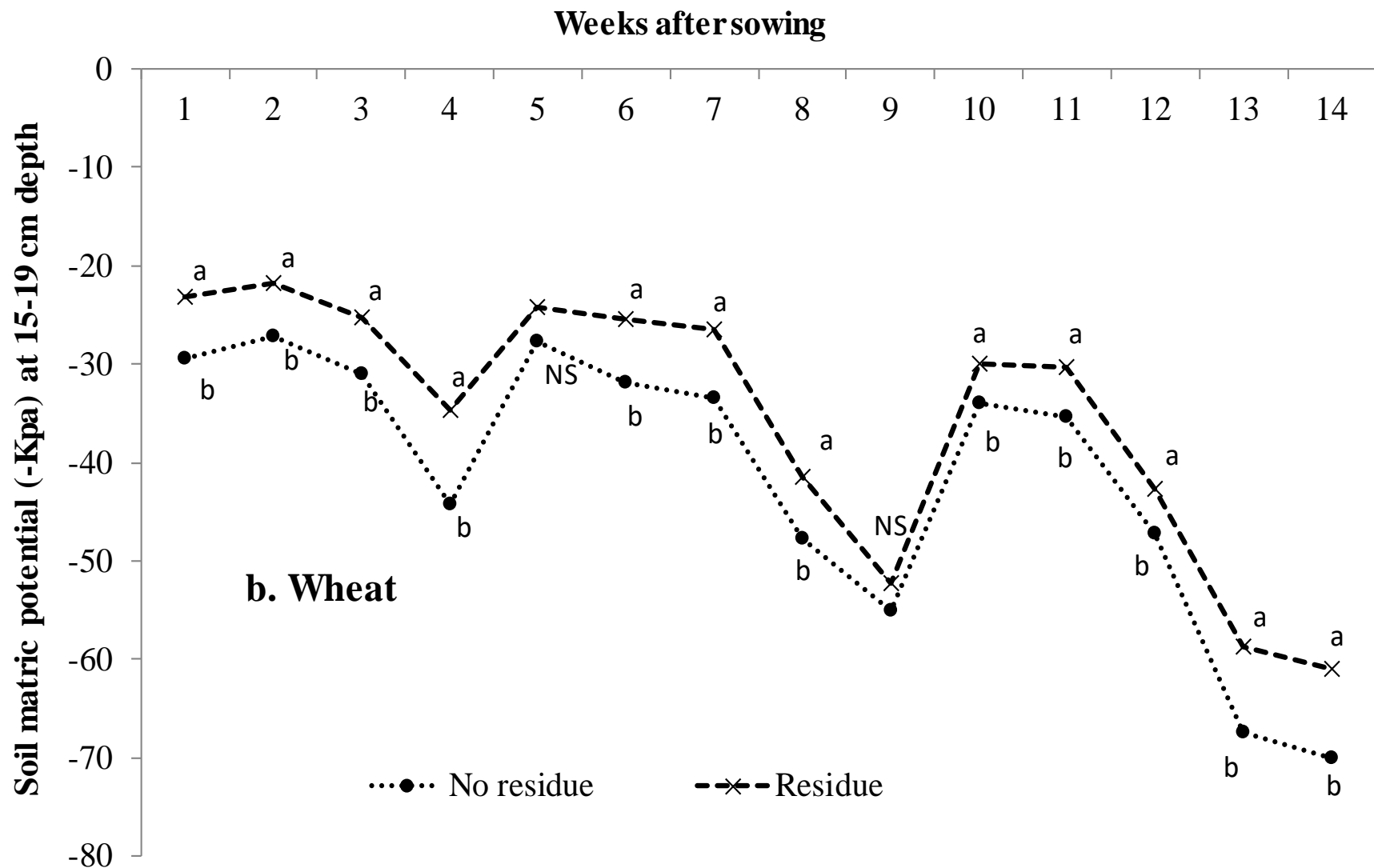
Soil temperature (°C) at 5 cm depth



Soil temperature (°C) at 5 cm depth

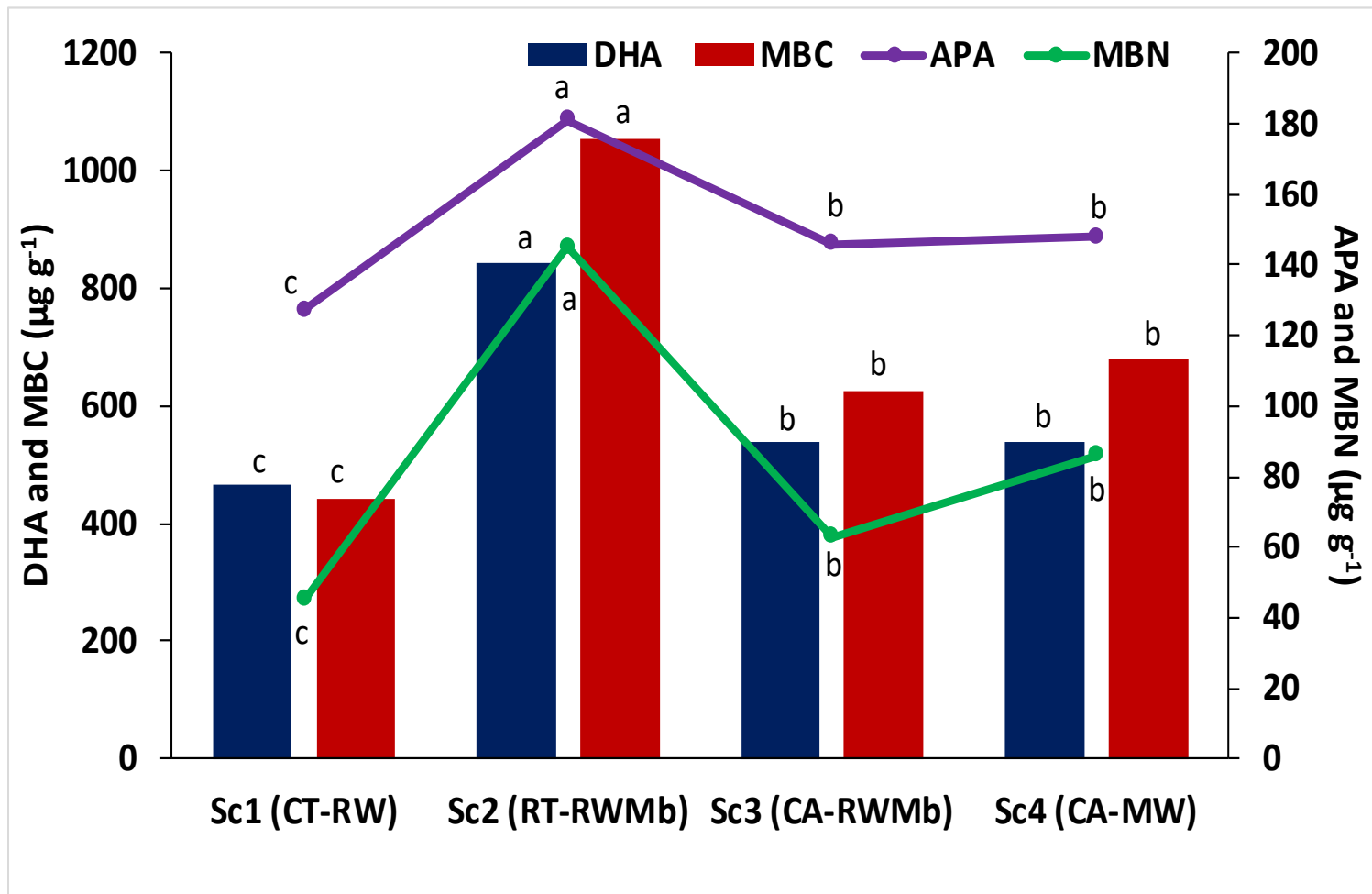


Soil matrix potential with and without crop residue



Soil biological properties under CA

Effect on soil enzymatic and soil microbial biomass



Increase in soil DHA, APA and soil microbial biomass of carbon and nitrogen **Biologically active fractions** -sensitive indicators, **predict direction and rate of change of soil quality earlier and better.**

Effect of CA practices on Soil microbial populations

Sustainable intensification of

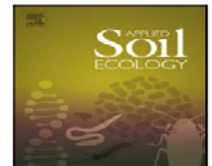
Microbial population	Rice based systems	Maize based systems
Bacteria	+26%	+28%,
Fungi	+61%	+68%
Actinomycetes	+92%	+98%

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Sustainable intensification influences soil quality, biota, and productivity in cereal-based agroecosystems

Madhu Choudhary^a, Hanuman S. Jat^{b,*}, Ashim Datta^a, Arvind K. Yadav^a, Tek B. Sapkota^b, Sandip Mondal^c, R.P. Meena^d, Parbodh C. Sharma^a, M.L. Jat^b

^a ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal, India

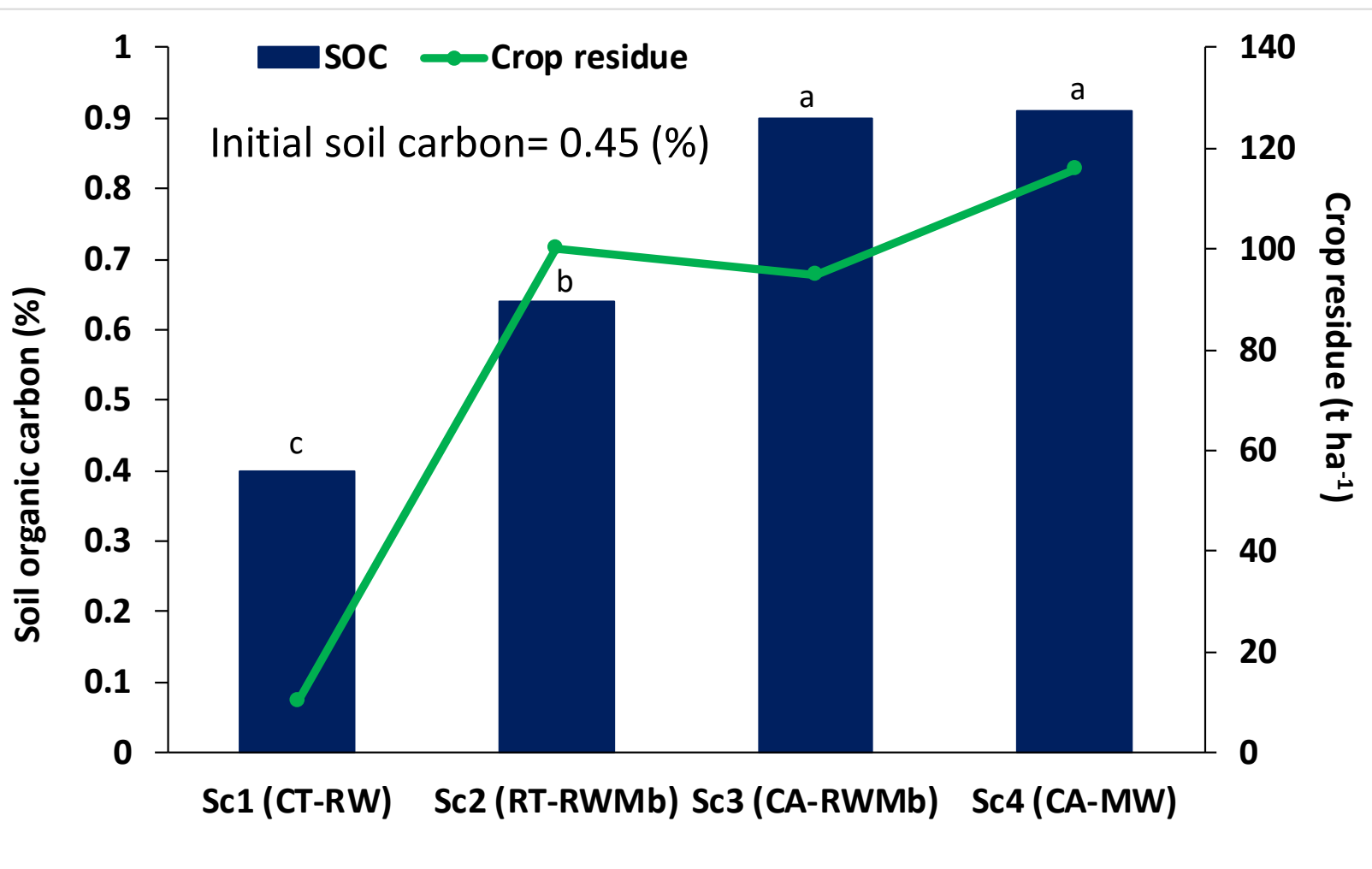
^b International Maize and Wheat Improvement Centre (CIMMYT), India

^c Indian Statistical Institute, Giridih, Jharkhand, India

^d ICAR-Indian Institute of Wheat and Barley Research (IIWBR), Karnal, India

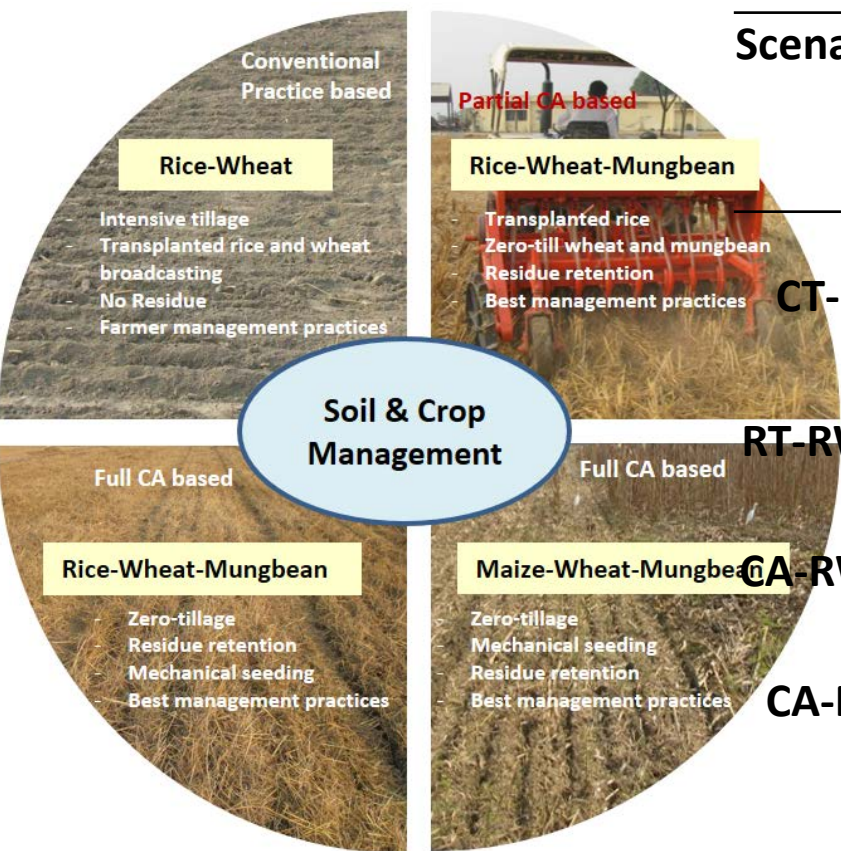


Change in soil organic carbon after 8 years crop residue management



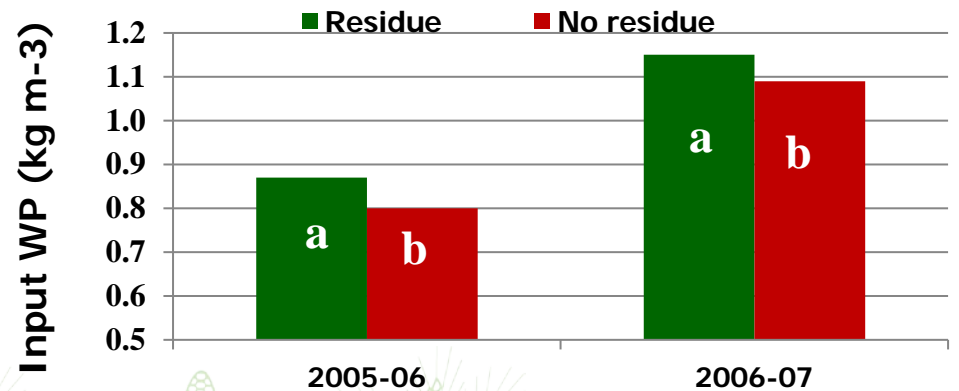
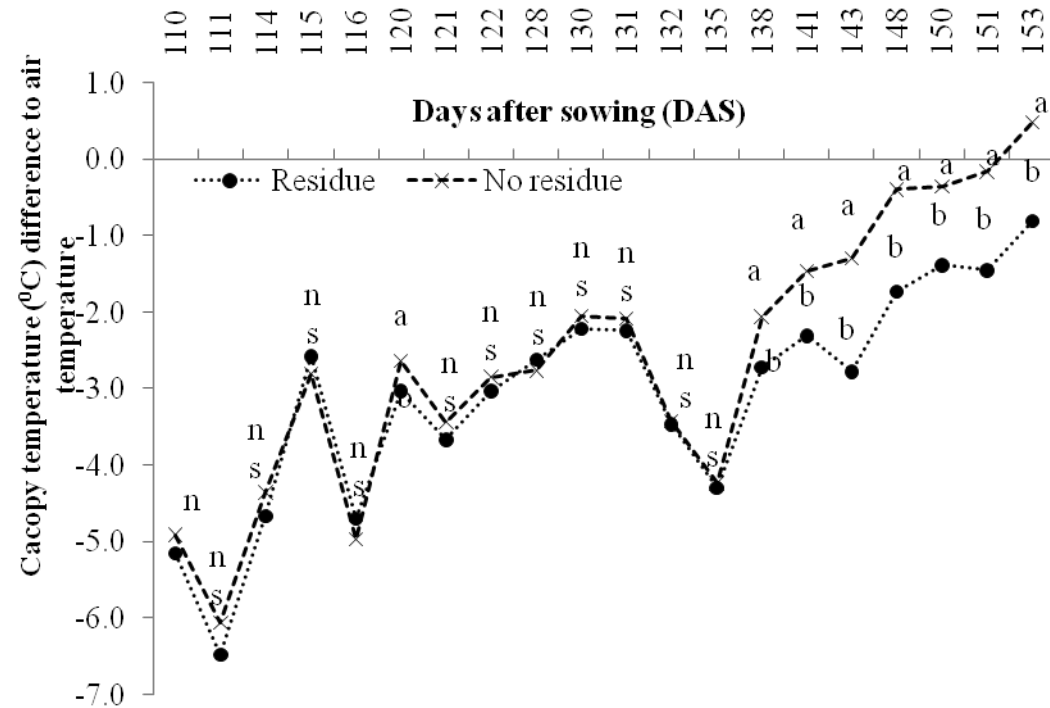
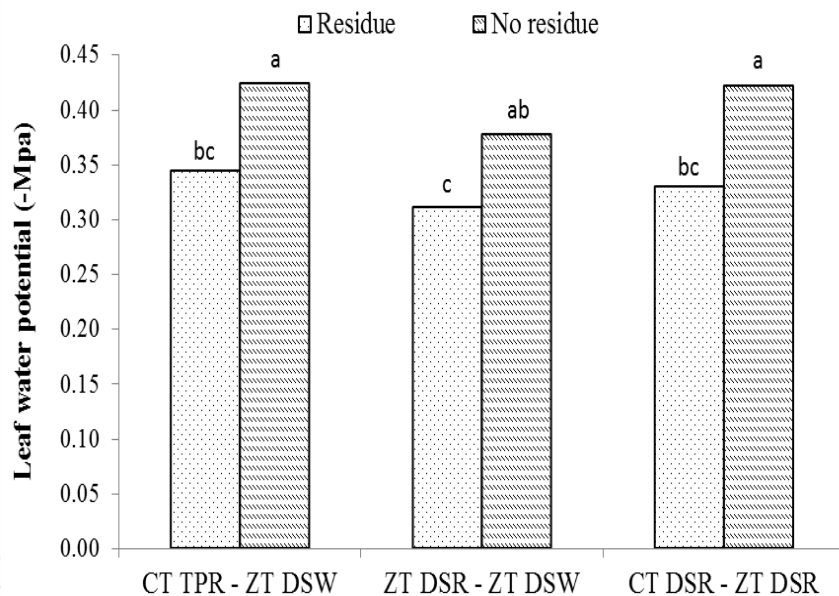
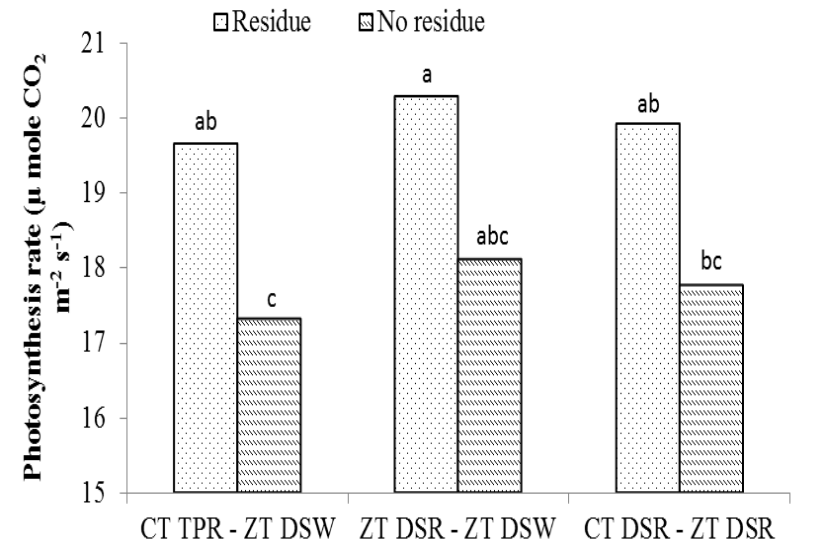
SOC strongly associated with crop residue recycled and soil disturbance

Changes in Nutrient Content in surface soil (0-15 cm) after 6 years



Scenario	SOC (%)	Kg ha ⁻¹				pH	SQI
		N	P	K			
CT-RW	0.49c	186.9c	28.1b	164.5b	7.68	0.30c	
RT-RWMb	0.68b	224.8b	21.3b	173.6b	7.37	1.00b	
CA-RWMb	0.89a	301.1a	39.5a	224.6a	7.55	1.79a	
CA-MW	0.82a	250.0ab	34.5a	268.8a	7.56	1.51a	
	(0.45)	(131.0)	(12.6)	(130.0)	(8.20)		

Residues: Physiological processes, water use efficiency and resilience



Source: Jat et al (2009, 2012) and Gathala et al., 2017

Conclusions

- ❖ Chemical, physical and biological properties are all important for soil health
- ❖ CA practice improve soil health compared to CT practice
- ❖ Healthier soils produce higher yields
- ❖ Soil health quick to degrade but takes time to improve
- ❖ Healthier soils increase resilience to climate variability and change and facilitates better human health