

DIRECTORATE OF ADVANCED STUDIES
EVENT CATALOGUE
2021

11TH SEMINAR OF DAS EVENTS CALENDAR – 2021

**CONSERVATION AGRICULTURE FOR SUSTAINABLE
SOIL MANAGEMENT IN RAINFED AREAS OF PAKISTAN**



11th Seminar (online through ZOOM) of DAS Events Calendar

**Conservation Agriculture for Sustainable Soil Management
in Rainfed Areas of Pakistan**

Speaker: Dr. Shahzada Sohail Ijaz
Associate Professor, Institute of Soil Science

Dated: Thursday, May 27, 2021 Time 02:00 p.m. - PKT GMT+5
ZOOM Meeting ID: 955 408 3170 - Passcode: 67890

Organized By: Directorate of Advance Studies, PMAS-AAUR

ACTIVITIES



Strategies for Climate Change Mitigation and Adaptation

1 Prevention of emission to the atmosphere by conserving existing soil C pool in the soil

2 Increasing the soil C pool through carbon sequestration

3 Mixed cropping and cover crop

4. Conservation Agriculture (CA)

5 Use of less labour-intensive technologies in agriculture

6 Enhance drought and pest resistance; enhance yields

7 Fertilizer or nitrogen taxes to reduce nitrous oxide

8 Innovative technologies in agriculture

9 Promotion of sustainability by developing standards and educational campaigns

10 Emission reduction through livestock management and fertilizer reduction

Agriculture is responsible for about 30% of total GHG emissions (IPPC, 2014).^{4/29}



Benefits of CA

- **Sustainability:** CA is a base for sustainable agricultural production intensification (Jat et al., 2014; Siddique & Farooq, 2014).
- **Increased Yields:** Yield levels of CA systems are comparable with and even higher than those under conventional intensive tillage systems
- **Carbon Sequestration:** It further helps to sequester soil carbon at a rate about 0.2 to 1.0 t/ha/ year depending on the location and management practices (Corsi et al., 2014).
- **Healthier Soils:** CA results in reduced erosion and leaching, reduced use of chemical fertilizer and pesticides, and increased system diversity
- **Labour Saving:** Labour requirements are generally reduced by about 50% (Baig & Gamache, 2009; Crabtree, 2010).
- **Lower costs:** Fuel savings in the order of around 60% or more are in general reported (Friedrich et al., 2009).

What is Conservation Agriculture?



- Conservation Agriculture (CA) is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment (FAO, 2016).
- CA is characterized by three principles:
 - 1. Minimal mechanical soil disturbance**
disturbing less than 25% of the soil surface
(e.g. No-till, minimum tillage, reduced tillage)
 - 2. Maintenance of a permanent soil cover**
especially by crop residues and cover crops
 - 3. Diversification of crop species** grown in
sequence through rotations including a balanced
mix of legume and non legume crops



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World Spread of CA



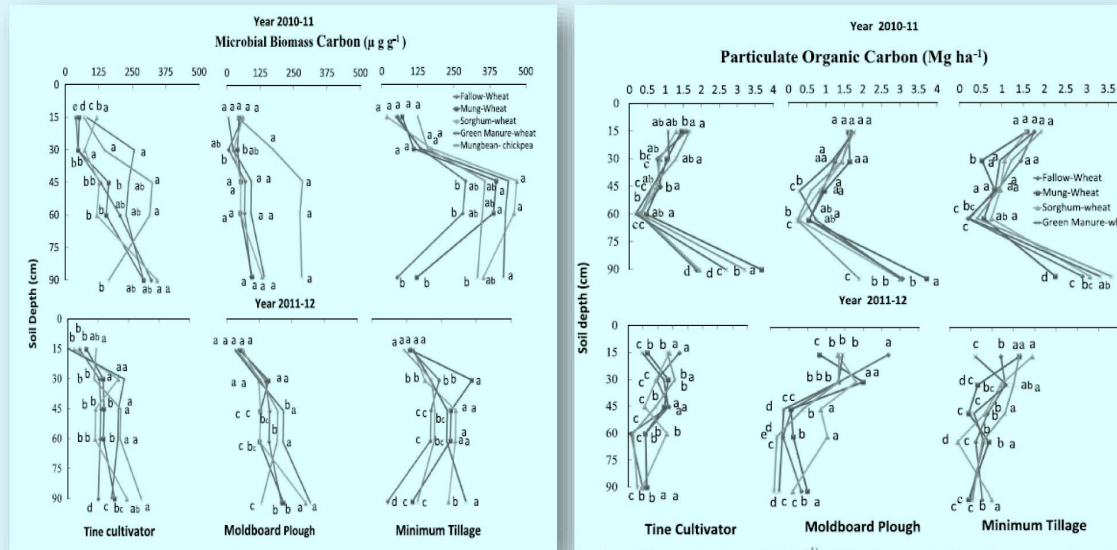
Table 1: CA adoption in different continents

Continent	Cropland under CA (Mha)	Percent of cropland
South America	66.4	60.0
North America	54.0	24.0
Australia & NZ	17.9	35.9
Asia	10.3	3.0
Russia & Ukraine	5.2	3.3
Europe	2.0	2.8
Africa	1.2	0.9
Global Total	157.0	10.9

Kassam et al. (2015)

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Depth distribution of SOC fractions under conservation tillage Year 2010- 11 and 2011-12



Land Degradation and Development 27: 1175-1185 (2016)

DEPTH DISTRIBUTION OF SOIL ORGANIC CARBON FRACTIONS IN RELATION
TO TILLAGE AND CROPPING SEQUENCES IN SOME DRY LANDS OF
PUNJAB, PAKISTAN

Azma Hussain¹, Shikozada Sohail Ijaz^{1*}, Rattan Lal², Sultdar Ali³, Qaiser Hussain¹, Muhammad Anwar¹,
Rozman Hayat Khattak², Muhammad Sharif Baloch¹

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CA Experiments in Rainfed Areas of Pakistan

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Table 2: CA adoption in **Asia**

Country	Cropland under CA (000 ha)
China	6670
Kazakhstan	2000
India	1500
Turkey	45
Syria	30
Korea	23
Iraq	15
Uzbekistan	2.45
Azerbaijan	1.2
Lebanon	1.3
Kirghizstan	0.7

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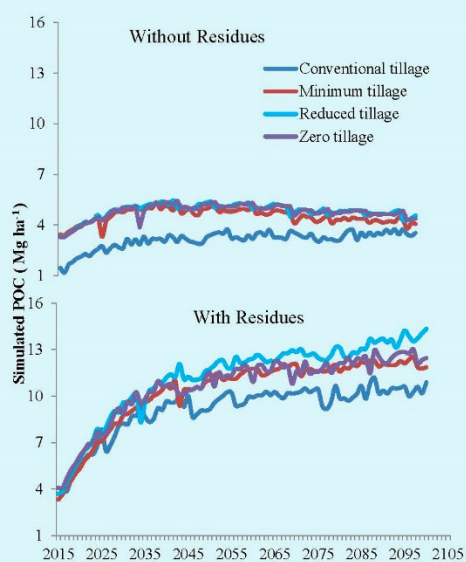
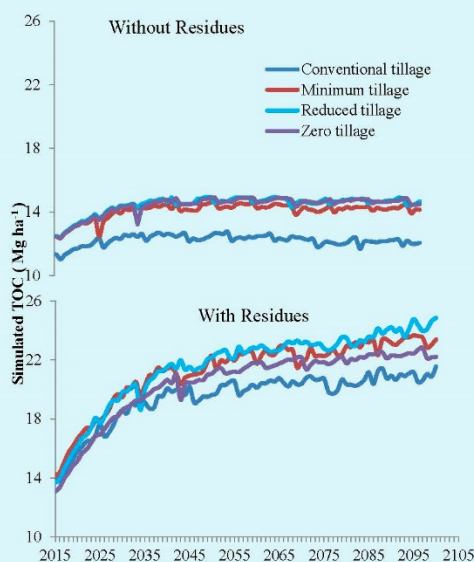
Conservation Tillage in Fallow Based Monocropping

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Crop Intensification to Conservation Agriculture

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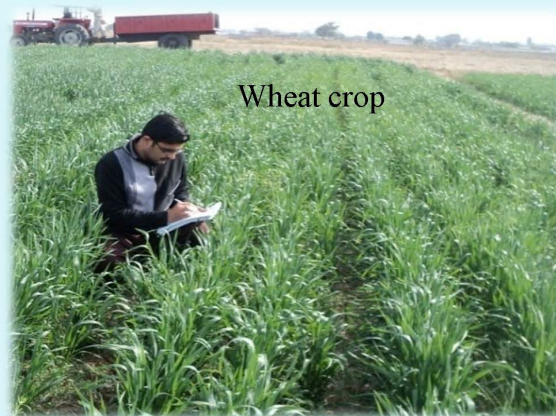
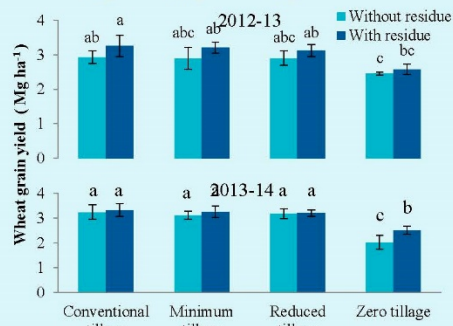
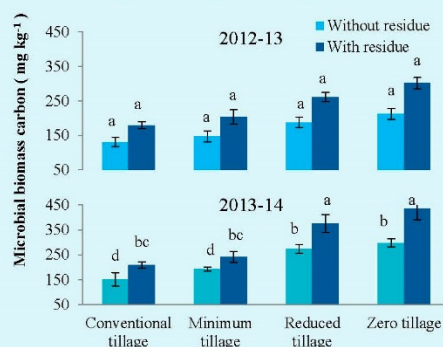
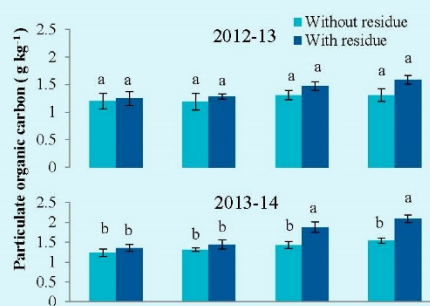
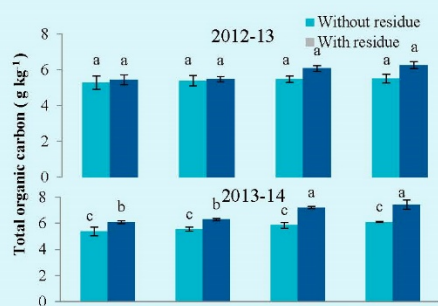
Archives of Agronomy and Soil Science
Archives of Agronomy and Soil Science

ISSN: 0360-3909 (Print) 1473-2050 (Online) DOI: 10.1080/03603909.2015.1040000

Prediction of tillage operation strategies for dryland wheat production in a degraded loess soil

Muhammad Sharif, Shahzada Sohail Ijaz, Safdar Ali, Muhammad Anwar & Armin Hansen

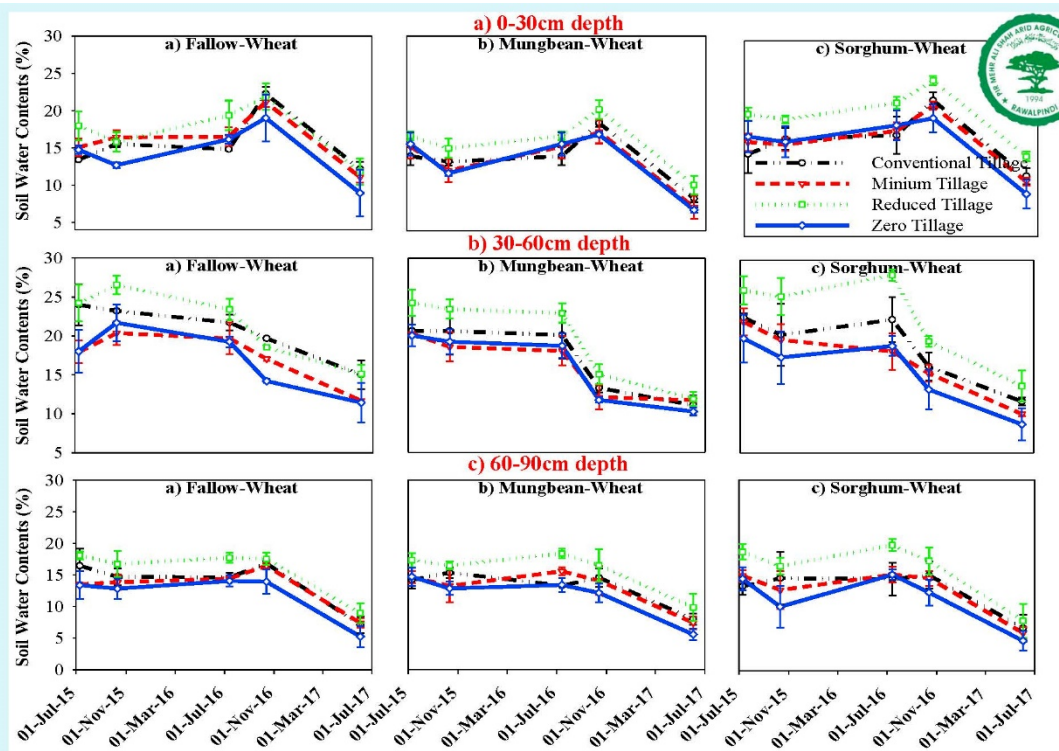
Soil Organic C and Crop Yield under Conservation vs. Conventional tillage



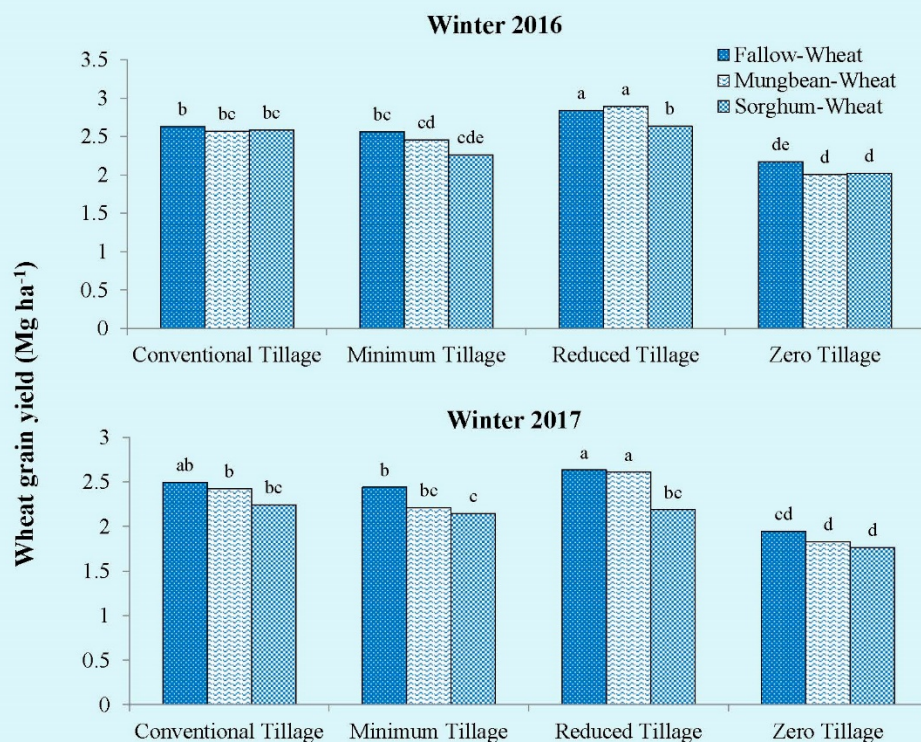
Summer season



Winter season

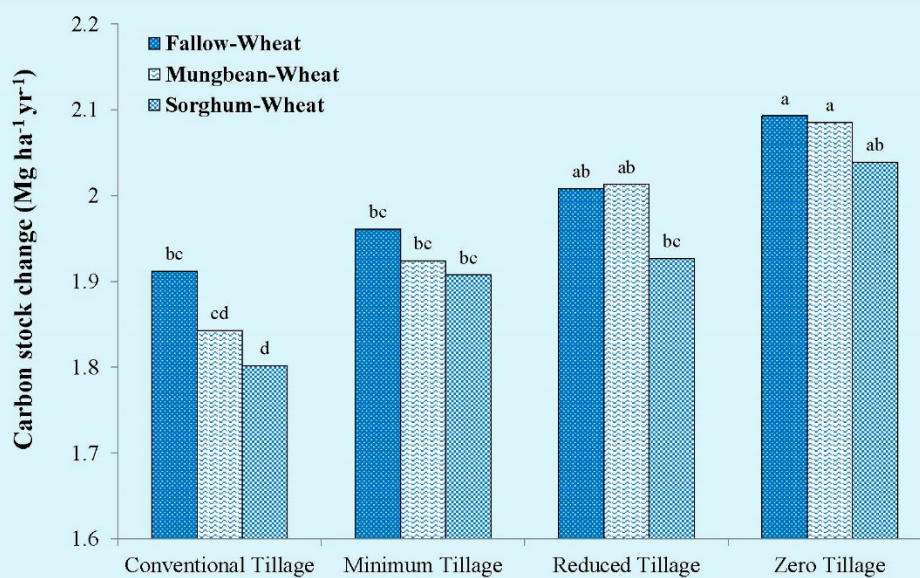


Soil moisture contents under conservation agriculture practices



Wheat grain yield under different tillage practices and cropping sequences

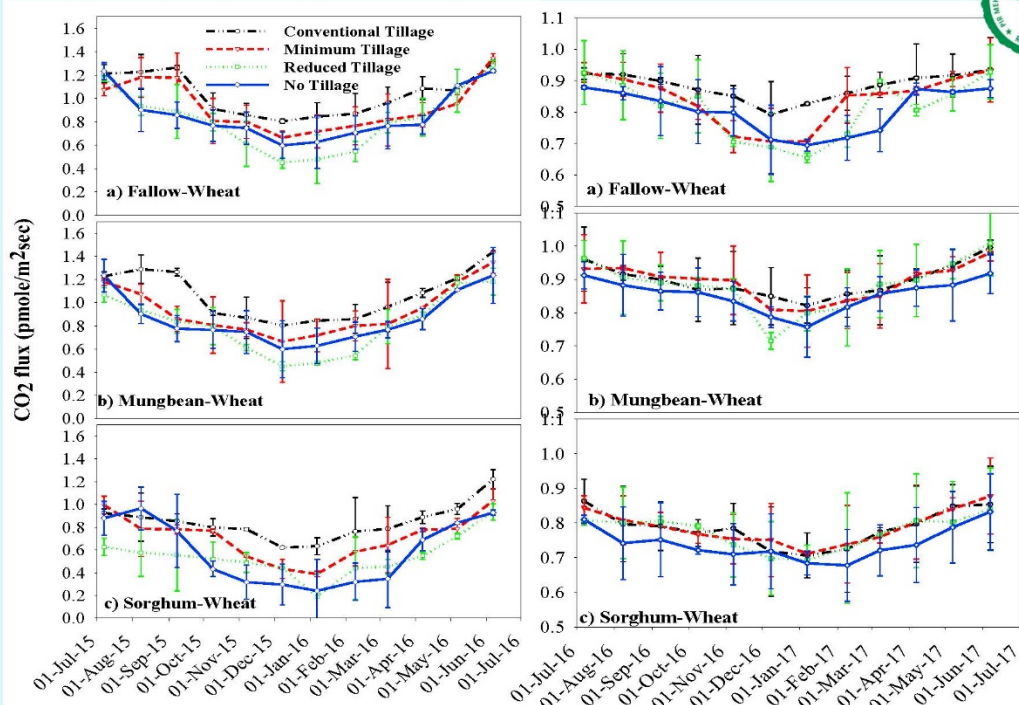
17/29



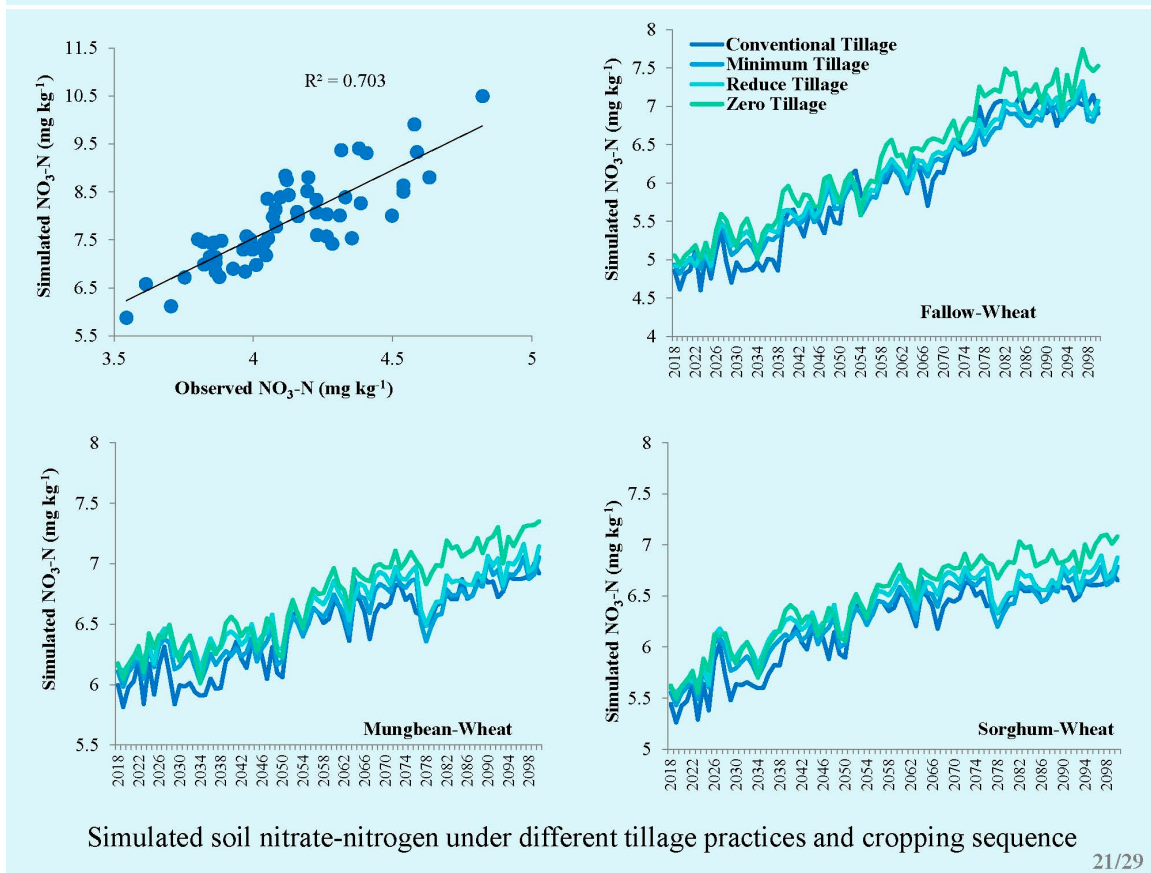
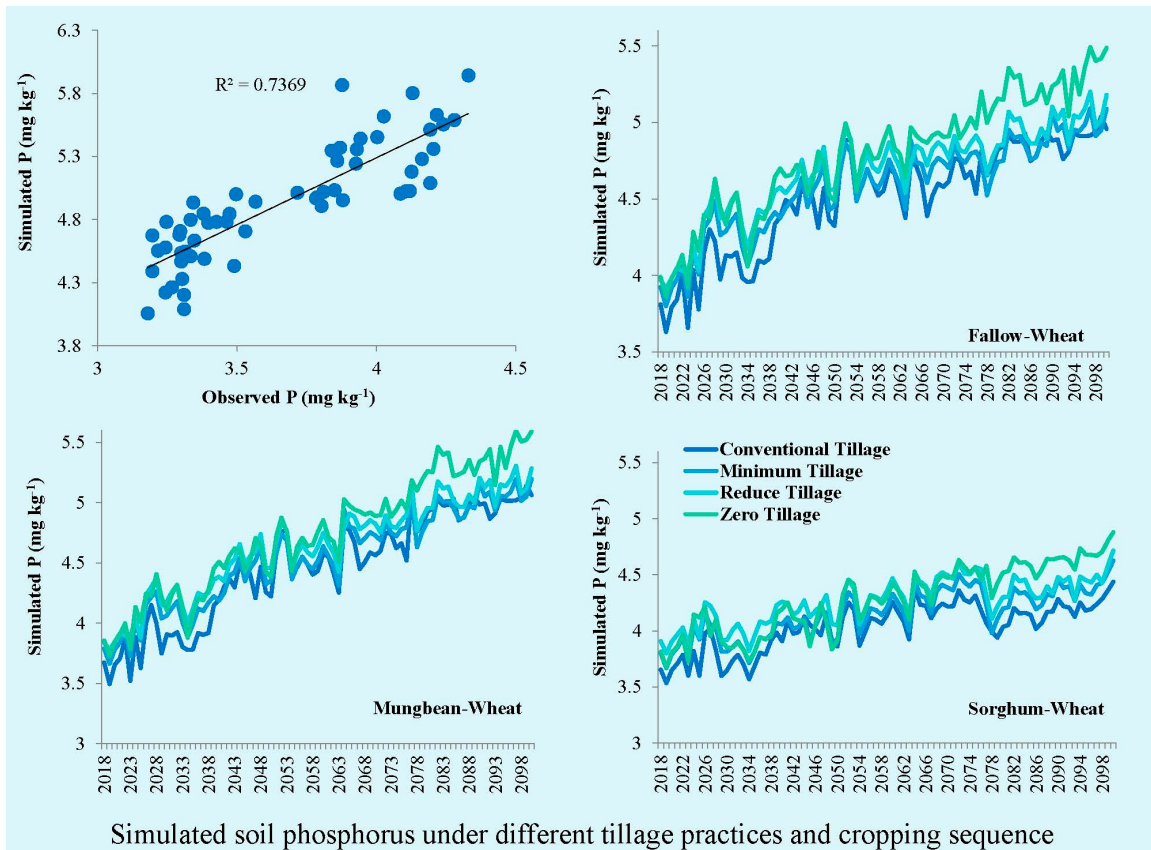
Soil carbon stock changes after 5 years of conservation tillage

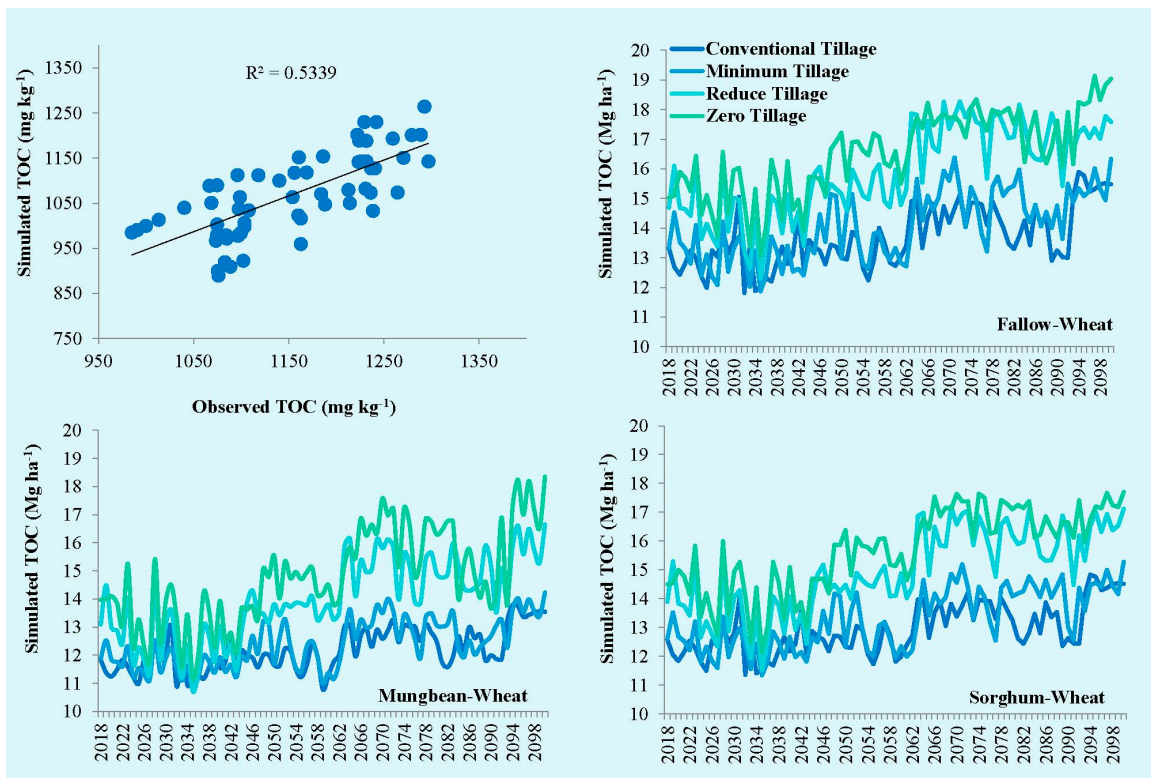
Year 2015-16

Year 2016-17



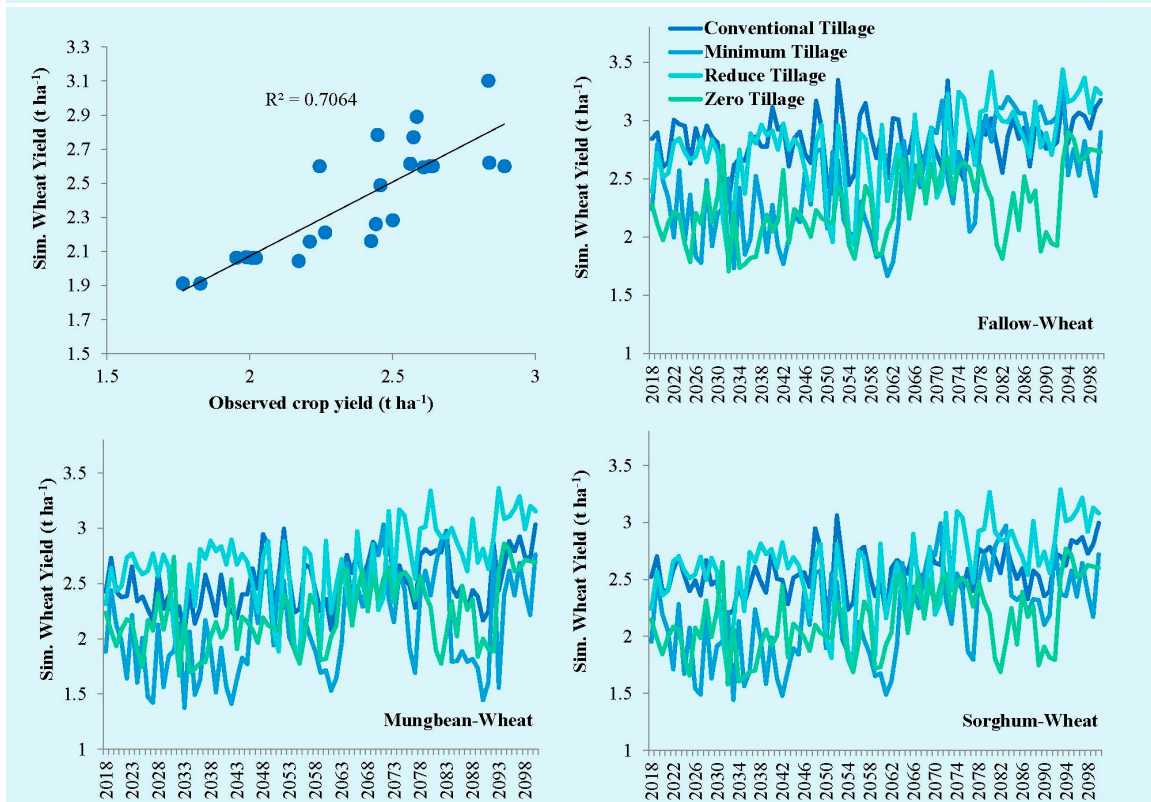
CO₂ flux measurement under conservation agriculture practices





Long term simulated total organic carbon under different tillage practices and cropping sequence

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Long term simulated wheat yield under different tillage practices and cropping sequence

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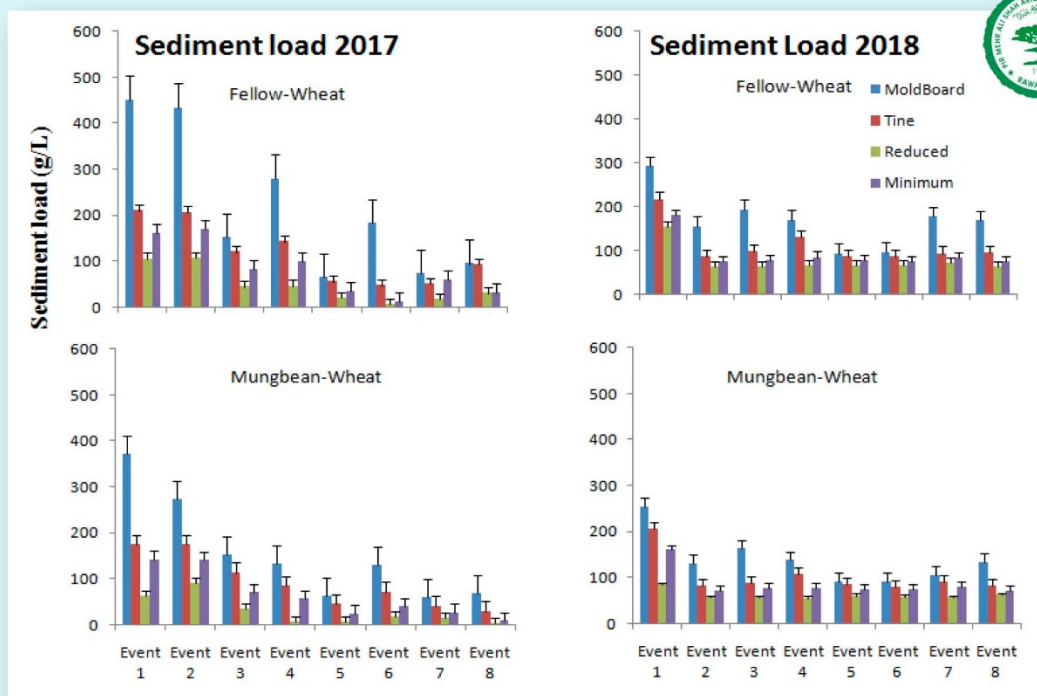


Fig. 1 Sediment load under different tillage practices and crop rotations

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Erosion under Conservation Agriculture

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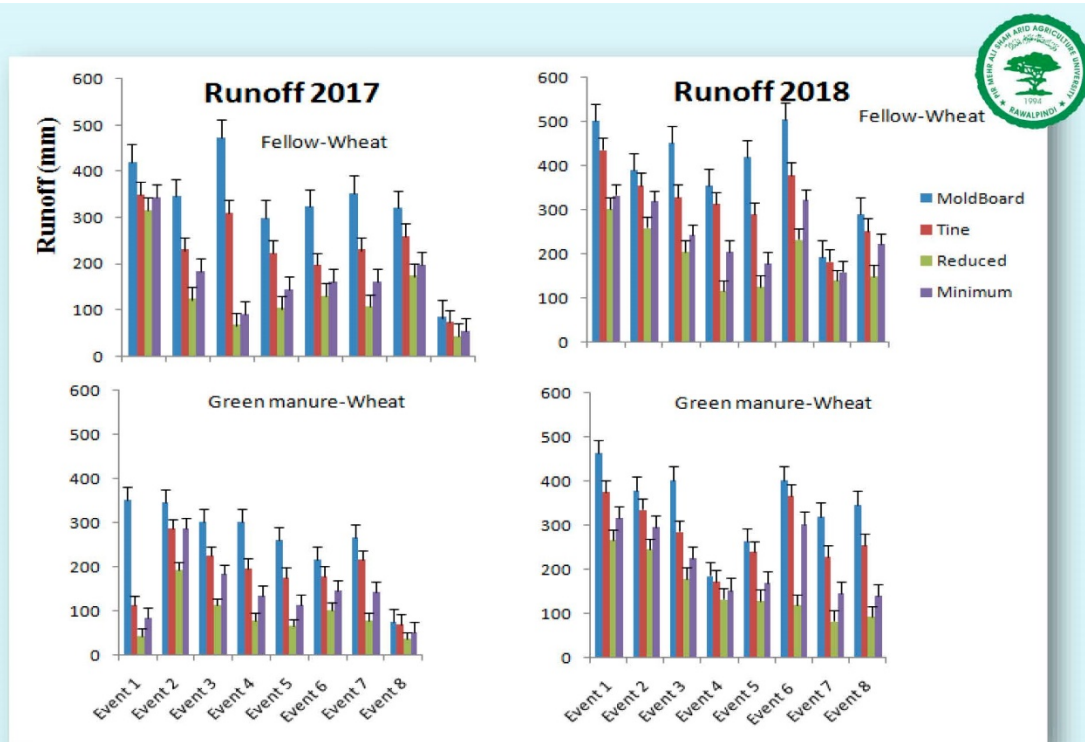


Fig. 3 Runoff under different tillage practices and crop rotations

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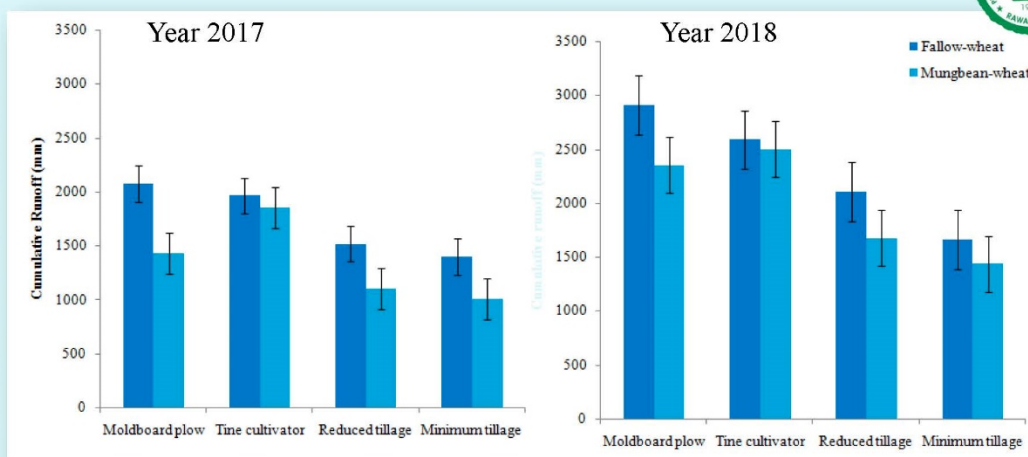


Fig. 4 Cumulative runoff under different tillage practices and crop rotations

Note:

- Runoff decreased with decrease in tillage intensity
- Double cropping reduced runoff than monocropping

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Conclusion

Reduced tillage (chisel plow plus cover crop) is a successful Conservation Agriculture (CA) strategy for soil carbon sequestration, climate change mitigation/ adaptation and thus the sustainable crop production in rainfed areas of Pakistan

Acknowledgement

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