

Impact of Cover Cropping on Agricultural Runoff and Nutrient Transport

Kokulan Vivekananthan



Grassroots Innovation *Since 1939*

Acknowledgements

OSCIA Led Collaborative Research Programs

- On-Farm Applied Research and Monitoring (ONFARM)
- Lake Erie Enhanced Agricultural Analysis Project (LEEAAP)

Funding Agencies

- Ontario Ministry of Agriculture, Food and Agribusiness
- Environment and Climate Change Canada
- Canada Water Agency

Partner Organizations

- Ausable Bayfield Conservation Authority
- Upper Thames River Conservation Authority
- Lower Thames Valley Conservation Authority
- Department of Geography and Environmental Management, University of Waterloo

Cover Cropping

- Plants grown between main crops to protect the soil, improve its health, and enhance its physical and biological properties.
 - Protect soils from erosive forces
 - Increase soil organic matter
 - Improve soil structure
 - Facilitate nutrient cycling
- A wide range of cover crops allows selection based on specific farm needs.
- Increased cover crop adoption among growers



PC: Anastassia Lagounova

Cover Crops and Water Quality

Nutrient losses from agricultural lands

Mostly associated with non-growing seasons (NGS) in regions like Southern Ontario, particularly phosphorus (P)

Associated with elevated runoff – surface and subsurface

**Can Cover Crops Reduce Runoff
and Nutrient Losses?**



Lake Erie

PC: Zachary Haslick/Aerial Associates
Photography Inc

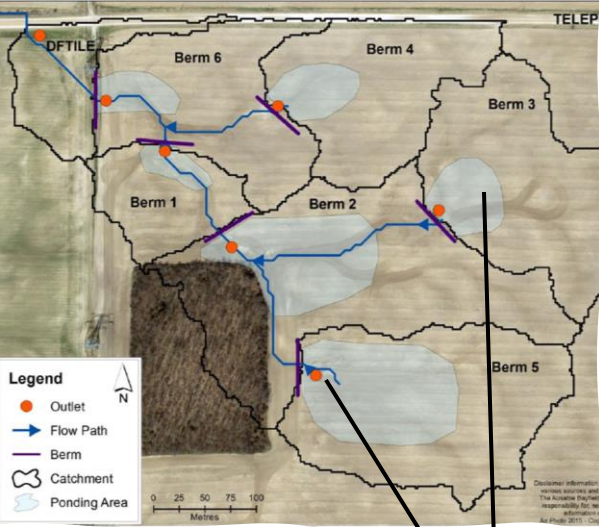
Cover Crops and Water Quality

- Slow down surface runoff –
Continuous soil cover, reduce
compaction
- Enhance infiltration and water
holding capacity – Aggregate stability
and organic matter
- Utilize residual nutrients

What does the research show?



Keeping Your Soils Covered can Reduce Surface Runoff Generation



- Exeter, Ontario
- Water and sediment control basin (WASCoB)
- Focus on Berm3 and Berm5
- Corn-Soybeans-Soybeans-Winter wheat rotation
- Oats cover crop after winter wheat harvest (B3- Harvest, B5-Unharvest)
- 2017 - 2024

Growing Season Surface Runoff Activation

- **No surface runoff** when the winter wheat was planted
- **Less than 10%** event response for oats
- Soybeans 10-14 % response
- Corn **25-35%**

Cover	Response (Total)		Avg. Runoff* Coef. (%)	
	B3 Harvest	B5 Unharvest	B3 Harvest	B5 Unharvest
Corn	13 (38)	9 (38)	20.5	24
Soybeans	4 (43)	6 (43)	16	26
Winter wheat	0 (20)	0 (20)	NA	NA
Oats**	1 (13)	2 (25)	2.3	15

* Surface runoff

** Sometimes present in Non-growing season

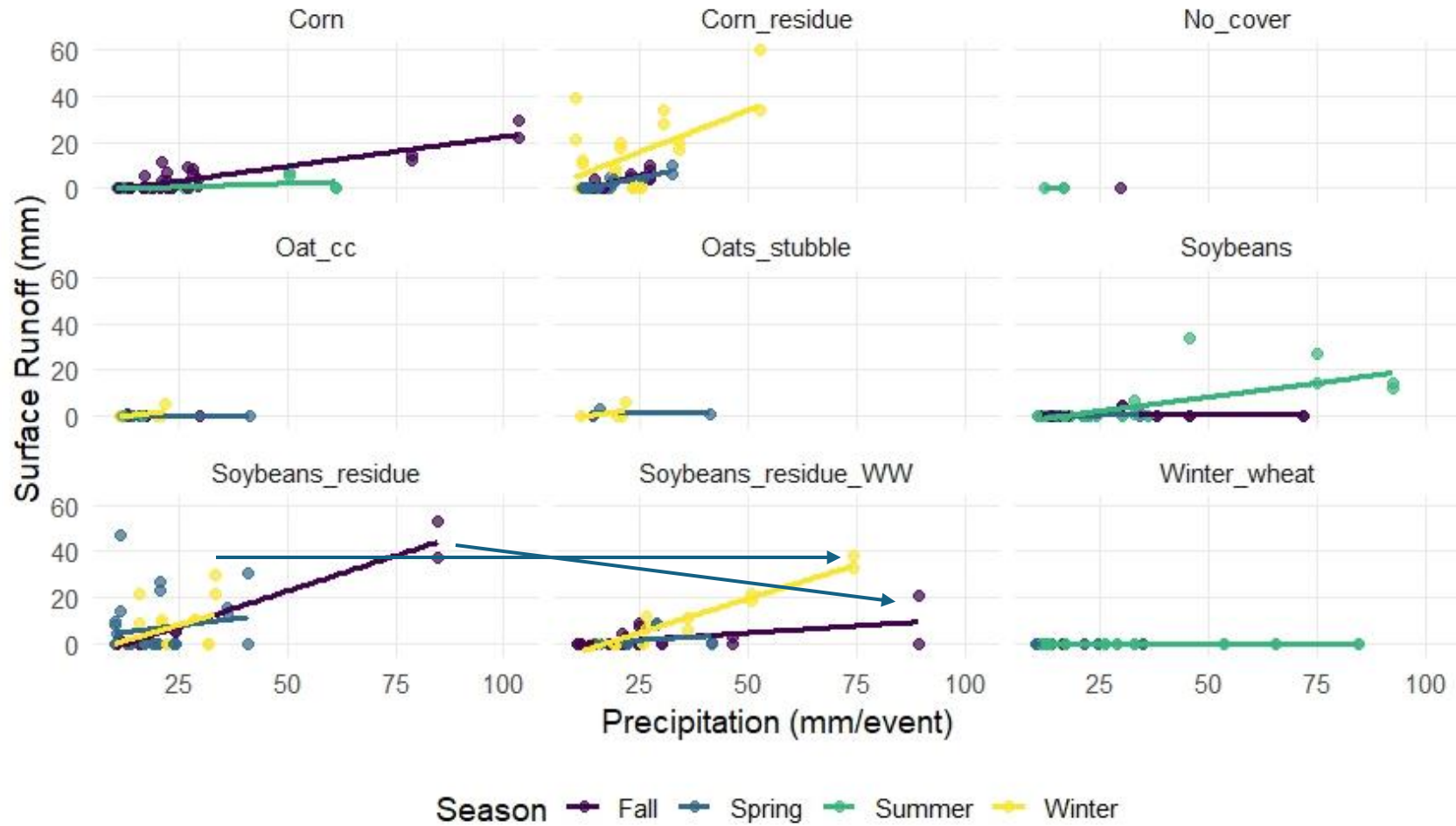
Non-growing season Surface Runoff Activation

- Both soybean and corn residue were **prone** to surface runoff
- **Reduction** in runoff coefficient when winter wheat was planted after soybeans
- **Less surface runoff responses** when oats stubble was present

Cover	Response (Total)		Avg. Runoff* Coef. (%)	
	B3 Harvest	B5 Unharvest	B3 Harvest	B5 Unharvest
Oats stubble	5 (24)	2 (16)	21	24
Corn residue	15 (30)	13 (30)	52	64
Soybeans residue	13 (34)	13 (34)	50	72
Soybeans residue & winter wheat	11 (30)	6 (30)	28	33

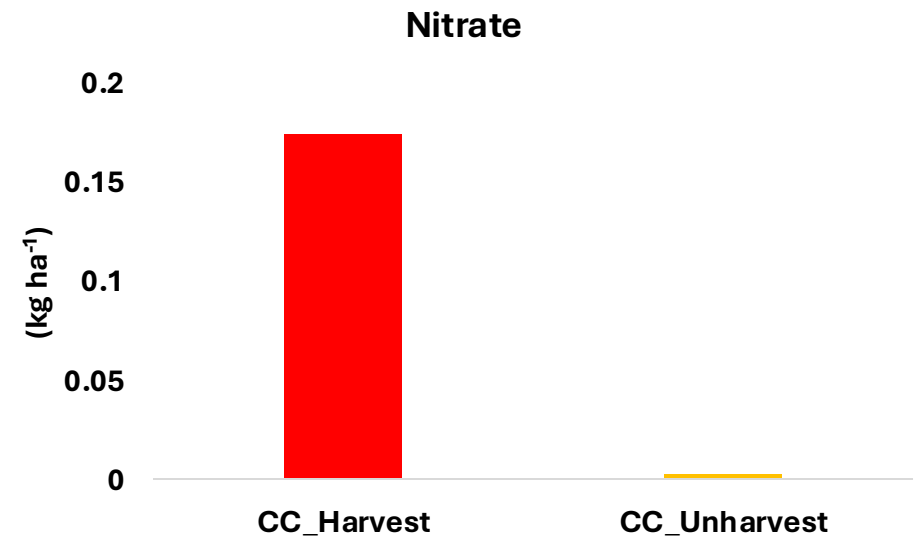
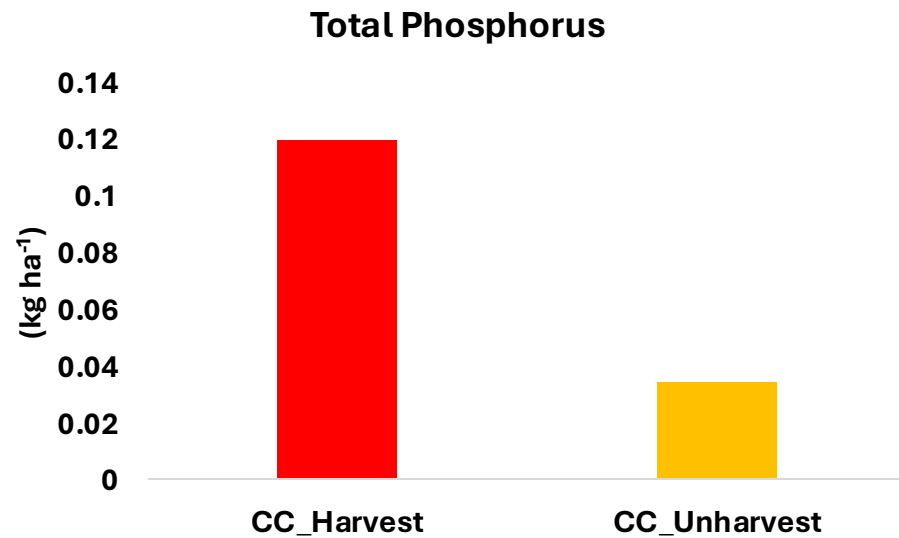
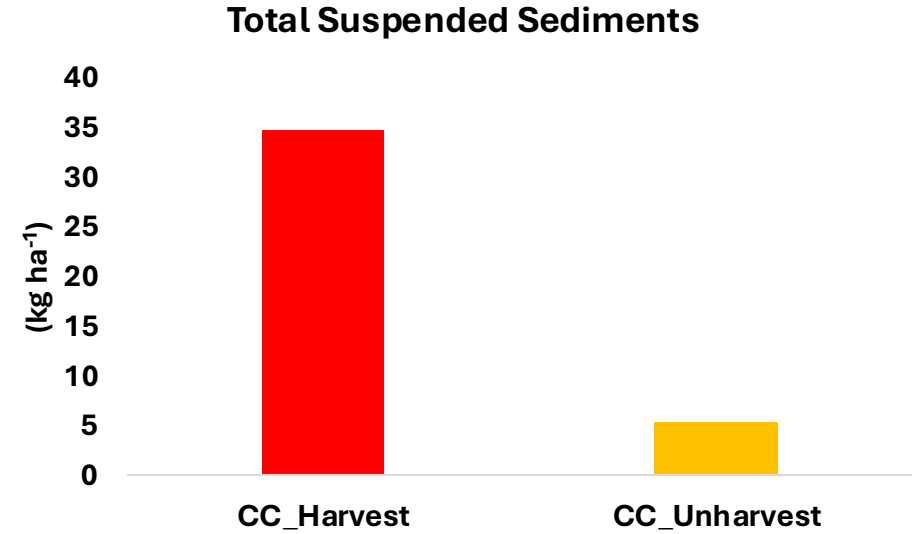
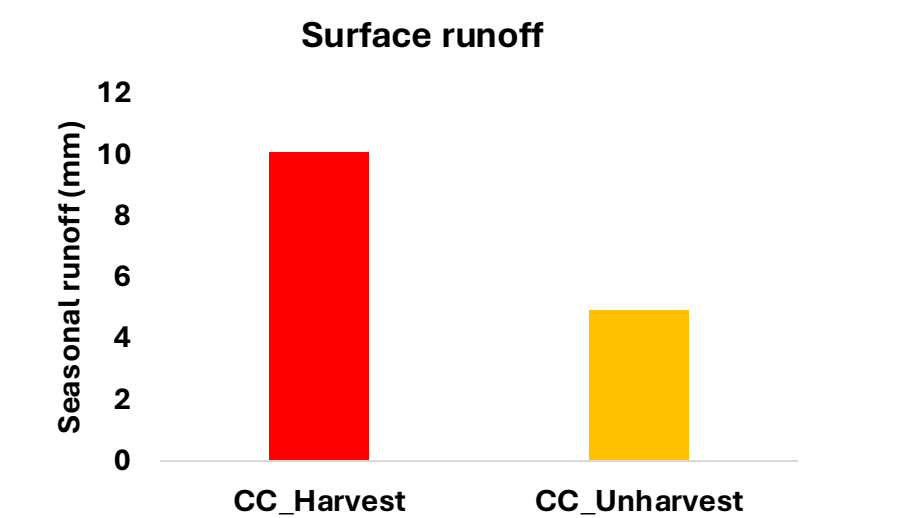
* Surface runoff

Surface Runoff Generation



- Surface runoff generation was influenced by
 - Precipitation size
 - Antecedent moisture
 - Season
 - Cover crop type

Cover Crop Harvesting (2020) on Runoff and Chemistry



Cover Crop Establishment on Runoff and Chemistry



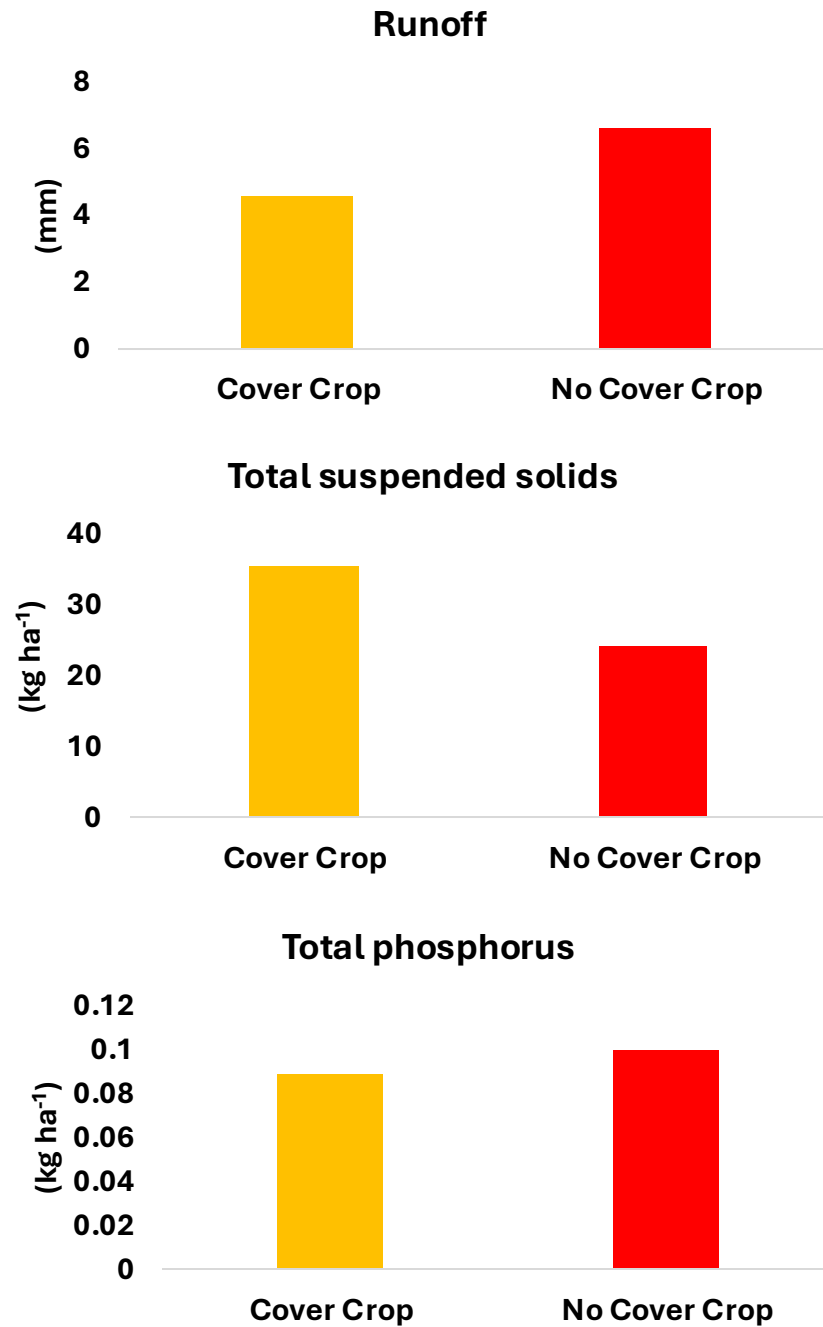
- London, Ontario
- Paired sites
- Cover crop comparison
- Tile flow
- Surface runoff reaches the tile through Hickenbottoms

Poor Cover Crop Catch

March 26, 2021

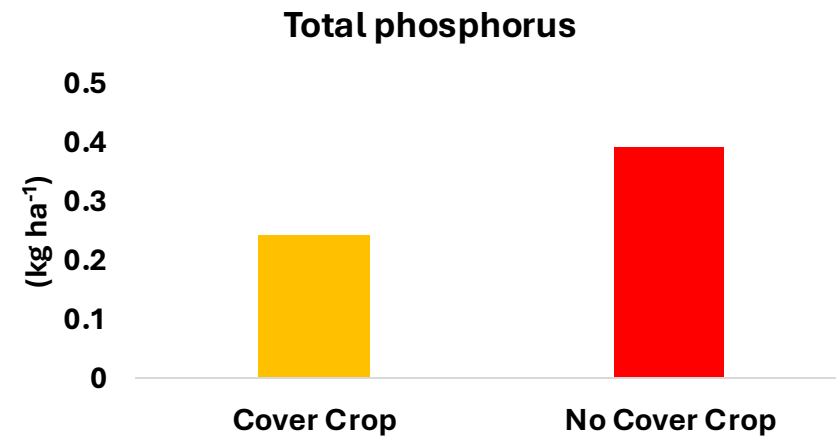
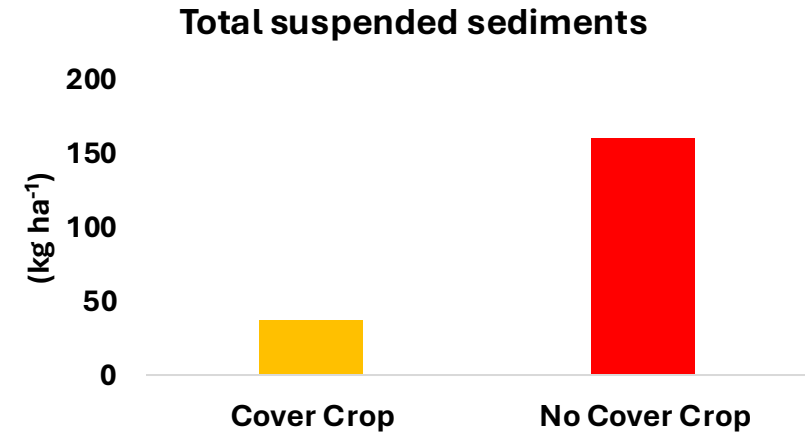
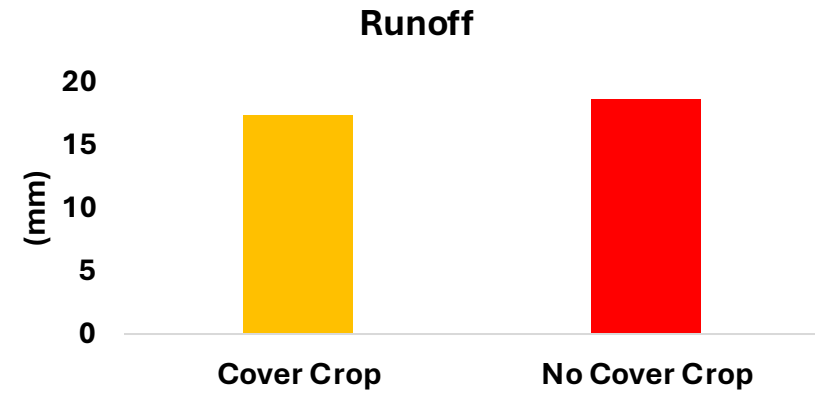


PC: UTRCA

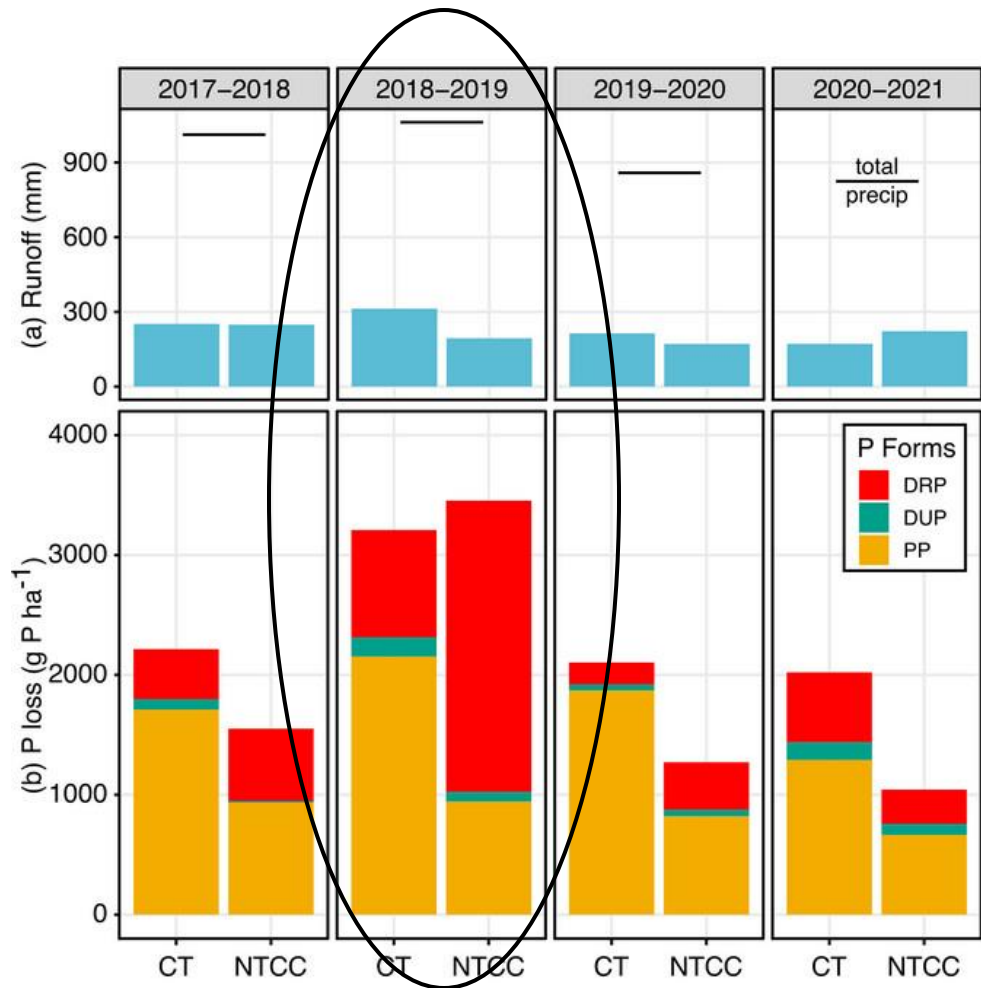


Good Cover Crop Catch

March 8-10, 2024



Incorporating Cover Crops with Other BMPs



- Recent study from Chatham-Kent, ON
- Total P losses were higher for the conventional till (CT) site than the no-till, cover crop (NTCC) site in 3 out of 4 years
- 2018-19 -> **Fall surface broadcast P application** at NTCC site followed by a poor winter wheat establishment

Summary and Future Directions

Soil cover **reduces** runoff, sediment, and phosphorus losses

Harvesting cover crops before winter **may offset** some of these benefits

Strong cover crop **establishment** is key to reducing sediment and P losses

Managemental decisions like **fall fertilizer use may offset** cover cropping benefits

OSCIA and partners will continue water monitoring at ONFARM and LEEAAP sites until 2028

Drone cover crop seeding research– Another ongoing research by OSCIA



Drone Cover Crop Seeding
PC: OSCIA/ Living Labs



Thank you

Email : kvivekananthan@ontariosoilcrop.org

Twitter : @KokulanV