Influence of Cover Crop Planting and Termination Time on Rainfed Corn Production in Western Nebraska

Alexandre Tonon Rosa, Liberty Butts, Daran Rudnick, Cody Creech, Roger Elmore and Rodrigo Werle

University of Nebraska-Lincoln, Lincoln, Nebraska; alexandre@huskers.unl.edu

Introduction

- ✓ Cover crops (CC) are becoming popular across the United States. In western Nebraska, wheat-corn-fallow is the predominant rotation strategy in rainfed fields. Inclusion of CC could succeed winter wheat, filling the fallow period before corn planting (Figure 1).

Fallow							Winter Wheat							Cover Crops							Corn							
Year 1													Year 2												Year 3				
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

Figure 1. Inclusion of cover crops after wheat harvest in winter wheat-corn-fallow (WCF) rotation in Western Nebraska.

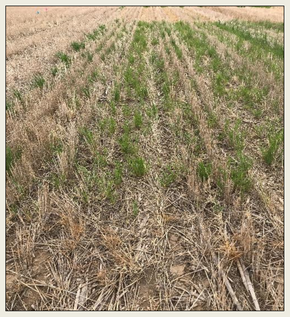
- ✓ Benefits of CC are potential increase in soil fertility, reduced soil erosion and weed suppression.
- ✓ However, in dryer environments, CC can use excessive amounts of soil water, which may significantly reduce grain yield of subsequent crops. Thus, dryland producers of western Nebraska are questioning whether their adoption is justifiable.

Objective

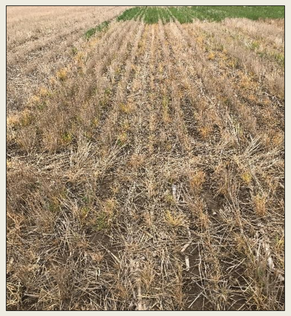
- ✓ Evaluate the impact of CC selection, planting and termination time on biomass production, soil moisture levels, and subsequent corn development.

Material and Methods

- ✓ Three CC planting times: 3, 6 and 9 weeks after wheat harvest, represented by P1, P2 and P3, respectively.
- ✓ Four CC termination times:



Winter-sensitive mixture, killed in the winter (WS)



Winter-hardy mixture early terminated (3 weeks prior corn planting; WHET)

Winter-hardy mixture late terminated (at or after corn planting; WHLT)

No cover crop (NCC)

- Winter-sensitive mixture species: black oats, spring barley, spring lentil, and diakon radish
- Winter-hardy mixture species: winter barley, winter triticale, hairy vetch, and diakon radish

- ✓ The experiment was established at two locations in 2016 (North Platte and Grant, NE).
- ✓ Cover crop biomass was collected after first frost event in the Fall 2016, and twice in the Spring 2017 (3 weeks before and at corn planting).
- ✓ Soil volumetric water content (VWC) measurements were taken at corn planting (0 to 20cm deep) using the Field Scout TDR 300 Soil Moisture Meter (Spectrum Technologies, Inc., Aurora, IL).
- ✓ Corn biomass was collected at V6 growth stage.
- ✓ The study was arranged in a randomized complete block design with four replications.
- ✓ Statistical Analysis was ran in SAS 9.4 using GLIMMIX.

Results

Cover Crop Biomass Accumulation

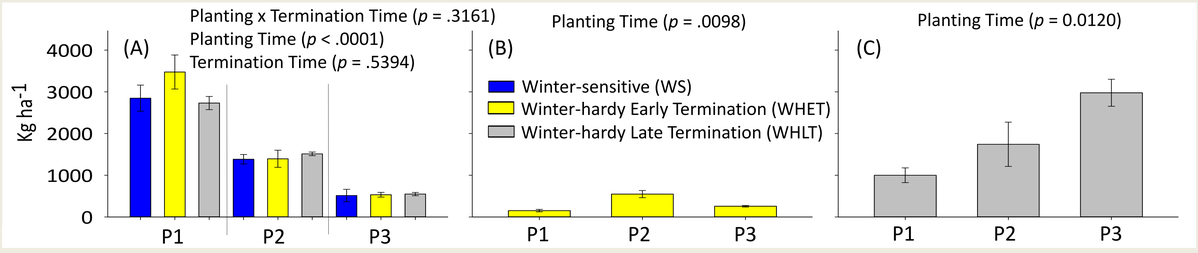


Figure 2. Cover crop biomass accumulation in the fall (A), early-spring (B), and late-spring (C), according to different planting times at North Platte, NE. For planting time information check figure 6.

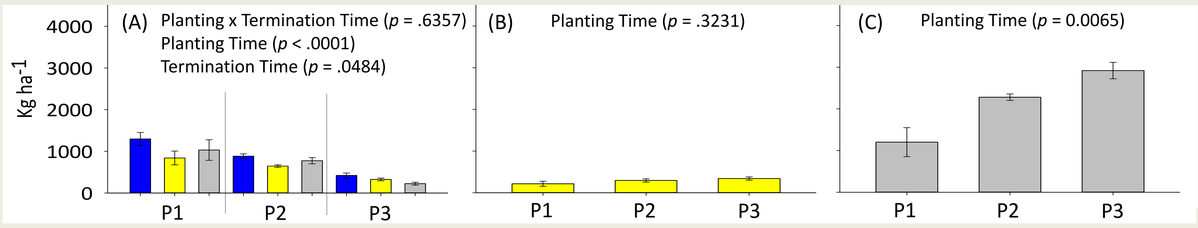


Figure 3. Cover crop biomass accumulation in the fall (A), early-spring (B), and late-spring (C), according to different planting times at Grant, NE. For planting time information check figure 6.

- The earliest planting time resulted in the highest CC biomass in the fall. At late-spring, the two later planting times in the fall resulted in higher CC biomass for both sites.

Results (Cont'd)

Soil Volumetric Water Content

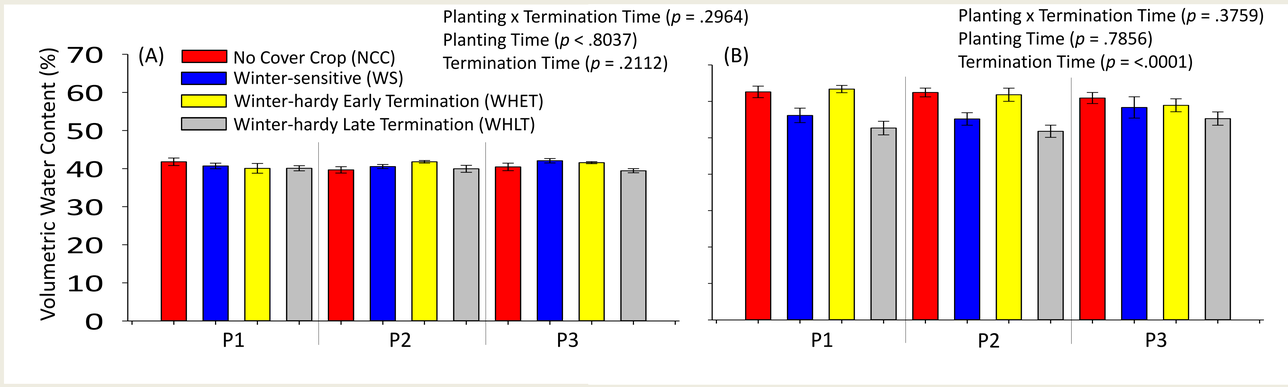


Figure 4. Soil volumetric water content (VWC) from 0-20 cm deep in North Platte (A) and Grant, NE (B) at corn planting, according to planting and termination times of cover crops. For planting time information see Figure 6.

- At North Platte, there was no difference in soil VWC among termination times. At Grant, the WHLT treatment reduced soil VWC significantly compared to other termination treatments.

Corn Biomass Accumulation at V6 Growth Stage

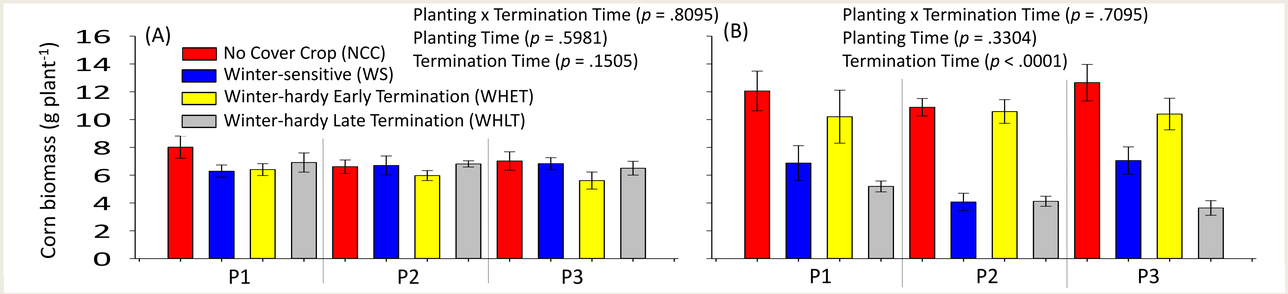


Figure 5. Corn biomass accumulation by plant at V6 growth stage according to planting and termination times at North Platte (A) and Grant, NE (B). For planting time information check figure 6.

- Corn biomass at V6 was lower when CC were late terminated, especially at Grant. None of the CC treatments resulted in higher corn biomass than the no CC treatment.

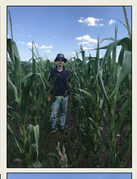
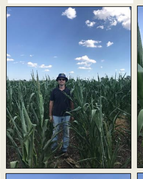
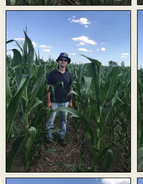
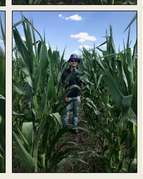
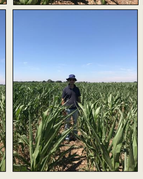
North Platte, NE	NCC	WS	WHET 04/14/2017	WHLT 05/02/2017	Grant, NE	NCC	WS	WHET 04/18/2017	WHLT 05/24/2017
Cover Crop Planting Time 1: 08/17/2016					Cover Crop Planting Time 1: 08/19/2016				
Cover Crop Planting Time 2: 09/07/2016					Cover Crop Planting Time 2: 09/08/2016				
Cover Crop Planting Time 3: 09/26/2016					Cover Crop Planting Time 3: 09/28/2016				

Figure 6. Visual effects on corn from combinations of cover crop planting and termination times at North Platte and Grant, NE (pictures taken in July 19, 2017). Corn was planted on May 5, 2017 at North Platte and May 15, 2017 at Grant.

Conclusions and Applications to Crop Management

- ✓ Winter-sensitive CC mixes died in the winter; winter-hardy mixes needed to be terminated with herbicides in the spring.
- ✓ To optimize CC biomass in the fall, producers should plant CC shortly after wheat harvest. For CC biomass in the spring, there was a wider window to plant CC after wheat harvest.
- ✓ In rainfed areas, CC termination time is key to avoid excessive cover crop growth, water use and nitrogen immobilization before corn establishment.

Future Directions

- ✓ Soil fertility, weed counts and yield data will be collected and published in the near future. The study will be replicated in 2017-2018. Additional projects looking at wheat stubble cutting height in combination with CC at several precipitation zones across NE will help us elaborate CC management recommendations for dryland cropping systems in western Nebraska.

Acknowledgements

- ✓ We would like to thank the UNL Cropping Systems team for the assistance with field activities. This project is being funded by the "*University of Nebraska-Lincoln IANR-ARD Wheat Innovation Funds*".