

Managing Perennial Cover Crop Systems

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INTRODUCTION

Increasing continuous vegetative cover in the upper Midwest is critical to mitigating the environmental consequences of conventional agricultural practices. Cover crops provide an effective, plant based solution to nutrient losses in the corn-soybean crop rotation, specifically with perennial species that provide year-round soil protection.

Problem: Developing cover crop systems that are present during the early spring to minimize early season soil erosion and nutrient loss.

Challenge: Identify perennial cover crop management techniques that maintain ground cover while reducing the inherent risk of yield loss in a corn and soybean rotation.

Approach: Integrate winter hardy, perennial legume and grass species that persist while grown simultaneously with corn and soybeans (Table 1, Fig 1).

Table 1. Explanation of desirable characteristics for perennial species to use as cover crops

Rationale	Characteristics	
	Perennial legumes	Fescues
	Long living	Low growing
	Spread by rhizomes	Shade tolerant
	Tolerate defoliation	Summer dormant
	Winter hardy	Winter hardy



Figure 1. Perennial species suitable for use of cover crops in a corn and soybean rotation.

Strategy 1: Apply tillage techniques with in-season suppression of covers to allow cash crops to grow effectively. Rotary zone tillage (Fig 2), cultivates 0.76 m wide strips, effectively destroys perennial root structures. Herbicide strip application (Fig 3), provides seed bed preparation for no-till systems.

Strategy 2: Chemically suppress cover crop species prior to planting of cover crops to minimize interaction of plants during critical weed free periods of cash cover crops.¹



Figure 3. Rotary zone tillage of crown vetch (Nov. 2016)



Figure 3. Herbicide strips in hard fescue (March 2017)

OBJECTIVE

Maximize yield of soybean (*Glycine max* L.) and corn (*Zea mays* L.) while maintaining the perennial cover crop establishment and persistence

MATERIALS & METHODS

Experimental Design

Randomized Complete Block Design

- 12 treatments
- Six blocks:
 - Three soybean
 - Three corn
- Three Locations:
 - Waseca, MN
 - Lamberton, MN
 - Rosemount, MN

Establishment

- 2015: Seed covers
- 2016: Establish covers
 - Apply fall tillage treatments (Figure 4)
- 2017: Suppress covers
 - Plant corn and soybean
 - Suppress covers
 - Harvest corn and soybeans

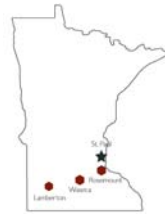


Figure 4. Aerial footage of perennial study after fall tillage was applied at Lamberton (November 2016)

Experimental Treatments

Table 2. Explanation of treatments. Five cover species are chewings fescue, legume mix, hard fescue, kura clover and crown vetch

Tillage	Perennial Cover Species	Suppression
Rotary zone tillage (Fig. 5)	(5) Cover species	1.66 kg/ha ¹ rate of glufosinate
Herbicide (glyphosate + aminopyralid) strip suppression (Fig. 6)	(5) Cover species	<ul style="list-style-type: none">• Planting• Mid-June
No tillage	No cover check	N/A
Conventional till	Conventional check	N/A

Agronomics

- Planting: no-till planter; fescue + band treatments were hand planted due to high cover residue
- Weed management: contact herbicide at time of suppression, 2-4D-B for broadleaves in legumes, Post in fescue species
- Fertilizer: Corn: Legumes: 160 kg / ha N
Fescues: 220 kg / ha N

Parameters measured

- Cover persistence (pre-plant, anthesis, first frost)
- Yield of cash crops

RESULTS

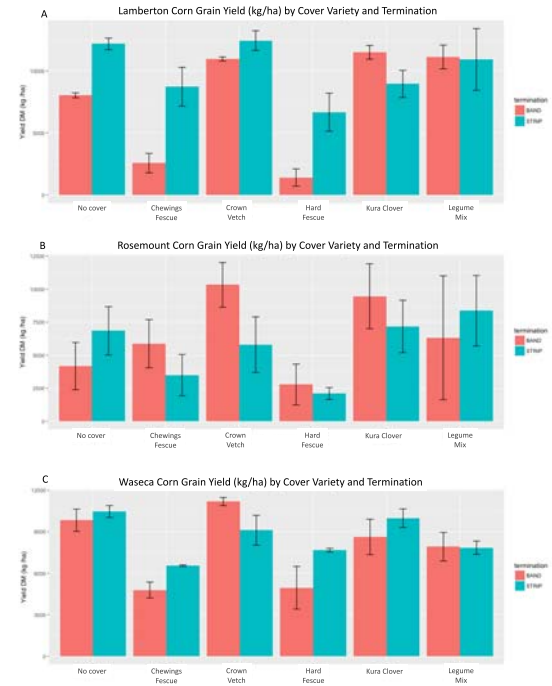


Figure 5. Corn grain yields (kg/ha) as influenced by perennial cover variety and seed bed termination for (A) Lamberton, (B) Rosemount, and (C) Waseca, MN. Yield means calculated over each block at each location.

DISCUSSION

- Band terminated hard fescue species performed poorest across all locations
- Band terminated crown vetch out yielded no-till check across all locations

Limitations

- Effective planting technologies for high residue systems
- Adequate suppression of fescues to minimize early season competition

Future Research

- Evaluate dry matter yield soybean, as competition slowed maturation of soybean
- Assess biomass and persistence of the perennial cover crop species prior to the first hard frost



Figure 6. Tipping back of corn ear in hard fescue plot due to competition (Waseca, MN).

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¹Bartel, C. A., C. Bank, A. W. Lensen, K. J. Moore, D. A. Laird, S. V. Archonoulis, and K. R. Lamkey. 2017. Establishment of Perennial Groundcovers for Maize-Based Bioenergy Production Systems. Agron. J. 109: 822 – 835.