Fall Herbicide Applications Allow for Frost-Seeding of Red Clover in Winter Wheat

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Introduction

- Frost-seeding red clover into winter wheat was a time-honored tradition for Michigan growers since the early 1900s.
- However, over the last thirty years many growers moved away from frost-seeding clover due to changes in tillage practices and the lack of compatibility between clover and herbicides that are often applied in the spring for weed control in winter wheat.
- Due to the renewed enthusiasm in cover crops, many growers have expressed interest in including red clover back into their crop rotations.
- The use of newer herbicides and the potential to apply some of these herbicides in the fall may allow for the inclusion of frost-seeded clover back into winter wheat.

Objective

- Determine the impact of fall and spring herbicide applications on frost-seeded clover survival, weed control, and winter wheat injury and yield.

Materials and Methods

Experimental design

- Field trials were established in the fall of 2013 at the Saginaw Valley Research and Extension Center near Frankenmuth, MI and in 2014 at the Michigan State University Agronomy farm in East Lansing, MI.
- Winter wheat was seeded at 4.5-5.5 M seed ha^{-1} (1.8-2.2 M seeds A^{-1})
- Medium red clover in was seeded in mid-March at 11.2-13.5 kg ha^{-1} (10-12 lb A^{-1})
- Split-plot design with 4 replications
  - Main plot: application timing
  - Sub-plot: herbicide treatment

Herbicide treatments

Application timings	Trade names	Active ingredients
Fall: Feeke's 1.3	Affinity BroadSpec* (0.75 oz A^{-1})	thifesulfuron + tribenuron (13+13 g ha^{-2})
Spring: Feeke's 5	Huskie* (13 fl oz A^{-1})	pyrasulfotole + bromoxynil (45 + 258 g ha^{-2})
	Osprey* (4.75 oz A^{-1})	mesosulfuron (14.5 g ha^{-2})
	PowerFlex HL* (2 oz A^{-1})	pyroxsulam (18 g ha^{-2})
	Clarity (0.25 pt A^{-1})	dicamba (140 g ha^{-2})
	2,4-D ester (1 pt A^{-1})§	2,4-D ester (560 g ha^{-2})
	MCPA (0.38 pt A^{-1})	MCPA (213 g ha^{-2})

* non-ionic surfactant + ammonium sulfate included
§ 2,4-D ester is not labeled for fall applications

Data collection and analysis

- Winter wheat injury
- Red clover injury prior to and after wheat harvest
- Winter wheat yield (2015 only)
- Common lambsquarters control after wheat harvest
- Red clover counts after wheat harvest
- Data were analyzed using PROC MIXED in SAS
  - Years were combined *(Random effects)*
  - Mean were separation Fisher's protected $LSD_{(0.05)}$

Results and Discussion

Wheat injury and yield

- Wheat injury was less that 10% for all herbicide applications, with the exception of fall-applied of 2,4-D ester (>40%). Injury from fall-applied 2,4-D ester resulted in a 28% reduction in winter wheat yield.

Common lambsquarters control

- Affinity BroadSpec was the only fall-applied treatment that controlled common lambsquarters (88%) after harvest *(Figure 1)*.
- Common lambsquarters control was greater than 80% with all spring herbicide treatments, with the exception of Osprey that did not control this weed *(Figure 1).*

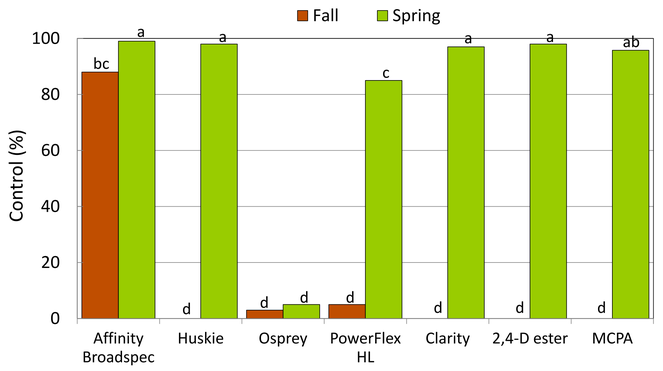

Figure 1. Common lambsquarters control 10 days after winter wheat harvest.

Injury to frost-seeded clover

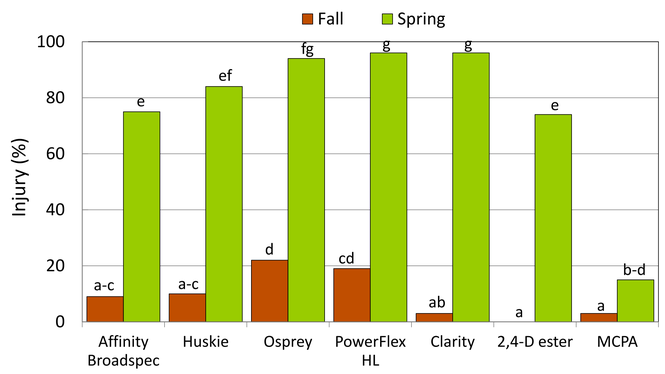

Figure 2. Frost-seeded clover injury from fall and spring herbicide treatments after winter wheat harvest.

- Red clover was able to tolerate all herbicides applied in the fall, although fall-applied Osprey caused 22% clover injury and resulted in nearly 30% reduction in clover stand *(Figures 2 & 3).*
- Spring applications of all herbicides, with the exception of MCPA, resulted in clover injury of 75% or greater, and reduced clover stands by 58% or more as compared with the untreated controls *(Figures 2-5).*
- MCPA was the only herbicide that could be applied in the spring that did not severely affect red clover stand *(Figures 3 & 6).*

Frost-seeded clover stand after wheat harvest

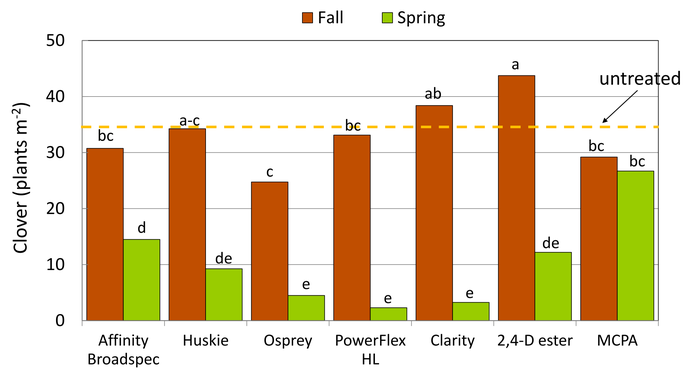

Figure 3. Frost-seeded clover stand counts after winter wheat harvest.

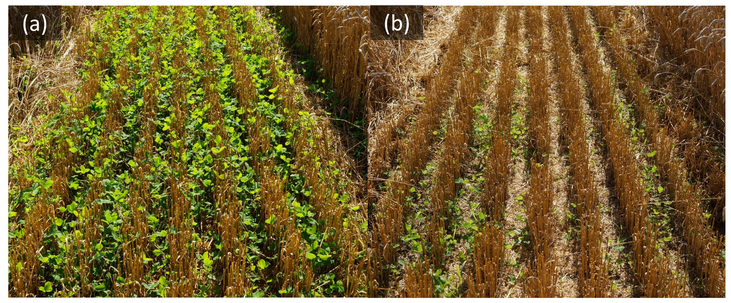

Figure 4. Frost-seeded clover stands after winter wheat harvest when Affinity BroadSpec was applied in the fall (a) and spring (b).

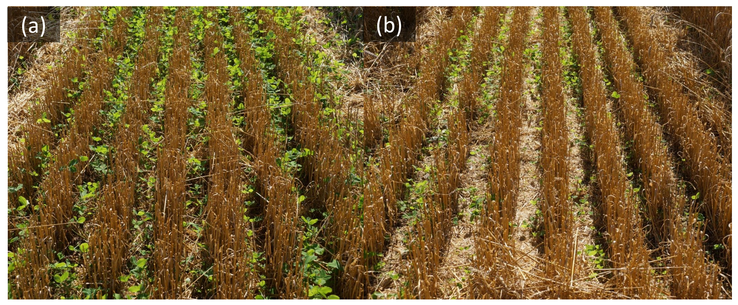

Figure 5. Frost-seeded clover stands after winter wheat harvest when Huskie was applied in the fall (a) and spring (b).

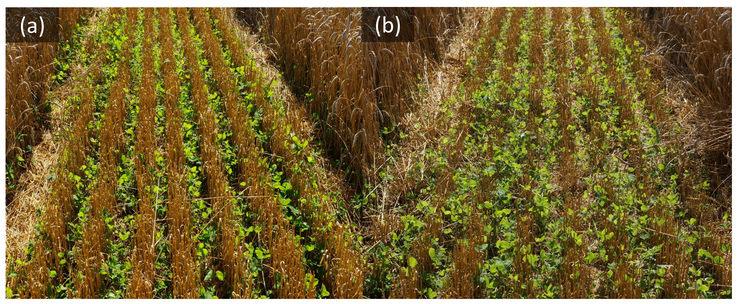

Figure 6. Frost-seeded clover stands after winter wheat harvest when MCPA was applied in the fall (a) and spring (b).

Conclusions

- This research shows that growers do have weed control options in winter wheat that are compatible with frost-seeding red clover.
- Spring-applied MCPA and fall applications of several of the herbicides examined were compatible with frost-seeding red clover. While spring-applied MCPA and fall-applied Affinity BroadSpec were the only treatments compatible with clover that controlled common lambsquarters, the other fall-applied herbicides many be used to control winter annual grasses and broadleaf weeds often found in winter wheat.
- Even though fall applications of 2,4-D ester was safe for frost-seeded clover, growers should never apply 2,4-D ester in the fall due to crop injury and reduced wheat yield concerns.

Acknowledgements

MICHIGAN WHEAT PROGRAM