The Impact of Fall-Planted Cover Crop Monocultures and Simple Mixtures on Weed Presence Prior to Corn

Victoria J. Ackroyd and Christy L. Sprague
Dept. of Plant, Soil, and Microbial Sciences
Michigan State University, E. Lansing, MI

Introduction

Farmers increasingly use cover crops synergistically in mixtures to simultaneously take advantage of the benefits of different types of cover crops.

- Legumes - fix nitrogen
- Grasses - scavenge nitrogen, suppress weeds
- Brassicas - scavenge nitrogen, suppress weeds, suppress erosion

The purpose of this study was to quantify the benefits of simple (two-species) cover crop mixtures as compared with pure stands of each cover crop. Weed suppression was one benefit of interest.

Figure 1. Clockwise from top right: hairy vetch, winter pea, annual ryegrass, oats, cereal rye, crimson clover, and radish.

Objectives

1. Determine biomass production for each cover crop when grown in a pure stand versus in a mixture.
2. Assess the impact of pure stands versus mixtures on weed biomass production.

Materials and Methods

Site: East Lansing, MI; 2011

Experimental design: RCBD with 3-4 replications and 3 years

Data analyzed: ANOVA in Statistix v. 9.0; mean separation at P<u><</u>0.05 using Tukey's HSD

Planting: cover crops were drilled between mid-August and early September each year after wheat harvest; planting rates are listed in Table 1

Table 1. Cover crop treatment planting rates.

Treatment	Pure stand rate (kg ha^{-1})	Rate in mixture with radish (kg ha^{-1})*
Weedy control	-	-
Radish 'Groundhog'	11.2	-
Oats	71.7	35.9
Cereal rye 'Wheeler'	125.5	62.8
Annual ryegrass	44.8	22.4
Crimson clover	11.2	5.6
Hairy vetch	33.6	16.8
Winter pea	67.2	33.6

*Radish in each two-species mixture was planted at 11.2 kg ha^{-1}.

Results and Discussion

Cover Crop Biomass

- Cover crop biomass and winter survival varied by year (data not shown).
- Oats and radish (winter killed covers) produced the greatest fall biomass.
- Radish dominated the fall biomass production of the mixture treatments.
- Crimson clover did not reliably establish each year.
- Among the legumes, hairy vetch produced the most biomass and was more successful at overwintering than winter pea.
- Cereal rye produced the most biomass in the spring.
- Cover crop mixtures produced less spring biomass than pure stands.
- The mild winter of '11-'12 resulted in similar legume and grass fall and spring biomass.

Fall Weed Biomass

- Low weed pressure in fall '11 resulted in few treatment differences (data not shown).
- Fall weed biomass was an order of magnitude greater in '12 than in '13 (Fig. 2).
- Radish and grass treatments had lower fall weed biomass than treatments including a legume.

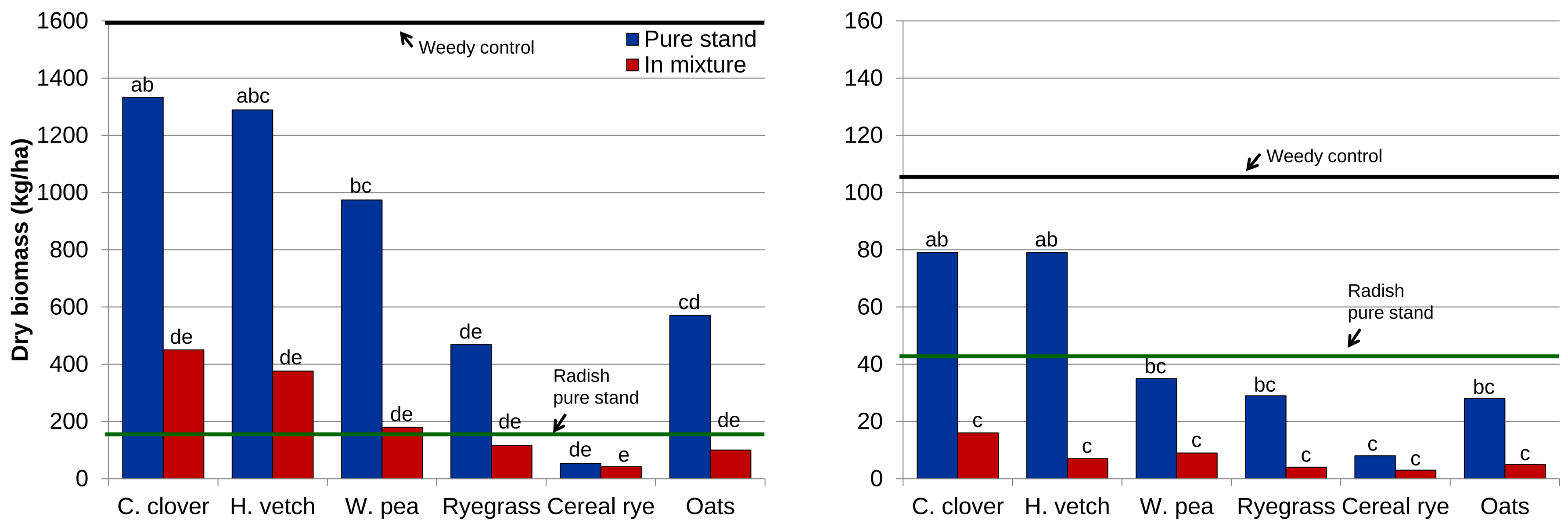

Figure 2. Fall 2012 (left) and 2013 (right) total weed biomass (weeds plus volunteer wheat).

Figure 3. Fall 2012 weedy control plot (top) and fall 2012 cereal rye plot (bottom).

Spring Weed Biomass

- Annual ryegrass and cereal rye reliably suppressed spring weeds (Fig. 4).
- Hairy vetch, which was the legume treatment with the most spring cover crop biomass, had the least amounts of weed biomass.
- Spring weed suppression was lowest in cover crop treatments which failed to establish (crimson clover) or overwinter (radish, oats, and winter pea).

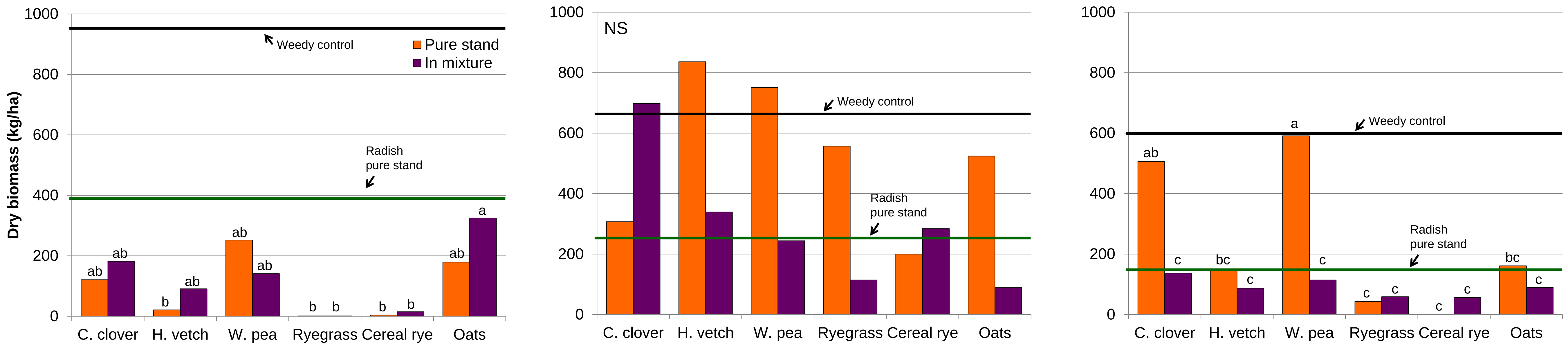

Figure 4. Spring 2012 (left), 2013 (center), and 2014 (right) total weed biomass (weeds plus volunteer wheat).

Conclusions

- Differences were likely due to a combination of varying weather over the three years and varying weed and wheat pressure between fields.
- Radish, both in monoculture and as part of a mixture, was a reliable choice for fall biomass production and weed suppression.
- Cereal rye and hairy vetch were the most reliable grass and legume, respectively, with regard to spring biomass production and weed suppression.

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