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Summary

Although cover crops are typically terminated 2–4 weeks prior to cash crop planting, there may be situations where late-burndown or planting into a living cover crop (planting green) may be necessary or even beneficial. This experiment investigated the effect of cover crop termination date on corn (*Zea mays*) yield and the presence of beneficial insects. Three different termination dates were tested: 4 weeks prior to planting (brown), 7 to 14 days prior to planting (green-brown), and at planting (green), as well as a check treatment with no cover crop planted. The site year by termination date interaction was significant for cover crop biomass and thus each year was analyzed separately. Preliminary results of sentinel prey assessments indicate no significant difference in the presence of beneficial insects in the systems. However, there was a significant yield decrease in treatments where corn was planted into a green cover crop in both 2021 and 2022. Cover crop yields in 2022 were 50% lower than those observed in 2021. The control and planting brown treatments resulted in significantly higher yields than the planting green-brown and green treatments in 2022.

Introduction

Cover crops continue to be studied in the Midwest for their potential benefit to agricultural soils. They have been found to improve soil physical properties which result in improved soil moisture retention and increased crop yields during shorter dry periods (Fageria et al., 2005). Research from the northeastern United States has found that delayed termination of cover crops can provide additional ecosystem services in the form of pest management for slug species (*Deroceras sp.*), but not without the risk of yield loss where corn was planted into a living cover crop (Le Gall et al., 2022). Another study from the same region concluded that a no-till system with or without cover crops provides sufficient habitat complexity to support predative insect communities, which can reduce pest problems (Rowen and Tooker, 2021). To our knowledge, these effects of planting green have not been investigated in Kansas prior to this study.

Procedures

This experiment was conducted in Junction City, KS, on a Reading silty clay loam in 2021 and a Kahola silt loam in 2022. Both fields were in dryland production, and the experimental design consisted of 16 plots that were 50 ft by 40 ft with 16 rows of corn in each. The cover crop species for this study was exclusively cereal rye (*Secale cereale*), which was planted in mid-to-late October in 2020 and 2021 following soybean harvest.

The four treatments in the study were a bare-ground check, and three different termination dates; 4 weeks prior to planting (brown), 7–14 days prior to planting (green-brown), and at planting (green). Cover crops were terminated using a mix of glyphosate and 2,4-D. Cover crop biomass was collected from four locations in each plot the day before termination, dried at 140°F for five days, and weighed. Corn planting dates for 2021 and 2022 were April 30 and May 11, respectively. Throughout the growing season, sentinel prey assessments were executed at V3, V5, and R3 growth stages. Bait for the sentinel prey assessments was waxworms (*Galleria mellonella*) pinned to clay balls that were partially buried in the soil so the worms were exposed. Small mammal-exclusion cages were placed over each sentinel pray trap. Six waxworms were distributed in each plot at 8 p.m. and were then assessed for predation at 8 a.m. and 8 p.m. the following day. The corn yield was determined by hand harvesting 17.5 ft of row from the two center rows which was equivalent to 1/1000th acre. The corn ears were shelled, and the grain weight and moisture determined.

Results

Cover Crop Growth

Cover crop biomass was lowest in the brown treatment and ranged from 2.0 ton/a in 2021 to 0.4 ton/a in 2022 (Table 1). Cover crop biomass in the green-brown treatment was higher than the brown treatment and lower than the green treatment in 2021 and 2022, and ranged from 3.6 to 0.8 ton/a (Table 1). The planting green treatment had the greatest cover crop biomass in 2021 and 2022 ranging from 5.5 to 1.8 ton/a (Table 1). Cover crop biomass was reduced by more than 65% in 2022 compared to 2021. This reduced biomass was likely a result of the lower winter precipitation observed in 2022 (Figure 1).

Insect Predation

Insect predation was not statistically different between the cereal rye cover crop termination date treatments, and the no cover crop control. Regardless of treatment, almost all waxworms were predated by the end of the assessment periods. The rye cover crop may have provided habitat for predatory insects, but the presence or absence of a cover crop did not make a significant difference in overall predation (Table 2). These results were consistent with what was observed by Rowen and Tooker in 2021.

Corn Yield

A significant impact of cover crop termination date on yield was observed in 2021 and 2022. In both years, the yields from planting green plots were significantly lower than those from the other treatments. In 2021, yields were not significantly different between control, planting brown, and planting green-brown (Table 2). In 2022, the difference in yields between treatments were more significant, and the planting green plots produced approximately 50% less than the control plots (Table 2). Yields in 2022 were overall lower than those observed in 2021, possibly due to less precipitation in the winter and spring (Figure 1). The cereal rye, especially in the late termination plots, may have depleted the soil of stored moisture prior to corn planting, and the impact of this was exaggerated in the drier 2022 season. Other potential causes of the reduced yield in the treatments with late-termination of the cereal rye are decreased soil temperatures or decreased solar radiation reaching seedlings due to shading from the cover crop residue (Yang et al., 2021).

Acknowledgments

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Table 1. Cover crop biomass and corn yield by termination date

	Average cover crop biomass (ton/a)		Average yield (bu/a)	
Treatment	**2021**	**2022**	**2021**	**2022**
Control	---	---	222.3 a	127.5 a
Brown	2.0 c	0.4 c	225.6 a	119.4 ab
Green-Brown	3.6 b	0.8 b	206.5 a	96.7 b
Green	5.5 a	1.8 a	175.3 b	53.6 c

Different letters indicate statistically different values ($P < 0.05$).
Control = check treatment with no cover crop planted. Brown = 4 weeks prior to planting.
Green-brown = 7 to 14 days prior to planting. Green = at planting.

Table 2. Significance of termination date and insect predation at V3, V5, and R3

	P-values	
Growth stage	**2021**	**2022**
V3	0.34	0.66
V5	0.13	0.4
R3	0.57	0.79

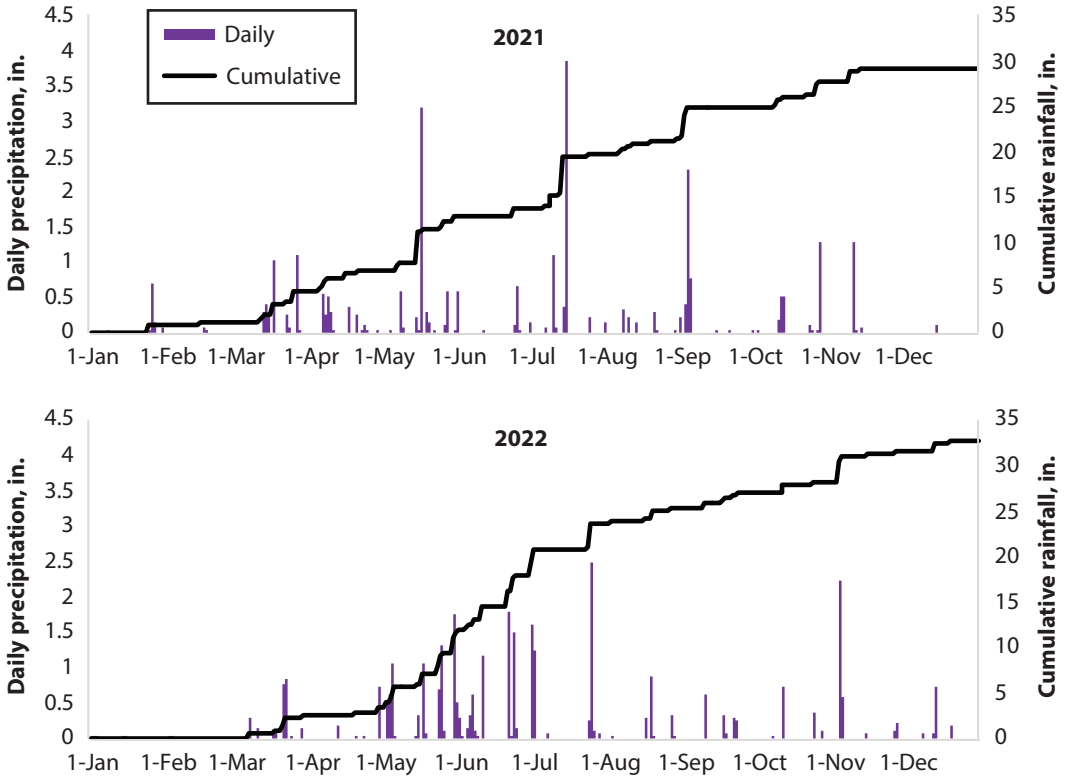

Figure 1. Annual precipitation, Ashland Bottoms (~10 miles from experiment sites, nearest Kansas Mesonet Station).