

# Termination Timing and Biomass Removal: Impacts on Soybean Systems

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## Introduction

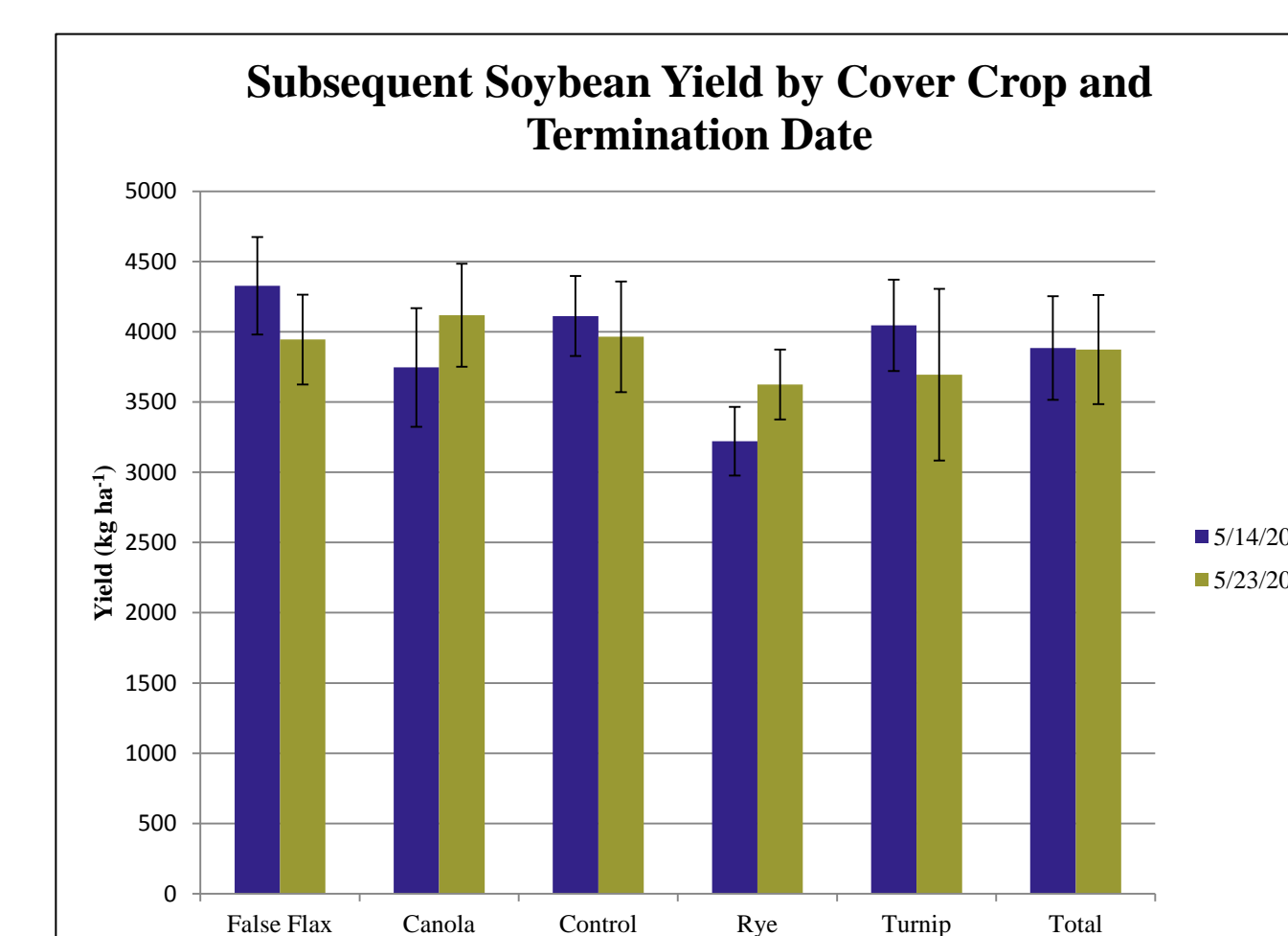
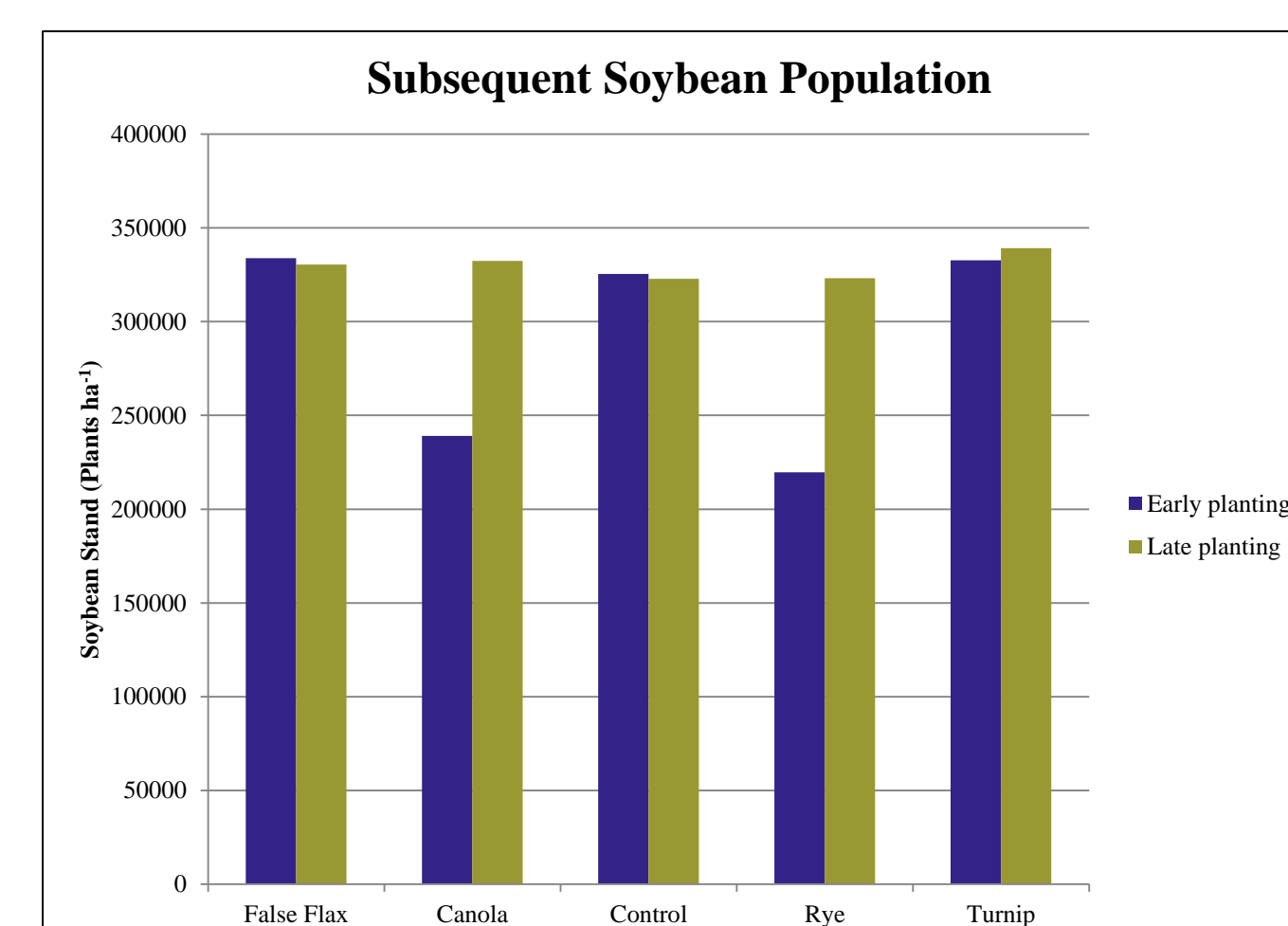
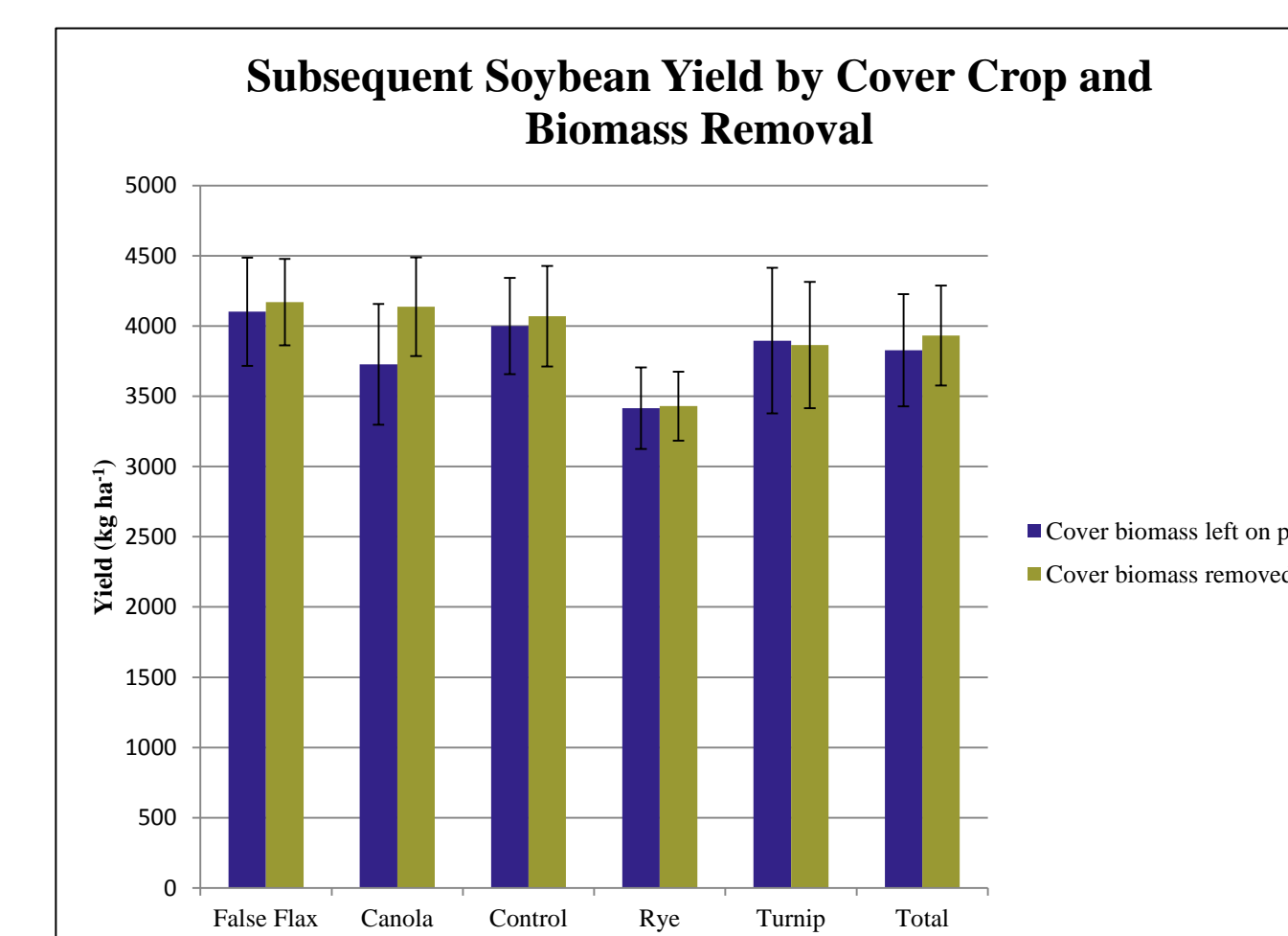
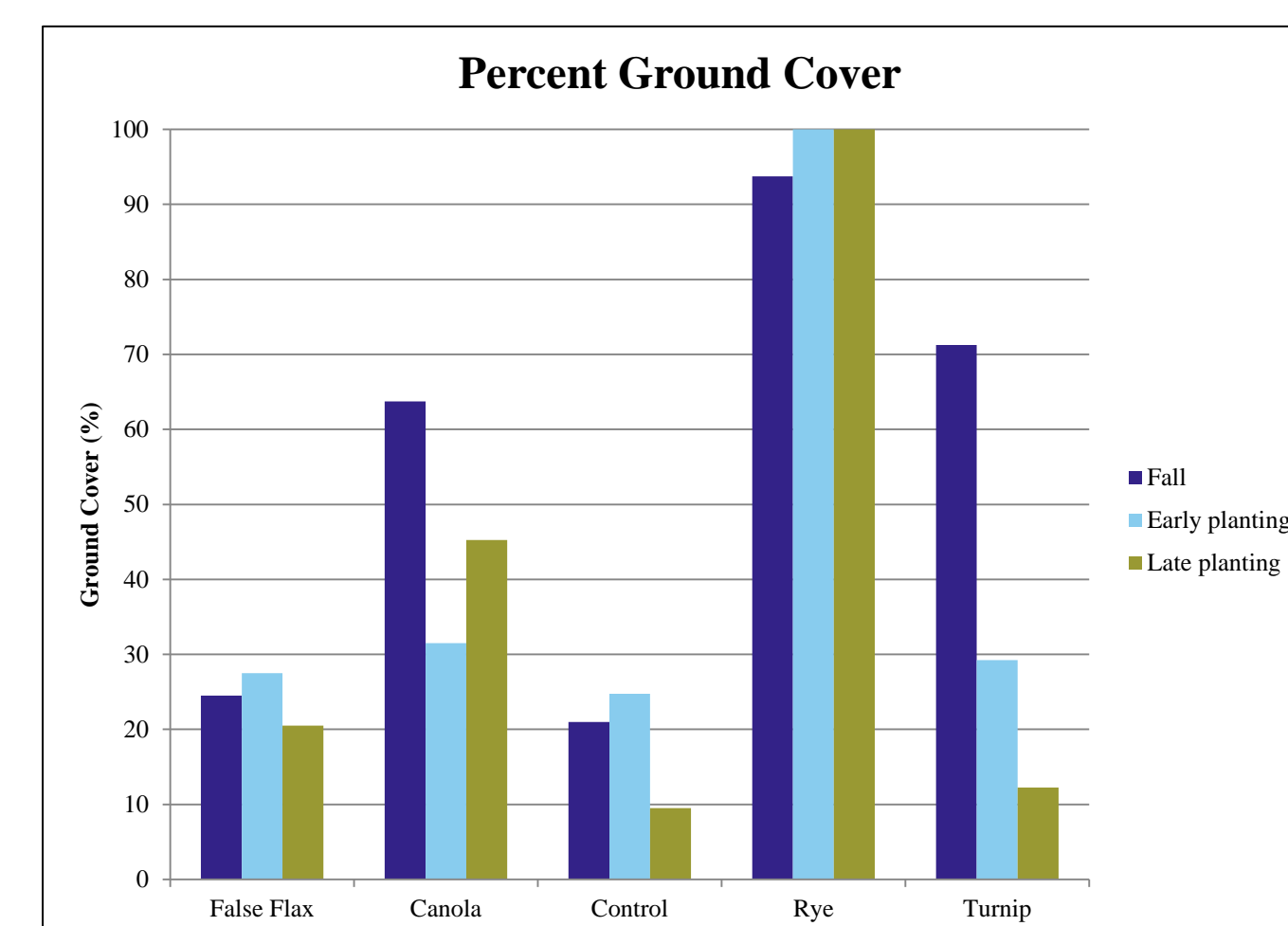
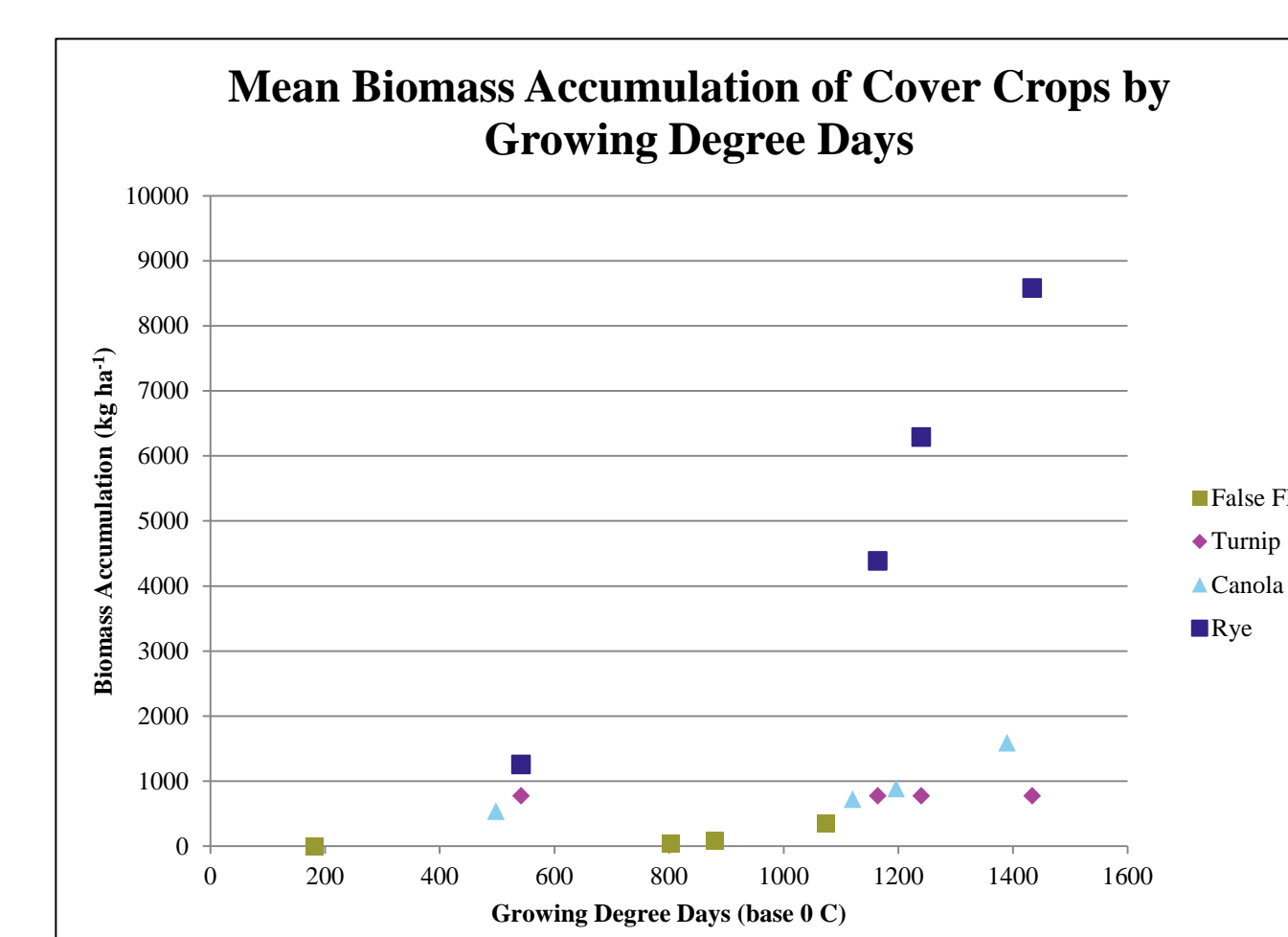
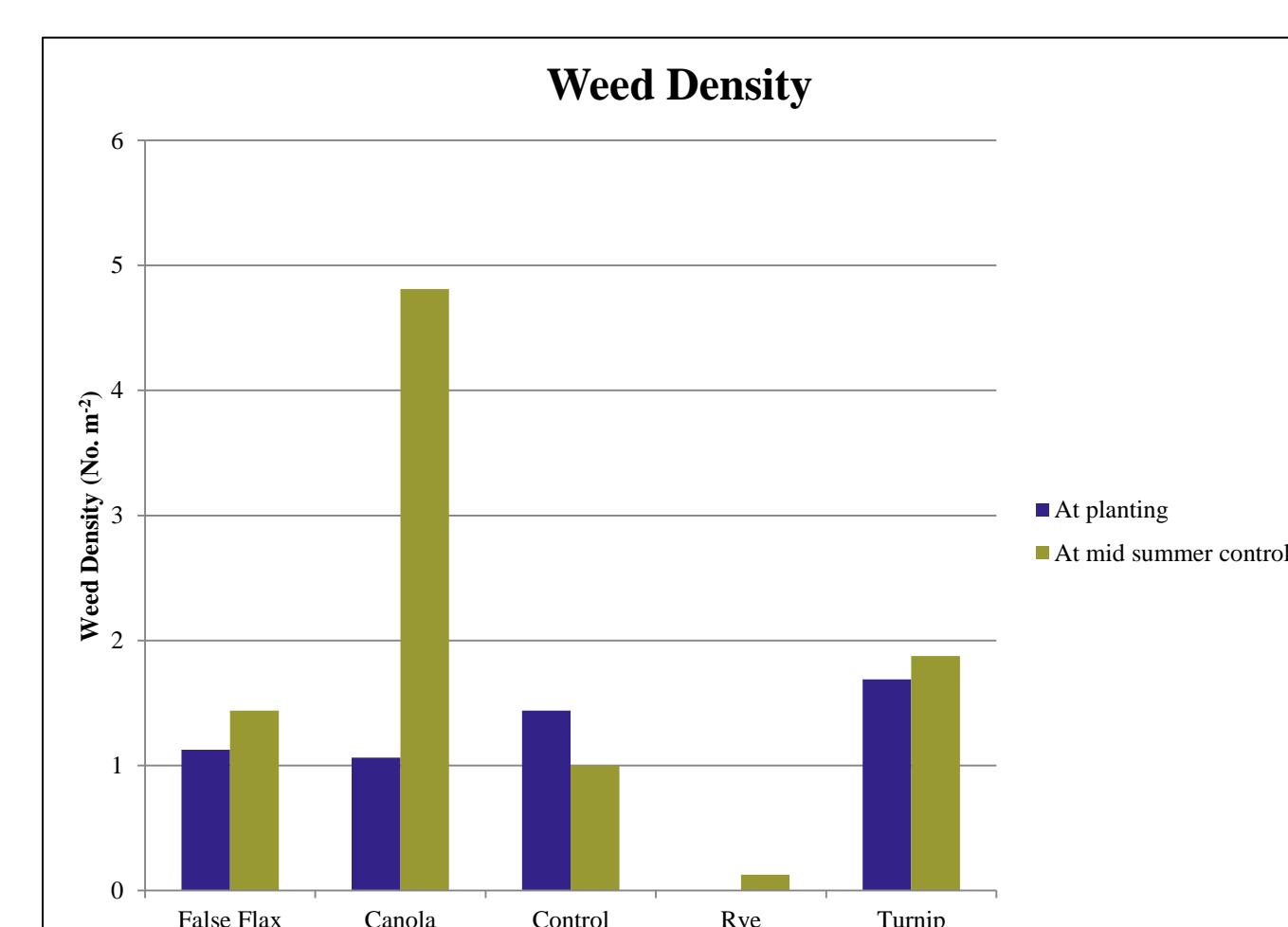
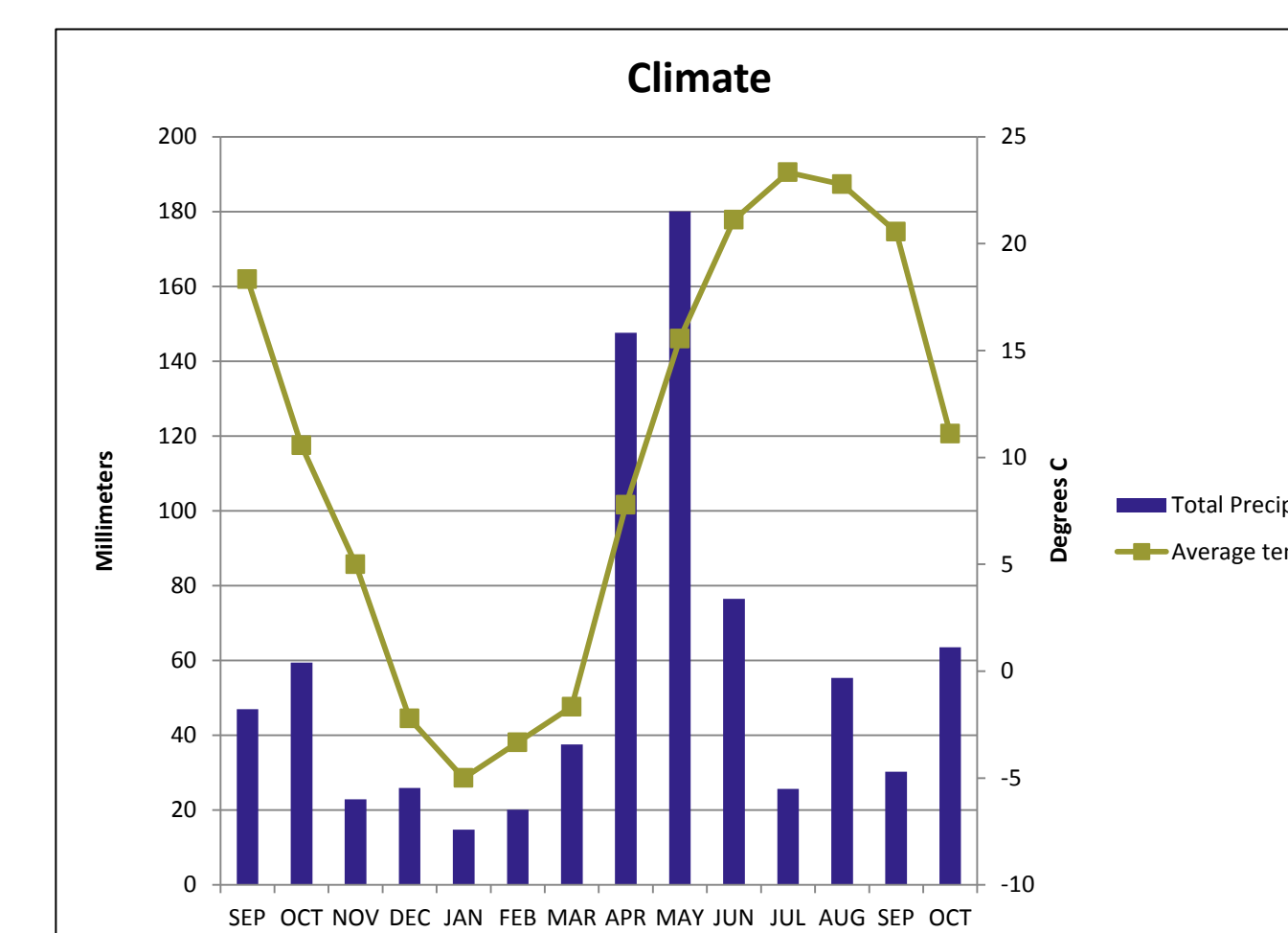
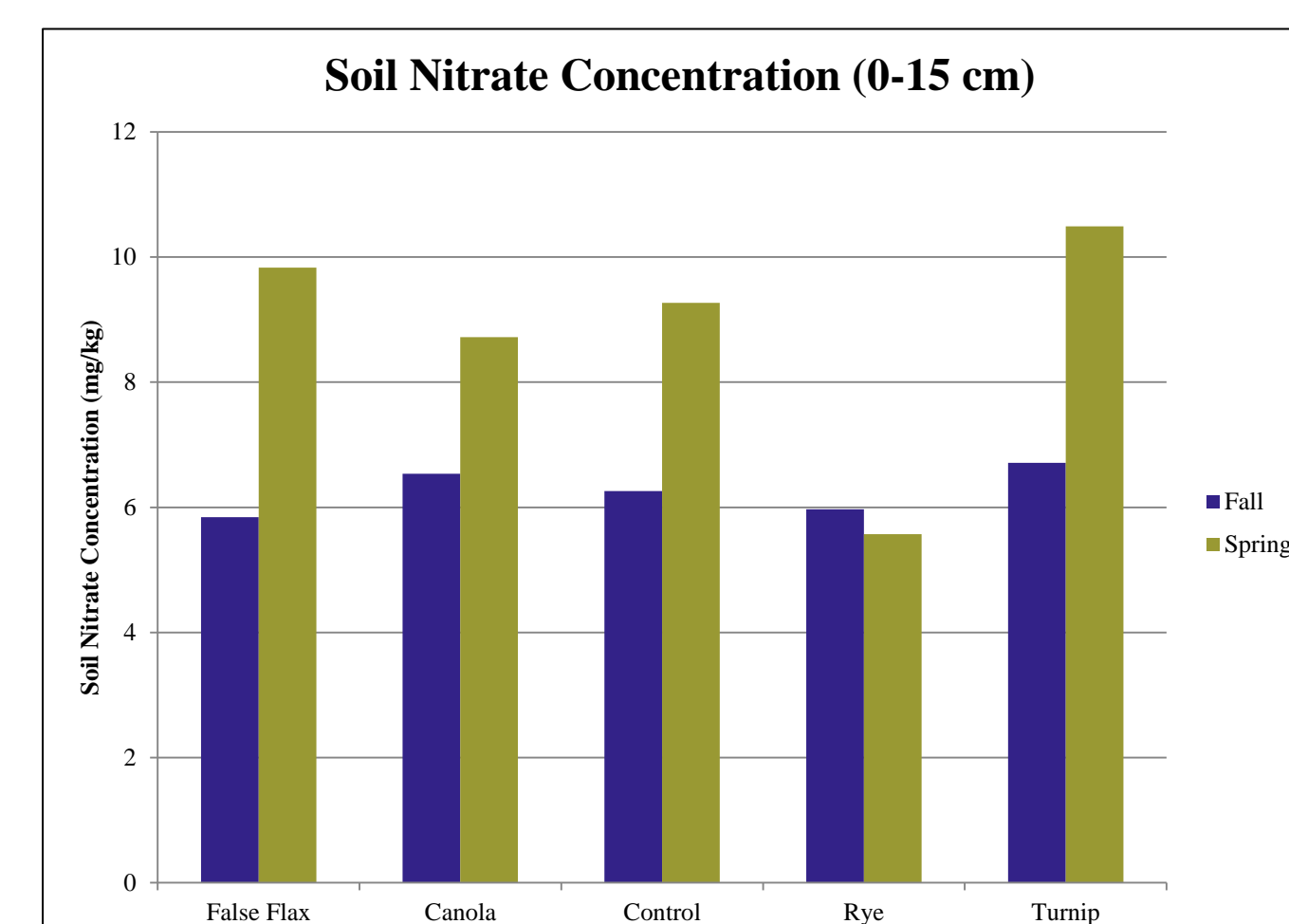
- Cover crops are an effective way to make significant strides toward nutrient export reduction goals (in particular nitrogen and phosphorus).
- While farms with cover crops are increasing in Iowa, they still only constitute around 0.5% of the total farmed acreage.
- One issue often cited is that farmers don't want to pay for cover crops if the cover crop won't provide them with a direct economic benefit.
- Harvest or use of a cover crop for grazing or silage may provide the direct economic benefit desired by many farmers.
- Predicting biomass accumulation is an important part of knowing the economic value of the cover crop before adoption.
- Cover crop species, termination timing and removal of cover crop biomass may affect subsequent soybean yield.
- Our goal is to provide better cover crop management options and a richer understanding of cover cropping systems to farmers and government agencies.

## Materials and methods

A two-year field study was conducted comparing cover crop-soybean systems. The experimental design was a randomized complete block in a split-split plot design with four replications. The whole plot factor was cover crop entry; termination date was the first level split-plot factor and aboveground biomass removal was the second level split-plot factor. Four cover crops were studied in a field trial near Ames, Iowa: winter rye (*Secale cereale* L.), canola (*Brassica napus* L.), false flax [*Camelina sativa* (L.) Crantz], turnip (*Brassica rapa* L.), and a no cover crop control. Cover crops were established in the fall and terminated on either May 14 or May 23, 2013. The above ground biomass was either left in place or removed, simulating forage harvest. After terminating the cover crops, Pioneer 92M40 soybean was planted. Soybeans were combine harvested on 3 November 2013.

## Results

Winter rye had the greatest aboveground biomass accumulation, the lowest soil nitrate concentration and the lowest weed density. However, soybean following winter rye had the lowest yield and the poorest soybean stand, likely due to the amount of aboveground cover crop biomass. High canola weed populations at the mid-summer herbicide application were due to canola plants that were not killed by glyphosate. Low biomass accumulation of false flax was due to poor germination and poor stand density. However, false flax plants that successfully established had excellent winter survival.



## What have we learned so far?

Cover crop termination date guidelines used by USDA Risk Management Agency and designed to ensure adequate moisture to the following crop aren't likely to be relevant in Iowa due to the high frequency of excess spring moisture.

Understanding the whole system is extremely important! Winter killed crops like the turnips in this experiment may be excellent fall nitrogen scavengers, keeping nitrogen in a field that would typically leach during a winter fallow period. However, unless there is a living cover in place during the spring, the nitrate that is released by the breakdown of winter killed crops will likely be taken up by weeds before subsequent crop establishment and may even increase spring weed pressure.

Early termination of canola is important to maximize the effectiveness of herbicide control.

Removal of aboveground biomass may be beneficial to subsequent soybean yield, particularly during years with above average spring precipitation.

False flax has high potential as a winter cover crop due to excellent winter hardiness.

The method used to calculate growing degree days is important in estimating biomass accrual for overwintering cover crops. The method common to wheat systems may be more accurate in than the method commonly used in corn and soybean systems.

In addition to reducing weed density, competition with rye also seemed to reduce the overall size of weeds present, although this is anecdotal as weed biomass was not determined in this experiment.

The only factor found to have a statistically significant effect on yield (at the  $\alpha = 0.05$  level) was aboveground biomass removal. Plots with aboveground biomass removed saw 150 kg ha<sup>-1</sup> better soybean yields than plots with biomass left in place.

## Literature cited

Kaspar, T.C., Singer, J.W. 2011. The use of cover crops to manage soil. In: Hatfield, J.L., Sauer, T.J., editors. Soil Management: Building a stable base for agriculture. Madison, WI: American Society of Agronomy and Soil Science Society of America. p. 321-337.

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