Finding the Balance Between Corn Yield and Cover Crop Biomass

Angela M. Bastidas[1], Christopher Proctor[1] and Roger W. Elmore[1]
[1]Department of Agronomy and Horticulture, University of Nebraska - Lincoln, Lincoln, NE USA

Introduction

Fall-seeded cover crops are limited by the relatively short growing season remaining after the primary crop is harvested in the US Midwest. Lengthening cover crop growing season might be possible if primary crop management is modified, enhancing cover crop productivity and advantages.

Corn management modifications such as planting date, maturity and plant population have not been explored lately with modern corn hybrids. Growers need to understand the impact of any of these changes as strategies for introducing cover crops into the cropping system.

The objectives of this study are:

1) **Understand the effects of planting date, corn maturity and plant population on corn yield.**
2) **Evaluate cover crop biomass production as affected by the different planting dates after corn is harvested.**

Methods

Nebraska Research Sites:

- Havelock Farm at Lincoln (rain-fed)
- South Central Agricultural Laboratory-SCAL at Clay Center (irrigated).
- At each location, two blocks were established; one for measuring corn yield and one for planting a cover crop.

Treatments:

- Corn Block: Factorial Combination of corn maturity (80 to 115 days relative maturity, RM) and plant population (low, average and high) at early and late planting dates.
- Cover Crop Block: Four planting dates of Rye (*Secale cereale* L.) according to estimated corn harvest maturities (Grain moisture ≤ 18%) of the different RM hybrids.

Experimental Designs:

- Corn Block: Split-plot organized on blocks with four replications; whole plot for planting date and within each whole plot the factorial combination of corn maturity and plant population. Each plot was 3.1m x 9.1m (four corn rows).
- Cover Crop Block: RCBD with four replications. Each plot was 3.1m x 9.1 m (four corn rows).

Measurements:

- Corn: Grain moisture drydown and grain yield.
- Cover Crops: Fall and spring biomass.

Management: No-till, corn-soybean rotation; region-specific fertilization and weed control.

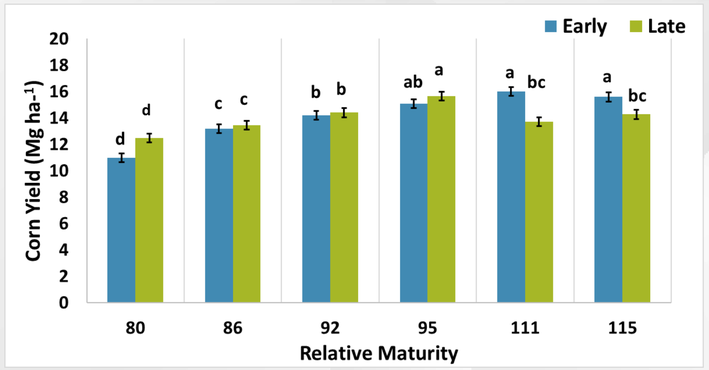

Fig. 1. Corn yield as affected by early and late planting date and relative maturity at SCAL (irrigated) across both years (2015 & 2016). Bars with the same letter(s) are not different (Significant at P ≤ 0.05).

Fig. 2. Effect of early (left) and late (right) planting date on corn at SCAL (irrigated) for 80RM hybrid (09/08/2015).

Fig. 3. Effect of plant population average (left) and high (right) on corn at SCAL (irrigated) for 115RM hybrid (09/08/2015).

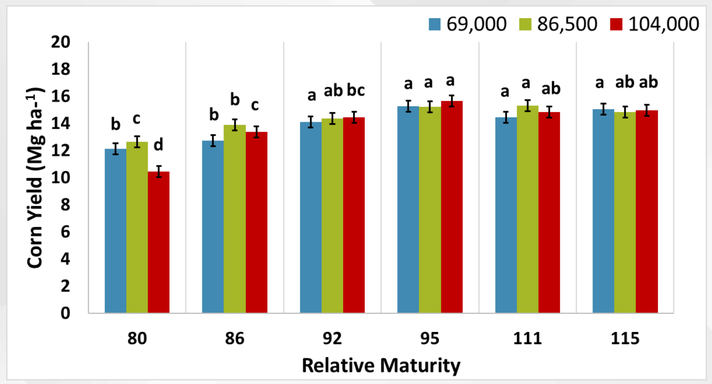

Fig. 4. Corn yield as affected by relative maturity and population (plants ha^{-1}) at SCAL (irrigated) across both years (2015 & 2016). Bars with the same letter(s) are not different (Significant at P ≤ 0.05).

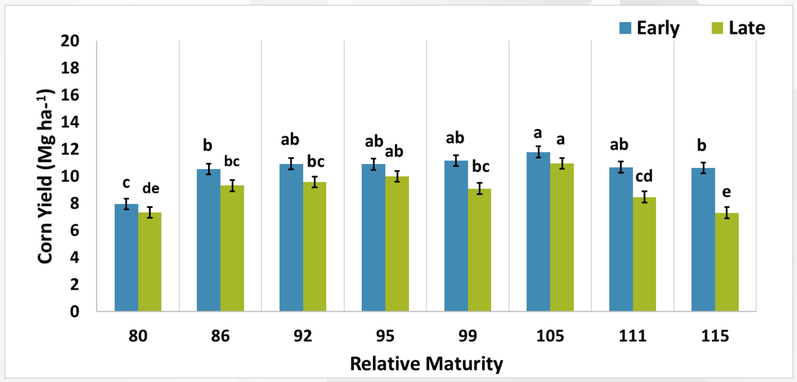

Fig. 5. Corn yield as affected by planting date and relative maturity at Havelock (rain-fed) in 2016. Bars with the same letter(s) are not different (Significant at P ≤ 0.05).

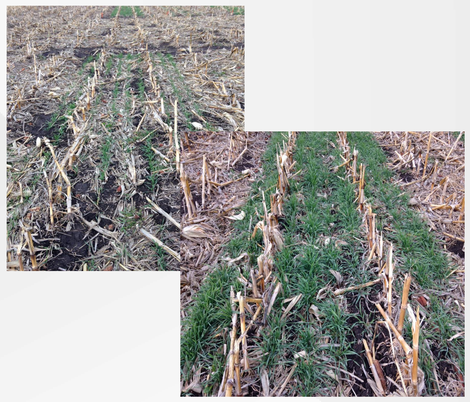

Fig. 6. Rye planted on 10/21/2015 (left) and 10/02/2015 (right) at SCAL (irrigated) during fall sampling (12/08/2015).

Fig. 7. Rye planted on 10/21/2015 (left) and 10/02/2015 (right) at SCAL (irrigated) during spring sampling (04/14/2016).

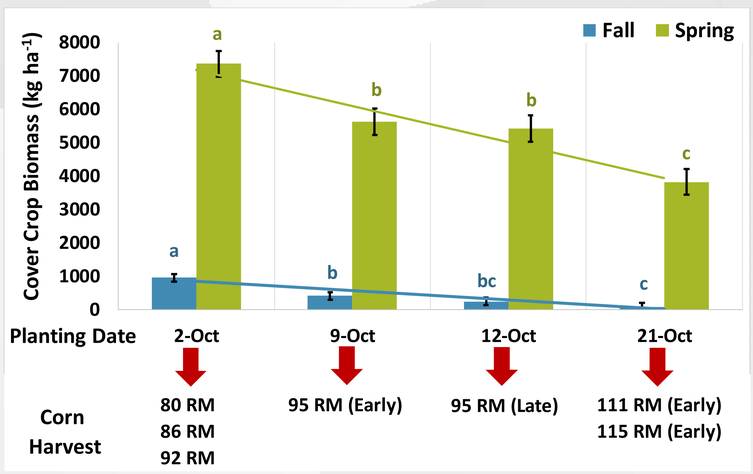

Fig. 8. Fall and Spring biomass production as affected by the planting date at SCAL (irrigated) and estimated corn RM harvest maturities. Bars with the same letter(s) within same sampling are not different (Significant at P ≤ 0.05). Sampling dates: 12/08/2015 and 04/14/2016. Linear regressions were also significant (P ≤ 0.001).

Results

- Corn yield was affected by planting date and RM across years under irrigated conditions. For early planting, there were no yield differences among the 115, 111 and 95 RM hybrids but yield was reduced with shorter RM hybrids. For late planting, 95 RM yielded highest (Fig. 1 and 2).
- Corn yield was also affected by plant population and RM across years under irrigated conditions. There were no yield differences due population among the 115, 111 and 95 RM but yield was reduced by population with shorter RM hybrids (Fig. 3 and 4).
- Corn yield was affected by planting date and RM under rain-fed conditions. For early planting, the 80 RM yielded lowest and 105 RM yielded highest. For late planting, 95 and 105 RM yielded highest (Fig. 5).
- Corn harvest maturity ranged across October 2015 for the different treatments, resulting in four cover crop planting dates:
  - Oct 2 for 80, 86 and 92 RM (early and late plantings) with grain moisture ≤ 18%.
  - Oct 9 for 95 RM (early planting) with grain moisture ≤ 18%.
  - Oct 12 for 95 RM (late planting) with grain moisture ≤ 18%.
  - Oct 21 for 111 and 115 RM (early planting) with grain moisture ≤ 18%. 111 and 115 RM (late planting) grain moisture > 18%.
- Spring cover crop biomass was higher than fall (Fig. 8).
- Biomass was affected by cover crop planting date for both fall and spring measurements. The earliest planting date had the highest production in fall and spring (Fig. 6, 7 and 8).

Conclusions

- Shorter-season hybrids, 95 and 105 RM, compared to the regionally used, 111 RM or higher, may allow earlier corn harvest and cover crop planting without negatively impacting corn yield and ultimately increase cover crop biomass production.
- The 80 and 86 RM provide potential for about 2,000 kg ha^{-1} more cover crop biomass than later-season hybrids but recognize there may be a negative impact on corn yield up to 5 Mg ha^{-1}.
- Under irrigation, early planting is important for late-season hybrids to achieve maximum yield potential.
- Under rain-fed, late planting affected negatively yield for all hybrids compared with early planting.