Effects of Preceding Crop On No-till Winter Wheat Yield and Quality

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Introduction

Hard red winter wheat is the predominant dryland crop for the western two-thirds of Kansas. To save time, fuel, soil, and soil moisture, producers are increasing the adoption of conservation tillage practices and no-tillage. Producers need rotational crops allowing increased residue levels while maintaining or increasing wheat yields as tillage is reduced. A desirable rotational crop allows for timely wheat planting, soil moisture recharge, and produces less crop residue than wheat.

Broadleaf rotational crops have the greatest potential for interrupting disease, weed, and insect cycles in wheat production. Soybean and sunflower can pose fewer problems than grass crops in rotation, but other problems such as drought and heat tolerance, soil moisture recharge, and input costs can be limiting. Other broadleaf crops like winter canola have potential to be grown in rotation with wheat. All of these potential rotational crops demonstrate positive and negative attributes. Research is needed to determine the effects of these crops on wheat growth and yield under no-till managed systems.

Objective

Describe the effect of rotational crops on wheat yield and quality compared to continuous wheat under a no-till cropping system.

Materials and Methods

- Winter wheat was planted behind six different crops commonly grown in Kansas
  - Location: Ashland Bottoms, KS
  - Canola (CA), corn (C), grain sorghum (GS), soybeans (SB), sunflowers (SF), winter wheat (WW)
  - Randomized complete block design with four replications
  - Yield components of winter wheat was evaluated throughout the growing season
    - Emergence rate, population, fall tillers, spring tillers, head number, height, spikelets per head, seed size
    - **Emergence Promptness Index (EPI)** was calculated to evaluate the emergence rate of the winter wheat
      - Emergence counts were taken daily (15 days) within the same unit area until seedling emergence ceased; n= number of emerged seedlings, i=days after planting

$$\mathbf{EPI} = \sum_{i=1}^{15} \left(\frac{n}{i}\right)$$

- Wheat/wheat and wheat/canola rotations were evaluated at two on-farm sites in Central Kansas
  - Marquette, KS and Wellington, KS

Results and Discussion

Table 1. Yield Components of Winter Wheat – Ashland Bottoms, KS.

Yield Component	Previous Crop: Canola	Corn	Grain Sorghum	Soybean	Sunflower	Wheat
EPI	58.5 a	58.1 a	48.3 ab	67.4 a	28.8 b	48.0 ab
Population (m^{-2})	238 ab	235 ab	229 ab	257 a	222 b	215 b
Fall Tillers (m-row)	134 a	126 ab	122 abc	137 a	104 bc	96 c
Spring Tillers (m-row)	180 ab	225 a	205 ab	217 a	190 ab	162 b
Head Number (m-row)	95 a	105 a	93 ab	101 a	99 a	80 a
Spikelet (number-head)	13.6 a	13.5 ab	13.1 ab	13.1 ab	12.9 ab	12.8 b
Height (cm)	82.3 a	81.3 ab	76.9 c	78.2 bc	77.6 c	77.7 c
Seed Size (g-1000 seeds)	35.3 b	36.7 ab	38.6 ab	39.0 a	38.2 ab	35.4 b

Values within the same row followed by the same letter are not significantly different (α = .05).

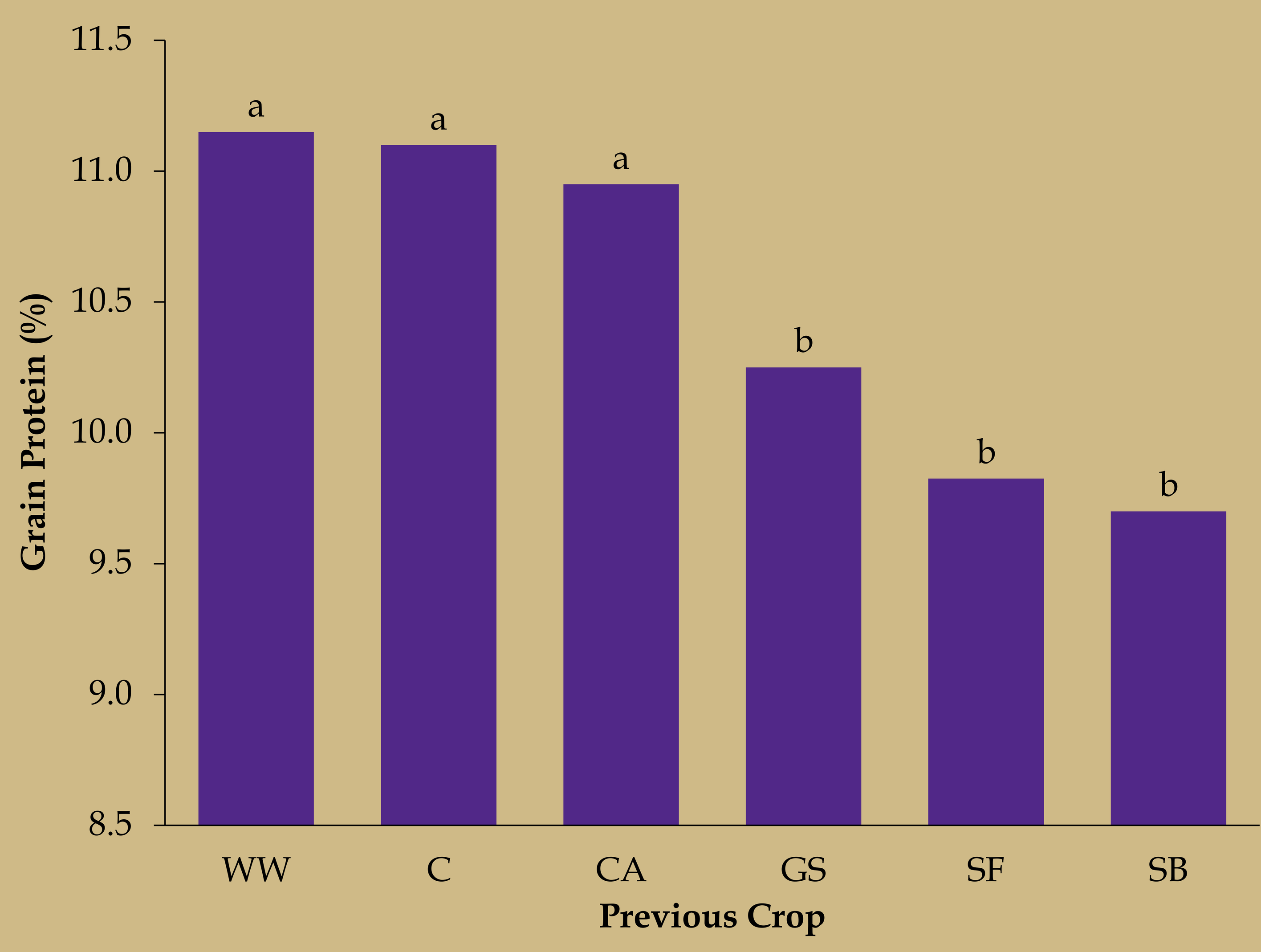

Figure 1. Grain protein (%) of winter wheat at Ashland Bottoms, KS following six different crops, α = .05.

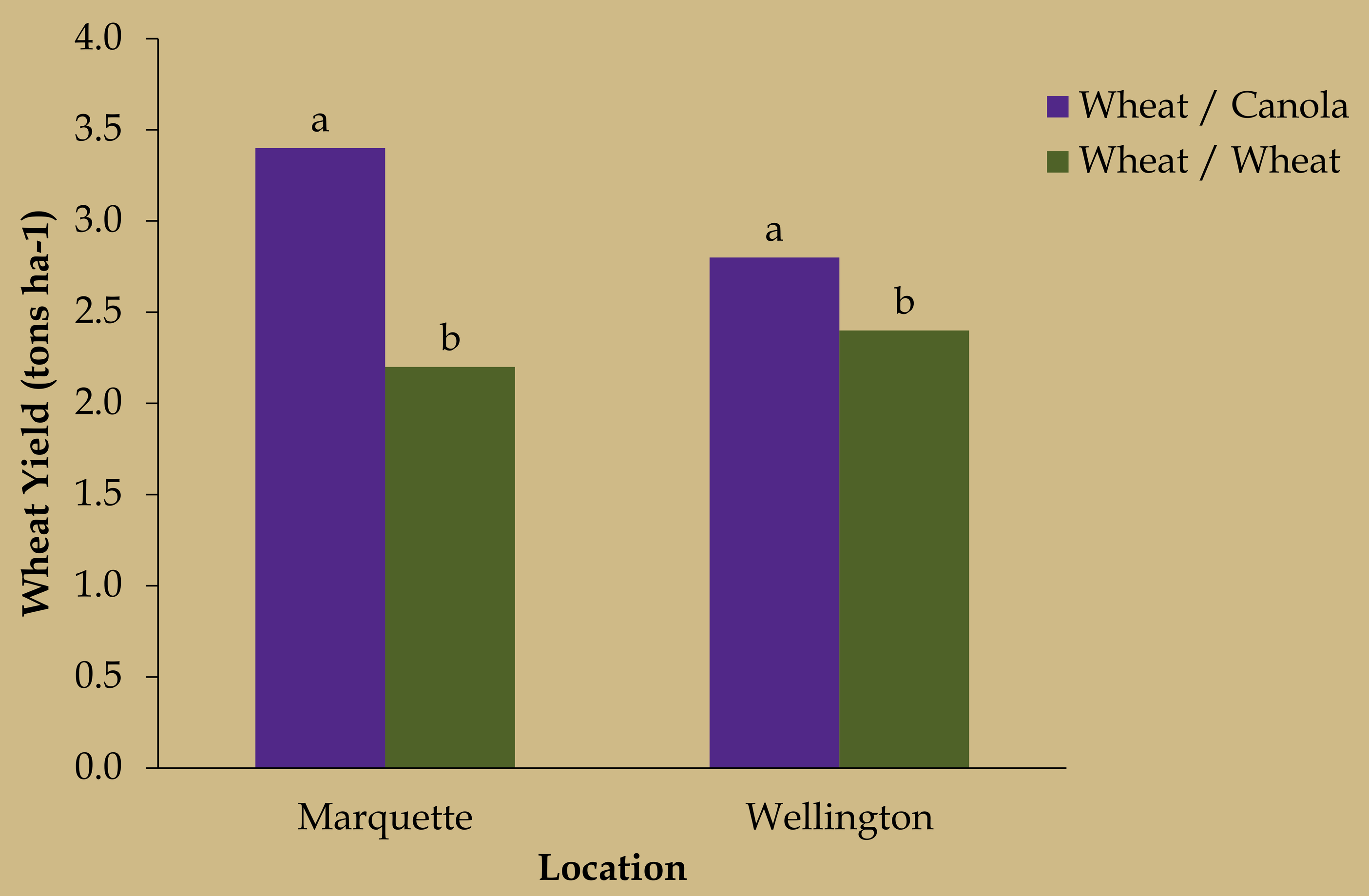

Figure 2. Winter wheat yield following both winter wheat and winter canola, α = .05.

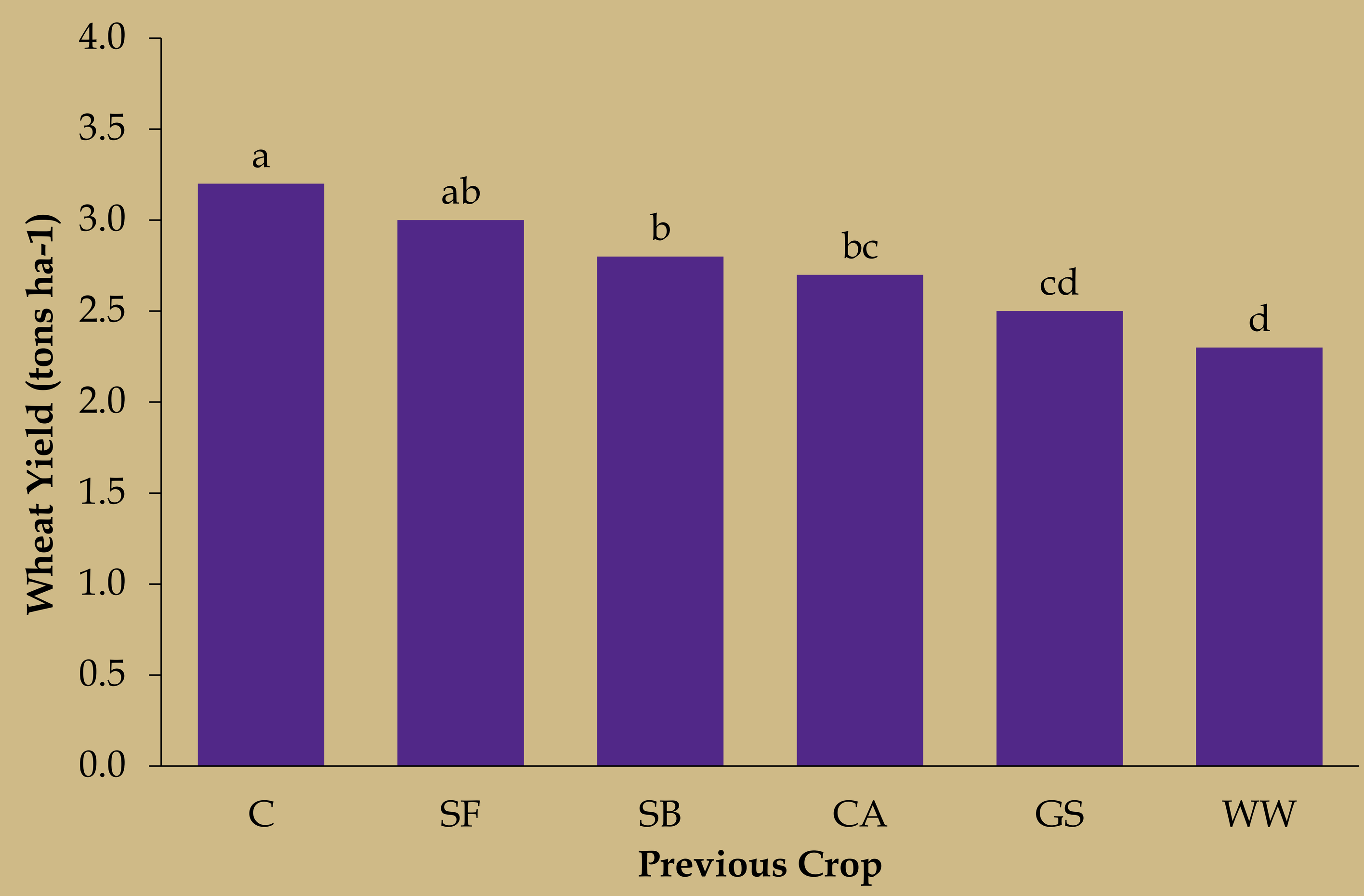

Figure 3. Winter wheat yield at Ashland Bottoms, KS following six different crops, α = .05.

- Yield components **(Table 1.)**
  - Yield components of wheat following wheat tended to be negatively impacted throughout the growing season compared to wheat after other crops.
  - Fall yield components of wheat were decreased in the fall by sunflowers, but spring components showed little impact.
  - Soybeans and Canola had little negative impact on the following wheat crop, except some decline in spring yield components.
  - All wheat yield components were improved following corn compared to wheat after other crops.
- Wheat grain protein following wheat, canola, and corn was greater than that of wheat following grain sorghum, soybeans, and sunflowers **(Fig. 1)**.
- Winter wheat yields following canola were increased compared to continuous **wheat** yields at both Central Kansas locations **(Fig. 2)**.
- Wheat yields were greatest following corn; wheat following wheat yielded the least **(Fig. 3).**

Conclusion

- Winter wheat yield, yield components, and quality was influenced by the preceding crop.
- In some cases, yield components often compensated later in the growing season resulting in similar yields.
- Diversification of a no-till, continuous winter wheat system can improve both grain yield and quality of the following wheat crop.