Winter Wheat Intercropping and Double-cropping Systems

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INTRODUCTION

Relay intercrop production involves overlapping growth cycles of two or more crops in order to maximize production on a piece of land through efficient use of resources (Echarte et al., 2011). This production system is common with legumes seeded into small grains; however, the companion crops may compete for water, nutrients and sunlight which may slow development of either crop. This cropping system has been proposed to reduce risk associated with double-crop soybean production, move double-crop production farther north, and increase farm profitability.

Determining appropriate plant spacing as well as timing is important for dictating the success of an intercrop system (Hussain et al., 2012). Diversifying crops used in a relay inter-cropping or double-cropping systems may allow farmers more crop production choices. Double-cropping is an alternative to avoid competition for resources among intercrops (Thiessen Martnes et al., 2001).

OBJECTIVES

Objective 1 – *Wheat row spacing*
- Evaluate the impact of 19 and 38 cm wheat row spacing on wheat and alternative crop yields.

Objective 2 – *Planting timing*
- Evaluate the effects of early broadcast and later planted alternative crop seedings on wheat and alternative crop yields.

Table 1. Wheat grain moisture and yields in 19 and 38 cm rows inter- and double-cropped with cowpea, grain sorghum, amaranth, soybean, red clover, hairy vetch, and pea for both years. Data were combined over intercrops.

	2012		2013	
Wheat row spacing	Moisture	Yield	Moisture	Yield
	%	Mg ha^{-1}	%	Mg ha^{-1}
19 cm relay-intercrop	12	3.93	12	4.33
38 cm relay-intercrop	12.6	3.93	19.5	4
19 cm double-crop	12.4	4.67	19.9	4.6
LSD (*P*=0.1)	0.6	0.73	0.4	0.27

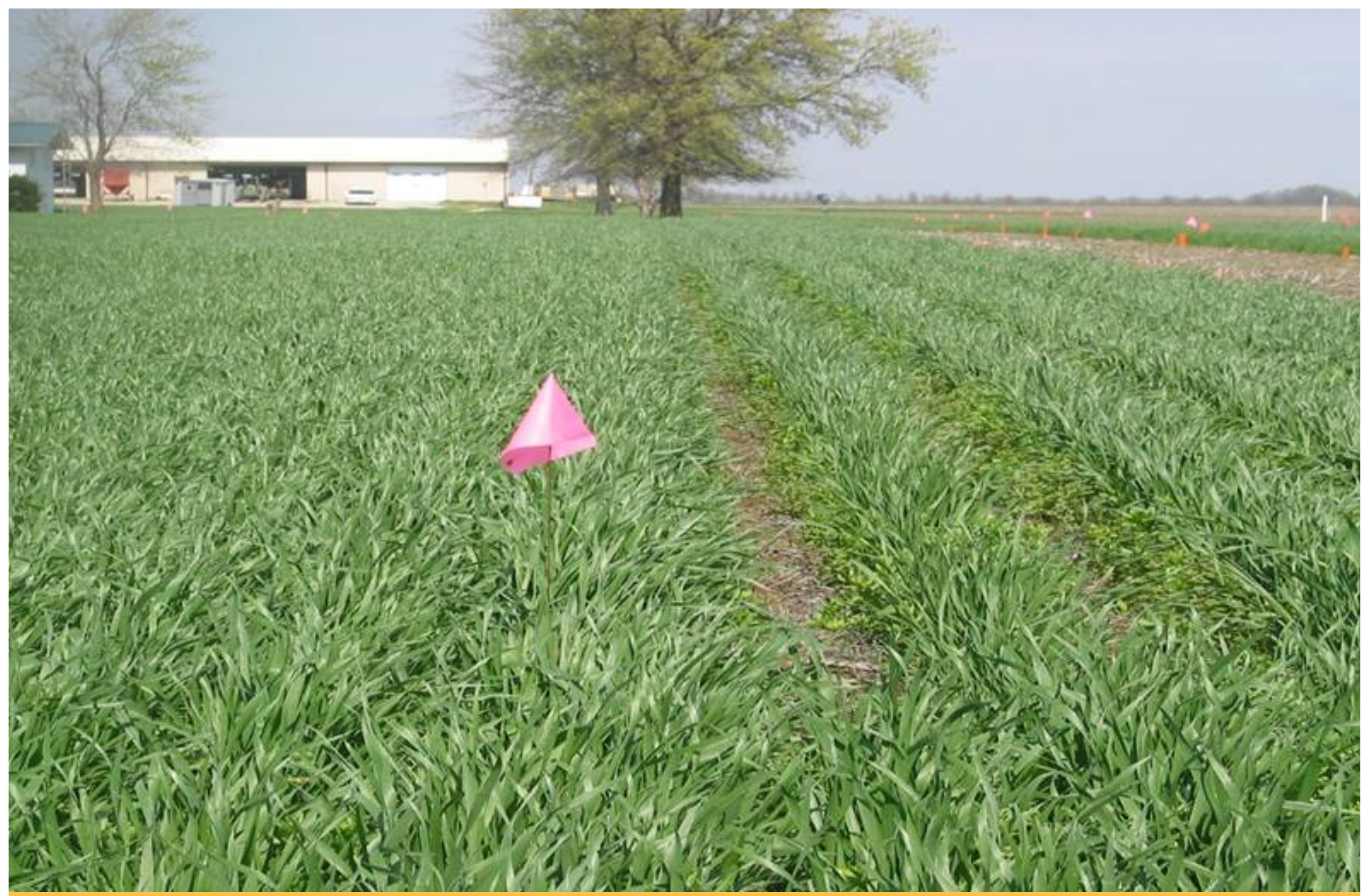

Figure 1. Wheat at 19 cm (left) and 38 cm (right) row spacing.

MATERIALS AND METHODS

Field experiments were conducted in 2012 and 2013 at the Greenley Research Center near Novelty, MO (Fig. 3). Winter wheat, 'MFA 2525,' was seeded in October of 2011 and 2012 at 112 kg ha^{-1} in 19 and 38 cm rows. Ammonia nitrate at 112 kg N ha^{-1} and diammonia phosphate and potash at 35 kg N ha^{-1}, 90 kg P_2O_5 ha^{-1} and 135 kg K_2O ha^{-1} were broadcast applied. Due to space constraints, this poster only contains the results of the wheat portion of this research.

Data were subjected to ANOVA and means separated using Fisher's Protected LSD (*P*=0.1). Main effects were presented in the absence of significant interactions.

Objective 1
- Nine (cowpea, soybean, winter pea, hairy vetch, red clover, grain amaranth, grain sorghum peal millet) alternative crops were drill seeded into standing wheat on 4 April 2012 and 21 February 2013 in either 19 cm row wheat, 38 cm row wheat (Figure 1), or no wheat.
- Wheat was harvested on 20 June 2012 and 3 July 2013, followed directly by a double-crop planting of the same nine alternative crops.
- Alternative crops were harvested 9 October 2012 and 24 October 2013.

Objective 2
- Five alternative (buckwheat, faba bean, oilseed radish, sunflower, hairy vetch) crops were frost seeded broadcasted on 4 April 2013 and 21 February 2013, and then drill seeded as an intercrop on 4 April 2012 and 29 April 2013 into 19 cm wheat .
- Wheat was harvested on 20 June 2012 and 3 July 2013, which was followed by a double-crop planting of the same five alternative crops.
- Alternative crops were harvested 9 October 2012 and 24 October 2013.

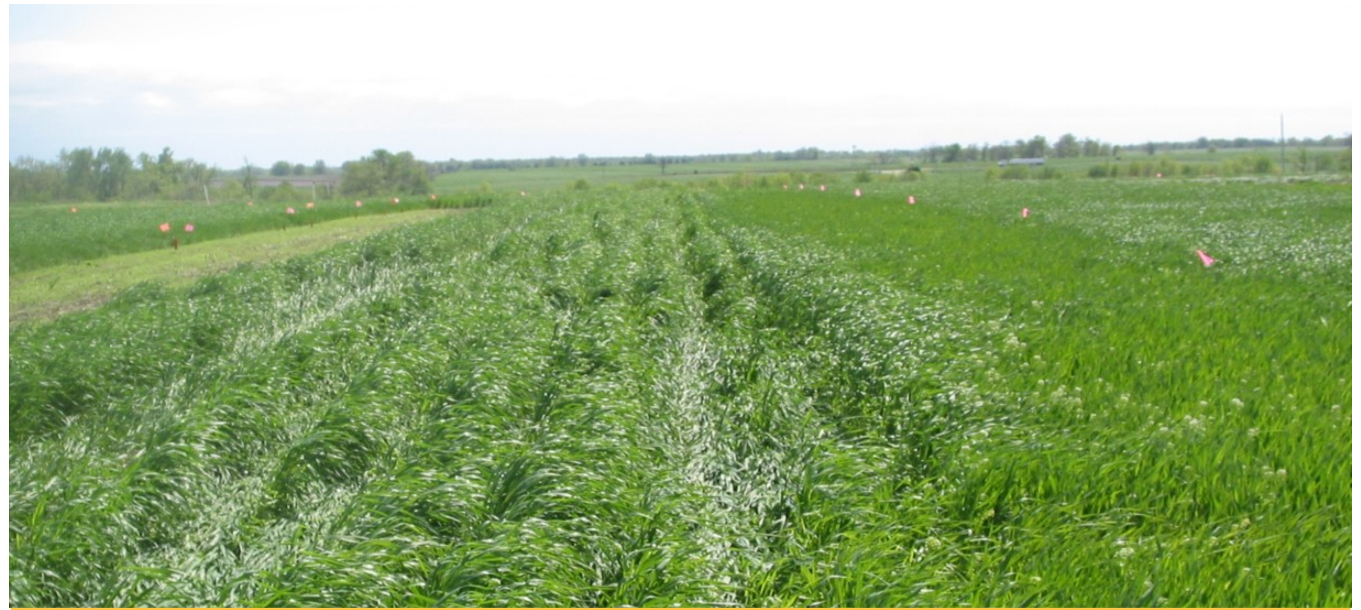

Figure 2. Machinery damage to winter wheat.

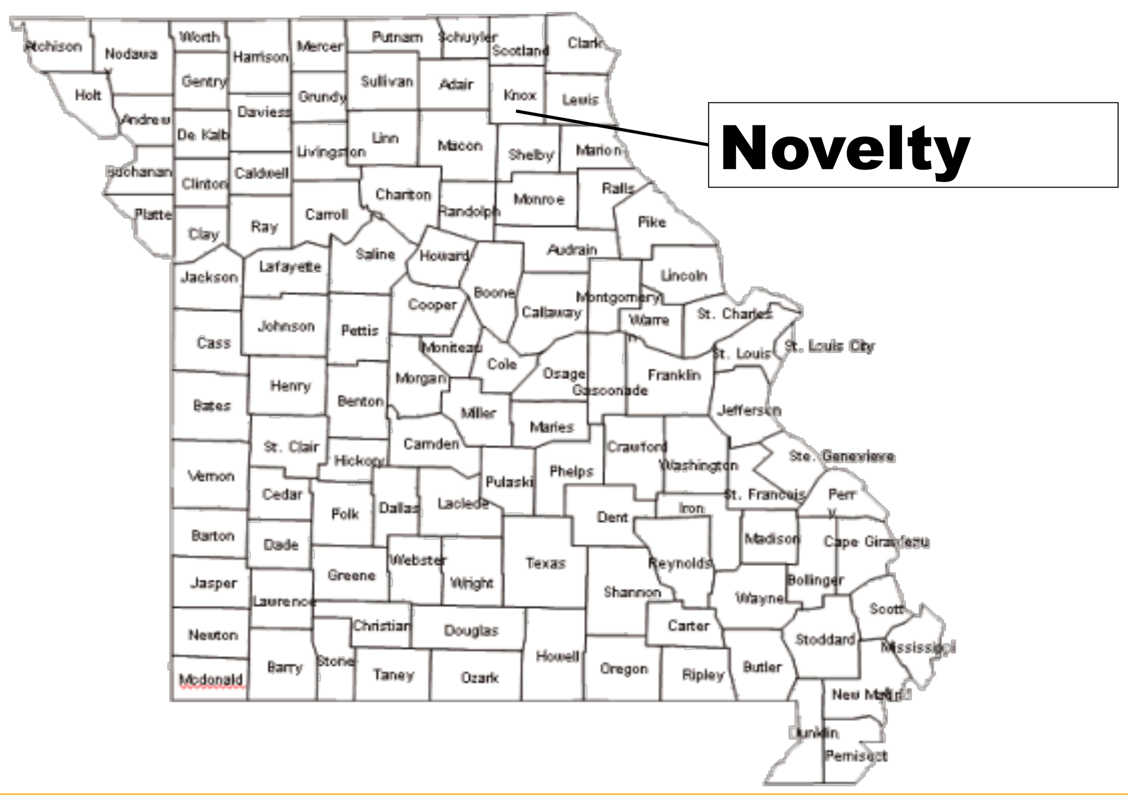

Figure 3. Location of the site for this research.

RESULTS

Objective 1
- Wheat yields were 4.67 Mg ha^{-1} in 19 cm double crop system in 2012 and 4.6 Mg ha^{-1} in 2013 (Table 1). Yields were reduced 0.73 Mg ha^{-1} with intercropping in 2012 and 0.6 Mg ha^{-1} in 2013.
- Wheat yield reductions may have been due to reduction in wheat row spacing in the 38 cm row wheat and physical injury due to the machinery of drill seeding at the time of relay-intercrop seeding (Figure 2).
- In 2012, 19 cm wheat intercepted 3% more light and had a leaf area index that was 0.3 greater that 38 cm wheat (Table 2).

Objective 2
- Planting date had a significant effect on wheat yields (Table 3).
- April relay-intercrop seeding reduced yields 0.73 to 0.8 Mg ha^{-1} in 2012 compared to an early broadcast seeding or double-crop wheat. Again this was probably due to physical damage to the wheat during seeding of the intercrop (Figure 2). However, yields in 2013 were only reduced by 0.2 Mg ha^{-1} (Table 3).
- There was no difference in wheat yields among crops that were inter-seeded into the wheat in either experiment (data not presented).
- In 2012, germination and emergence differences were observed of many alternative crops (visual observation). However, due to the significant drought that summer and subsequent limited resources, alternative crops were not able to survive (data not presented).

Table 2. Light interception and leaf area index of 19 cm and 38 cm wheat n June 2012 and June 2013.

	2012		2013	
Row spacing	Light interception	Leaf Area Index	Light interception	Leaf Area Index
	%		%	
19 cm row	77	2.7	89	3.4
38 cm row	74	2.4	91	4
LSD (*P*=0.1)	2	0.2	NA	0.1

Table 3. Wheat grain yields for broadcast (frost-seeded), intercropping (April seeded), and double-crop systems. Data were combined over intercrops (buckwheat, sunflower, radish, fava bean and hairy vetch).

	2012		2013	
Seeding date	Moisture	Yield	Moisture	Yield
	%	Mg ha^{-1}	%	Mg ha^{-1}
Frost-seeded	12.7	4.93	14.1	3.67
April-seeded	13	4.13	14.1	3.47
Double-crop	13.1	4.87	14.1	3.67
LSD (*P*=0.1)	NS	0.6	NS	0.23

SUMMARY

- In the first objective, intercropping in both row spacings reduced wheat yields with a greater reduction in wheat planted in 38 cm rows.
- In the second objective, planting date significantly affected wheat yields. April seeded intercrop reduced yields slightly compared to the other treatments.
- A dry year in 2012 dramatically reduced alternative crop yields limiting production.

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