

# Agronomy Guide

Purdue University Cooperative Extension Service

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## Management Considerations for Relay Intercropping: I. Wheat

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Double cropping of soybeans following winter wheat is common in Indiana south of Interstate 70, where the growing season is long enough for these two crops to be grown in one season. However, in central and especially northern Indiana, there is insufficient time to produce two crops annually by planting one crop immediately after another is harvested.

Relay cropping is a method of multiple cropping where soybeans are planted into standing wheat well before wheat harvest (4 to 8 weeks depending on location within the state). The word “relay” is used to describe the fact that a second crop is seeded into an existing crop before the harvest of the first crop.

Therefore, the two crops are in different stages of their respective life cycles. As the wheat is maturing, the inter-seeded soybean crop may be just beginning its reproductive growth stage. The relay or inter-seeded soybeans reach maturity a few weeks before double-crop soybeans. Relay intercropping (Fig. 1) may allow crop producers in central and northern Indiana to grow two crops in the same field in a single growing season.

### Management Guidelines

#### *Wheat Variety Choice*

Variety choice for this system is an important consideration. Use the same criteria as when choosing your regular monocrop variety (winter hardiness, disease resistance, etc.), but keep in mind these important factors:

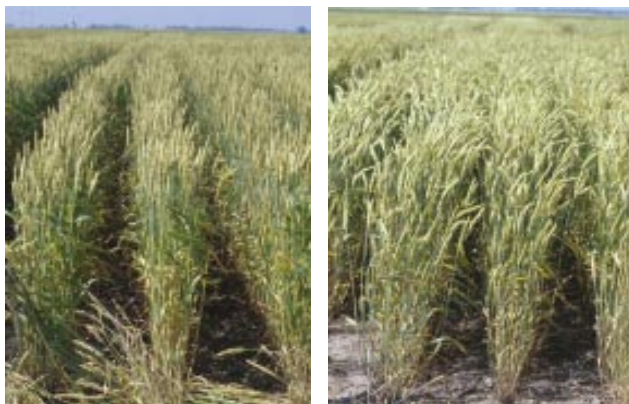


**Figure 1.** Soybeans Intercropped into Wheat Stubble

- Short to medium height – shorter plants reduce lodging and result in less shading to the soybean crop, but can also make harvest difficult if the wheat is too short. A height of 30 to 34 inches at maturity is ideal.
- High yielding in 15 inch rows
- Early to medium maturity to allow for an earlier wheat harvest
- Excellent standability – not prone to lodging
- Erect, compact growth habit – to let sunlight in to promote early soybean growth and reduce wheat damage during soybean planting (Fig. 2).

#### *Wheat Seeding*

Row spacings for wheat are typically 10 to 15 inches for relay intercropping to facilitate the planting of soybeans into the wheat (Fig. 3). Since the wheat is seeded into wider rows than normal, the seeding rate is approximately 50



**Figure 2.** Good (left) vs. Poor (right) Canopy



**Figure 3.** Wide (15 inch) vs. Narrow (7 inch) Canopy

percent of typical 7.5 - inch wheat seeding rates. A seeding rate of 800,000 seeds per acre is optimum for relay cropping systems. Although seeding rate response to row width varies among varieties, yield results of five varieties over two years confirmed the advantage of a seeding rate of 800,000 seeds per acre seeding rate (Table 1). In addition,

**Table 1. Wheat Seeding Rate Effect on Head Density and Yields in 15" Rows (2000-01)**

Seeding Rate (seeds / acre)	Head density (heads / ft <sup>2</sup> )	Yield (bushels / acre)
1,200,000	56	75
800,000	51	73
600,000	48	69

seed as soon as possible after the Hessian fly-free date to maximize yield potential. This allows increased growth before winter for improved winter hardiness. Wheat sown shortly after the fly-free date will mature earlier, leading to a more timely harvest and lower harvest moisture.

#### **Weed Control**

Fields with a history of grass problems are not recommended for this system, as it will be difficult to treat these weeds before wheat harvest. If broadleaf weed control is needed, Buctril and/or 2,4-D are choices for application because they are economical and have no carryover concerns for the soybean crop planted several weeks later.

#### **Nutrient Applications**

It is generally recommended to apply 20 to 30 pounds per acre of nitrogen (N) to wheat in the fall. This gives the wheat an initial boost in growth and helps prepare the plants for winter. A follow-up spring top-dress of no more than 80 to 90 pounds N per acre is common. This can be applied as a single application or as a split application if N loss is a concern.

In the relay intercropping system, optimum N rates may be slightly lower than those for monocrop wheat since the plant population is lower. Furthermore, excessive nitrogen to wheat in relay cropping will cause increased wheat lodging, increased shading for soybeans. If the wheat lodges early, it can be severely damaged during soybean planting, reducing its yield. It is not recommended to exceed a total of 100 pounds N per acre in this system.

Phosphorus (P) and potassium (K) levels in the soil should be tested. Recommendations for nutrient applications should be based on these results as well as yield goals for both the wheat and soybean crops in this system. For typical conditions in Indiana, apply fertilizer for 70 bushels per acre wheat and 40 bushels per acre soybeans. Consult the Tri-State Fertilizer Recommendations for specific guidelines.

#### **Soybean Seeding**

Soybean planting is recommended between Feekes wheat growth stages 8 and 10. Depending on location and weather during the growing season, this usually occurs during the first two weeks of May in Northern Indiana. Equipment with narrow tires or the use of traffic lanes (created with skip-row planting systems) will minimize the amount of damage to wheat when planting soybeans. Also, attachments such as row spreaders in front of the tires and seed openers will also reduce wheat damage while interseeding soybeans. Traffic lanes can also act as a guide for driving while top dressing and applying herbicides to winter wheat.



**Figure 4. Harvesting Intercropped Wheat**

#### **Harvest**

Ideally, wheat should be harvested when the grain moisture is between 20 and 25 percent, and then dried to the desired market moisture. When wheat is harvested at this higher moisture, the soybeans benefit by having full sunlight earlier in the season to promote growth, which allows for a higher yield potential. Drying costs may be offset by higher wheat grain quality and increased income from the soybeans.

When harvesting with conventional combines, maintaining proper height of the cutter bar (12 to 15 inches) is essential. Cut the wheat as low as possible without removing the growing point of the soybean plants (Fig. 4). However, the combine head should be low enough to maximize wheat yields.

The combine should be equipped with a chopper and a chaff spreader to evenly spread the chaff and straw. Young soybean plants could otherwise be smothered with excessive residue. Narrow tires and a wide grain table on the combine for wheat harvest will reduce damage to growing soybean plants. Fewer soybean rows will be trampled due to a reduction of passes across the field.



**Figure 5.** Successful Relay Soybean Establishment With Minimum Harvest Traffic Loss.

**Yield Loss Expectations**

When wheat is planted in 15-inch rows, the average yield decrease is only 10 to 15 percent when compared to 7.5 - inch rows (Table 2) despite the 50% reduction in seeding rate with 15-inch rows. Wheat plants in wide rows compensated with additional tillering; however, this changes depending on variety. Indiana studies have shown that wheat intercropped with soybeans yielded between 93 to 97 percent of mono-cropped wheat in similar wide rows (Table 2). This slight yield decrease may be associated with the traffic damage to wheat when planting the soybeans.

**Table 2. Wheat Relay Cropping Trials—Row Width and Average Yields in Indiana (1999-2001)**

Row Width (inches)	Yield (bushels / acre)		
	North	Central	South
7.5 Monocrop	82	77	75
15 Monocrop	72	70	66
15 Intercrop	70	69	64

**Summary of Key Points**

1. Select an appropriate variety.
2. Plant wheat at the appropriate rate in 15-inch rows as soon as possible after the Hessian fly-free date.
3. Do not apply excessive nitrogen.
4. Keep field traffic to a minimum.
5. Harvest when grain moisture is between 20 and 25 percent, and then dry.
6. Pay attention to height of combine header and adjust properly.
7. Spread straw and chaff evenly over harvest path.
8. Use soybean planting equipment that minimizes damage to wheat.
9. Use herbicides that minimize stress to the relay soybean crop.

**Other Resources**

**Purdue University Agronomy Guide:**

- Wheat Production and Fertilization in Indiana: <[www.agcom.purdue.edu/AgCom/Pubs/AY/AY-244.html](http://www.agcom.purdue.edu/AgCom/Pubs/AY/AY-244.html)>
- Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat & Alfalfa <[www.ces.purdue.edu/extmedia/AY/AY-9-32.pdf](http://www.ces.purdue.edu/extmedia/AY/AY-9-32.pdf)>

**Ohio State University FactSheets:**

- Steps to Better Wheat Yields: <[ohioline.osu.edu/agf-fact/0104.html](http://ohioline.osu.edu/agf-fact/0104.html)>
- Relay Cropping Wheat and Soybeans: <[ohioline.osu.edu/agf-fact/0106.html](http://ohioline.osu.edu/agf-fact/0106.html)>

**Landec Ag:**

- Relay Crop: <[relaycrop.com/](http://relaycrop.com/)>

**Clemson University Extension:**

- Relay Intercropping with Wheat: <[www.clemson.edu/public/](http://www.clemson.edu/public/)>

**University of Nebraska NebGuide:**

- Two Crops in One Year: Relay Intercropping: <[www.ianr.unl.edu/pubs/fieldcrops/g1024.htm](http://www.ianr.unl.edu/pubs/fieldcrops/g1024.htm)>

\* Pictures taken by Scott McCoy and Tony Vyn, Purdue University

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