

EFFECT OF WHEAT CULTIVAR ON DOUBLE-CROP AND RELAY-INTERCROP SOYBEAN

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Claypan soils are poorly drained partially because of an argillic claypan layer 15- to 24-cm below the soil surface, and they are highly erodible due to slopes up to 20% and surface water runoff. Conservation tillage systems are recommended to reduce soil loss. Due to economic considerations and relatively strong corn and soybean prices, cropping systems have shifted from a rotation of corn (*Zea mays* L.), soybeans, [*Glycine max* (L.) Merr.] and wheat (*Triticum aestivum* L.) to a rotation of corn and soybeans. Some farmers have used double-cropped soybean production to increase wheat profitability. In the absence of government programs, a risk and return analysis in southeast Kansas favored double-cropped wheat-soybeans over monocropped wheat or soybeans (Burton et al., 1996). Relay-intercrop production has been proposed in the Midwest to reduce production risks of double-cropping. Double-cropping soybeans after wheat is risky above 38° latitude due not only to low rainfall and dry soils at planting, but also to a relatively short growing season that can be limited by early frost which reduces grain quality and yield (Dewell et al., 2003; Duncan et al., 1990). One of the main opportunity costs farmers encounter with relay-intercropping is the risk of seeding wheat in 15-inch wide rows and not being able to plant soybeans due to inclement weather conditions. Wheat is typically seeded in narrow rows (7.5 inches). Most wheat row spacing research has evaluated 4 to 12 inch wide rows in order to reduce weed interference (Drews et al., 2009; Justice et al., 1993; Koscelny et al., 1990; and Roberts et al., 2001).

Beuerlein et al. (2002) reported that high-yielding wheat planted in 15-inch wide rows had grain yields similar to a 7.5-inch row spacing. Since previous relay-intercrop research was conducted, imidazolinone-tolerant wheat, glyphosate-resistant soybean, polymer-coated soybean seed technology, and tractor guidance systems have been introduced while widespread use of planters on 15-inch wide-row spacings is common. Polymer-coated seed technology regulates germination based on soil temperature and moisture content (Balachander, 2003) which may allow earlier relay-intercropped soybean planting dates and reduce mechanical damage to wheat compared to later planting dates. Delayed soybean germination may also reduce interference between wheat and soybeans. However, no research has evaluated the impact of wheat cultivars on light interception and subsequent wheat yields, relay-intercropped soybean response, or the cost-effectiveness of these systems using currently available technology. The objectives of this research were to (1) evaluate the effect of wheat row spacing and cultivar on wheat and double-cropped soybean response; (2) evaluate the effect of wheat cultivar in a relay-intercropping system on wheat and soybean response; and (3) determine the effect of wheat cultivar selection on gross margins of relay-intercropped and double-cropped soybeans compared to monocropped soybeans.

Field research from 2003-2005 evaluated the effect of wheat row spacing (7.5- and 15-inch) and cultivar on double-cropped (DC) soybean response, 15-inch wheat on relay-intercrop (RI) response, and wheat cultivar selection on gross margins of these cropping systems. Narrow-row wheat increased grain yield 7 bu/acre, light interception (LI) 7%, and leaf area index (LAI) 0.5 compared to wide rows (data not presented), but did not affect DC soybean yield (Table 1).

High yielding wheat (P25R37) with greater LI and LAI produced lower (5 bu/acre) soybean yields in a RI system than a low yielding cultivar (Ernie). Gross margins were \$103/acre greater when P25R37 was RI with H431 Intellicoat (ITC) soybean compared to Ernie. Gross margins were similar for monocrop H431 non-coated (NC) or ITC soybean, P25R37 in 7.5- or 15-inch rows with DC H431 NC soybean, and P25R37 in 15-inch rows with RI H431 ITC soybean in the absence of a fall frost.

In an attempt to reduce risk associated with double-cropped soybean production due to an early fall frost and dry conditions at planting, a relay-intercropping system using coated soybeans was as cost-effective as monocropped and double-cropped soybeans, even in the absence of a yield limiting early frost in the three years of this research. Farmers considering relay-intercropped soybean production in order to keep wheat in their crop rotation should utilize high-yielding wheat cultivars and coated-soybeans to maximize gross margins. Early-planted, relay-intercropped soybean into 15-inch wide-row wheat production must consider not only the soybean cultivar and seed coat technology, but also a high yielding wheat cultivar.

Table 1. Monocropped (MC), double-cropped (DC), and relay-intercropped (RI) system wheat yields, soybean yields, receipts, expenses, and gross margins. Data were averaged over years (2003-2005).

| Soybean cropping system | Wheat cultivar and row spacing | Soybean cultivar | Wheat yield | Soybean yield | Receipts | Expenses | Gross margins |
|-------------------------|--------------------------------|------------------|---------------------|---------------|----------|----------|---------------|
| | | | ----- bu/acre ----- | | | | |
| MC | None | H431 NC | 0 | 52 | 447 | 157 | 290 |
| | None | H431 ITC | 0 | 52 | 447 | 170 | 277 |
| | None | DK 38-52 | 0 | 50 | 431 | 156 | 275 |
| DC | Pioneer 25R37, 7.5-inch | H431 NC | 66 | 26 | 616 | 273 | 343 |
| | Pioneer 25R37, 15-inch | H431 NC | 60 | 27 | 587 | 272 | 315 |
| | Ernie, 7.5-inch | H431 NC | 49 | 27 | 521 | 269 | 252 |
| | Ernie, 15-inch | H431 NC | 41 | 28 | 478 | 268 | 210 |
| | AgriPro 502 CL, 7.5-inch | H431 NC | 46 | 27 | 499 | 268 | 230 |
| | AgriPro 502 CL, 15-inch | H431 NC | 33 | 26 | 421 | 266 | 155 |
| | | | | | | | |
| RI | Pioneer 25R37, 15-inch | H431 NC | 53 | 26 | 532 | 270 | 262 |
| | Pioneer 25R37, 15-inch | H431 ITC | 53 | 33 | 596 | 285 | 312 |
| | Pioneer 25R37, 15-inch | DK 38-52 | 52 | 22 | 494 | 269 | 225 |
| | Ernie, 15-inch | H431 NC | 29 | 34 | 464 | 266 | 197 |
| | Ernie, 15-inch | H431 ITC | 31 | 35 | 484 | 280 | 204 |
| | Ernie, 15-inch | DK 38-52 | 34 | 28 | 443 | 266 | 177 |
| LSD ($P = 0.01$) | | | 6 | 7 | 69 | 2 | 67 |

^aAbbreviations: ITC, Intellicoat; NC, Non-coated.

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