Developing Profitable Double-Crop Systems after Winter Barley

NCR- SARE Partnership Project Report

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Double Cropping After Winter Barley

Replicated trials were conducted in 2018 and 2019 at the W.K. Kellogg Biological Station (KBS) to evaluate the potential and profitability to double crop soybeans, forage crops and cover crops after a crop of winter malting barley (Puffin). Soybean maturity groups (MG) included 1.9, 2.4 and 2.8, all of which were planted at 140,000 seeds per acre and 200,000 seeds per acre. Additionally, one large block of the experiment was irrigated whereas another block was not irrigated. In each block, we also included a treatment of sorghum-sudan for forage, and a diverse cover crop mix.

In 2018, the winter barley was harvested on June 30th, and the second crops were no-till planted on July 2nd. We received ample rainfall in August and September of 2018, but still applied 5 inches of irrigation water to the irrigated block, mostly in July after seeding. Due to a significant amount of rainfall in the fall, soybean plots weren't harvested until mid-December.

Figure 1. *Double crop soybean project at KBS shown at the time of first frost (left) and harvest (right)* in 2018.

The 1.9 and 2.4 MG soybeans matured prior to the first frost in mid-October, but the 2.8 MG soybeans were still green and immature at the time of the first frost. Planting rate did not affect soybean yield, but variety (i.e. MG) did affect yield, as shown in Figure 2. The highest producing treatments resulted in just under 45 bushels per acre, which is worth $400 per acre in gross profits, with as little as $40 per acre in direct input costs (not counting labor or machinery depreciation).

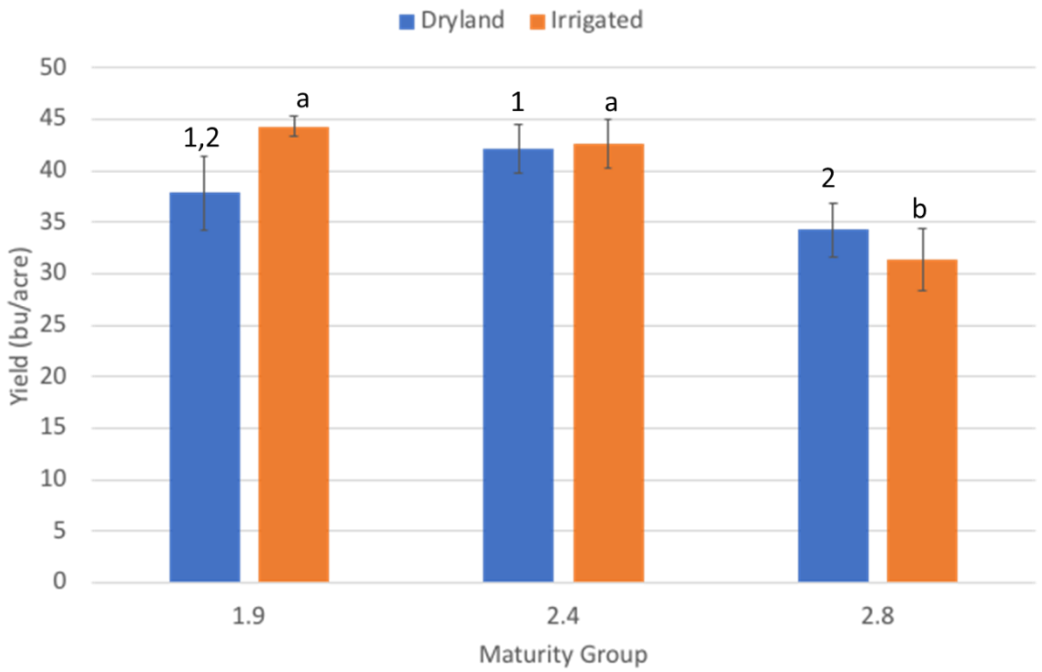

Figure 2*. Grain yield of soybeans following winter barley in 2018. The design doesn't allow for direct statistical comparison of irrigated vs. dryland, so maturity groups are compared against each other within the irrigated or dryland block, using numbers and letters to indicate statistical significance.*

Soybean seed from each treatment is being evaluated for quality since the 2.8 MG did not reach physiological maturity (R8) prior to the first frost. The sorghum sudan crop was harvested once for forage, and produced between 2-4.5 tons of biomass per acre. The cover crop biomass was not measured, but visual evaluation (see plots in Figure 1 left) showed abundant growth of diverse species that will be returned to the soil prior to next year's crop.

In 2019, the winter barley was harvested on July 3rd, and the second crops were no-till planted on July 5th and 6th. Some small rain showers at the time of planting provided soil moisture for the soybeans to germinate, but subsequent months were drier than average, including 1.34 inches for the remainder of July, and 1.73 inches in August. Approximately 5 inches of irrigation water was added to the irrigated block. Due to a significant amount of rainfall in the fall, and slow dry-down of frosted, immature soybeans, the plots weren't harvested until early December.

Figure 3. *Double crop soybean project at KBS shown at the time of first frost (left) and harvest (right)* in 2019.

Similar to 2018, the 1.9 and 2.4 MG soybeans matured prior to the first frost in mid-October, but the 2.8 MG soybeans were still green and immature at the time of the first frost. We are still performing statistical analyses for the 2019 data, but trends appear to show that irrigation and variety influenced yield, and planting rate influenced yield for some of the varieties (Figure 4). Soybean plants were short in general, which led to difficulty at harvest time related to getting all of the soybean pods harvested by the plot combine. Thus, a subset of the overall yield was left in the field, which may have been harvested by more sophisticated field scale equipment. The highest producing treatment resulted in 27 bushels per acre, which is worth $250 per acre in gross profits, with as little as $40 per acre in direct input costs (not counting labor or machinery depreciation). Sorghum sudan biomass harvested from the control plots in October ranged from 5.5 tons/acre (non-irrigated) to 6.25 tons per acre (irrigated).

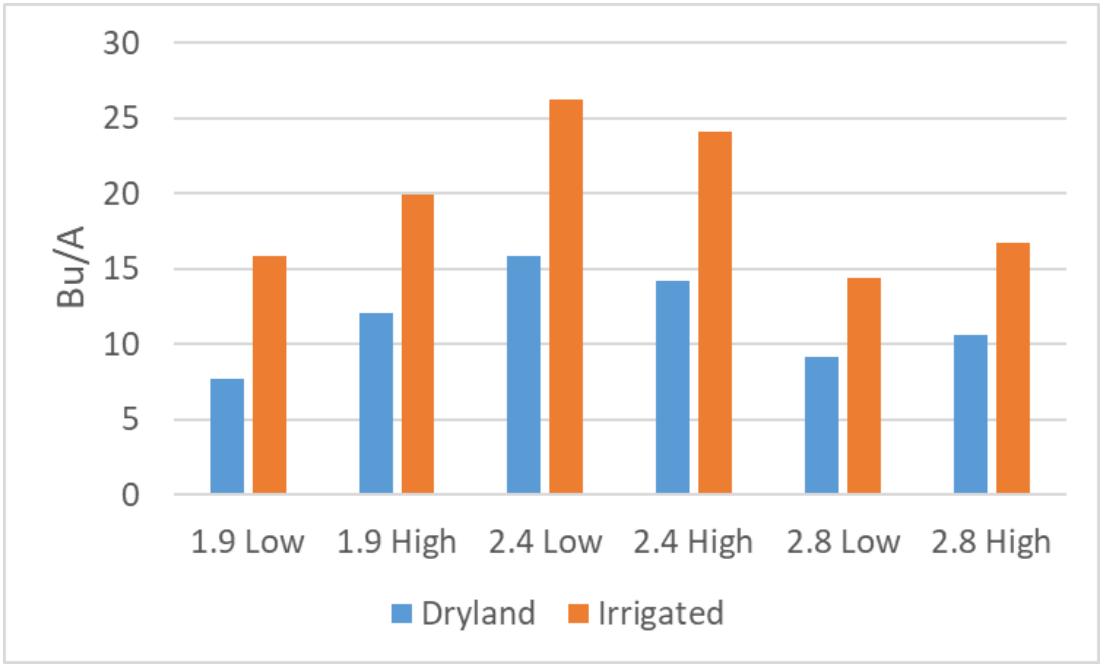

***Figure 4**. Grain yield of soybeans following winter barley in 2019. The terms "Low" and "High" indicate seeding rate of 140K seeds per acre and 200K seeds per acre respectively. Statistical analysis is still being performed on these data at the time of this report.*

In addition to evaluating yields of the double crop experiment, we are also evaluating soybean grain quality as well as individual plant performance to determine effect of seeding rate on branching, etc.. Those data will be available with the final report.

Two of the cooperating farmers were able to follow winter barley with soybeans in 2018. One farmer in Kawkawlin, MI harvested 26 bushels of soybeans per acre using a 1.1 MG soybean. Another farmer near Crosswell, MI attempted to relay intercrop soybeans within his winter barley without success. A third farmer wasn't able to get soybeans planted after barley because the summer schedule got too busy.

Three additional farmers that didn't have barley planted at the start of the grant, were able to plant barley in the fall of 2018 and will be double cropping soybeans in 2019. One of these growers relay-intercropped soybeans early in the spring, with little success. His narrative is listed below.

"I got very poor yields out of both the barley and soybeans in the relay system last year. Most of the barley went down in a storm just days before harvest. Yields were around 15 bu/ac. Once the barley goes down, it can't really be picked back up in the beans. The barley then smothered the beans pretty well, and contributed to a lot of volunteer barley weed pressure during the rest of the season. I didn't manage the field as closely as I could have. For just the three acres I had, I fertilized and treated with fungicide when the wheat needed it, not necessarily the barley. I probably could have gotten a bit more bean yield if I had been aggressive about herbicide use though July and August, but the bean yield potential didn't seem to justify the costs. In contrast, the wheat this last year ran about 65 bu/ac and the relay soybeans 25 bu/ac. Not great for wheat, but I was happy with the beans."

Another grower was comparing double cropping after wheat with double cropping after winter barley. A full narrative has not been obtained from this farmer at the time of this report, but the farmer has indicated that barley was harvested in late June, approximately 10 days prior to wheat. A third farmer was unable to get soybeans planted after barley due to the later harvest in 2019 relative to normal, and workload associated with getting straw baled, etc..

Results of these trials have been presented at the AMBA BIC conference, and will be presented at the Great Lakes Hop and Barley Conference and other conferences / meetings that allow. We will also be creating a report that will be distributed through our listserv and social media, and posted to our website. Field days were held at KBS in June and November of 2018, and June and September of 2019. The early field days highlighted the plans for the project, and the later field days showed the field trials.

After the project was initiated, we've developed a new relationship with Eric Richer with Ohio State University Extension – Fulton County (https://fulton.osu.edu/people/eric-richer), who is working with a number of farmers to evaluate double cropping after winter barley in northern Ohio. We invited Eric to join and present at our Great Lakes Hop and Barley Conference in Traverse City, MI, and have continued to develop that relationship to learn together. We've also initiated a relationship with Dr. Tim Boring, Vice President of the Michigan Agribusiness Association (https://miagbiz.org/index.php/about/staff). Dr.

Boring is a leader related to innovative agricultural practices in Michigan, including implementing many trials on his own family farms, and leading innovation groups and networks such as the 2018 and 2019 Underground Innovations Conferences in Frankenmuth, MI.

Origin Malt from Marysville, OH, and Independent Barley and Malt from Litchfield, MI, have continued to be strategic partners both on research and education. Origin, in particular, has been purchasing barley from farmers for the past couple of years, and double cropping soybeans is a key portion of profitability for those farmers. Dr. Wilke has been participating in a number of interactions (webinars, phone calls) with farmers that grow for Origin, helping assist with barley production as well as cropping system questions.

Both 2018 and 2019 had wet, cold springs that led to delayed crop development, and later barley harvest relative to 2017. Later barley harvest has resulted in more challenging conditions to successfully double crop soybeans. While we feel confident in our research plot data, we would like to extend this partnership project for one more year at no extra cost, to provide more opportunities for independent growers to evaluate double crop methods, including failures and successes. We also have increasing number of growers in Michigan that are producing barley for Origin and Independent, which will provide more opportunities for evaluation and education.