

An Economic Comparison of Double Crop Wheat in a Corn Soybean Rotation

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Introduction

Background:

- Part of NREC project by Lowell Gentry evaluating soil nitrate loss through tile drainage
- Conducted on Eric Miller farm, Piatt County (central Illinois)
- Profit maximizing – applications change - not an experimental design
- Not many other wheat double crop trials in Central IL

Importance:

- Double-crops have the potential to produce increased returns through second income on the same land, allocating costs
- Overwintering crops reduce nitrate runoff into water
- Double-cropping can reduce fertilizer requirements
- Double-cropping can reduce exposure of soil between harvest periods
- Overwintering to improve soil quality by increasing soil organic matter
- Wheat is a revenue producing cover crop

Objectives

- Compare returns from wheat-double-crop-soybean rotation to corn-soybeans rotation
- Evaluate economic benefits of adding another crop to rotation
- Develop a "trial" that reduced nitrate runoff while still being profitable through the use of wheat-double-crop-soybeans

Results

Total Rotation Net Return Comparison

- Control Plot's standard corn, soybean rotation was more profitable by \$47.00/acre**
 - Only \$17.00/acre more profitable excluding 2019 data
- Primarily influenced by extremely volatile prices of the double crop

Enterprise Analysis – Corn

- 2016 was omitted as a transition year
- 2019 prevent plant – Trial Plot corn, only
- Trial (with 2019): higher yields, lower revenue, lower cost, lower return by \$42.00/acre**
 - Highly impacted by 2019 prevent plant outliers
- Trial (without 2019): higher yields, higher revenue, higher cost, higher return by \$14.00/acre**
 - Higher cost from increased fertilizer (dry and nitrogen) and no-till/strip-till cost

Enterprise Analysis -Soybean

- 2016 was omitted as a transition year
- Included the use of a cover crop – cereal rye
- Trial: lower yields, lower revenue, higher costs, lower returns**
 - Higher cost due to cover crop expense, no-till/strip-till cost

Enterprise Analysis – Double Crop Wheat

- 2016 was omitted as a transition year
- Average net return of \$158.00/acre**
- Yields are extremely high**
 - Around 100 bushels/acre compared to the IL state average of 70 bushels/acre

- Lower returns due to high cost from pushing wheat to produce high yields
- Wheat is not a profitable stand along crop in IL

Enterprise Analysis – Double Crop Soybean

- 2016 was omitted as a transition year
- Average net return of \$306.00/acre**
- Extremely low yields of 2019 and 2020 impact profitability**
 - Due to late frost before harvest

Total Rotation Net Return Comparison (All Crops)

	Trial Plot				Control Plot			Difference (Trial Less Control)
	Corn	Soybeans	Wheat-Double Crop	Average (Trial)	Corn	Soybeans	Average (Control)	
2016								
2017	\$458	\$466	\$527	\$484	\$470	\$415	\$442	\$42
2018	\$668	\$520	\$460	\$549	\$688	\$458	\$573	-\$14
2019	\$266	\$330	\$286	\$294	\$532	\$391	\$461	-\$167
2020	\$622	\$464	\$258	\$448	\$573	\$596	\$585	-\$137
2021	\$641	\$706	\$777	\$708	\$603	\$710	\$657	\$51
Average (w/ 2019)	\$531	\$497	\$462	\$497	\$573	\$514	\$544	-\$47
Average (w/out 2019)	\$597	\$539	\$506	\$547	\$584	\$545	\$564	-\$17

Enterprise Analysis – Corn (Trial vs. Control) 2017-2021

	Yield/Acre			Revenue/Acre			Expense/Acre			Net Return/Acre		
	Trial	Control	Difference	Trial	Control	Difference	Trial	Control	Difference	Trial	Control	Difference
2016												
2017	259	242	17	\$1,114	\$1,041	\$73	\$655	\$571	\$84	\$458	\$470	(\$12)
2018	265	271	-6	\$1,259	\$1,287	(\$28)	\$590	\$599	(\$9)	\$668	\$688	(\$20)
2019	Prev. Plant	221		\$502	\$1,116	(\$614)	\$236	\$584	(\$348)	\$266	\$532	\$266
2020	231	217	14	\$1,167	\$1,096	\$71	\$544	\$523	\$22	\$622	\$573	\$49
2021	241	228	13	\$1,265	\$1,197	\$68	\$625	\$594	\$31	\$641	\$603	\$38
Average (w/ 2019)	249	236	10	\$1,061	\$1,147	(\$86)	\$530	\$574	(\$44)	\$531	\$573	(\$42)
Average (w/out 2019)	249	236	10	\$1,201	\$1,155	\$46	\$604	\$572	\$32	\$597	\$583	\$14

Enterprise Analysis - Soybean

	Yield/Acre			Revenue/Acre			Expense/Acre			Net Return/Acre		
	Trial	Control	Difference	Trial	Control	Difference	Trial	Control	Difference	Trial	Control	Difference
2016												
2017	80	79	1	\$804	\$794	\$10	\$338	\$379	\$41	\$466	\$415	\$51
2018	97	86	11	\$897	\$796	\$101	\$378	\$337	\$41	\$520	\$458	\$62
2019	75	83	-8	\$750	\$830	(\$80)	\$420	\$439	\$19	\$330	\$391	(\$61)
2020	71	80	-9	\$763	\$860	(\$97)	\$299	\$264	\$35	\$464	\$596	-\$132
2021	83	80	3	\$1,058	\$1,020	\$38	\$353	\$310	\$43	\$706	\$710	(\$4)
Average	81	82	-0.5	\$854	\$860	(\$6)	\$357	\$346	\$11	\$497	\$514	(\$17)

Enterprise Analysis – Double Crop Wheat

	Yield/Acre	Revenue/Acre	Expense/Acre	Net Return/Acre
2016				
2017	98	\$456	\$359	\$97
2018	88	\$453	\$335	\$118
2019	103	\$536	\$383	\$153
2020	92	\$543	\$386	\$157
2021	106	\$636	\$365	\$272
Average	98	\$523	\$365	\$158

Enterprise Analysis – Double Crop Soybean

	Yield/Acre	Revenue/Acre	Expense/Acre	Net Return/Acre
2016				
2017	55	\$553	\$122	\$431
2018	52	\$481	\$139	\$342
2019	25	\$250	\$117	\$133
2020	20	\$215	\$114	\$101
2021	53	\$674	\$168	\$506
Average	41	\$438	\$132	\$306

Conclusion

- Control without wheat double-crop more profitable by \$47.00 per acre
 - Driven by low double-crop soybean yields in 2019 and 2020
 - Some of this is due to learning about system
 - Need higher returns for large number of farmers to adopt more intense wheat double-crop soybeans
- Soybeans with cover crops (trial) averaged returns -\$17.00/acre less than those without
 - How can we increase return with cover crops?

Research Design

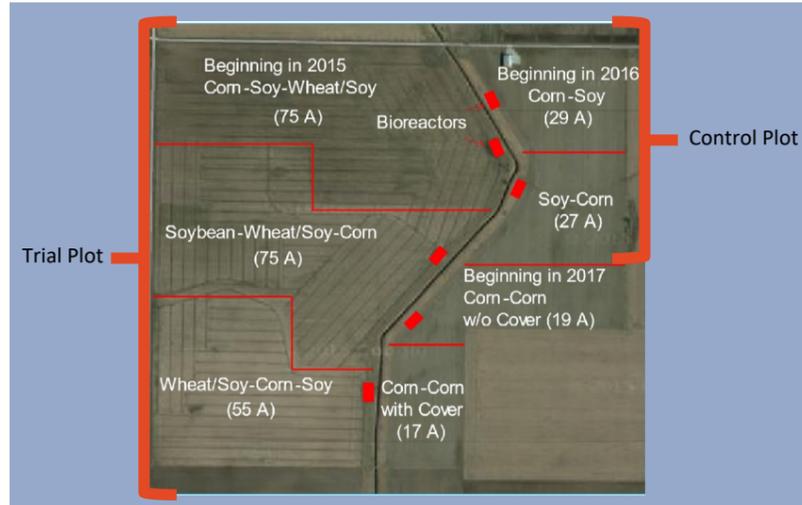
- Conducted on Eric Miller farm, 300-acre, Piatt County (central Illinois) from, 2016-2021
- Eric Miller provided application data
- Controlled prices and input costs
 - Utilized Precision Conversation Management's (PCM) average market price for the year for revenue
 - University of Illinois' machinery cost data for field operation expenses

Field Design:

- Trial Plot (pictured on the left): diversified rotation of wheat-double-crop-soybean, corn, soybean, and a cover crop
- Control Plot (pictured on the right): standard rotation of corn, soybean
- Plots are divided by centrally located ditch lined with bioreactors, collect data on nitrate loss

Crop Rotations:

- Trial Plot (west/left):
 - Wheat-double-crop-soybean, corn, soybean + cover crop (cereal rye)
 - Rotation of 3 crops, in their 'relative third' of the field
 - Section Planting Pattern: soybeans follow corn, wheat-double-crop-soybean follows soybean, and corn follows the wheat-double-crop-soybeans
 - Note : 2019 Trial Plot section planted to corn was prevent plant
- Control Plot (east/right):
 - Corn, soybean



	Trial Plot Rotation			Control Plot Rotation		
	North	Middle	South	North	South	
2016	Soybean	DC Wheat	Corn	2016	Corn	Soybean
2017	DC Wheat	Corn	Soybean	2017	Soybean	Corn
2018	Corn	Soybean	DC Wheat	2018	Corn	Soybean
2019	Soybean	DC Wheat	*Corn	2019	Soybean	Corn
2020	DC Wheat	Corn	Soybean	2020	Corn	Soybean
2021	Corn	Soybean	DC Wheat	2021	Soybean	Corn

References

- Beuerlein, J. 2001. "Relay Cropping Wheat and Soybeans." *Extension Fact Sheet*. Columbus: Ohio State University. (<http://ohioline.osu.edu/agf-fact/0106.html>).
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- Hegenstaller, A.H., R.P. Anex, M. Liebman, D.N. Sundberg and L.R. Gibson. 2008. "Productivity and Nutrient Dynamics in Bioenergy Double-Cropping Systems," *Agronomy Journal* 100: 1740-1748.