Bioenergy Cropping Systems Study – 2017 Summary

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Treatments (all combinations of the following crop rotation and residue removal treatments, all no-till)
Rotations:

1. Spring Wheat – Dry Pea (W-P)
2. Spring Wheat – Dry Pea/ Cover Crop mix (W-P/CC)
3. Spring Wheat – Dry Pea - Corn (W-P-C)

Residue Removal:

A. No residue removed
B. Wheat straw baled and removed
C. Wheat straw, corn stover, and pea residue baled and removed
D. Wheat straw, corn stover, and peas residue grazed

2017 Planting Dates, Seed, and Fertilizer Rates:

Crop/ Rotation	Planting Date	Cultivar/ Type	Planting Rate	Fertilizer (lb material)	Drill/ Planter	Harvest Date
Spring Wheat W-P-C	5/04/2017	SY Soren	130 lb/ac	199 lb/ac urea 50 lb/ac 11-52-0	JD 750	8/18/2017
Spring Wheat W-P	5/04/2017	SY Soren	130 lb/ac	22 lb/ac urea 50 lb/ac 11-52-0	JD 750	8/18/2017
Spring Wheat W-P/CC	5/04/2017	SY Soren	130 lb/ac	42 lb/ac urea 50 lb/ac 11-52-0	JD 750	8/18/2017
Dry Pea W-P	5/03/2017	Nette	130 lb/ac	0 lb/ac urea 50 lb/ac 11-52-0	JD 750	7/31/2017
Dry Pea W-P/CC	5/03/2017	Nette	139 lb/ac	0 lb/ac urea 50 lb/ac 11-52-0	JD 750	7/31/2017
Dry Pea W-P-C	5/03/2017	Nette	139 lb/ac	0 lb/ac urea 50 lb/ac 11-52-0	JD 750	7/31/2017
Corn W-P-C	5/11/2017	47J2823 GTCBLL [Legend Seeds]	24,300 seeds/ac	59 lb/ac urea 50 lb/ac 11-52-0	JD Max Emerge II	10/24/2017
Cover Crop W-P/CC	8/18/2017	Mix	34 lb/ac	----	JD 750	----

Fertilizer rates based on soil test and NDSU fertilizer recommendations. Cover crop mix: 4.7 lb/a soybean, 11.2 lb/a spring triticale, 10.4 lb/a Arvika pea, 6 lb/a Rosetown lentil, 1.6 lb/a red clover, and 0.13 lb/a purple top turnip.

Planting wheat in the BCS

2017 Spray Dates, Pesticides Used, & Rates:

Crop	Date	Plot Areas	Chemical	Rate
All Crops	05/02/2017	Spring Burndown: All rotations/crops/plots	Cornerstone 5 Plus Class Act	25 oz./a 64 oz./100gallons
Spring Wheat	06/03/2017	All wheat rotations/plots	Perfect Match Headline	16 oz./a 8 oz./a
Peas	6/7/2017	All pea rotations/plots	Basagran Pursuit Crop oil	32 oz./a 2 oz/a 32 oz./100 gallon (20 gal/ac)
	6/8/2017	All pea rotations/plots	Section Crop oil	8 oz./a 3.2 oz/a
	6/16/2017	All pea rotations/plots	Basagran Class Act	25 oz./a 32 oz./100 gallon
	7/21/2017	All pea plots from removal treatments A,B,C	Cornerstone 5 Plus Class Act	48 oz./a 64 oz./100 gallon
Corn	6/12/2017	All corn rotations/plots	Cornerstone 5 Plus Widematch Class Act	25 oz./a 2 oz./a 32 oz./100 gallon
	6/29/2017	All corn rotations/plots	Cornerstone 5 Plus Class Act	20 oz./a 32 oz./100 gallon
Fall Burndown	9/6/2017	All rotations/plots **EXCEPT:** grazed (D), corn, and cover crop	Cornerstone 5 Plus 2,4-D LV6 Class Act	25 oz./a 25 oz/a 64 oz./100gallons

Summary:

- Spring wheat yields were significantly higher for the W-P than for the W-P/CC rotation, but were not significantly different between W-P-C and either W-P or W-P/CC (Figure 1). There was some indication of lower yield where residue had been harvested and removed every year (C) than for the no residue harvest treatment (A). However the differences in wheat yields between residue removal treatments were not statistically significant.
- There was some indication of lower pea yield where residue had been harvested and removed every year (C) than for the no residue harvest treatment (A). However, no statistically significant differences in pea yields were detected among crop rotation or residue removal treatments (Figure 2).
- There were no statistically significant differences in corn yields between residue removal treatments (Figure 3).
- Even though there was good cover crop growth in the cover crop phase of the W-P/CC rotation, the amount of grazing was limited, as powdery mildew was common on the peas in the cover crop phase (Figure 4). This was also the case with the pea phase of the W-P rotation, where there was good volunteer pea growth, but powdery mildew was common on the volunteer peas.

- In determining fertilizer application rates, all plots were soil sampled in the fall. After high cover crop production in 2016, soil tests showed substantially lower NO_3-N following P/CC than following P in the W-P/CC and W-P rotations, respectively, presumably due to uptake by the cover crops. Following the NDSU guidelines, this meant we would need to apply 129 lb urea/ac (59 lb N/ac) to the W plots in the W-P/CC rotation versus 22 lb/ac urea in the W-P rotation. However,we expected some of the additional N would likely be released during the growing season, so the application was reduced by 87 lb urea/ac (40 lb N/ac) to 42 lb urea/ac (as shown in the table). To test the effect of this reduction, we included a strip where we applied the full recommended amount of 129 lb urea/ac. Wheat yield in this "Enhanced" strip was not different from the rest of the plot (data not shown). However, looking at wheat grain protein content (Figure 5), protein was lower in W-P/CC than for the other rotations. Protein in the "Enhanced" strip (W-P/CC E) was higher than in W-P/CC, but was still lower than in the other rotations. So, with the conditions that occurred in 2017, reducing the N rate to account for potential cover crop contribution appeared to have a negative effect on grain protein.

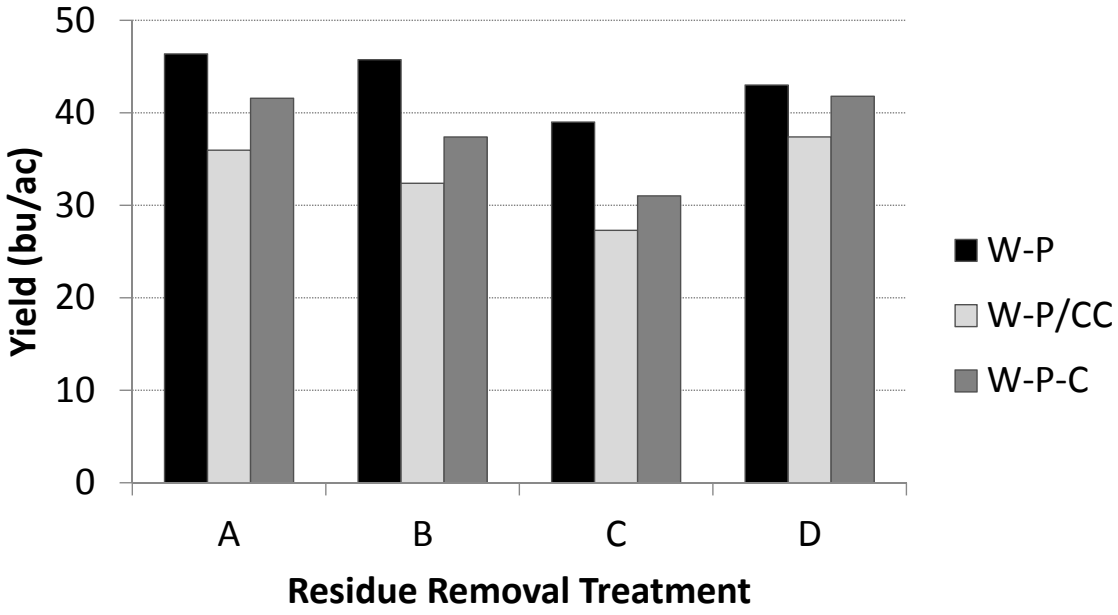

Fig. 1. 2017 spring wheat seed yield as influence by crop rotation and residue removal treatments.

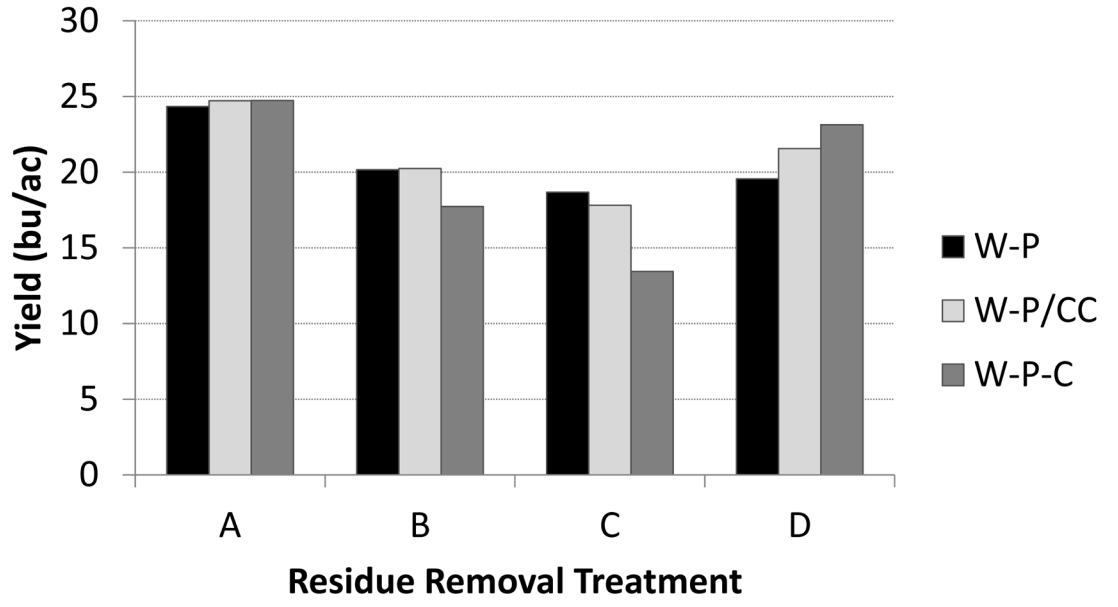

Fig. 2. 2017 dry pea seed yield as influenced by crop rotation and residue removal treatments.

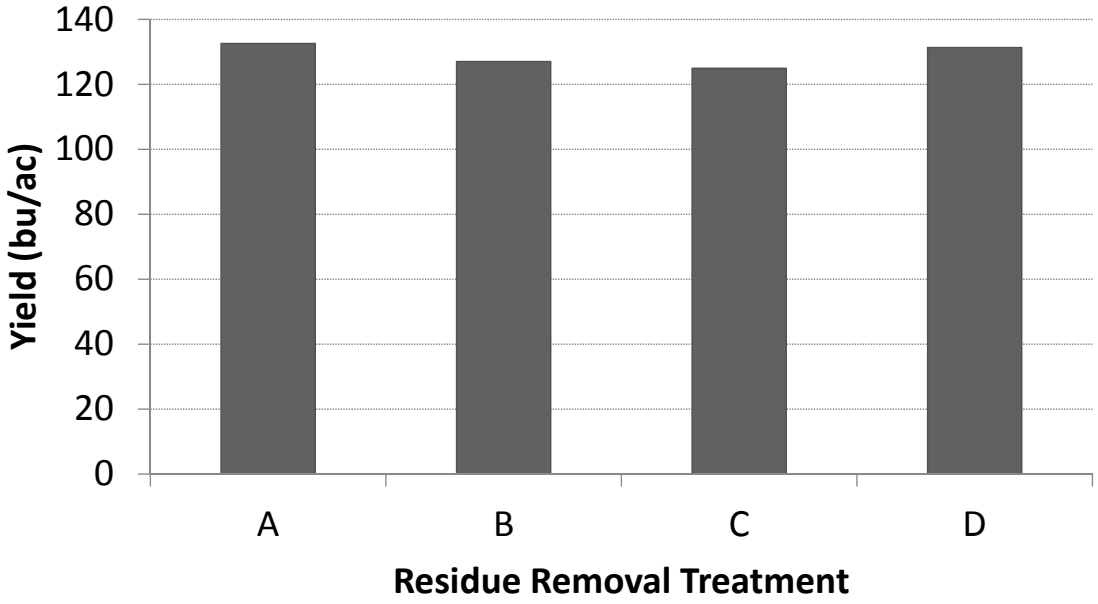

Fig. 3. 2017 corn seed yield as influenced by residue removal treatments.

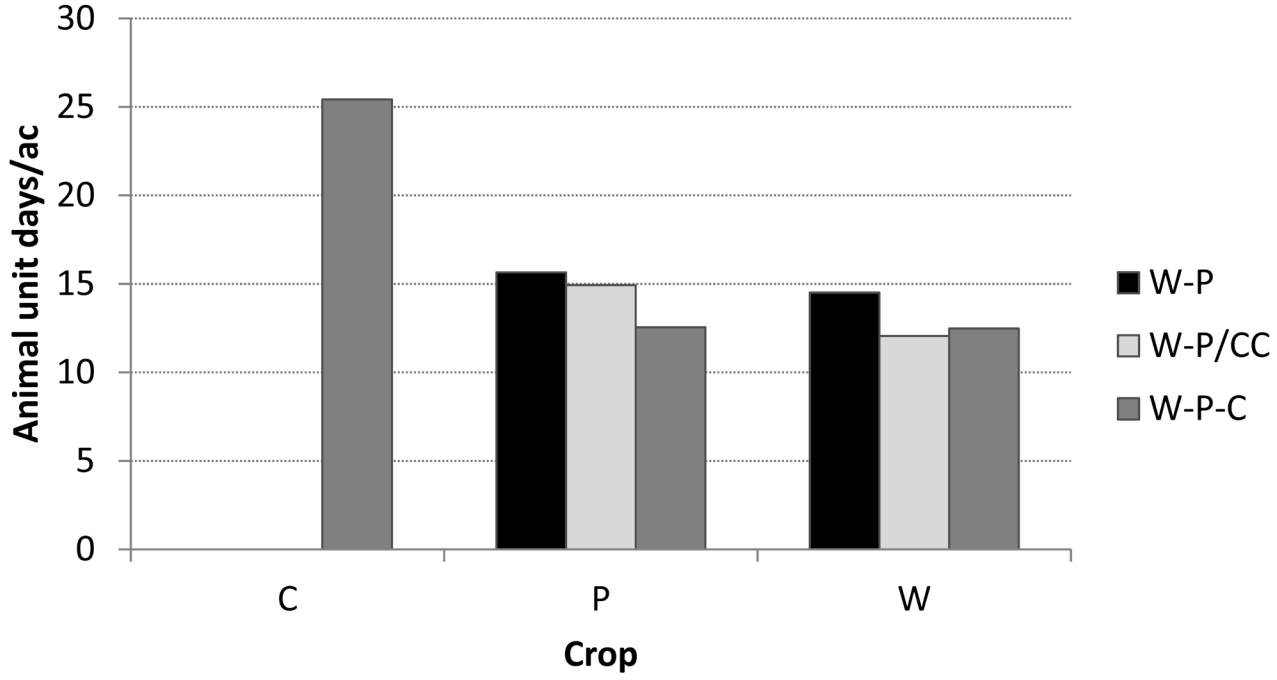

Fig. 4. 2017 grazing amount by crop and rotation

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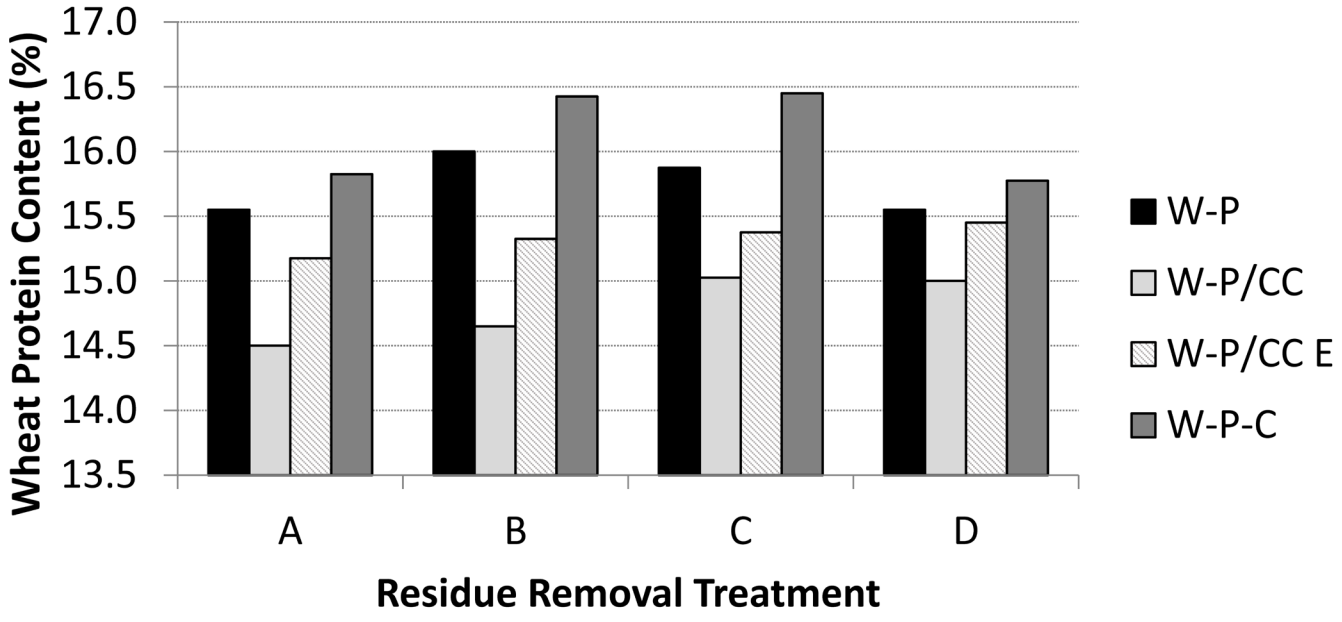

Fig.5. 2017 wheat protein content for each residue removal treatment, including an “Enhanced” N treatment, W-P/CC E, that received an additional 40 lbs N/ac compared to W-P/CC.