Soybean response following winter rye cover crop, Wishek, 2021.
(Greg Endres, Tim Indergaard and Mike Ostlie)

The fourth and final year of the study was conducted in 2021 at the NDSU Carrington Research Extension Center off-station crop research site near Wishek, with support from the ND Soybean Council, to examine the performance of soybean with winter rye grown as a preplant (PP) cover crop. Experimental design was a randomized complete block with four replications. The dryland trial was established on a reduced-till loam soil with spring soil test indicating 63 ppm P (Olsen), 360 ppm K, 4.6% organic matter, 6.3 buffer pH (0-6" depth), and 0.45 mmho/cm soluble salts (0-6" depth). 'ND Dylan' rye (98% germ; 16,670 seeds/lb) was direct seeded into wheat stubble in 7-inch rows at 1 million PLS/A on October 21, 2020. 'PFS19B04' seed was planted in 14-inch rows on May 13, 2021. Wishek NDAWN monthly rain (inches): May = 3.4; June = 1.5; July = 1.6; August = 6.8; September = 3.5; and season total=16.8 inches. Soybean seed was harvested with a plot combine on October 8.

Treatments for rye termination methods with glyphosate based on timing of soybean planting:

1. Conventional check (no rye). Pre-emergence (PRE) glyphosate (Roundup PowerMax at 28.4 fl oz/A) plus NIS+AMS (2.5% v/v; Class-Act NG) plus pyroxasulfone&saflufenacil&imazethapyr (Zidua Pro at 4.5 fl oz/A) on May 19 (6 days after planting) to jointing- to tillering-stage (4- to 6-inch tall) rye.
2. Preplant glyphosate plus NIS+AMS on May 4 (9 days before planting) to tillering (4-inch tall) rye.
3. PRE glyphosate plus NIS+AMS on May 19.

Post-emergence glyphosate (Envy 6 at 24 fl oz/A) plus AMS (3 lb/A) was applied on June 24 across all plots for general weed control with soybean at V3-4 growth stages. Herbicides were applied with a hand-boom sprayer delivering 14 gpa at 35 psi with TJ Turbo 02 nozzles.

Rye plant density across trial on May 13 was low, averaging 262,000 plants/A (6 plants/ft^2). Topsoil moisture at soybean planting and 3 weeks after was similar among treatments (Table). Foxtail and horseweed control (89 and 77%, respectively) 3 weeks after soybean planting was greater with the conventional check, due to the soil-applied herbicide, compared to treatments with rye cover crop. Soybean plant stand was similar among treatments, and the trial stand was about half of targeted density. Seed yield was 50 bu/A with the conventional check, and was substantially greater than yield with rye treatments. This was due primarily to early season weed control with the soil-applied herbicide. Also, glyphosate application for trial maintenance on June 24 was not timely for foxtail control for the rye treatments. Weeds used topsoil moisture that was not available for soybean, which delayed soybean plant development and yield.

Table. Soil moisture, weed control and soybean response with preplant winter rye cover crop, Wishek, 2021.

Trt no.	Topsoil moisture (%)[a]		Weed control[b] 4-Jun			Soybean Plant	Soybean Seed				
			Fota	Howe	Wibw	Stand (4-Jun; VE-VC stages)	Yield	Test weight	Count	Oil	Protein
	13-May	4-Jun	%			plt/A	bu/A	lb/bu	no./lb	%	
1	16.8	19.0	89	77	99	86,800	50.0	55.5	2,680	19.6	37.5
2	17.0	18.5	0	22	64	79,680	16.3	56.2	2,600	18.7	38.8
3	16.4	17.7	20	40	94	75,410	18.2	56.2	2,610	18.6	39.0
Mean	16.7	18.4	36	49	86	80,630	28.2	56.0	2630	19.0	38.4
CV (%)	10.1	13.4	39.3	53.2	30.9	27.7	12.9	0.7	2.6	1.5	1.6
LSD (0.10)	NS	NS	20	37	NS	NS	5.0	0.5	NS	0.4	0.8

[a]Extech digital soil moisture meter (model MO750) at 4-inch soil depth.

[b]Fota=green (primary species) and yellow foxtail; Howe=horseweed; Wibw=wild buckwheat.