

Winter rye cover crop seeding date and rate impact on soil, weeds and soybean, Carrington, 2021.

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The field study is being conducted at the NDSU Carrington Research Extension Center with support from ND Soybean Council to examine impact on soil, weeds, and soybean with winter rye seeded on two fall dates and at three rates grown as a preplant cover crop. Study objective is to identify the best combination of rye seeding dates and rates for reaching goals with the cover crop including soil and weed management while maintaining high potential for soybean seed yield. Experimental design was a randomized complete block (split-plot arrangement for rye: main plot=seeding date; subplot=seeding rate) and four replications. The dryland trial was established on Heimdal-Emrick loam soil with 4.0% organic matter, 7.7 pH, 11 ppm P (med; Olsen test), 199 ppm K, 2.16 mmho/cm soluble salts (0- to 6-inch depth), and 0.4% carbonate (CCE). 'ND Dylan' rye (98% germ. and 16,670 seeds/lb) was direct seeded into glyphosate-terminated green fallow (annual grass) on September 17 and October 8, 2020 at seeding rates of 25, 50, and 75 lb/A (PLS/A: 25 lb=410,130; 50 lb=820,260; 75 lb=1,230,390). Early seeded rye was at 4-leaf stage and late-seeded was 1 leaf rye at close of growing season (NDAWN). 'AG03X7' soybean was direct-planted into living rye in 30-inch rows on May 18, 2021. Tillering rye was terminated on May 20 with glyphosate (Roundup PowerMax at 28.4 fl oz/A) plus AMS+NIS. Glyphosate plus AMS+NIS was applied on June 14 and July 9 (R2 soybean growth stage) across the trial for general weed control. NDAWN monthly rain (inches) in 2021: May=1.4; June=1.8; July=0.1; August=2.6; September (1-23) =1.7; and 5-month total=7.6. Seed was harvested with a plot combine on September 23.

Averaged across rye seeding rates, early seeded rye averaged 85,850 plants/A with ground cover at 4% and late seeded at 270,830 plants/A and 17% ground cover when evaluated on May 18 (stand) and 24 (ground cover), 2021. The stand and ground cover advantage with the late planting is contrary to results from the two previous years of the study in which the advantage with the factors was with early planting. Averaged across fall seeding dates, rye plant density and ground cover among the three seeding rates: 25 lb/A = 64,740 plants/A and 7%; 50 lb/A = 170,040 plants/A and 11%; and 75 lb/A = 300,230 plants/A and 14%. The poor stands and very minimal ground cover were due to dry topsoil conditions from minimal rain during September (0.13 inch) and October (0.41 inch), 2020 (NDAWN).

Table 1 indicates rye plant density and ground cover, and weed control with the interaction of seeding dates and rates. Plant stand ranged from 29,880 plants/A to 448,210 plants/A (10 plants/ft²) with highest density obtained with late seeding at the high seeding rate. Ground cover was greater with late seeding versus early, and increased with increasing seeding rates. Primary weed in the trial was green foxtail. The mid-June weed control evaluation occurred 25 days after glyphosate was applied across the trial for terminating the rye cover crop and weeds, and 2 days following the first POST glyphosate application for general trial weed control. Green foxtail suppression was similar (54-67%) among rye treatments.

Table 1. Winter rye plant cover crop density, ground cover and weed suppression with winter rye cover crop seeding dates and rates, Carrington, 2021.

Rye seeding treatment		Rye		Weed control
Date	Rate	Plant density (18-May) plt/A	Ground cover	Green foxtail
	lb/A		Visual (24-May) %	16-Jun %
17-Sep	25	29,880	4	61
	50	75,410	3	54
	75	152,250	6	64
8-Oct	25	99,600	10	59
	50	264,660	19	67
	75	448,210	23	64
CV (%)		36.6	24.3	22.0
LSD (0.10)		82,180	3	NS

Table 2 indicates soybean performance with the interaction of rye seeding dates and rates. Soybean plant stand and development including first flower date (data not shown), and canopy closure generally were similar among rye treatments. Soybean seed yield, test weight, seed count, and protein and oil percentage were similar among treatments. Soybean yield averaged 40.6 bu/A under this production system.

Table 2. Soybean response with winter rye cover crop seeding dates and rates, Carrington, 2021.

Rye seeding treatment		Plant				Seed				
Date	Rate lb/A	Stand plt/A	Emergence Day of year	Canopy closure (17-Aug)	Physiological maturity (R8) Day of year	Yield bu/A	TW lb/bu	Count no./lb	Protein %	Oil
				Canopeo %						
17-Sep	25	128,160	154	82	254	38.6	57.2	3,276	33.8	20.1
	50	142,100	155	85	254	39.9	57.3	3,346	33.8	20.3
	75	136,790	155	88	255	40.7	57.0	3,237	34.0	20.2
8-Oct	25	139,450	155	89	255	41.3	57.1	3,117	33.9	20.1
	50	153,390	154	86	255	41.8	57.2	3,197	33.9	19.9
	75	130,150	155	87	255	41.0	57.4	3,102	34.1	19.9
CV (%)		9.2	0.3	3.5	0.4	9.1	0.4	3.7	1.1	1.3
LSD (0.10)		NS	1	4	NS	NS	NS	NS	NS	NS