

Winter rye cover crop seeding date and rate impact on soil, weeds and soybean, Carrington, 2019.

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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 at two fall dates and 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 management and weed control 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 with corn as the previous crop on a Heimdal-Emrick loam soil with 3.9% organic matter, 7.2 pH, 22 lb N/A, 8 ppm P, 211 ppm K, and 0.16 mmho/cm soluble salts. 'ND Dylan' rye was direct seeded in 7-inch rows on October 2 and 31, 2018 at seeding rates of 25, 50, and 75 lb/A. Early seeded rye reached about 1.5 leaf stage while late-seeded rye did not emerge at close of growing season. Soil moisture was measured using an Extech digital soil moisture meter (model MO750) at 4-inch soil depth. Tillering rye at 3- to 6-inch height was terminated May 23, 2019 with an application of glyphosate (Roundup PowerMax at 32 fl oz/A) plus NIS+AMS (Class Act NG at 2.5% v/v). PFS19B04' soybean was planted into rye residue in 21-inch rows on May 30. Glyphosate plus NIS+AMS was applied on June 26 across the trial for general weed control in soybean (V1 growth stage). NDAWN monthly rain (inches): May=1.46; June=3.00; July=3.64; August=3.08; September=8.26; and October=1.85; 6-month total=21.29. Seed was harvested with a plot combine on November 5.

Averaged across seeding rates, rye ground cover was 18% with early fall seeding compared to 7% with late seeding, when visually evaluated on May 21. Averaged across fall seeding dates, rye ground cover increased from 9% at 25 lb/A seeding rate to 13% at 50 lb/A and 16% at 75 lb/A. Soybean yield with rye seeding rates averaged across dates: 25 lb/A=48.4 bu/A; 50 lb=45.4 bu/A; and 75 lb/A=44.3 bu/A (LSD 0.10=3.1 bu/A).

Table 1 indicates rye ground cover and plant density, and soil moisture with the interaction of rye fall seeding dates and rates. Plant stand ranged from 39,800 plants/A (1 plant/ft²) to 614,700 plants/A (14 plants/ft²) with highest density obtained with early seeding at the high rate. Stand generally was reduced with late seeding date when comparing each seeding rate. Ground cover was similar among treatments either visually estimated or measured using the Canopeo app. Soil moisture generally was similar among treatments.

Rye seeding treatment		Rye			Soil moisture			
Date	Rate lb/A	Plant density (21-May) plt/A	Ground cover		20-May	31-May	10-Jun	8-Jul
			Visual (21-May)	Canopeo (20-May)				
2-Oct	25	133,800	14	4	16.5	16.7	18.6	18.8
	50	352,900	18	7	17.2	17.1	18.9	20.7
	75	614,700	23	7	15.8	17.3	17.7	19.3
31-Oct	25	39,800	5	2	16.1	18.5	18.8	18.3
	50	167,900	8	2	17.1	17.9	18.5	19.1
	75	233,400	10	3	17.7	17.8	20.5	21.4
CV (%)		37.0	17.6	57.0	7.8	7.2	6.1	11.2
LSD (0.10)		120,200	NS	NS	NS	NS	1.4	NS

Primary weeds in the trial were grasses: yellow and green foxtail, volunteer rye and barnyardgrass. The grass weeds were visually evaluated on June 21, with control ranging 65-74%. There was not a significant statistical difference on weed control with the interaction of rye fall seeding dates and rates.

Table 2 indicates soybean performance with the interaction of rye fall seeding dates and rates. Soybean plant stand and development generally was similar among rye treatments. Soybean seed yield under this production system ranged from 43.3 to 49.6 bu/A. Soybean yield and test weight were similar among treatments, though there was a trend of yield reduction with increasing rye seeding rates.

Rye seeding treatment		Plant						Seed	
Date	Rate lb/A	Stand plt/A	Emergence	Flower	Canopy closure		Physiological maturity	yield bu/A	TW lb/bu
			Day of year	Day of year	Visual (Jul-26) %	Canopeo (Jul-29) %	Day of year		
2-Oct	25	146,600	157	199	86	93	269	47.1	60.9
	50	139,900	157	200	86	92	269	47.3	60.9
	75	125,200	158	199	87	90	269	45.3	61.0
31-Oct	25	165,500	158	199	87	91	268	49.6	61.1
	50	144,200	158	199	87	90	268	43.5	61.0
	75	164,100	157	199	87	89	268	43.3	61.1
CV (%)		13.3	0.3	0.3	2.8	33.5	0.1	7.6	0.3
LSD (0.10)		NS	NS	1	NS	NS	NS	NS	NS

In summary, the first year of research in this multi-year study indicates minimal influence among rye fall seeding dates and rates on soil cover and moisture, and control of grass weeds. Also, performance of soybean generally was not affected by rye seeding date or rate. This likely was due to adequate soil moisture present throughout the soybean production period.