North Central Region Canola Research Grant
Progress Report
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Title

Effect of Tillage System and Nitrogen Source and Fertility on Canola Performance in Central North Dakota.

Investigators

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Objectives

To determine the effect of tillage system, N fertility, and soybean as an alternative crop prior to canola on canola establishment, yield and quality, disease incidence and severity, and weed management.

Progress

Methods: The trial was conducted at Carrington in 2007. The experimental design for the trial was a split-split-plot design with three replicates.

The proposed treatments would utilize Roundup Ready soybean as the previous crop. Therefore, we will utilize Liberty Link canola to be competitive across tillage systems and to reduce the potential for building herbicide resistance.

Farm equipment sized tillage systems, 60 feet wide by 300 feet long, have been established since 1987. The tillage systems are conventional, minimum, no till. The conventional tillage system is defined by multiple tillage (~3) operations resulting in less that thirty percent residue cover after seeding. The minimum tillage system generally has two tillage operations (non-inversion) resulting in greater than thirty percent residue cover after seeding. The no-till has zero tillage other than disc openers from the drill resulting in greater than eighty percent residue cover after seeding.

Four N fertility treatments will be imposed perpendicularly across the tillage systems. Fertility treatments are urea applied with the drill each spring to plots at 0, 50, and 100 actual pounds of N per acre. An addition N treatment is a composted manure application designed to make available 50 pounds of N per year for the duration of the four year rotation. This creates a split-split-plot design with crop as the whole plot (1.25 Acres) tillage system as the subplot (.42 Acre) and N fertility treatment as the sub-sub-plot (.10 Acre). The large size allows for adequate sampling area for data collection of the numerous parameters without confounding data.

Hybrid canola seed was planted on May 3 at 500,000 seeds / acre. The trial was harvested August 9.

Results: The 2007 growing started out with above average temperatures and below average precipitation until May 22. These two factors coupled with the dry fall of 2006 and lower than normal snowfall led to a very dry spring prior to May 22. May was above average for precipitation however June was much below normal. July and August were above average and September was below average. The monthly average temperatures for April, Many, June, and

July were much above normal. August was below normal and September was well above normal. Consequently canola stands we reduced due to dry conditions at planting and flowering and the yields suffered consequently (Table 1,2,3). Canola yields ranged from 619 to 1,366 lbs / acre (Table 3). Total above ground biomass ranged for 3,649 to 5,928 lbs / acre (Table 3).

Tillage system across did not significantly affect any of the parameters measured across all N fertility treatments (Table 1).

As N fertility across all tillage systems increased so did plant stand, plant height, and yield (Table 2). However, as higher N fertility treatments across all tillage systems began flowering sooner and had lower seed oil content than the lower N fertility treatments (Table 2). Manure is a viable alternative source of crop nutrients that does not have a negative impact on yield verses commercial fertilizer (Table 2,3).

The interaction of tillage and N fertility shows an increased response to N fertilizer in the reduced tillage systems and that manure had a greater response in the conventional tillage system (Table 3).

This data also shows that canola can be produced on ground that was soybean the previous year (Table 1,2,3).

Impact

This research project has helped identify an alternative fertilizer source along with tillage systems and a crop prior to canola that can be used to reduce the input costs of producing canola and thereby increasing potential acreage in North Dakota.

Conclusions

By utilizing manure as a fertilizer source we are able to show that canola can achieve the same yields as applying N as synthetic fertilizer thereby proving that manure is an economically viable way to decrease input costs. Also, there is no statistical difference in canola yield across tillage systems so reducing tillage is also an economically viable way to decrease input costs. In addition, with soybean as a previous crop we can take advantage of the legume N credit further reducing input costs and potentially increasing canola acreage. A word of caution however, always be mindful of herbicides used in the soybean crop that can have detrimental carryover effect in the canola crop.

Table 1.The Affect of Tillage System Across N fertility Treatments

	Biomass Weight lbs/acre	1000 KWT gm	Oil %	Grain Yield lbs/acre	Straw Weight lbs/acre	Stand plants/acre	Plant Height cm	Beginning Bloom J. day
M	4,757	3.0	43.1	1,006	3,268	435,074	88	175
N	4,181	3.0	43.7	829	2,900	434,493	89	175
T	4,079	3.0	43.1	988	2,699	438,559	96	175
Average	4,339	3.0	43.3	941	2,956	436,042	90.9	174.9
C.V.	36	6.4	3.1	42	44	2	11.8	0.5
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. The Affect of N Fertility Treatments Across Tillage Systems

	Biomass Weight lbs/acre	1000 KWT gm	Oil %	Grain Yield lbs/acre	Straw Weight lbs/acre	Stand plants/acre	Plant Height cm	Beginning Bloom J. day
0	3,974	2.9	44.1	854	2,733	432,686	81	176
50	4,030	2.9	43.3	727	2,847	431,653	89	176
100	5,072	3.1	42.0	1,082	3,453	440,689	93	175
M	4,280	14.9	43.9	1,101	2,789	439,140	100	174
Average	4,339	5.9	43.3	941	2,956	436,042	90.9	174.9
C.V.	36	6.4	3.1	42	44	2	11.8	0.5
LSD 0.05	NS	NS	1.3	258	NS	7,769	10.5	0.8

Table 3. The Affect of Tillage Systems and N Fertility Treatments Across Replications

		Biomass Weight lbs/acre	1000 KWT gm	Oil %	Grain Yield lbs/acre	Straw Weight lbs/acre	Stand plants/acre	Plant Height cm
M	0	4,437	3.0	44.2	996	3,081	429,071	83
M	50	4,401	2.9	43.7	757	3,117	430,620	79
M	100	5,928	3.1	41.8	1,366	3,969	440,689	93
M	M	4,261	2.9	42.8	905	2,904	439,914	98
N	0	3,837	2.9	45.0	619	2,745	434,493	79
N	50	3,716	2.8	42.7	731	2,617	426,748	89
N	100	4,691	3.0	42.0	922	3,246	444,561	92
N	M	4,482	3.1	45.1	1,043	2,993	432,169	94
T	0	3,649	2.9	43.1	946	2,373	434,493	82
T	50	3,972	2.9	43.6	695	2,806	437,591	98
T	100	4,597	3.1	42.2	958	3,145	436,816	94
T	M	4,098	3.0	43.7	1,354	2,470	445,336	109
Average		4,339	3.0	43.3	941	2,956	436,042	90.9
C.V.		36	6.4	3.1	42	44	2	11.8
LSD 0.05		2,260	NS	2.3	446	NS	13,456	18