Effects of Seeding Rate on Lentil Production in North Dakota

Eric Eriksmoen, Neil Riveland, Mark Halvorson and Robert Henson

Summary
Applying correct seeding rates is the backbone of all commercial production. Limited studies in North Dakota have suggested the use of higher seeding rates vs. low rates. This study evaluated the effects of plant density on agronomic, yield and seed quality characteristics of lentil. Five seeding rates at four locations were studied. Yields increased with increasing seeding rates at three of four locations without compromising other agronomic and seed quality characteristics.

Introduction
All major lentil growing regions of the world have recommended seeding rates for this crop. These recommendations vary from 10 seeds per square foot in Alberta, Canada to 20 seeds per square foot in the state of Washington. Recommended seeding rates in North Dakota are 12 to 14 seeds per square foot. The basis for this recommendation is unknown as there have not been any comprehensive seeding rate studies conducted in North Dakota, however, it is assumed that this recommendation was assimilated with the introduction of this crop to North Dakota from other growing regions. It is also assumed that this recommendation fits all growing regions of the state. A study conducted in 2003 and 2004 at the NDSU Hettinger Research Extension Center looked at relatively low seeding rates of lentil (4 – 12 seeds/ft^2). Results showed significant incremental yield increases with each seeding rate increase. The optimum seed yield per seeding rate was not achieved in this study. Canadian reports on higher seeding rates have suggested an increase in plant diseases, an increase in lodging, poor pod set and no increase in seed yield. Reports from Australia have suggested an increase in weed competition, increased harvestability, reduced aphid infestations, lower soil water evaporation and higher seed yields.

Materials and Methods
The trial was conducted at the NDSU Hettinger, Williston, Minot and Carrington Research Extension Centers during the 2005 growing season. CDC Richlea was seeded into small plots at seeding rates of 8, 12, 16, 20 and 24 pure live seeds per square foot. The experiment was arranged in a randomized complete block design with four replications. Data was collected on weather and soil conditions, established plant stand, days to flower, plant height, 1000 seed weight, test weight and seed yield, and was analyzed for statistical comparisons at each location.

Results and Discussion
Hettinger Growing conditions were generally ideal for lentil production with mild spring temperatures, adequate soil moisture and growing season rainfall, and hot and dry weather conditions preceding harvest. The trial was seeded into no-till barley stubble on April 7 and was harvested on August 5. An application of sulfentrazone (Spartan) was applied pre-emergence to control broadleaf weeds and an application of quizalofop (AssureII) was applied post-emergence to control grassy weeds. Diseases and insect pests were not observed. Results are shown in table 1. Days to bloom and the duration of bloom were not affected by seeding rate, however, days to mature tended to increase as seeding rates decreased. Plant height was not affected by seeding rate but lodging tended to become worse as seeding rates increased. As would be expected, there was a direct relationship between plant stand and broadleaf weed competition. As plant stands increased, broadleaf weeds decreased. 1000 seed weight and test weights were not affected by seeding rates but seed yields increased incrementally as seeding rates increased. It appears that optimum yields were achieved with a seeding rate of around 20 seeds per square foot.

Williston Growing conditions were generally ideal with mild temperatures and good rainfall. The trial was seeded on April 25 into soil that was summer fallow the previous year and was harvested on August 6. A Fall application of trifluralin (Treflan) provided good weed control. Diseases and insect pests were not observed. Results are shown in table 2. Statistically, there were no significant differences between seeding rates for days to bloom, plant height, test weight, seed weight or seed yield, however, there was a tendency for seed yields to increase with increasing seeding rates. It appears that optimum yields were achieved with a seeding rate around 16 seeds per square foot.

Minot Growing conditions were generally good with mild springtime temperatures and an abundance of rainfall. The trial was seeded on May 3 and was harvested on September 12. An application of pendimethalin (Prowl) was applied pre-plant to control grassy weeds. Diseases and insect pests were not observed. Results are shown in table 3. Days to bloom, plant height, seed weight and test weights were not affected by seeding rate, however, seed yields increased incrementally as seeding rates increased. It appears that optimum yields were achieved with a seeding rate of 16 to 20 seeds per square foot.

Carrington Growing conditions were generally good with mild temperatures and an abundance of rainfall. The trial was seeded on May 19, swathed on August 15 and was combined on August 23. A pre-plant incorporated application of ethalfuralin (Sonalan) provided good weed control. Diseases and insect pests were not observed. Stand establishment was relatively poor resulting in statistically non-significant differences between seeding rates. As a result, data from this site is not reported.

Conclusions

Seeding rates of 16 to 20 pure live seeds per square foot provided optimum seed yields without compromising other agronomic and seed quality characteristics. Heavier plant stands contributed to better weed competition and did not have an affect on disease or insect pests. These characteristics were relatively consistent across locations. A higher degree of lodging was observed with higher seeding rates at one location.

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Table 1. 2005 Lentil Seeding Rate Trial at Hettinger.

Seeding Rate	Plant Stand	Days to Bloom	Duration of Bloom	Days to Mature	Plant Height	Bdlf Weeds	Lodg.	1000 Seed wt.	Test Weight	Seed Yield
#/ft^2	#/ft^2		days		inches	*	**	grams	lbs/bu	lbs/A
8	4	74	17	107	10	3.0	1.8	43.6	57.4	1979
12	11	74	17	106	9	1.2	2.5	44.6	57.7	2352
16	11	74	17	105	8	1.2	3.0	43.2	57.4	2464
20	19	74	17	105	9	1.0	3.0	44.3	57.4	2623
24	18	74	17	105	9	1.0	3.2	42.6	57.4	2660
C.V. %	27.7	0.0	0.0	0.9	20.0	18.3	17.6	3.6	1.6	7.3
LSD .05	5	NS	NS	1	NS	0.4	0.7	NS	NS	270

* Broadleaf Weeds (mainly Russian Thistle): 1 = few, 3 = many.

** Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: April 7; Harvest Date: August 5; Previous Crop: Barley

NS = no statistical difference between seeding rates.

Table 2. 2005 Lentil Seeding Rate Trial at Williston.

Seeding Rate	Plant Stand	Days to Bloom	Plant Height	1000 Seed wt.	Test Weight	Seed Yield
#/ft^2	#/ft^2		inches	grams	lbs/bu	lbs/A
8	7.5	62	14	54.2	61.1	1890
12	11.5	62	15	53.7	60.9	1871
16	16.7	62	14	54.8	61.0	2019
20	17.2	62	14	53.1	61.1	2020
24	21.5	62	14	53.1	61.0	2138
C.V. %	15.3	0.0	8.9	2.1	0.4	11.2
LSD .05	3.5	NS	NS	NS	NS	NS

Planting Date: April 25; Harvest Date: August 6
NS = no statistical difference between seeding rates.

Table 3. 2005 Lentil Seeding Rate Trial at Minot.

Seeding Rate	Plant Stand	Days to Bloom	Plant Height	1000 Seed wt.	Test Weight	Seed Yield
#/ft^2	#/ft^2		inches	grams	lbs/bu	lbs/A
8	5.7	53	13	52.8	60.7	2104
12	6.7	52	13	53.0	60.6	2381
16	7.8	52	13	52.3	60.6	2835
20	10.8	52	13	52.8	60.8	2679
24	16.3	52	12	52.8	60.9	3058
C.V. %	24.3	0.7	6.1	2.2	0.4	10.1
LSD .05	3.5	NS	NS	NS	NS	404

Planting Date: May 3; Harvest Date: September 12
NS = no statistical difference between seeding rates.