Soybean Planting Strategies for Central and Western North Dakota

R. Henson, G. Endres, E. Eriksmoen, and M. Halvorson
North Dakota State University

Abstract

A soybean field trial was conducted during 2002 and 2003 at the North Dakota State University Research Extension Centers in Carrington, Minot and Hettinger to evaluate the impact of planting strategies on soybean performance. Two cultivars (Walsh, maturity group 0.0, and Barnes, maturity group 0.3) in combination with two planting dates, two row spacings (15.2/17.8 and 30.5/35.6 cm), and two planting rates (432,250 and 555,750 pure live seeds ha^{-1}) were evaluated at each location. Compared to planting during the last 10 days of May, early planting (10 or 15 May) did not improve soybean seed yield, but late planting (6 June) reduced yield by 14 percent. However, at Carrington in 2002, Barnes seed yield was 2762 kg ha^{-1} with 10 May planting compared to 2224 kg ha^{-1} with 20 May, while planting date did not impact Walsh yield. Solid-seeding improved yield compared to narrow rows by an average of more than 300 kg ha^{-1} in two of three site-years. In one instance (Minot 2002), the high seeding rate improved yield by 262 kg ha^{-1}. Extreme drought at Hettinger resulted in very low yield (538 to 605 kg ha^{-1}) and inconclusive results.

Introduction

North Dakota soybean production area has grown from 200,000 ha in 1990 to more than 1.2 million ha in 2003, with much of the new production occurring in the central and western regions of the state. Hectare increase is due to economics, pest problems in traditional crops, and soil fertility and rotational benefits of growing soybean. Current recommendations for planting soybean are based on old data in the more humid, eastern part of the state.

Objective

Phase I of this project (1999-2001) investigated North Dakota State University (NDSU) planting recommendations for soybean in these new production regions. Phase II began in 2002 to examine additional planting options and to potentially refine recommendations.

Materials and Methods

The trial was conducted by NDSU Research Extension Centers at Carrington during 2002 and 2003, and at Minot and Hettinger during 2002. Plots of 1.5 to 3.0 by 6.7 to 7.6 m were planted in a randomized complete block experimental design with a split-plot arrangement and four replicates. In Carrington, early planting (10 May 2002 and 15 May 2003) was compared to a normal date (20 May 2002 and 30 May 2003). In Minot, a normal (20 May) planting date was compared to delayed planting (6 June). Subplots at all three sites consisted of cultivars Walsh (maturity group 0.0) and Barnes (maturity group 0.3) planted in all combinations of two row spacings (15.2 or 17.8 and 30.5 or 35.6 cm) and two seeding rates (432,250 and 555,750 pure live seeds ha^{-1}).

Results and Discussion

Planting Date: At Carrington, delayed May planting reduced days to plant emergence, canopy closure and physiological maturity and improved plant stands, but seed yield and quality across the other treatments were similar (Table 1). However, early planting only advanced the calendar date of physiological maturity by one day in 2002 and two days in 2003. Thus, the increased risk of frost with very early planting may not be compensated by earlier harvest or higher yield. In 2002, yield of Barnes increased 19.5% with the early planting, but yield of Walsh was not significantly affected (Fig. 1). At Minot, delaying planting from 20 May until 6 June reduced yield by 14%, in part because the longer-season cultivar did not reach full maturity before the first killing frost. This reduction was especially pronounced in the higher-yielding environment with 15.2-cm rows (Table 2).

Table 1. Influence of planting date on soybean development, Carrington, 2002-03.

Planting date	Emergence	Stand	Canopy closure	Physiological maturity	Seed yield
	(DAP[1])	(plants ha^{-1})	(DAP)	(DAP)	(kg ha^{-1})
2002					
10-May	19	284,050	69	121	2493
20-May	14	328,510	59	112	2580
t-test	**	*	**	**	NS
2003					
15-May	22	318,630	70	121	2029
30-May	13	461,890	52	108	2056
t-test	**	**	**	**	NS

[1] Days after planting.

Figure 1. Yield impact of soybean planting date by variety interaction, Carrington, 2002.

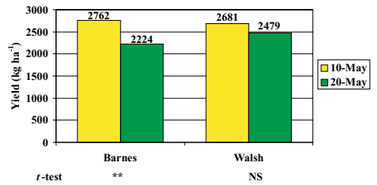


Table 2. Effect of soybean planting date and row spacing on yield, Minot, 2002.

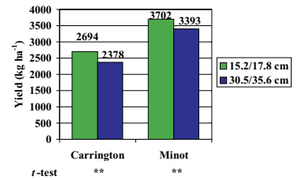
Planting date	Row spacing	
	15.2 cm	30.5 cm
	---------- (kg ha^{-1}) ----------	
20 May	4112	3534
6 June	3299	3259
LSD (0.01)	191	

Example of differences among planting dates, soybean varieties, row spacing and planting rate in trial.

Cultivar: At Carrington, the longer-season cultivar, Barnes, out-yielded Walsh an average of 279 kg ha^{-1}, indicating the benefit of planting a full-season variety in an environment that consistently allows the crop to reach physiological maturity. However, at Minot the yield of Walsh was 168 kg ha^{-1} greater than Barnes, due to a killing frost before Barnes completed maturity.

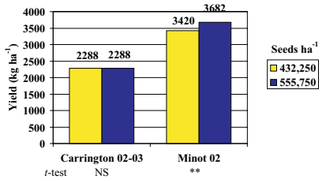
Row Spacing: Solid-seeding (15.2- or 17.8-cm rows) improved yield over narrow rows (30.5 or 35.6 cm) by an average of more than 30 kg ha^{-1} at Carrington and Minot in 2002 (Fig. 2). Yield was not impacted by row spacing at Carrington in 2003. Generally, plant and pod height, and lodging were similar between row spacings (data not shown). At Carrington in 2002, canopy closure was delayed by three days with wider rows.

Figure 2. Row spacing effect on soybean yield, 2002.



Planting Rate: Averaged across years at Carrington, the high planting rate produced a stand of 374,200 plants ha^{-1}, which is similar to the plant population currently recommended by NDSU. However, yield did not increase compared to the lower planting rate. In Minot during a year with high yield potential, the high planting rate increased yield by 262 kg ha^{-1} (Fig. 3). Planting at 555,750 kg ha^{-1} provides an opportunity for higher yield when environmental conditions are favorable. Under modest yield conditions, yield was not reduced with the high planting rate but higher seed costs exist. Generally, days to plant emergence and physiological maturity, plant and pod height and plant lodging were similar between planting rates (data not shown). At Carrington, canopy closure was two days earlier with the higher planting rate.

Figure 3. Planting rate effect on soybean yield.



Acknowledgments

The authors wish to thank the State Board of Agricultural Research and Education, the North Dakota Soybean Council, and the North Dakota State University Agricultural Experiment Station for financial support, B. Schatz for scientific collaboration, M. Friedt for poster design and compilation, and E. Aberle, J. Forde, R. Gjellstad, P. Hendrickson, T. Indergaard, T. Ingebretson, M. Miller, R. Olson, J. Rau, L. Scheen, and C. Wolf for capable technical assistance.