Effect of Planting Date and Population of Two Soybean Varieties under Dryland and Irrigation

Jasper M. Teboh, Szilvia Yuja, and Kelly Bjerke

Research Objectives

To improve farmers and stakeholder understanding of:

(1) Effects of planting dates on soybean performance under dryland and irrigated conditions
(2) Impact of three practicable seeding rates on yields
(3) Interaction of variety and planting date on soybean seed performance

Methods

This trial was conducted at the Carrington REC to assess the effects that early, normal or late planting, and plant population (seeding rates) would have on two soybean varieties – an early and a late relative maturity group (MG). Both varieties were Roundup Ready from the same company. The early MG (0.2) and late MG (0.8) soybeans were planted at rates to attain three target populations: 150,000 (150K), 175,000 (175K), and 200,000 (200K) plants/acre. The three planting dates were approximately two weeks apart, from early planting on May 11, normal planting date on May 24, and late planting on June 9. The trial was conducted on separate fields, one on dryland, and the other under irrigation. Previous crop was corn on both fields. Soybeans were planted at 14-inch row spacing.

Results

Under both dryland and irrigated conditions, plant population had no interaction with planting date or MG. Result means are therefore presented only for interactions between planting dates and MGs, and for each main effect (dates, population, MGs), where significant interaction effects were observed between MG and planting date for yields, test weight (TWT), protein, and oil on dryland (Table 1), and for oil under irrigation (Table 2).

Table 1. Dryland. Effect of planting data, maturity group, and seeding rates on soybean yield and seed quality

Sources of Variation	Yield	TWT	Protein	Oil	KWT (250 seeds)
	bu/ac	lb/bu	-------%-------		g
Planting date (PD)					
Early (May-11)	52.2	57.6	36.3	18.5	38.2a
Normal (May-24)	48.5	57.6	35.7	18.2	35.6b
Late (June-9)	45.0	57.6	35.9	17.2	31.9c
Maturity Group (MG)					
0.2	47.4	57.5	36.1	18.2	35.7a
0.8	49.7	57.7	35.9	17.8	34.8b
Population					
150000	46.6b	57.6	35.9	18.0	35.3
175000	49.9a	57.5	35.9	18.0	35.2
200000	49.2ab	57.6	36.1	18.0	35.2
MG x PD					
Early-0.2	48.3b	57.3b	36.3ab	19.2a	38.9
Early-0.8	56.2a	58.0a	35.6c	17.9b	37.5
Normal-0.2	49.1b	57.6ab	35.7bc	18.3b	35.9
Normal-0.8	47.9b	57.7ab	35.8abc	18.2b	35.3
Late-0.2	45.0b	57.6ab	36.3a	17.2c	32.3
Late-0.8	45.0b	57.5ab	36.3ab	17.2c	31.5
Analysis of variance	----------*Pr>F*----------				
Date	0.0053	0.841	0.0265	<.0001	<.0001
MG	0.0439	0.032	0.0413	<.0001	0.0092
Date x MG	0.0024	0.007	0.0164	<.0001	0.5626
Pop	0.0446	0.779	0.1315	0.944	0.9907
Date x Pop	0.1432	0.368	0.9565	0.726	0.7738
MG x Pop	0.406	0.423	0.1157	0.154	0.5911
Date x M x Pop	0.9066	0.562	0.157	0.155	0.9008

Highlighted values indicate significant effect

Means with identical letters within each column are not statistically different

Table 2. Irrigated. Effect of planting data, maturity group, and seeding rates on soybean yield and seed quality

Sources of Variation	Yield	TWT	Protein	Oil	KWT (250 seeds)
	bu/ac	lb/bu	-------%-------		g
Planting date (PD)					
Early (May-11)	59.2a	57.9a	37.1	17.4	36.8a
Normal (May-24)	57.7a	57.4b	37.2	17.0	35.6ab
Late (June-9)	50.0b	58.1a	36.9	16.5	34.4c
Maturity Group (MG)					
0.2	55.6	57.7b	37.0	17.1	35.7
0.8	55.6	57.9a	37.1	16.8	35.6
Population					
150000	53.0b	57.9	36.9	17.0	35.5
175000	55.9ab	57.8	37.1	16.9	35.6
200000	58.0a	57.8	37.1	16.9	35.8
MG x PD					
Early-0.2	58.4	57.7	36.9	17.8a	36.9
Early-0.8	60.0	58.2	37.3	17.0b	36.7
Normal-0.2	58.2	57.4	37.2	17.0b	35.8
Normal-0.8	57.2	57.4	37.2	17.0b	35.5
Late-0.2	50.2	58.0	36.9	16.5bc	34.4
Late-0.8	49.8	58.2	36.8	16.4c	34.4
Analysis of variance	----------*Pr>F*----------				
Date	0.0023	<.0001	0.1660	<.0001	0.0261
MG	0.9952	0.0339	0.3216	0.001	0.7374
Date x MG	0.6662	0.1317	0.0677	0.003	0.9474
Pop	0.0047	0.8261	0.2290	0.6450	0.7949
Date x Pop	0.9402	0.5229	0.4543	0.9833	0.7492
MG x Pop	0.7652	0.2072	0.8382	0.5691	0.5897
Date x M x Pop	0.1457	0.2251	0.1699	0.4560	0.6394

Highlighted values indicate significant effect

Means with identical letters within each column are not statistically different

Dryland soybeans

Significant yield interactions between planting date and maturity group indicated that, despite decreasing yield trends from early to late planting, significant differences in yields were only between MG 0.8 planted early compared to normal and late planting. Yields from early planting of MG 0.8 were also significantly different from yields of MG 0.2 across planting dates. There was a yield advantage of about 8 bushels when MG 0.8 was planted early compared to the normal planting date, and 10 bushels more compared to late planting under dryland. Results from 2015 and 2016 at Carrington showed that MG 0.8 or 0.6 produced greater yields, than MG 0.2. Yield differences in plant population were

significant. Mean yield at 175K (50 bushels) was significantly greater than yield at 150K (47 bushels). Yield at 200K (49 bushels) was not different from either plant population. This may have been due to plant competition for moisture given that between mid-May to late July there were some prolonged periods of moisture stress from shortage of rainfall.

It was evident that greater protein accumulation happened with delayed planting of MG 0.8 soybeans. This was not evident with MG 0.2. Protein content of MG 0.2 was significantly greater than MG 0.8 for early planting date, but not later. This may be a result of protein dilution by the relatively higher yield of MG 0.8 compared to MG 0.2 for early planting. Meanwhile, seed oil was greatest for MG 0.2 especially with early planting. Oil produced by MG 0.8 was not different between early and normal planting, but decreased significantly at late planting.

Seeding date and maturity group each had significant effects on seed weight. Seed weight decreased significantly, and linear from early to late planting. Seed weight of MG 0.2 soybean was significantly greater than for MG 0.8.

Irrigated soybeans

Yields were significantly greater for early (59 bu/ac) and normal (58 bu/ac) planting dates compared to those of the late (50 bu/ac) planting dates. Similar to dryland, higher seeding rates enhanced yields from 53 bushels at 150K to 56 bushels at 175K and 58 bushels at 200K. Yields were significantly different only between 150K and 200K. Under irrigation, where moisture was adequate, yields at 200K were likely unaffected by moisture stress, which probably explained higher yields (56 bu/ac) under irrigation compared to dryland (49 bu/ac).

Conclusion

Our results support previous studies showing that planting soybeans at the Carrington area early, or before mid-May, will likely produce better yields than planting later. Delaying beyond May increases the risk of yield loss, except in years where moisture is adequate year-round and growing season is long. Under conditions where drought can be an impediment to crop yields, early planting in May enabled soybeans to use early spring soil moisture for growth. Meanwhile the longer growing season due to late rainfall in August, allowed the earlier planted crop to grow and accumulate dry matter for a longer period. Planting at 175,000 seeds/ac presented the best seeding rate for yield production. Maturity Group 0.8 produced higher yields than 0.2 at this site. Further studies need to examine other varieties since we could not determine whether differences are due to other inherent traits associate with yield potential, or mainly due to relative maturity.