**Technical Report**

**Seeding Date and Cultivar Influence on Soybean Performance in Northeastern North Dakota - 2019**

*Principle Investigator: Bryan Hanson – NDSU Langdon Research Extension Center*

**Objectives:**

**1.** Improve soybean performance for North Dakota producers in the northern counties of northeast North Dakota by determining the relationship between cultivar maturity and seeding date on soybean yield and agronomic traits.

**2.** To provide RMA (Risk Management Agency) and crop insurance agents data on the effects of replanting past the final planting date (June 10) on yield and quality of soybeans in the northern most counties of northeast North Dakota.

**Methodology**

The experimental field design was a randomized complete block in a split-plot arrangement with four replications. Soil type was a Svea-Barnes loam. Soil tests indicated 16 lbs N/a, 8 ppm P, 248 ppm K, pH 7.1, OM% 4.0 and EC 0.41 and 0.50 mmho/cm soluble salts (0-6” and 6-24”). An additional 31 lbs N/a, 39 lbs P/a and 20 lbs S/a were applied. Three Roundup Ready cultivars with maturity groups (MG) of 00.5, 00.9 and 0.1 were seeded on May 14, May 23, June 3, June 13, and June 24. The target established population was 180,000 plants/a. Plot size was 3.5’ x 22’ with seven six-inch rows. Harvest dates for the May 14 and 23 seeding dates were October 9, while the June 3, 13 and 24 seeding dates was harvested on October 30.

**Results**

Rainfall totaled 17.97 inches during April to September, 3.62 inches above normal, with 10.5 inches of that total received in August and September. Temperatures were 3.3 degrees F. below normal in May, near normal in June and July, 1.4 degrees F. below normal in August and 1.2 degrees F. above normal in September for an average of 0.6 degrees F. below normal for the season. Frost of 32 degrees F. occurred on September 28 and October 3 with the first killing freeze of 28 degrees F. on October 10.

October weather was one for the record books. Precipitation was 3.67 inches, 1.26 above normal, tied for the 4th wettest on record. The average monthly temperature was 35.0 degrees F., -6.6 degrees F. below normal and the 8th coldest on record. In addition, a snowstorm with blizzard winds, dropped 19.5 inches of snow from October 10-12. This was the 2nd greatest snowfall on record for the month. The snowstorm covered the entire unharvested last three planting dates (Fig.1). The melting snow dragged the soybeans to ground level that made an efficient harvest unattainable. The June 13 and 24 seeding date had not matured prior to the first killing freeze and no useable harvest data was obtained from those dates. The June 3 seeding date yield was not reliable because of the snow effects, but we were able to obtain some agronomic information from the harvested sample. Only plant stand, plant height and pod height of 1st pod data are reported for all seeding dates.

The analysis of variance (p>F) is reported in Table 1. Statistically significant seeding date by cultivar interactions occurred for the agronomic traits days to mature, test weight and yield. Only means averaged over cultivars and seeding dates are examined (Table 2). Plant stands for the May 23 seeding date were 52% of the average of the other seeding dates, which resulted from soil crusting caused by rains shortly after planting. Yields for the May 23 seeding date were lower compared to the May 14 seeding date. The date x cultivar interaction occurred as a result of the MG 00.9 and 0.1 cultivar yielding 3.3 and 5.3 bu/a less, respectively on May 23 compared to the May 14 seeding date, while the MG 00.5 cultivar was 12.9 bu/a less at the May 23 seeding date (Data not shown). Reduced stands were likely the cause of reduced yields rather than later seeding date. Plant and pod height were greater for the later maturity cultivars. The number of days to mature decreased with later seeding dates while days to mature increased with later MG. An inverse relationship between grain protein and percent oil was observed with grain protein increasing with delayed seeding dates and percent oil decreasing. The MG 0.1 had the greatest 1000 KWT but also had the lowest test weight. Test weights decreased with later seeding dates.

**Table 1. Soybean seeding date and cultivar analysis of variance (p>F)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Effects | Plant  Stand | Plant  Height | Pod  Height | Day to  Mature(R7) | Grain  Protein | Oil | 1000  KWT | Test  Wt. | Yield |
| Date (D) | <.0001 | 0.3632 | 0.1797 | <.0001 | 0.0005 | <.0001 | 0.0898 | 0.0038 | 0.0336 |
| Cultivar (C) | 0.1433 | 0.0032 | 0.0270 | <.0001 | <.0001 | <.0001 | <.0001 | 0.0001 | 0.0035 |
| D x C | 0.1172 | 0.5906 | 0.4419 | 0.0142 | 0.4003 | 0.8889 | 0.4334 | 0.0001 | 0.0093 |
| CV% | 17.7 | 8.6 | 18.2 | 0.8 | 1.4 | 2.1 | 2.4 | 1.2 | 6.5 |

**Table 2. Seeding date effects on various agronomic traits averaged over cultivar maturity group.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Seeding | Plant | Plant | Pod | Days to | Grain |  | 1000 | Test |  |
| Date | Stand | Height | Height | Mature3 | Protein | Oil | KWT | Weight | Yield |
|  | plts/ft2 | inches | inches | DAP1 | % | % | g | lbs/bu | bu/a |
| May 14 | 4.2 | 24.3 | 2.3 | 119 | 32.1 | 15.0 | 181 | 54.8 | 43.0 |
| May 23 | 2.4 | 23.3 | 2.5 | 118 | 33.2 | 14.3 | 180 | 53.8 | 37.6 |
| June 3 | 5.0 | 24.4 | 2.9 | 108 | 33.6 | 13.8 | 176 | 52.8 | - |
| June 13 | 4.7 | 25.4 | 3.0 | - | - | - | - | - | - |
| June 24 | 5.0 | 23.8 | 2.9 | - | - | - | - | - | - |
| Mean | 4.2 | 24.2 | 2.7 | 114 | 33.0 | 14.4 | 179 | 53.8 | 41.2 |
| LSD 5% | 0.8 | NS | NS | 1.0 | 0.4 | 0.3 | 4.4 | 0.8 | 6.1 |

**Cultivar maturity group effect on various agronomic traits averaged over seeding dates.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cultivar | Plant | Plant | Pod | Days to | Grain |  | 1000 | Test |  |
| Maturity | Stand | Height | Height | Mature3 | Protein | Oil | KWT | Weight | Yield |
| Group | plts/ft2 | inches | inches | DAP1 | % | % | g | lbs/bu | bu/a |
| 00.5 | 4.0 | 22.9 | 2.5 | 113 | 32.5 | 14.7 | 173 | 54.3 | 37.9 |
| 00.9 | 4.5 | 24.7 | 2.7 | 114 | 32.5 | 14.5 | 173 | 54.3 | 42.8 |
| 0.1 | 4.2 | 25.2 | 2.9 | 118 | 33.8 | 13.8 | 191 | 52.8 | 43.0 |
| LSD 5% | NS | 1.3 | 0.3 | 0.8 | 0.4 | 0.3 | 3.6 | 0.5 | 2.9 |

*1Days after planting. 2Cultivars seeded on June 24 did not mature prior to the first killing freeze.*

*3Growth stage R7 – one brown pod on the main stem obtains mature brown or tan color.*

**Benefits to the North Dakota soybean industry.**

Northeast North Dakota has seen a dramatic increase in soybean acreage in recent years. Choosing the right combination of seeding date and cultivar maturity group is an important decision producers make in obtaining optimum soybean production. Prior research on the relationship between seeding dates and cultivar maturity has been located in east central and southeast North Dakota. Developing a database for the cooler and shorter growing seasons of northeast North Dakota is critical. First year results from 2018 suggest that when seeding between a mid-May to June 4 seeding date, a 00.9 or 0.1 cultivar MG resulted in higher yields and greater net return $/a, but at the June 14 seeding date an early MG 00.5 cultivar resulted in a higher yield and net return $/a. Unfortunately, this year’s results were incomplete and/or unreliable due to the snowstorm from October 10-12. We will be conducting the trial again in 2020.

**Figure 1. June 3, 13, 24 soybean seeding dates after October 10-12 blizzard.**