

Soybean Seeding Depth Evaluation

Project Duration: 2017-2019

Objectives

The objective of this study is to identify the optimum seeding depth for soybeans in Manitoba. The current recommendation is to seed soybeans between 0.75 and 1.5 inches based on guidelines from other regions. However, dry spring soil conditions often lead agronomists and farmers to ‘chase moisture’ and seed soybeans at 1.75 inches or deeper as has occurred in 2017 and 2018. Observations on the success of this practice have been mixed - delayed emergence is a frequent observation and reduced emergence has occurred in some but not all cases. On the other hand, very wet soil conditions have led some farmers to broadcast and incorporate their seed. The yield impact (if any) of deep and shallow seeding is currently unknown in Manitoba and western Canada.

Collaborators: Kristen P. MacMillan, University of Manitoba

Results

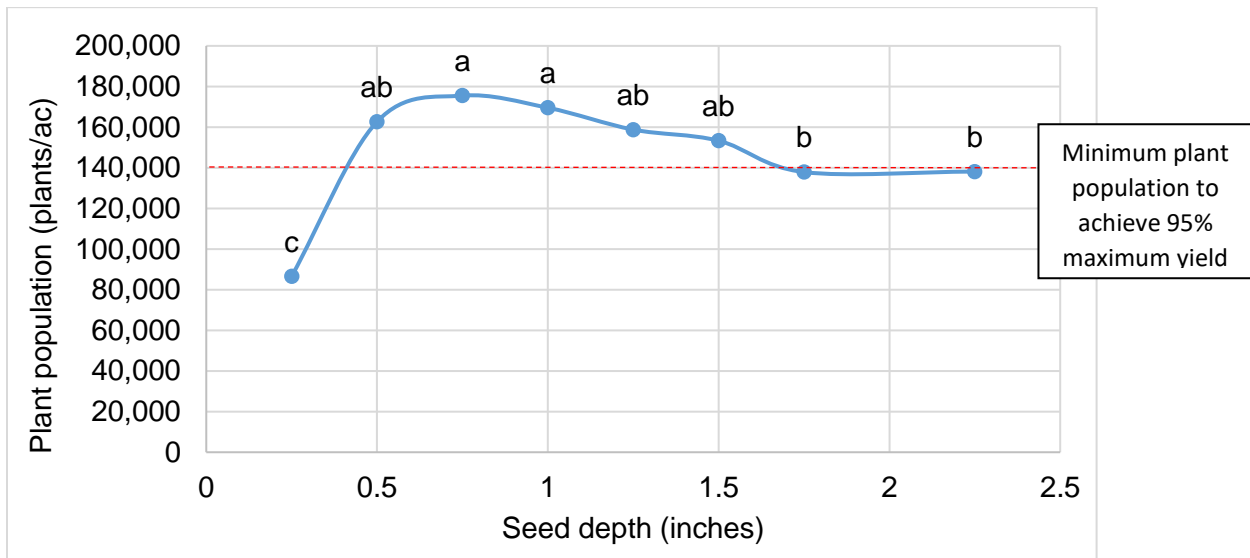


Figure 1. Effect of seeding depth on established plant population among environments. Means that contain the same letter are not statistically different at $P \leq 0.05$.

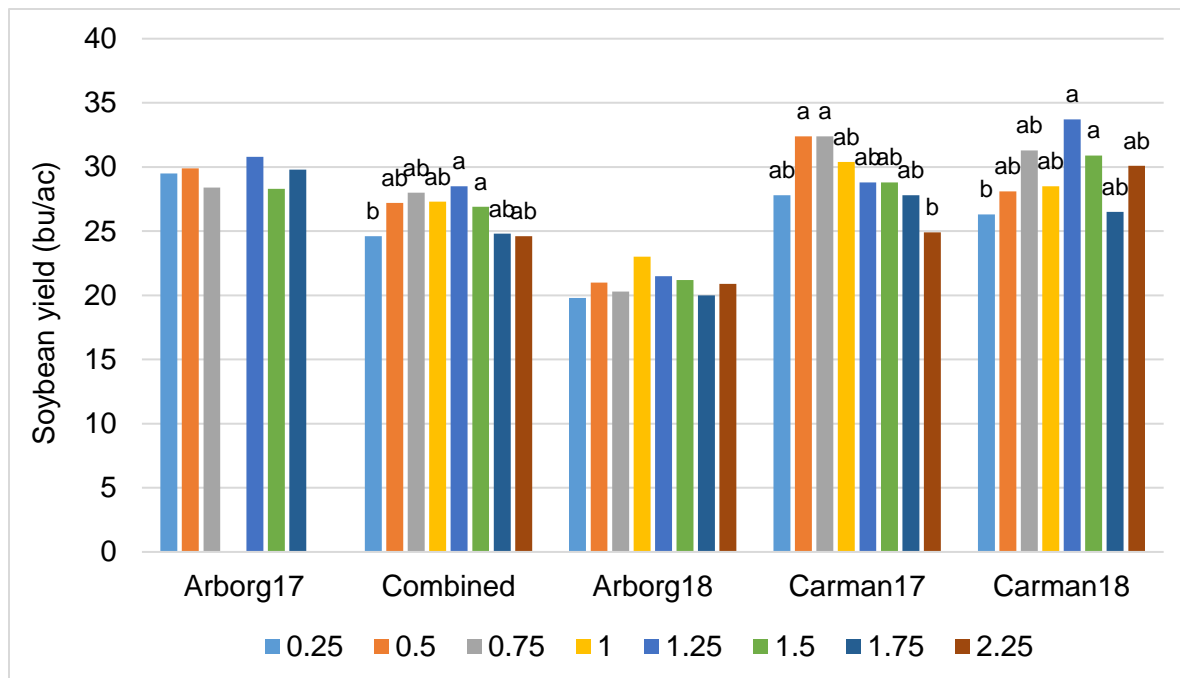


Figure 2. Effect of seed depth x environment and the overall effect of seeding depth (“combined”, excluding Arborg17) on soybean yield.

Project Findings

Trials were seeded with a double disc plot seeder between May 14 and May 24. At the time of seeding, moist soil was at 1.25” in 2018 and an accumulated 25mm of rain took about 14 and 21 days in 2017 and 2018, respectively. All trials were seeded into tilled stubble, except Arborg 2017 which was seeded into tilled fallow. Also, at Arborg 2017, the plot seeder could only reach a depth of 1.75”. For those reasons, Arborg17 was excluded from the combined analysis. Data was analyzed using Proc Mixed in SAS 9.4 with environment and treatment as fixed effects and block within environment as a random effect.

At Arborg17, soybean seeding depth from 0.25 to 1.75” did not affect soybean plant density or yield (28.4 to 30.8 bu/ac). This is not necessarily surprising as the depth range was narrower and the trial was seeded into tilled fallow land, which promotes loose soil that may not elicit potential impacts of deep seeding. In the combined analysis of Arborg18, Carman17 and Carman18, soybean plant density was significantly affected by seeding depth (Figure 1). Soybean yield was affected by both main effects (environment and seeding depth) and their interaction (E x SD). At Carman17, soybean yield was reduced by 25% when seeded at 2.25” compared to 0.5 and 0.75” (Figure 2). The other seed depths produced yields similar to all other treatments. At Carman18, soybean yield was reduced by 20% with shallow seeding (0.25”) compared to seeding at 1.25 and 1.5”. The other depths were statistically similar to all others. At Arborg18, seeding depth did not affect soybean yield. When looking at the overall effect of seed depth on yield, the same trend exists at each environment - although to different degrees, which leads to the interaction. Yield loss with very shallow or deep seeding is not consistent, however, when it does occur (2 out of 4 environments thus far), it is substantial (20-25%).

Delayed and reduced plant establishment and reduced seedling vigour are potential factors contributing to yield loss with non-optimal seeding depth. Shallow seeded soybeans (0.25") are more prone to moisture fluctuations, resulting in wetting and drying of the seed which leads to poor germination and establishment. Deep seeded soybean seedlings (2.25") show hypocotyl swelling, loss of cotyledons and chlorosis (Figure 3). To identify other mechanisms potentially contributing to yield differences, we measured the effect of seed depth on pod height in 2018 and we plan to measure nodulation and root rot in 2019, which will be the last year of the study. In 2018, seed depth did not affect pod height.

Based on the first 2 years of study, farmers should choose seeding depths between 0.5 and 1.5 inches depending on their soil type, management practices, equipment and rain forecast. Measuring seed depth during seeding and adjustments by field may be necessary. A post-emergent assessment to measure actual seeding depth at the cotyledon or unifoliate stage should be incorporated to ensure that the target seeding depth was achieved.



Figure 3. Soybean seedlings emerging from 0.5 to 2.25" seed depth (L-R), 7 days after seeding on May 24, 2017. As depth increases, emergence is slower and vigour is reduced.

Background/References/Additional Resources

Seeding depth is important to ensure adequate moisture for germination and for good, even emergence. A soybean seed will imbibe 50% of its weight in moisture before germination. The recommended **seeding depth for soybeans is 0.75 to 1.5"**. There are certain environmental conditions and equipment factors to consider when determining if you should aim for the low or high end of this range. For example, dry soil conditions during the first week of May were leading growers to go deeper, closer to 2 inches. Going deeper than 2 inches may reduce soybean emergence and yield. Under warm, moist soil conditions, seeding shallower can result in good, rapid emergence. Understanding depth control of your equipment is also important when determining your target seeding depth. In some air seeders, depth can fluctuate from one end to the other by as much as ½" resulting in uneven emergence. Additional soil cover that may result

from rolling is another consideration. If depth control is not ideal on your seeding unit and/or rolling flattens deep furrows, your target seeding depth should allow for variation of 0.5”.

Materials & Methods

Soybean seeding depths between 0.25 and 2.25 inches were tested at Arborg (clay soil) and Carman (loam soil) in 2017 and 2018 in a randomized complete block design experiment.

Experimental Design - Randomized Block Design

Treatments - Eight seeding depths (0.25”, 0.50”, 0.75”, 1.25”, 1.50”, 1.75”, 2.00” and 2.25”), three replicates

Data collected - plant height, lodging, days to maturity, yield

Pesticides Applied (doses and dates):

Glyphosate @ 0.67 L/acre + Pursuit @ 85 ml / acre on June 12

Glyphosate @ 0.67 L/acre on July 5

Seeding Date: May 16

Harvest Date: October 9