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# Soybean production: Little things that can make a difference

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## Introduction

While some are working on hitting home runs, many of our research projects are focused around getting on base. This presentation will focus on strategies to minimize harvest losses through managing the height of the lowest pod, understanding the risks and rewards of planting long season varieties, maximizing harvest efficiency with rock rollers, and management and environmental effects on soybean seed quality. While this paper presents data assembled in 2008 and earlier, the presentation will include new crop data.

## Reducing harvest losses

We have had some difficulty replicating our successes with high yield studies in Minnesota. Therefore, we have taken a more pragmatic approach and have invested some energy into managing input costs and minimizing losses. Here we will briefly discuss some of our research into reducing harvest losses.

### *Lowest pod height in soybean*

Farmers in Minnesota have, with greater frequency, been complaining about increased harvest losses due to low podding height in soybean. Previous research in our lab indicated that individual soybean plants spaced at greater than about 1 ½" spacing had a high frequency of branching while those spaced at less than 1 ½" were significantly less likely to be branched. Because there has been a movement among producers to plant lower seeding rates (due to increased seed costs and subsequent recommendations by state Soybean Agronomists), we felt that current plant stands may support maximum yield potential, while increasing the risk of low podding height and harvest losses. Therefore we set out to examine seeding rate, row spacing, maturity, and residue effects on lowest podding height in soybean.

We found that both plant population and soybean maturity play a large role in determining the height of the lowest pod in soybean. When we looked more closely at plant arrangement, we found that row width and interplant spacing (within rows), themselves, have little impact on height of the lowest pod. Plant population in the larger sense appears to be the driver. In other words, plants do not appear to 'sense' their neighbors within the row or across the row, but they do seem impacted by the population at a larger scale (likely around a square yard). Colored mulches (including a white mulch intended to simulate corn stalks) did not greatly affect height of the lowest pod.

In order to better understand the mechanism behind the determination of lowest pod height, we thinned soybean stands from 175,000 per acre to 75,000 per acre at V1, R3, R4, and R5. We found that the critical time for determination of lowest podding height to be somewhere between R3 and R5. In other words, this phenomenon does not appear to be related to stem elongation (intermodal length) or branching. It does appear to be dependent on source-sink relations in the plant whereby extra yield (on a per plant basis) is simply placed lower on the plants when available podding sites in the center portion of the plant are already taken with developing seed.

### *Rolling soybeans*

Rolling soybeans with heavy, large diameter, gas pipes has become a true rural phenomenon in pockets of geography throughout Minnesota. While this technique was first utilized to push rocks down into the ground to avoid combine damage, producers quickly learned that pushing corn root-balls flat at the time of planting can increase harvest efficiency. We have conducted on-farm research utilizing full scale equipment in 2008 and 2009. We found no yield benefit to rolling; however, we have noted significant interactions with the amount of corn residue in fields. High reside fields appear to be more tolerant of post-emergence rolling. These fields are also less prone to disastrous side effects of rolling – wind and water erosion.

## Seed quality

While most producers are not affected by soybean seed quality in an obvious way, soybean seed quality by region does have a direct effect on the local basis. The difference between CBOT and local price includes much more than transportation costs. Regional differences in protein and oil concentration result in lower local prices in the upper Midwest. Increasing the value of the harvested crop improves returns for all producers. We have conducted many studies in the past ten years that examine environmental and genetic impacts on soybean quality. We will discuss just a few of them in this session.

### *Minnesota and US soybean quality surveys*

We have demonstrated that soybeans produced in the upper Midwest tend to have protein concentrations that are about one percentage point lower than the US average, and our oil concentrations are no better than average. Moreover, US soybeans tend to be lower in protein and oil than those produced in Brazil. With an increased interest in soybean oil from greater utilization of biofuels, we have used the Minnesota soybean quality survey as a method to investigate climatic factors on soybean seed composition. We found that the ambient temperature during seed filling (August 15 – September 14) is critically important for oil production in soybean. We noted a one percentage point increase in soybean oil for every 3 oF increase in average air temperature.

### *Seed quality: Whole plant physiology studies*

In order to better understand limitations to protein and oil accrual in soybean we conducted several studies in 2006 and 2007 that utilized treatments impacting source and sink strength in soybean plants. Treatments included defoliation, depodding, or shading at several intensities. We were able to create soybean seed that was either much higher or much lower in protein than our control treatments; however, treatments only had negative effects on oil concentration. This implies that while soybean is often called an ‘oil seed’, in reality it is much better at storing protein. This work also confirms why soybean breeders struggle with producing high oil soybean varieties.