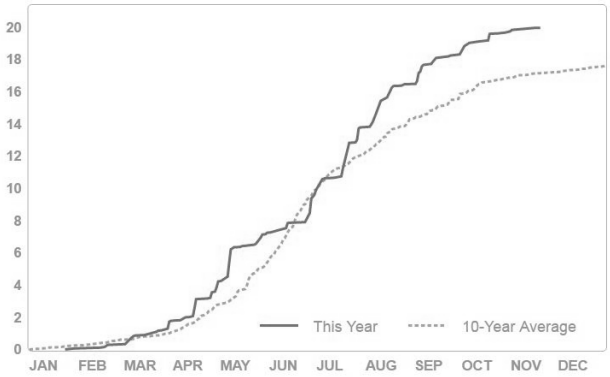
Dry Bean Direct Harvest Combine Speed Evaluation

Study ID: 608013201601
County: Box Butte
Soil Type: Keith silt loam 0-1% slope; Busher-Jayem loamy very fine sand 0-3% slope; Duroc loam occasionally flooded; Satanta fine sandy loam 1-3% slope
Planting Date: 5/29/2016
Harvest Date: 9/12/16
Population: 124,000
Row Spacing (in): 7.5 drilled
Hybrid: Sinaloa Pinto Bean
Reps: 4
Previous Crop: Corn
Tillage: Vertical Till, Chisel and 2 Packings
Herbicides: ***Pre:*** None ***Post:*** Raptor®/Basagran®
Foliar Insecticides: None
Foliar Fungicides: 40 oz/ac Priaxor® and 1 lb/ac Kocide® on 7/28/16
Fertilizer: 40 lb N/ac, 40 lb/ac P, 10 lb/ac S, 1 lb/ac Zn on 6/4/16
Irrigation: Pivot, Total: 8-10
Rainfall (in):



Introduction:

Combining harvest is the final and one of the most critical aspects of raising dry beans. You can grow a good crop but combine operation is critical to successfully harvesting that crop. The purpose of this study is to examine combine speed and the affect it has on harvest loss and bean quality. In this case we looked at a John Deere 9760 combine with a JD635 flex auger head (35 ft.) using a Crary wind system. The plots were 300 feet long by the width of the combine and the speeds were 2, 3.5 and 4.5 mph. The beans were harvested on September 12th. The beans were drilled in 7.5 inch rows with an estimated population of 124,000 plants/ac. No desiccant was applied to the crop. The temperature was 64°F and relative humidity was 46% at harvest time. The harvested bean moisture was 12.8%. The overall yield for the field was 55 bu/ac. Nine square foot samples were taken randomly in the harvested area in the left, center and right zones behind the combine and header to estimate harvest loss. The bean variety was Sinaloa and the pod height was measured at 94.5% being two inches or more above the soil surface. In the table, damage means any seed visibly split, cracked or broken (*Figure 1*), and seed coat damage means visibly intact beans that show wrinkling during a 5 minute water soak test (*Figure 2*). One hundred grams of seed was examined for damage and damage percent by weight was recorded. One hundred seeds were tested for seed coat damage and the percent by number of seeds was recorded.

Figure 1. Bean seed damage (splits and cracks).

Figure 2. Seed coat damage. Left damaged (wrinkled), right not damaged as determined by soak test.

Because combine speed impacts harvest loss and damaged seed, combine speed directly influences profit. Profit lost due to harvest loss was calculated by multiplying the harvest loss by the price beans would have been sold for ($18/bu). Total damaged beans for each treatment strip (bu/acre) were determined using the average yield for the field (55 bu/acre) adjusted for harvest loss (adding in bu/acre lost for each treatment strip to determine a relative total yield) and multiplied by the percent damaged beans. No payment is made for damaged beans, therefore the bu/acre of damaged beans for each treatment strip was multiplied by the price the beans would have been sold for. The profit losses due to harvest loss and due to damaged beans were summed to determine the total profit loss. Seed coat damage does not impact profit.

Results:

	Harvest Loss (bu/ac)	Damaged (%)	Seed Coat Damage (%)	Profit Loss ($/acre)
Combine Speed 2 mph	1.9 B*	1.4 A	19 A	47.96 B
Combine Speed 3.5 mph	2.8 AB	1.6 A	18 A	67.24 AB
Combine Speed 4.5 mph	3.3 A	1.7 A	16 A	77.23 A
P-Value	0.078	0.632	0.775	0.066

*Values with the same letter are not significantly different at a 90% confidence level.

Summary and Observations:

1) The higher combining speed of 4.5 mph had significantly higher harvest loss but not a lot higher. Overall harvest loss was in an acceptable range.
2) In this study there was not a significant difference in damage (splits and cracks), or in seed coat damage at the different speeds.
3) Combining at 4.5 mph resulted in greater profit loss than combining at 2 mph. There is a trend toward increasing profit loss as speed increases. The grower's standard combine speed is 3 to 3.5 mph; the impact of changing combine speeds can be evaluated by looking at the change in profit loss for an increase or decrease in harvest speed. In the profit loss figures shown, increased harvest time for slower combine speeds is not accounted for, but is certainly an economic and practical consideration. Growers need to evaluate the expected profit loss associated with different combine speeds and determine the level of loss and length of harvest time that works with their operation.
4) This study evaluated harvest loss and seed damage at varying harvest speeds. Ideal harvest speeds may vary depending on the harvest equipment and the operator's comfort level. However, we would expect similar trends between harvest speed and loss or damage. This study demonstrates the need for operators to understand the importance of harvest speed and take observations on loss or damage in order to determine an optimal harvest speed.

Sponsored by: University of Nebraska Lincoln; Nebraska Corn Board

In Partnership with: Nebraska Soybean Checkoff; Nebraska Corn Growers Association; Nebraska Dry Bean Commission