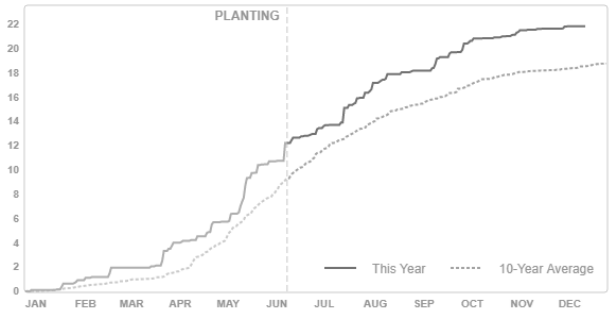
Dry Bean Direct Harvest Combine Speed

Study ID: 601161201702
County: Sheridan
Soil Type: Johnstown loam 0-2% slope; Keith loam 1-3% slope
Planting Date: 6/14/2017
Harvest Date: 10/24/17
Population: 120,000
Row Spacing (in): 15
Variety: Sinaloa pinto beans
Reps: 4
Previous Crop: Oats
Tillage: Field cultivator and vertical tillage 3 times
Herbicides: ***Pre:*** 32 oz Prowl® and 14 oz Outlook® on 6/17/17 ***Post:*** 21 oz Varisto® (Raptor® + Basagran®) and 8 oz Basagran® on 7/17/17

Seed Treatment: None
Foliar Fungicides: 32 oz Sanidate® on 9/1/17
Fertilizer: 25 lb/ac N, 25 lb/ac P, 10 lb/ac S, 1 lb/ac Zn, and 2 lb/ac Mn dry spread on 6/13/17
Irrigation: Pivot, Total: 10"
Rainfall (in):



Introduction: Combine 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 S690 combine with a 40' MacDon flex draper head. The plots were 300 feet long by the width of the combine and the speeds were 1.0, 2.0, and 4.0 mph. The beans were harvested on October 24. No desiccant was applied to the crop. The temperature was 58°F and relative humidity was 22 percent at harvest time. The harvested bean moisture was 13 percent. 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 90.6 percent being 2" or more above the soil surface. In the table, damage means any seed visibly split, cracked, or broken (and therefore rejected at the elevator), and seed coat damage means visibly intact beans that show wrinkling during a five minute water soak test. One hundred grams of seed was examined for damage and damage percent by weight was recorded. One hundred seeds were soaked in water for five minutes to determine seed coat damage and the percent by number of seeds was recorded.

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 ($14.40/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 loss due to harvest loss and due to damaged beans was 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) ($/ac)
1 MPH	5.5 A*	3.2 A	15.0 A	106.03 A
2 MPH	4.9 A	2.0 B	5.5 B	87.65 A
4 MPH	7.0 A	1.3 B	7.8 B	112.92 A
P-Value	0.350	0.009	0.001	0.541

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

Summary:

- There was no significant difference in harvest loss between the three combining speeds tested.
- Visibly broken seed was higher at the slowest combining speed of 1 mph. The medium and high speed treatments were not significantly different from one another. This is probably due to a lower volume of plant material moving through the machine at the slower speeds, resulting in bean seeds having greater contact with the metal surfaces within the combine. This is consistent with results of this study in 2016.
- Wrinkling of seed coats from the five minute soak test showed greatest damage under the slowest speed tested, reinforcing increased seed contact with metal surfaces inside the combine during the harvesting process. This is consistent with results of this study in 2016.
- There was no significant difference in profit loss between the three combine speeds tested. 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. This grower's standard operation is close to 2 mph; therefore, increasing the combine speed to 4 mph resulted in an additional profit loss of $25.27/ac.
- 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.

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