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Comparison of Static and Active Downforce on Corn at the Kansas River Valley Experiment Field in 2020

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Introduction

Uniformity of plant spacing and emergence have been shown to be significant contributing factors to increasing corn yields. Improved seed meters that offer very precise seed drop have been available on planters for a number of years. However, uniformity in plant emergence continues to be a challenge, especially with reduction of tillage and in fields with variable soils. Correct, consistent depth is critical for uniform corn emergence. By keeping the gauge wheels on the ground, consistent depth is achieved. An active downforce system, such as Precision Planting's DeltaForce, applies hydraulic downforce or lift to the row unit. With a Precision 20|20 planter monitor, load sensor readings of the downforce on the gauge wheels can be monitored and the target pressure adjusted from the monitor. The 20|20 display detects the load cell readings and adjusts the applied downforce or lift to maintain the gauge wheels' contact with the ground while also preventing compaction beyond what is necessary for creating a good furrow.

Procedure

A John Deere 7200 planter was equipped with a DeltaForce system at Kansas River Valley Experiment Field, near Topeka, KS. Connected to the Precision 20|20 planter monitor, the downforce could be set at any static (constant) pressure, or in the active downforce mode. The active downforce mode continues to monitor the pressure sensors on the gauge wheels of each row and calculate the percent of time the gauge wheels are in contact with the soil. The target pressure can be adjusted so the gauge wheels are in contact with soil, planting at the proper depth without unnecessary compaction around the seed.

Two studies were conducted in 2020 at Kansas River Valley Experiment Field (KRV) near Rossville (irrigated) and Kiro (dryland). Both fields were sub-soiled with a Blue-Jet in-line sub-soiler in the fall, and field cultivated prior to planting in the spring. The soil type at Rossville is Eudora silt loam, and at Kiro is Muir silt loam. The soil conditions at both fields were very mellow, especially at Rossville. Planting dates were April 21 and 23 at Kiro and Rossville, respectively. The treatments were 1) no downforce, 2) 125 lb static downforce, 3) 250 lb static downforce, 4) 375 lb static downforce, and 5) auto downforce. At Kiro the target downforce was set at 90 lb, and at Rossville the target force was set at 50 lb for the auto downforce treatments. Plots were 200-ft long at both locations. About 13 days after emergence, stand counts of 1/1000th of an acre, and number of plants at each leaf stage within each stand count were quantified from each plot at two sites at Rossville and four sites at Kiro.

Results

Stand counts taken May 29, 2020, show that the 375 lb static downforce reduced that stand by approximately 3000 plants/a compared to the other treatments (Table 1), which were not significantly different from each other. Within each stand count, there were very few plants at V2 and at V5, with no differences between treatments. The 250 and 375 lb treatments had more than 40% of the plants at V3, while the auto treatment had 94% of the plants at V4. As a result, the plants with the auto treatment were ahead in emergence and uniformity, as shown by the average leaf number, than the 250 and 375 lb treatments. The plants in the no downforce and 125 lb downforce treatments were between the two extremes. The yield results had a similar pattern, showing the highest yields with the auto, no downforce, and 125 lb downforce treatments. The yield with the 375 lb treatment was up to 36 bu/a less than with those three treatments.

Conclusions

These data show the negative impact of having too much down pressure on a row unit to keep the seed at the proper depth. The reduction in plant population, development, and uniformity with the higher down pressures in this very mellow seedbed contributed to the reduction in yield. In a situation with heavier soils and/or more residue cover, higher downforce pressures may be needed to maintain seed depth. However, when the firmness of soil or residue cover are variable, it would be challenging to select a static downforce that would work for all conditions. There are plans to compare the static vs. auto downforce in more variable conditions resulting from different tillage systems and amount of residue cover at the KRV fields.

Table 1. Comparison of static and active downforce systems on planter units on plant population, plant uniformity and yield at Kansas River Valley Experiment Field in 2020

Treatment	Plant population	At v2	At v3	At v4	At v5	Avg leaf	Grain moisture	Test weight	Yield
	------------------- plants/a May 29, 2020 -------------------					leaves/plt	pct	lb/bu	bu/a
No downforce	28875 a*	0	8000 a	21250 b	880	3.79 b	16.8	59.7	202.1 a
125 lb	28187 ab	0	7800 a	21500 b	380	3.79 b	17.0	59.3	200.2 a
250 lb	27781 b	375	12000 a	17750 b	0	3.66 b	17.3	59.1	185.0 ab
375 lb	25135 c	0	10400 a	17380 b	500	3.72 b	17.2	58.7	168.0 b
Auto	28969 a	0	1500 b	27250 a	1880	4.01 a	16.7	59.6	204.2 a
PR>F	<.0001	0.42	0.04	0.02	0.69	0.04	0.5	0.25	0.02

*Means followed by the same letter are not significantly different at $P = 0.05$.