Crop Production Clinics

Testing Downforce Pressure Planting Systems in Corn

Sarah A. Sivits
Cropping Systems Extension Educator
Dawson-Buffalo-Hall Counties

This is a brief summary of two on-farm research studies done in 2020 in Dawson County, NE.

Crop Production Clinics

Background

- Planting concerns
  - Soil type
  - Field topography
  - Residue management
  - Weather conditions
  - Time
- Get a good start
  - Proper planting depth
  - Proper seed placement
  - Avoid sidewall compaction
  - Avoid rootless corn syndrome

When farmers are ready to plant in the spring, there's many factors that need to be considered to ensure their crop gets a good start for the growing season. Issues during planting can lead to season-long problems, so we want to plant at the right time with the right equipment.

Crop Production Clinics

Downforce Pressure Study

- Proper downforce pressure on each row unit.
  - Spring adjustment on row units
  - Hydraulic down force system
- Using downforce pressure
  - Different pressures
  - Different speeds
- Ag Leader
  - SureForce
    - Planter hydraulic downforce with uplift
  - SureDrive
    - Electric drives for the planter/meter

Lots of producers are interested in downforce pressure systems. Several companies utilize this technology to ensure proper seed placement based on soil texture and field topography. Questions arise though on how much pressure is needed and how fast can we plant. Companies are interested in testing out their products on-farm to see how it work with their producers. Ag Leader approached a producer in my area about testing their SureForce/SureDrive system. The producer wanted to test it through the NOFRN to ensure proper statistics and data analysis.

Disclaimer: This study cooperation between Farmer, UNL, and Ag Leader is not being sponsored and no products are being touted. Products and company names are strictly for educational purposes and each producer works with different equipment/companies/products for their unique operation.

Crop Production Clinics

Downforce Pressure Study

First study we are going to discuss is the downforce pressure study.

Crop Production Clinics

Downforce Pressure Study

- Testing Ag Leader SureForce system at different pressures
  - Manual—100 lb to weight of boxes (check)
  - Medium—100 lb downforce at gauge wheel (active)
  - Heavy—150 lb downforce at gauge wheel (active)
    - All planted at ~6 mph
    - SDI field

Trial located in Dawson County, NE with subsurface drip irrigation (SDI). Three treatments tested: Manual (100lbs), Medium (100lb active downforce on wheel), and Heavy (150lb active downforce on wheel). Producer picked the manual application, Ag Leader picked the other two pressure amounts. Producer planted this field in April at 6.5 mph (producer choice).

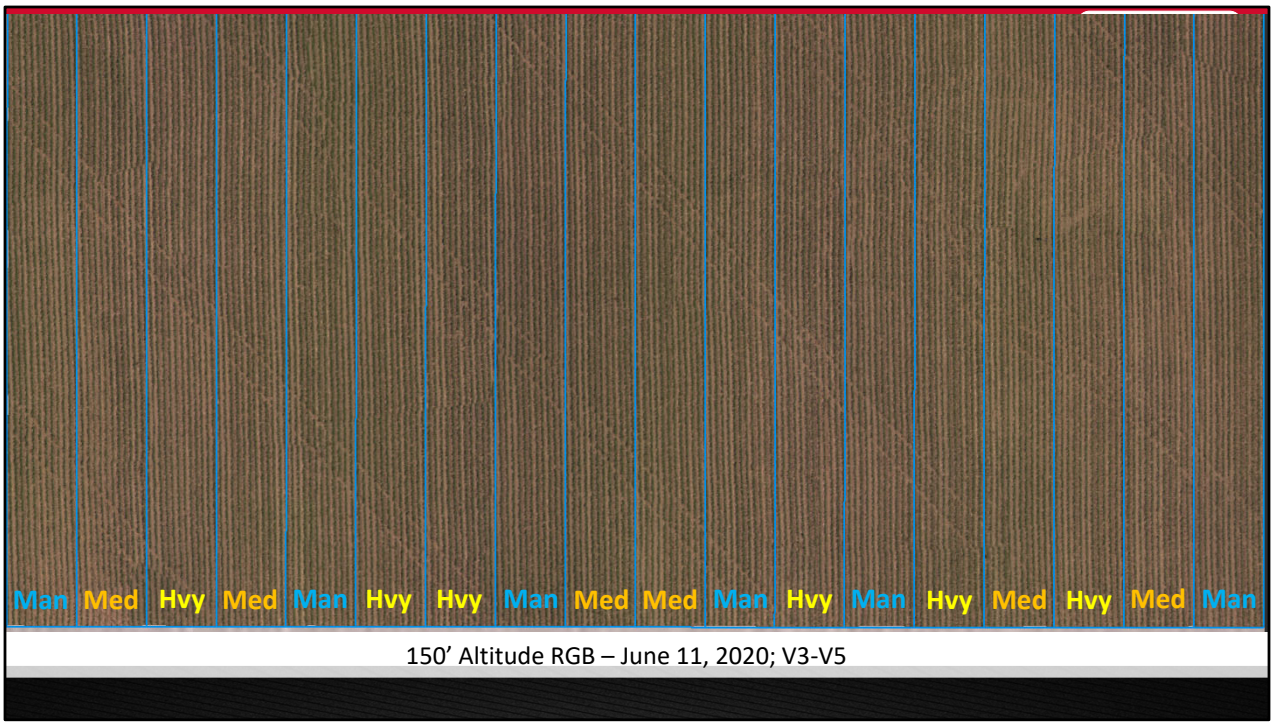
Crop Production Clinics

Data Collected

- NOFRN
  - Emergence counts
  - Early season stand counts (V4-V6)
  - Harvest stand counts
  - Yield
  - Moisture
  - Net return
- Ag Leader
  - Drone imagery/technology

The Nebraska On-Farm Research Network (NOFRN) collected early season stand counts every day for 2 weeks, early season stand counts, and late season stand counts (same plots counted). The producer collected the yield and moisture data from the yield monitor. All of this data was shared with the NOFRN to run for statistical analysis and marginal net return.

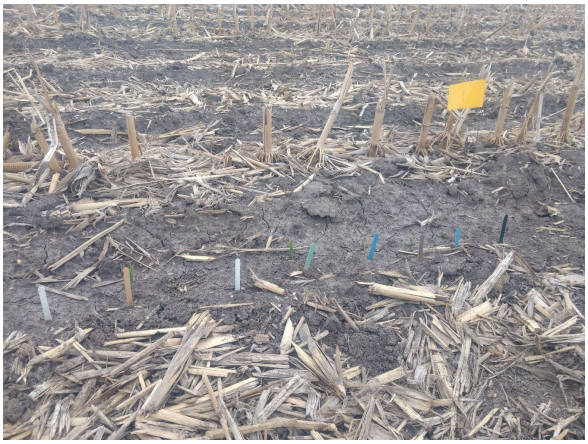
Ag Leader also collected aerial imagery using their drones to compare notes.



150’ Altitude RGB – June 11, 2020; V3-V5

Ag Leader imagery to show randomization and replication of plots.

Crop Production Clinics



Emergence counts taken using spray painted popsicle sticks instead of flags (more economical and degradable). Early season stand counts taken between V4-V6.

Crop Production Clinics

Downforce Results—Emergence

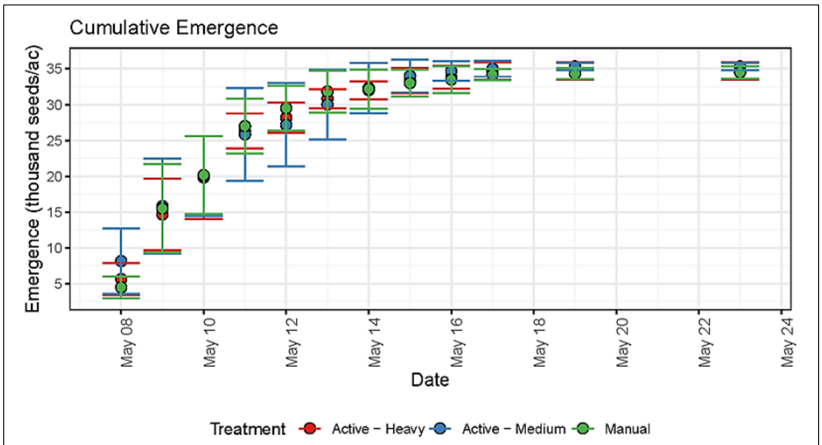


Figure 1. Cumulative emergence by date for manual downforce, active downforce at medium pressure, and active downforce at heavy pressure.

Emergence results: the T shaped projections coming from the center of each color coded dot indicates the spread of the data. Focusing just on the dots we can see a nice trend with all three treatments that looks pretty similar for emergence. Remember this as we will look at a similar graph in the travel speed study.

Crop Production Clinics

Downforce Results—Other

	Early Season Stand Count (plants/ac)	Harvest Stand Count (plants/ac)	Moisture (%)	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
Manual Downforce (100 lb added)	34,167 A*	32,722 A	17.7 B	224 A	785.16 A
Active Downforce - Medium pressure (Net 100 lb at gauge wheel)	34,667 A	32,389 A	17.7 AB	234 A	820.01 A
Active Downforce - Heavy pressure (Net 150 lb at gauge wheel)	34,278 A	32,056 A	17.7 A	222 A	778.75 A
P-Value	0.364	0.427	0.078	0.270	0.282

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.51/bu corn and $1.90/ac for active downforce ($20,000 cost for active downforce system spread over 1500 acres and prorated over 7 years).

Other Results: If there's similar letters behind each number (i.e. A, A, and A in early season stand counts for all three treatments), that means there's no difference statistically between treatments. However, if there's an A and a B (i.e. moisture values show B, AB, and B respectively), there are statistically significant differences between treatments. P value for this is <0.10 (90% confidence level). Results indicate no difference in early/late season stand counts, yield, or net return between treatments. There's some slight differences in moisture, but it doesn't impact the overall yield or net return.

Crop Production Clinics

Downforce Pressure—Summary

- There were no statistically significant differences
  - Emergence
  - Stand counts
  - Yield
  - Net return

Summarize that there's no significant difference between treatments at a $p<0.10$ for emergence, stand counts, yield, or net return.

Crop Production Clinics

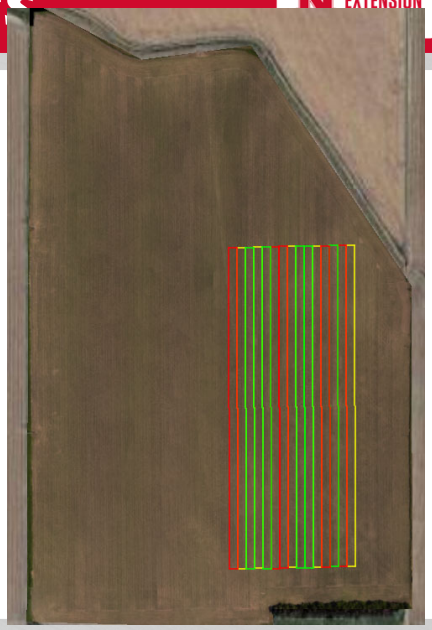
Travel Speed Study

This next study will focus on how fast you can plant using Ag Leaders SureForce/SureDrive system.

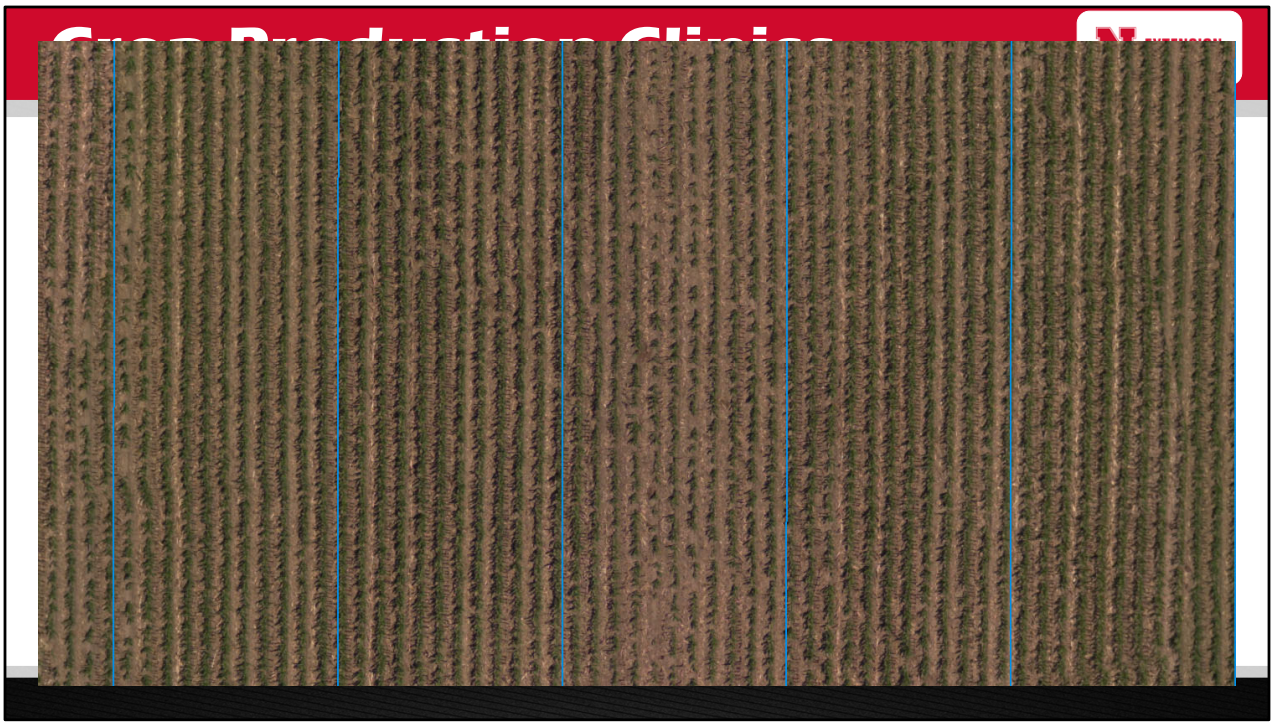
Crop Production Clinics

Travel Speed Study

- Testing Ag Leader SureForce SureDrive system at different travel speeds
  - 5 mph (check)
  - 7 mph
  - 10 mph
    - All planted with 100lb downforce at gauge wheel (medium app in 1st study)
- Data collected
  - Same as downforce pressure study
  - SDI field



This study was set up in the same SDI field as the downforce pressure study, just on the eastern half of the field. Ag Leader recommended testing their system out at 5, 7, and 10mph. The farmer traditionally plants around 6-6.5 mph so he seemed comfortable with the first two treatments but had some reservations about the 10mph. Data collected was the same as the downforce study: emergence counts for two weeks, early season stand counts, late season stand counts, yield, moisture, net return, and drone imagery.



Drone imagery showing uneven emergence in some of the treatments.

Zooming in, you can easily tell which passes correspond to specific treatments. The 5 and 7mph plots seemed to emerge ok, although the 5mph came up very quickly compared to the 7mph based purely on observation. The 10mph took forever to emerge and it was very spotty with large gaps, double planting, and even seeds on the soil surface. The producer didn't have any issues planting the first two treatments but had a rough time with the 10mph. He actually had to take the tractor off auto-steer in order finish planting. First time he has physically drove the tractor to plant in years.

Crop Production Clinics

Emergence sticks on the left, early season stand counts on the right.

Crop Production Clinics

Travel Speed Results—Emergence

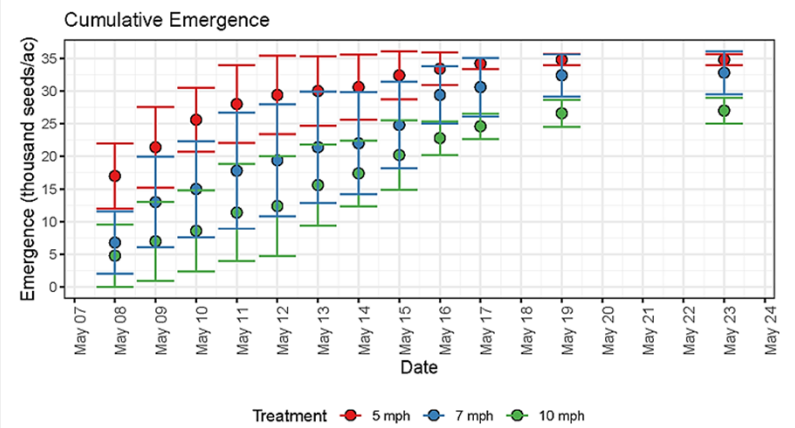


Figure 1. Cumulative emergence by date for 5 mph, 7 mph, and 10 mph planting speeds.

Emergence Results: if you remember back to the downforce pressure chart and how pretty it looked to see a nice smooth curve, that didn't happen here. You can clearly see a trend looking at each colored dot. The 5mph (red) dots look like a nice curve that emerged quickly. 7mph (blue) dots lagged behind but gradually caught up towards the end of the emergence period and looked very similar to the 5mph plots. The 10mph plots lagged behind the entire season due to planting issues. While the data looks messy at first, taking each color individually and comparing it at the end does show a trendline, but there's definitely more separation here compared to the other study.

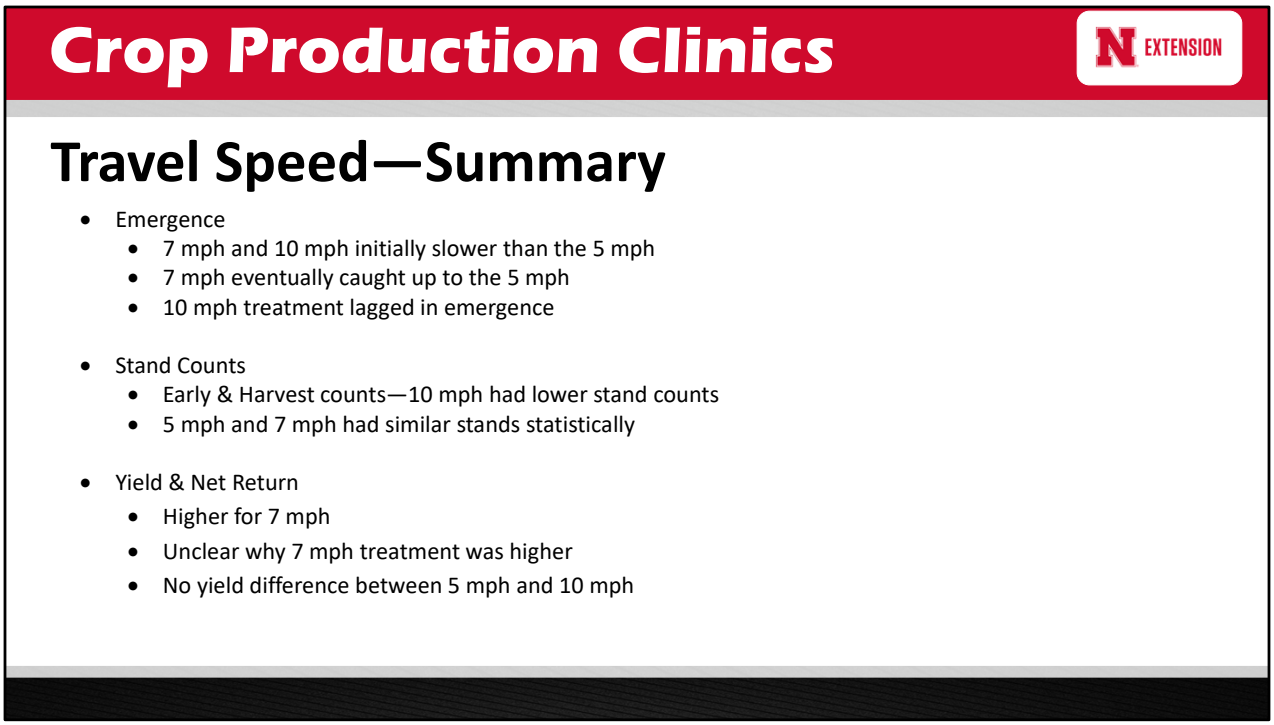
Crop Production Clinics

Travel Speed Results—Other

	Early Season Stand Count (plants/ac)	Harvest Stand Count (plants/ac)	Moisture (%)	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
5 mph	34,067 A*	32,400 A	17.8 A	240 B	841.64 B
7 mph	33,733 A	31,467 A	17.8 A	256 A	895.10 A
10 mph	27,667 B	26,267 B	17.8 A	235 B	821.05 B
P-Value	<0.0001	0.0001	0.546	0.006	0.006

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.51/bu corn and $1.90 for active downforce for the 7 mph and 10 mph treatment ($20,000 cost for active downforce system spread over 1500 acres and prorated over 7 years).

Other Results: the 10mph stand counts were lower in both the early and late season counts compared to the 5 and 7mph plots. Moisture was similar across treatments, but we start to see differences in yield and net return. Yield and net return are statistically higher for the 7mph plots and the 5/10 mph plots were similar to one another (still less than the 7mph treatment).



Summary: emergence was quite poor for the 10mph plots as was early and late season stand counts. The 5 and 7mph treatments were similar in emergence (eventually) and in stand counts. Yield and net return were the highest for the 7mph treatment although we are not sure why. The farmer traditionally plants at 6-6.5mph with his equipment, so it appears plausible that if he were to increase his speed to 7mph, he would achieve decent emergence, stand counts, yield, and net return utilizing this system. Ag Leader suggested during the experimental design that the 10mph would be too fast for their system, but they wanted to see the limitations of their equipment so they included it in the trial.

Crop Production Clinics

Future Plans

- Plan to repeat this study again in 2021?

  – Downforce Pressure
    - Yes, depending on field availability

  – Travel Speed
    - Maybe, 10 mph a little too fast for comfort!

There's a good chance the producer will repeat the downforce pressure study in 2021 if he has enough field space, but he was worried about repeating the travel speed study. The producer was not thrilled about planting at 10mph again as it was a rough ride in the tractor.

Crop Production Clinics

Resources

- Nebraska On-Farm Research Network
  - Website: https://cropwatch.unl.edu/on-farm-research
  - Publications (print or online)

- Virtual Field Days
  - Twitter: @OnFarmResearch
  - YouTube: Nebraska Extension On-Farm Research Network Channel
  - WCREEC: https://mediahub.unl.edu/media/14308

- CropWatch
  - Website: https://cropwatch.unl.edu

For in-season video footage and to listen to interviews from the producer, Ag Leader, and UNL Extension, please check out the media hub website listed under WCREEC (field day). These studies will be published in the 2020 Growing Season Results online and in paper version.

Crop Production Clinics

Question? Thank You!

Sarah A. Sivits

Cropping Systems Extension Educator

Dawson-Buffalo-Hall Counties

sarah.sivits@unl.edu

308-324-5501

@centralNE_crops