GOAL - Precision Seeding

- Identify and quantify variability within fields.
- **Understand** the impact of variability.
- Manage variability to increase profits while reducing environmental risks.

Topics

1. Fertilizer Placement at Planting
2. Downforce and Seeding Depth
3. Dual Hybrid Planting
4. On-farm Research Considerations

Ohio State Precision Ag Program

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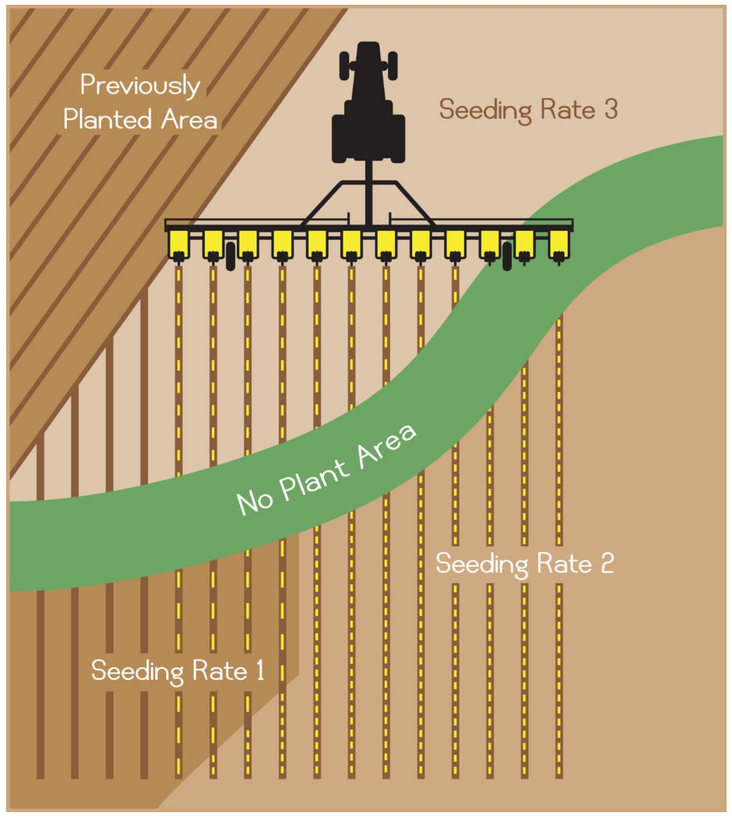
Precision Seeding Technology

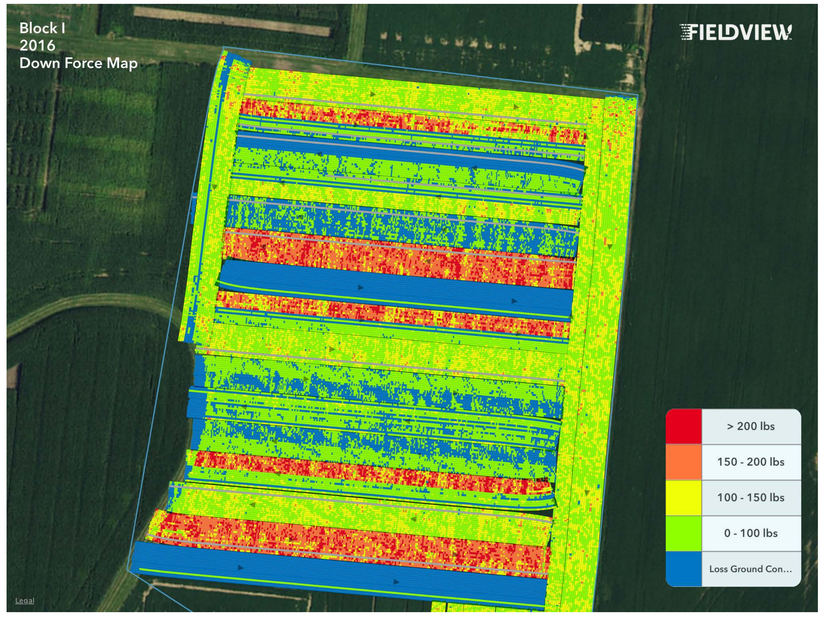
Benefits

- Row-by-row performance feedback
- Electric drive per row
  - Per-row population
  - Per-row On/Off
  - Turn compensation
- Active downforce – maintain proper seeding depth & ground contact as soil conditions vary
- As-planted data for verification and analyses

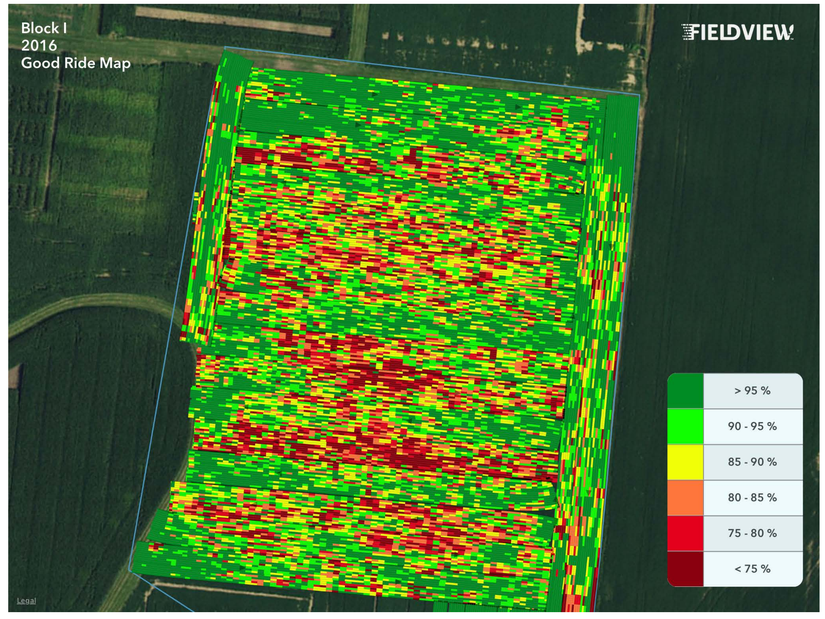


Bare Soil Visible Image

Down Force Map



Good Ride Map



DownForce x Seeding Depth

Study Overview

- Target Population:
  - 32,000 seeds/ac
  - 6.53-in. seed spacing
- Conventional tilled
- Dry planting conditions

Results

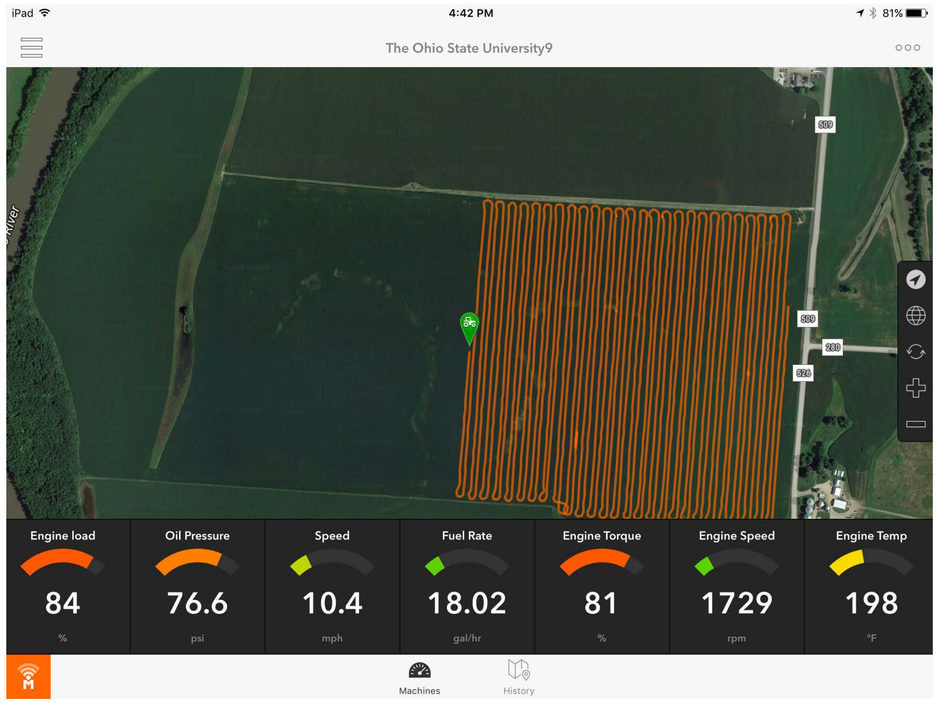
- In-field variability of soil type and texture can impact seeding depth.
- Final seeding depth impacted by downforce.
- Active downforce maintains engagement with soil improving row-unit ride and seed placement.

Target Planting Depth (in.)	Active Downforce (lbs.)	Downforce Margin (lbs)	Good Ride (%)	Measured Seeding Depth (in.)	Live Population (plants/ac)	Seed Spacing inches (CV; %)
1	Off	30	79	0.9	29,560	6.49 (48%)
1	100	97	87	1.3	31,870	6.34 (31%)
1	195	186	85	1.3	32,515	6.28 (31%)
2	Off	9	84	1.8	31,860	6.27 (32%)
2	100	100	87	2.2	32,290	6.16 (33%)
2	195	169	91	2.3	31,520	6.29 (33%)
3	Off	2	89	2.3	31,430	6.30 (35%)
3	100	35	91	3.2	28,740	6.56 (46%)
3	195	42	94	3.0	30,590	6.43 (39%)

High Speed Planting

Considerations

- More acres planted per hour (or day)
  - Increased acres planted within window of opportunity
- Multi-precision technology (population, ON/OFF, turn compensation)
- Upstream supply demands for planting must adjust accordingly
- Limiting factors
  - Field size
  - Field conditions
  - Tractor HP and hydraulics



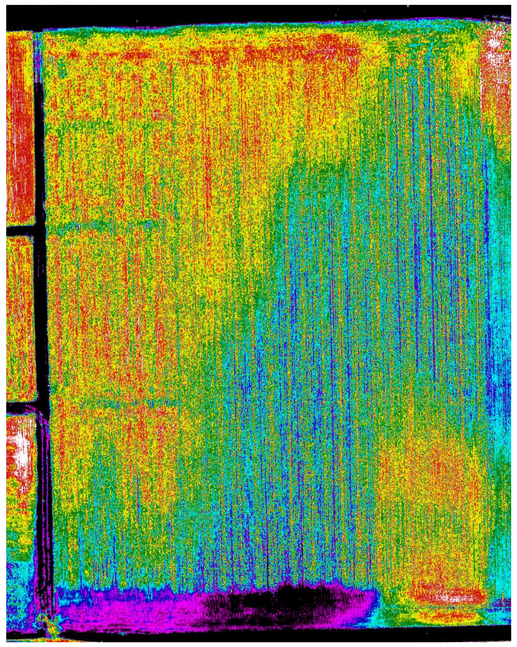
Speed (mph)	Theoretical Field Capacity[1] (ac/hr)	Adjusted Field Capacity[2] (ac/hr)
5	24	19
7.5	36	29
10	48	38

1) Assumes no stops or downtime.
2) Accounts for turning, re-loading, etc.

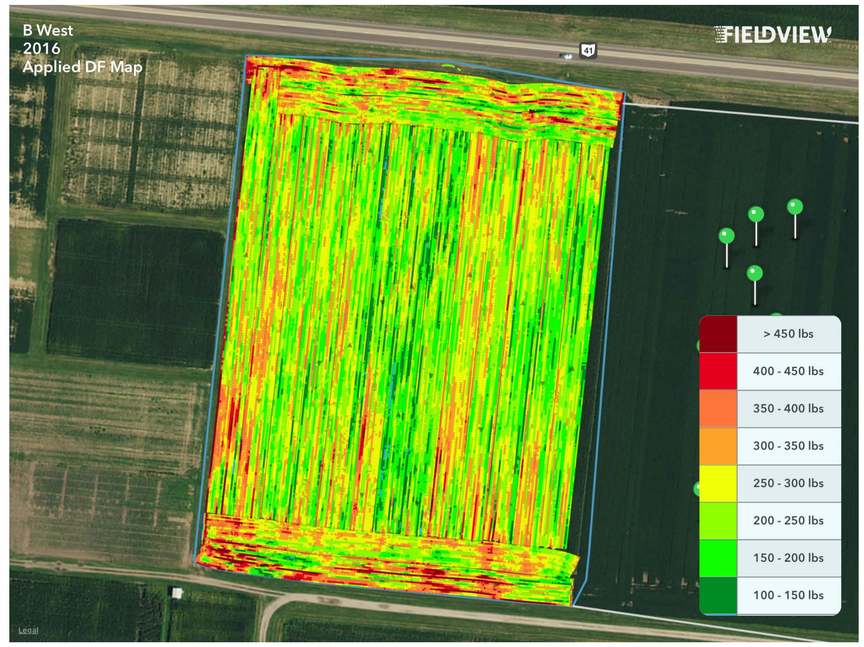
High Speed Results

- Singulation did not vary between speed treatments.
- Seed spacing remained relatively consistent at various grounds speeds but indicated an increasing trend with increase in speed.
- Active downforce needed to maintain proper row-unit contact with soil.

ADVI Bare Soil



Applied Down Force



As-planted Data			Emergence Data	
Ground Speed (mph)	Downforce Margin (lbs.)	Singulation (%)	Seed Spacing (in.)	CV of Spacing
5	93.3	99.4	6.34	28%
7.5	82.9	99.7	6.25	30%
10	78.3	99.9	6.34	32%
12.5	74.2	99.8	6.39	35%

In-season Data & Notes

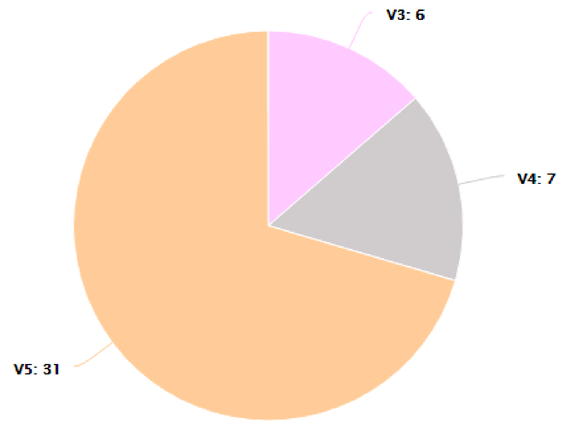
- Live Stand Counts
- Seed spacing
- Growth stage by plant
- Link data to GPS location
- Record notes and take images

Research POGO: Run Summary

Export Data | « Back to Runs

Run Info			
Run Date	June 24, 2016		
Farm Name	WARS	Field Name	Downforce
Row #	4076	Row Spacing	30"
# of Plants Sampled	44		
Population			
Planted Population	31,165.60	Nominal Population	33,793.90
Singulation			
# Multiples	0	# Misplaced (Total)	1
Singulation %	93.33%	# Skips	3
# Misplaced 1	1	# Misplaced 2	0
Spacing			
SRI	41.44	# Good Spacing	42
Good Spacing %	98.00%	Standard Deviation	2.56
Nominal Spacing	6.19		

Emergence Summary



V5	V5	V5	V5	V5	V5	V5	V5	V5	V5	V4	V3	V3	V3	V3	V3
3.96"	8.04"	6.53"	5.36"	6.74"	6.20"	5.75"	4.51"	8.71"	6.23"	7.53"	5.30"	7.72"			
Start	MP1 Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	Good Spacing	

On-Farm Research Tips

- Use replicated strips or blocks to evaluate inputs and practices.
- Backup raw as-planted and yield data.
- Properly calibrate yield monitors.
- Harvest test strips parallel to direction they were laid out.
- In light of identifying man-made variability, consider areas to harvest to evaluate treatment effects.
- Maintain seasonal field notes
  - Take photos of crop development and issues as often as possible
  - As-planted maps
  - Track field conditions, weather events, etc.