

SmartFirmer™

SmartFirmer Operations Guide Gen 2 20/20 Display

Precision Planting®

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Setting up the 20/20 SeedSense Display

Note: Before Installing SmartFirmers: Update 20/20 with 2018 Software found at www.precisionplanting.com.

Assign SmartFirmer as your soil system before proceeding.

Select Setup — Planter — Soil System

Planter Setup				Home
Planter Make	Rows	Spacing		Enter
John Deere	3	40.0 in		
Active Rows	Meter Type	Drive Type	Down Force System	GPS Setup
All	Vac (vSet)	vDrive	Side Springs	
Fertility System	Insecticide System	Soil System	Down Force Sensor Type	
vApplyHD	vDrive Insecticide	SmartFirmer	Smart Pin	
Effective Row Spacing	Effective Planter Width	SRM Row Mapping		Back
40.0 in	10.0 ft	All Rows		

Select SmartFirmer

Planter Setup		Home
Soil System		Enter
None SmartFirmer		↑
		↓
		← Back

Setup Overview

Select Setup — Systems — Display — Dashboard View — Configure Dashboard Buttons.

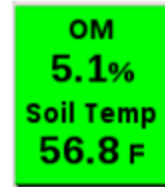
Dashboard Setup					Home
Plant	Systems	Crops	Diagnose	Data	Enter
Step 1: Select a layout.		Step 2: Select a button on the right to change its contents.			
2 x 2	Apply Defaults	Skips 0.3%	Field Acres 4.5	↑	
2 x 4		Vacuum L: 17.1	SRI 19.6		
4 x 2		Good Ride 98%	Loss/ Acre \$5.10		
4 x 4		vDrive No vDrive	DeltaForce Disabled		
					↓
					← Back

Select one of the options to be replaced with SmartFirmer Metrics.

Note: There are six options for SmartFirmer metrics on the 20/20 HomeScreen.

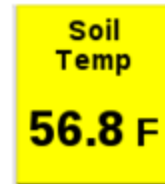
Note: Metrics on the home screen are adjustable. Home —> Setup —> Crops —> Limit Adjustments.

Organic Matter (OM): is the portion of the soil that consists of plant material in various stages of decomposition. The SmartFirmer organic matter measurement includes all of this except the visible crop residue. The reported organic matter values are similar to what is reported in a lab using the "Loss On Ignition" organic matter test. For most fields, reported organic matter will be greater than 0.5% and less than 6%. The value should be fairly stable each second and only change over hundreds of feet.



OM
5.1%
Soil Temp
56.8 F

Soil Temperature (Temp) is the real time temperature at seeding depth.



Soil
Temp
56.8 F

Goal: Above 50 degrees.

Uniform Furrow: Variation in furrow (light, cloddiness, moisture changes).

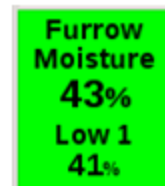


Uniform
Furrow
100%
Low 1
100%

Goal: Above 95%.

Note: Can indicate row unit mechanical problems, tillage patterns, opportunity to use row cleaners, windrowed residue.

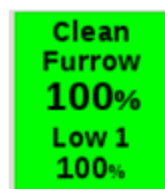
Furrow Moisture: is the percent water weight that a corn seed is projected to absorb in a 3 day time period. A corn seed needs to take up 30% of its weight in moisture to start germination. It is recommended to keep this value above 20% for adequate moisture conditions. Conditions that may result in values lower than 20% could be cloddy conditions, sandy soils, and light knobs. If the SmartFirmer is highlighting dry areas, please stop & dig to ensure seeds are in an environment with moisture.



Furrow
Moisture
43%
Low 1
41%

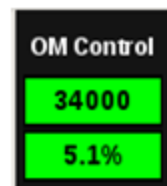
Goal: Above 20%.

Clean Furrow: is a measure of the crop residue in the furrow. A value of 100% represents a perfectly clean furrow, but any value above 90% is considered to be acceptable. Either surface residue dropping into the furrow or incorporated residue will be sensed by SmartFirmer if it passes by the sensor window.



Goal: Above 95%.

Real time control: This feature allows grower to control seeding population, hybrid selection, insecticide rates, and fertilizer application (Liquid) based upon organic matter. Refer to the Real Time Control section for instructions on setup and operations.



Real Time Control:

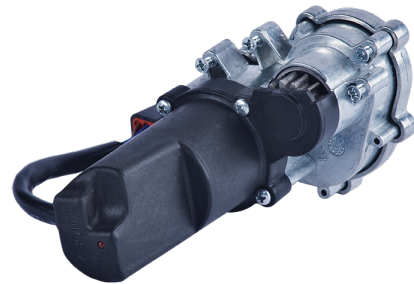
Introduction

A primary contributor to soil productivity is the soil organic matter. Organic matter (OM) is the portion of the soil that consists of plant material in various stages of decomposition.

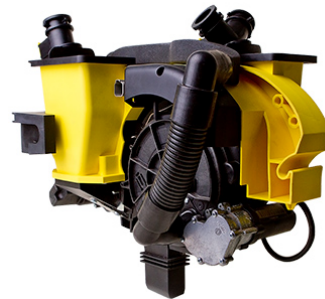
SmartFirmer can control seeding, hybrid selection, insecticide rates, and fertilizer application rates (liquid) based on the real-time organic matter measurements and the corresponding population/hybrid/rate selected by the user.

Note: Products can be enabled or disabled individually: Example- User can use Real Time control to variable rate population (vDrive) and fertilizer rates (vApply) based upon organic matter readings, but use a static rate for insecticide application (vDrive Insecticide).

vDrive: Real Time Control of Population.



vSet Select: Real Time Control of Population and Hybrid.



vApply: Real Time Control of Fertilizer Application Rates.



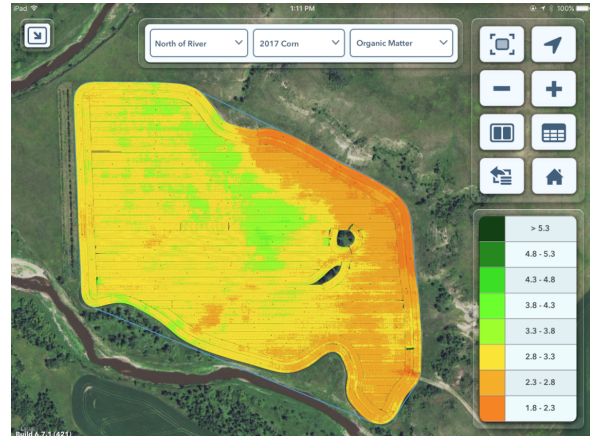
vDrive Insecticide: Real Time Control of Insecticide Application Rate.



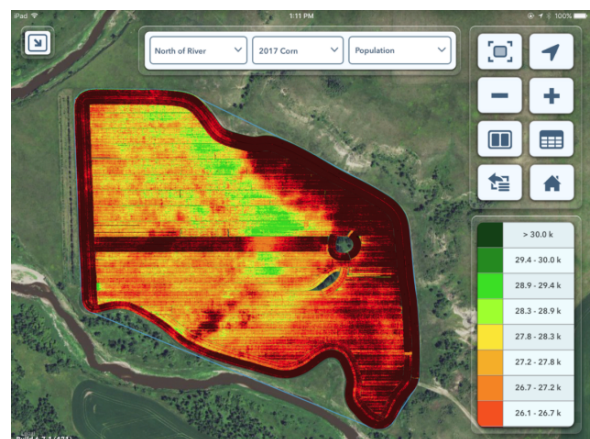
Recommended Procedure

Plant 1 or 2 headland rounds, and a couple planter passes in your field without enabling control to make sure the OM is responding as expected. With Real-Time control from SmartFirmer, it is critical to make sure the SmartFirmer OM readings are in line with your expectations. Select the OM control range based on what you see in these first passes.

Organic Matter Map: Plant headland passes and two planter passes to understand field variability, and OM % ranges before enabling OM Control.



Population Map: Headland Passes and two middle passes are planted at static rate. Using OM% data from SmartFirmer select setpoints to change population, hybrid, nutrient application, & insecticide rate.

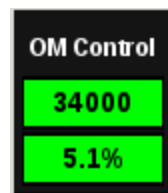


Setting Up Organic Matter Setpoints

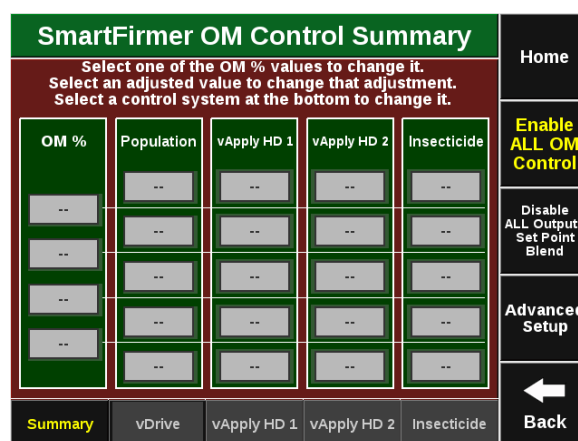
This step is universal and used for all Real Time Control Products.

Note: All referenced populations are examples, consult with your local agronomist before setting up your populations.

Push the dashboard button called “OM Control” on the main screen from the display settings menu. This button is how you will access the SmartFirmer control menu to allow real time control of Population, Hybrid, & Nutrient Application.

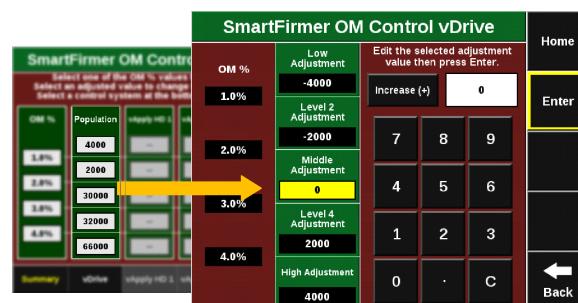


When you press the "OM Control" button, the SmartFirmer Variable Rate Control Screen will appear as shown below. Real-Time control is enabled or disabled by pressing the button on the right of this screen. (Current screen shows OM Control Disabled).



Note: SmartFirmer OM Control Page: Adjust the OM set points according to what the SmartFirmer has reported for the first part of the field, and set the population adjustments to what you are comfortable with. The population adjustments are made to the population that is entered in the normal vDrive control screen. Fill out all the “OM Set Point” boxes and the “Population Adjustment” boxes.

Selecting OM Setpoints: One set of OM% setpoints will be used for all real time control applications. OM Setpoints cannot be changed on a per product basis.



Press OM% this will take you to the OM control setpoint page.

Edit the Setpoints by selecting the Setpoint and adjust using the number pad on the right.

These set points should be set by driving the headlands (1 or 2 passes) and 2 (or more) planter passes. This will give you a range of OM points to set your adjustments to.

Verify Population in Seeding Population correlate to OM% adjustments made on previous screen are correct.

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	Disabled	--	Disabled	Disable ALL Outputs Set Point Blend
2.0%	28000	--	--	--	
3.0%	30000	--	--	--	Advanced Setup
4.0%	32000	--	--	--	
	34000	--	--	--	← Back
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	

Adjust the OM set points according to what the SmartFirmer has reported for the first part of the field, and set the population adjustments to what you are comfortable with. The population adjustments are made to the population that is entered in the normal vDrive control screen. Fill out all the “OM Set Point” boxes and the “Population Adjustment” boxes. In this example, the population would be controlled as follows:

Example: OM% Control for population is enable. The base population is set for 30,000.				
Base Population: 30,000	SmartFirmer OM Control vDrive			Home
Less than 1% OM: Population- 26,000	OM %	Low Adjustment -4000	Edit the selected adjustment value then press Enter. Increase (+) 0	Enter
1-2% OM Population- 28,000	1.0%	Level 2 Adjustment -2000	7 8 9	
2-3% OM Population- 30,000	2.0%	Middle Adjustment 0	4 5 6	
3-4% OM Population- 32,000	3.0%	Level 4 Adjustment 2000	1 2 3	
Great than 4% OM Population 34,000	4.0%	High Adjustment 4000	0 . C	← Back

Below 1% OM, reduce population by 4,000 seeds from base population to a total of 26,000 seeds per acre.

From 1 — 2% OM, reduce population by 2,000 seeds from the base population to a total of 28,000 seeds per acre.

From 2 — 3% OM, make no adjustment to the base population to a total of 30,000 seeds per acre.

From 3-4% OM, increase population by 2,000 seeds from base population to a total of 32,000 seeds per acre.

Above 4% OM, increase population by 4,000 seeds from base population to a total of 34,000 seeds per acre.

vDrive: Real Time Control

If using prescriptions go to OM Control with prescription section.

Refer to vDrive Setup and Operations manual to ensure proper setup of vDrive prior to attempting SmartFirmer: Real Time Control

Note: All referenced populations are examples, consult with your local agronomist before setting up your populations.

Set the “Base Population” in the vDrive control screen. The Base Population should be approximately in the middle of your planned population range. The SmartFirmer makes adjustments from this Base Population. For example, the grower is planning to plant from 26,000 to 34,000 seeds per acre, so the base population 30,000.

vDrive Control						Home
Population Control		Pop Set Points		Single		Swath Control
Manual		32000		32000		No Swath
+500 Adjust		35000		30000		
30000		0		0		
-500 Adjust		0		0		
Clutch from Left				Clutch from Right		
➡				⬅		
Population						
33.0						
32.0						
31.0						
						Back

Real time OM% control for vDrive.

The population shown (30,000) is the base population set from the vDrive control page. Once adjustments are made these values will mirror the adjustments made.

SmartFirmer OM Control Summary						Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.						
OM %	Population	vApply HD 1	vApply HD 2	Insecticide		
1.0%	30000	--	--	--		
2.0%	30000	--	--	--		
3.0%	30000	--	--	--		
4.0%	30000	--	--	--		
Summary						Back
	vDrive	vApply HD 1	vApply HD 2	Insecticide		

Selecting Population Adjustments- the middle adjustment will be your base population in this example.

Adjustments: These set points will correlate to the related OM%. Adjust population set points off of the Base population selected in vDrive control. Do not enter the wanted population; instead enter the deviation from the population base point.

SmartFirmer OM Control vDrive				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		
1.0%	-4000	Increase (+) 0		Enter
2.0%	Level 2 Adjustment			
	-2000			
3.0%	Middle Adjustment			
	0			
4.0%	Level 4 Adjustment			
	2000			
	High Adjustment			
	4000			
				Back

vSet Select: Real Time Control

If using prescriptions please go to OM Control With Prescription section.

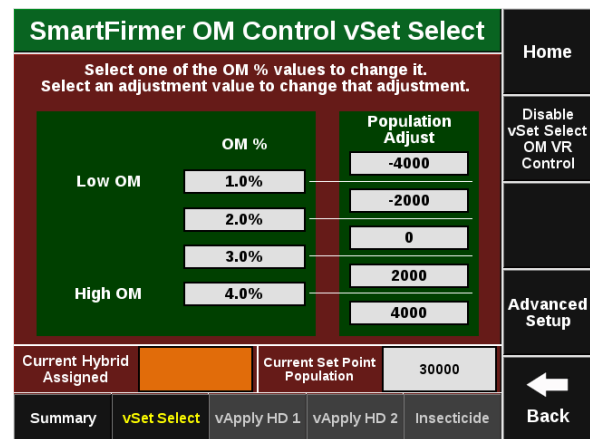
Note: Refer to vSet Select Setup and Operations manual to ensure proper setup of vSet Select prior to attempting SmartFirmer: Real Time Control

Note: All referenced populations are examples, consult with your local agronomist before setting up your populations.

Selecting OM Setpoints. Press OM% this will take you to the OM control setpoint page.

Edit the Setpoints by selecting the Setpoint and adjust using the number pad on the right.

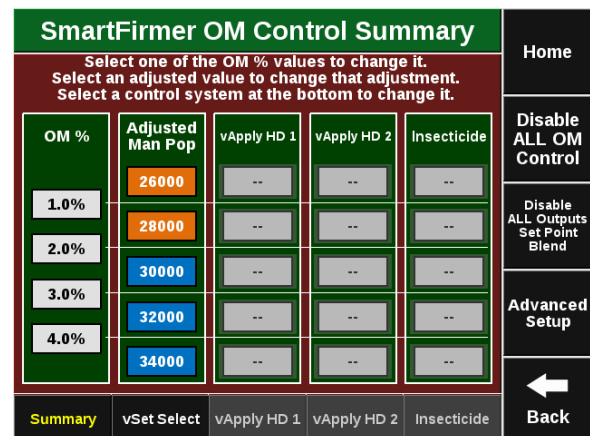
These set points should be set by driving the headlands (1 or 2 passes) and 2 (or more) planter passes. This will give you a range of OM points to set your adjustments to.



The screen displays the 'SmartFirmer OM Control vSet Select' interface. It prompts the user to 'Select one of the OM % values to change it. Select an adjustment value to change that adjustment.' The interface shows two columns: 'OM %' and 'Population Adjust'. The 'OM %' column has 'Low OM' (1.0%, 2.0%, 3.0%) and 'High OM' (4.0%). The 'Population Adjust' column shows values: -4000, -2000, 0, 2000, 4000. Below these, 'Current Hybrid Assigned' is blank and 'Current Set Point Population' is 30000. At the bottom, there are buttons for Summary, vSet Select, vApply HD 1, vApply HD 2, Insecticide, and a Back button.

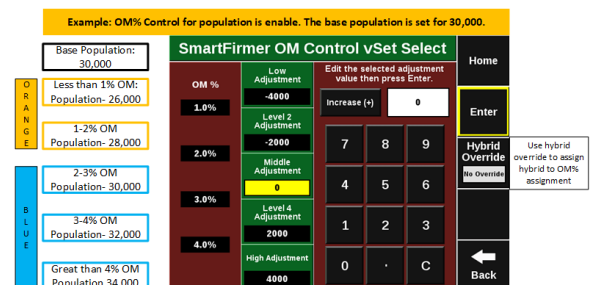
Selecting Population & Hybrid Adjustments (Hybrid can be assigned or left to default tank).

Adjustments: These set points will correlate to the related OM%. Adjust population set points off of the Base population selected in vSet Select control. Do not enter the wanted population; instead enter the deviation from the population base point.



The screen displays the 'SmartFirmer OM Control Summary' interface. It prompts the user to 'Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.' The interface shows a table with columns: OM %, Adjusted Man Pop, vApply HD 1, vApply HD 2, and Insecticide. The 'OM %' column has 1.0%, 2.0%, 3.0%, and 4.0%. The 'Adjusted Man Pop' column shows values: 26000, 28000, 30000, 32000, 34000. Below the table, there are buttons for Summary, vSet Select, vApply HD 1, vApply HD 2, Insecticide, and a Back button.

Adjust the OM set points according to what the SmartFirmer has reported for the first part of the field, and set the population adjustments to what you are comfortable with. The population adjustments are made to the population/hybrid that is entered in the normal vSet Select control screen. Fill out all the “OM Set Point” boxes and the “Population Adjustment” boxes. Use the Hybrid Override to assign hybrids to OM% assignment & population.



The screen displays the 'SmartFirmer OM Control vSet Select' interface with example data. It prompts the user to 'Select one of the OM % values to change it. Select an adjustment value to change that adjustment. Select a control system at the bottom to change it.' The interface shows a table with columns: OM %, Low Adjustment, Level 2 Adjustment, Middle Adjustment, Level 4 Adjustment, High Adjustment, and a numeric keypad. The 'OM %' column has 1.0%, 2.0%, 3.0%, and 4.0%. The 'Low Adjustment' column shows values: -4000, -2000, 0, 2000, 4000. The 'Level 2 Adjustment' column shows values: -4000, -2000, 0, 2000, 4000. The 'Middle Adjustment' column shows values: -4000, -2000, 0, 2000, 4000. The 'Level 4 Adjustment' column shows values: -4000, -2000, 0, 2000, 4000. The 'High Adjustment' column shows values: -4000, -2000, 0, 2000, 4000. Below the table, there are buttons for Summary, vSet Select, vApply HD 1, vApply HD 2, Insecticide, and a Back button.

In this example, the population would be controlled as follows:

Below 1% OM, reduce population by 4,000 seeds from base population to a total of 26,000 seeds per acre using hybrid from orange tank.

SmartFirmer OM Control vSet Select				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		
1.0%	-4000	Decrease (-)	4000	Enter
2.0%	Level 2 Adjustment	7	8	9
	-2000	4	5	6
3.0%	Middle Adjustment	1	2	3
	0	0	.	C
4.0%	Level 4 Adjustment			Back
	2000			
	High Adjustment			
	4000			

From 1 — 2% OM, reduce population by 2,000 seeds from base population to a total of 28,000 seeds per acre using hybrid from orange tank.

SmartFirmer OM Control vSet Select				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		
1.0%	-4000	Decrease (-)	2000	Enter
2.0%	Level 2 Adjustment	7	8	9
	-2000	4	5	6
3.0%	Middle Adjustment	1	2	3
	0	0	.	C
4.0%	Level 4 Adjustment			Back
	2000			
	High Adjustment			
	4000			

From 2 — 3% OM, make no adjustment to the base population of 30,000 seeds per acre using hybrid from orange tank.

SmartFirmer OM Control vSet Select				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		
1.0%	-4000	Increase (+)	0	Enter
2.0%	Level 2 Adjustment	7	8	9
	-2000	4	5	6
3.0%	Middle Adjustment	1	2	3
	0	0	.	C
4.0%	Level 4 Adjustment			Back
	2000			
	High Adjustment			
	4000			

From 3 — 4% OM, increase population by 2,000 seeds from base population to a total of 32,000 seeds per acre using hybrid from blue tank.

SmartFirmer OM Control vSet Select				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		
1.0%	-4000	Increase (+)	2000	Enter
2.0%	Level 2 Adjustment	7	8	9
	-2000	4	5	6
3.0%	Middle Adjustment	1	2	3
	0	0	.	C
4.0%	Level 4 Adjustment			Back
	2000			
	High Adjustment			
	4000			

Above 4% OM, increase population by 4,000 seeds from base population to a total of 34,000 seeds per acre using hybrid from blue tank.

SmartFirmer OM Control vSet Select				Home
OM %	Low Adjustment	-4000		Edit the selected adjustment value then press Enter. Increase (+) 4000 Enter
	Level 2 Adjustment	-2000		
	Middle Adjustment	0		
	Level 4 Adjustment	2000		
	High Adjustment	4000		
	4.0%			
1.0%				Hybrid Override Blue/Front Back
2.0%				
3.0%				
4.0%				

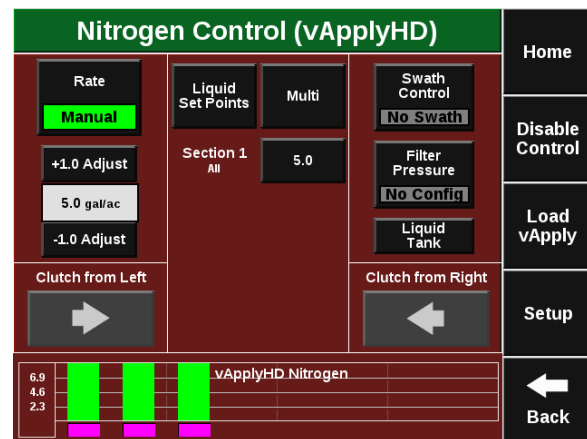
vApplyHD: Real Time Control

If using prescriptions please go to OM Control With Prescription section.

Refer to vApplyHD Setup and Operations manual to ensure proper setup of vApplyHD prior to attempting SmartFirmer: Real Time Control

Note: All referenced setpoints are examples, consult with your local agronomist before setting up your populations.

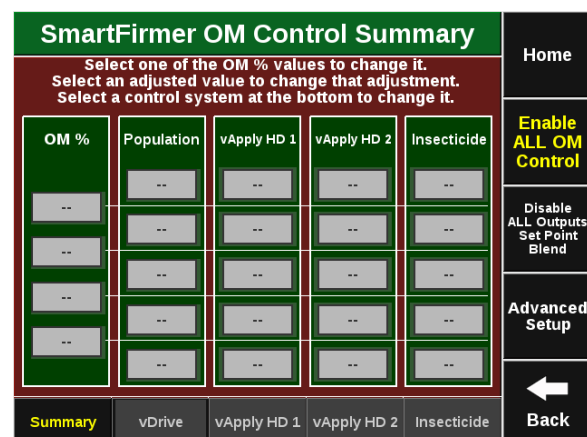
Set the “Liquid Set Points” in the vApply HD control screen (Home Page). The SmartFirmer makes adjustments from this base rate. For example, the grower is planning to plant from 2 to 8 gallons per acre, so he made the base rate 5.



Put the dashboard button called “OM Control” on the main screen from the display settings menu. This button is how you will access the SmartFirmer control menu to allow real time control of Population, Hybrid, & Nutrient Application.



When you press the “OM Control” button, the SmartFirmer Variable Rate Control Screen will appear as shown below. Real-Time control is enabled or disabled by pressing the button on the right of this screen. (Current screen shows OM Control Disabled).



Note: SmartFirmer OM Control Page: Adjust the OM Set Points according to what the SmartFirmer has reported for the first part of the field, and set the population adjustments to what you are comfortable with. The application adjustments are made to the Base Gallons per Acre that is entered in the vApply control screen. Fill out all the “OM Set Point” boxes and the “Rate Adjustment” boxes.

Real time OM% control for vApply HD:

At the bottom of this page press: **vApplyHD 1**

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control Disable ALL Outputs Set Point Blend Advanced Setup ← Back
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	Disabled	--	Disabled	
2.0%	28000	--	--	--	
3.0%	30000	--	--	--	
4.0%	32000	--	--	--	
	34000	--	--	--	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	

Note: This process is applicable for more than one vApplyHD module. If two modules are installed, use the same process for real time control of the second vApplyHD 2.

Selecting OM Setpoints

Press OM% this will take you to the OM control setpoint page. The rate will show you base rate selected from the vApplyHD control page.

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control Disable ALL Outputs Set Point Blend Advanced Setup ← Back
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	5.0	--	Disabled	
2.0%	28000	5.0	--	--	
3.0%	30000	5.0	--	--	
4.0%	32000	5.0	--	--	
	34000	5.0	--	--	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	

Edit OM Control Setpoints: Select the Setpoint and adjust using the number pad on the right.

If previous Organic Matter data points are not available for your field, set points should be set by driving the headlands (1 or 2 passes) and 2 (or more) planter passes. This will give you a range of OM points to set your adjustments to.

Selecting Rate Adjustments- If no OM% adjustments are wanted for base rate leave the middle rate adjustment at 0.

SmartFirmer OM Control vApplyHD 1			Home	
Select one of the OM % values to change it. Select an adjustment value to change that adjustment.			Enable vApplyHD 1 OM VR Control Advanced Setup ← Back	
Low OM	OM %	Rate Adjust		
	1.0%	0.0		
	2.0%	0.0		
	3.0%	0.0		
High OM	4.0%	0.0		
		0.0		
Current Tank Mix		Current Set Point Application Rate	5.0	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide

Rate Adjustments: These set points will correlate to the related OM% displayed to the left.

Use Rate Adjust set points off of the Base rate selected in vApplyHD control.

Note: Do not enter the wanted rate; instead enter the deviation from the base rate +/-.

SmartFirmer OM Control vApplyHD 1				Home
OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		Enter
	3.0	Decrease (-)	3	
	Level 2 Adjustment			
	1.5			
	Middle Adjustment			
2.0%	0.0			
3.0%	Level 4 Adjustment			
	-1.5			
4.0%	High Adjustment			
	0.0			Back

Example: OM% Control for vApply is enable. The base rate is set for 5 Gallons per acre.

SmartFirmer OM Control vApplyHD 1				Home	
Base Rate: 5 Gallons Per Acre	OM %	Low Adjustment	Edit the selected adjustment value then press Enter.		Enter
Less than 1% OM: Rate- 8 Gal/Ac		3.0	Decrease (-)	3	
1-2% OM Rate- 6.5 Gal/Ac		Level 2 Adjustment			
2-3% OM Rate- 5 Gal/Ac		1.5			
3-4% OM Rate- 3.5 Gal/Ac		Middle Adjustment			
Great than 4% OM Rate- 2 Gal/Ac	3.0%	0.0			
	4.0%	Level 4 Adjustment			
		-1.5			
		High Adjustment			
		0.0			Back

vApplyHd 1/2 Summary

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	8.0	--	Disabled	
2.0%	28000	6.5	--	--	
3.0%	30000	5.0	--	--	
4.0%	32000	3.5	--	--	Advanced Setup
	34000	2.0	--	--	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	Back

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	8.0	11.0	-3.00	
2.0%	28000	6.5	9.5	-2.00	
3.0%	30000	5.0	8.0	0.00	
4.0%	32000	3.5	6.5	1.00	Advanced Setup
	34000	2.0	5.0	2.00	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	Back

vDrive Insecticide: Real Time Control

vDrive Insecticide: Real Time Control

Refer to vDrive Insecticide Setup and Operations Manual to ensure proper setup of vDrive Insecticide prior to attempting SmartFirmer: Real Time Control.

Note: All referenced setpoints are examples, consult with your local agronomist before setting up your populations.

Set the “Base Rate” in the vDrive Insecticide control screen (Home Page). The SmartFirmer makes adjustments from this Base rate. For example, the grower is planning to plant from 2 to 8 lbs per acre, so he made the base rate 5.

vDrive Insecticide Control				Home
Enabled	Set Points	Single	Row Rate Adjustment	
Adjust +0.1	5.00	5.50		
4.50 lbs/ac	4.50	0.00		
Adjust -0.1	0.00	0.00		
	0.00	0.00		Setup
Current rate of 4.50 lbs per ac is equivalent to 4.13 oz per 1000 ft				Back

Push the dashboard button called “OM Control” on the main screen from the display settings menu. This button is how you will access the SmartFirmer control menu to allow real time control of Population, Hybrid, Nutrient Application, & Insecticide.

OM Control
34000
5.1%

Real time OM% control for vDrive Insecticide

At the bottom of this page press:

Insecticide

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	Disabled	--	Disabled	Disable ALL OM Control
2.0%	28000	--	--	--	Disable ALL Outputs Set Point Blend
3.0%	30000	--	--	--	
4.0%	32000	--	--	--	Advanced Setup
	34000	--	--	--	
Summary	vDrive	vApplyHD 1	vApplyHD 2	Insecticide	Back

Selecting OM Setpoints: Press Insecticide

Press OM% this will take you to the OM control setpoint page. The rate will show you base rate selected from the Insecticide control page.

Edit OM Control Setpoints: Select the Setpoint and adjust using the number pad on the right.

If previous Organic Matter data points are not available for your field, set points should be set by driving the headlands (1 or 2 passes) and 2 (or more) planter passes. This will give you a range of OM points to set your adjustments to.

Selecting Rate Adjustments- If no OM% adjustments are wanted for base rate leave the middle rate adjustment at 0.

Rate Adjustments: These set points will correlate to the related OM% displayed to the left.

Use Rate Adjust set points off of the Base rate selected in Insecticide control.

Do not enter the wanted rate; instead enter the deviation from the base rate +/-.

vDrive Insecticide Summary

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control Disable ALL Outputs Set Point Blend Advanced Setup Back
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	5.0	--	Disabled	
2.0%	28000	5.0	--	--	
3.0%	30000	5.0	--	--	
4.0%	32000	5.0	--	--	
Summary					vDrive
					vApplyHD 1
					vApplyHD 2
					Insecticide

SmartFirmer OM Control Insecticide			Home
Select one of the OM % values to change it. Select an adjustment value to change that adjustment.			Enable Insecticide OM VR Control Advanced Setup Back
Low OM	OM %	Rate Adjust	
	1.0%	0.00	
	2.0%	0.00	
	3.0%	0.00	
High OM	4.0%	0.00	
Current Product Assigned		Force 3G AMVAC	Current Set Point Application Rate
			0.00
Summary			vDrive
			vApplyHD 1
			vApplyHD 2
			Insecticide

SmartFirmer OM Control Summary					Home
Select one of the OM % values to change it. Select an adjusted value to change that adjustment. Select a control system at the bottom to change it.					Disable ALL OM Control Disable ALL Outputs Set Point Blend Advanced Setup Back
OM %	Seeding Population	vApplyHD 1	vApplyHD 2	Insecticide	
1.0%	26000	11.0	--	-3.00	
2.0%	28000	9.5	--	-2.00	
3.0%	30000	8.0	--	0.00	
4.0%	32000	6.5	--	1.00	
Summary					vDrive
					vApplyHD 1
					vApplyHD 2
					Insecticide

Prescription: Real Time Control

Refer to 20/20 Setup & Operations manual for setting up prescriptions for the 20/20 Seedsense Monitor

Note: This function is useful for prescriptions that capture features that are not influenced by Organic Matter (like a pivot, drainage issues, etc). This feature is not intended to be used on Soil Zone based prescriptions.

Overview: Real Time Control can be used in tandem with prescriptions. For specific setup for compatible Precision Planting products, please use product setup for Real Time Control listed previously.

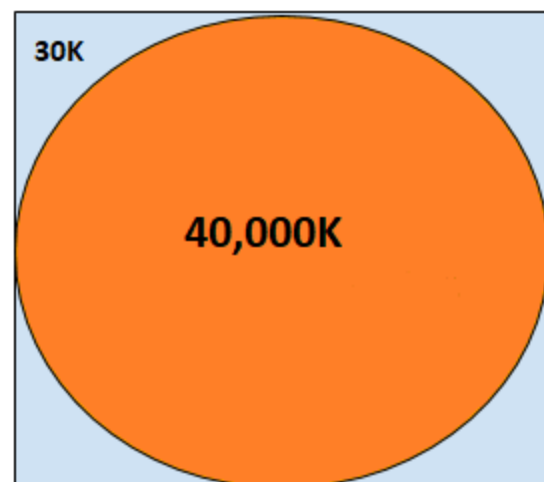
Real time control within prescriptions will function like your prescriptions currently do.

To assign a Seeding Prescription to the selected field, press the “Seeding Prescription” button. This will display ALL shapefiles that have been imported into the display. Choose the appropriate prescription for the field name. After selecting the prescription name, an attribute MUST be selected for each rate section that has been setup for the planter. An attribute is based on a defined product and contains a single defined rate for each management zone and is defined/named during the creation of the prescription. A different attribute can be selected for each rate section (allowing each rate section to be controlled by a different attribute/seeding rate), or the same attribute can be selected for each rate section.

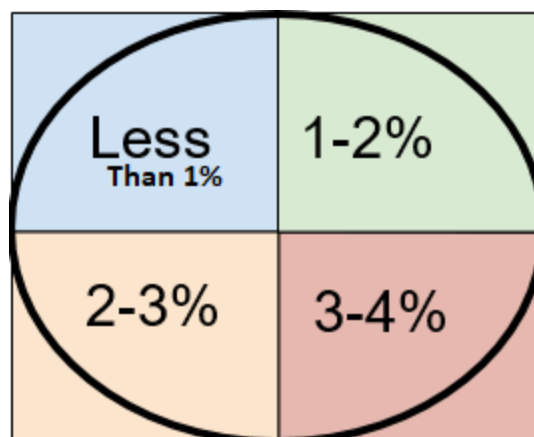
When Real Time Control is enabled inside a prescription adjustments will be made based upon percentage of organic matter being read. This function will act the same as it does when no prescription is assigned. Adjustments will be made to the commanded population, hybrid, &/or rate base assigned in the prescription and adjust based upon organic matter % readings.

Example: Population

Prescription commands a 30,000 base rate for drylands, and 40,000 under the pivot.



Organic Matter readings from Smartfirmer.

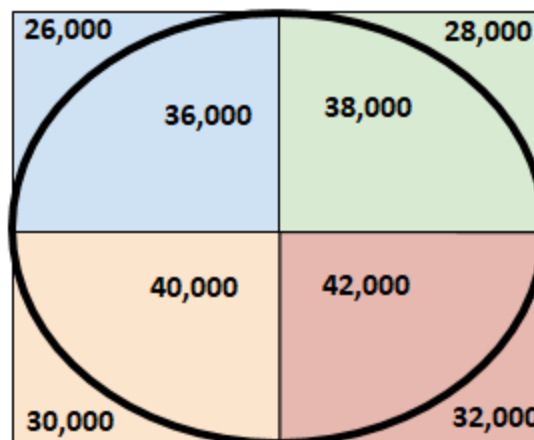


SmartFirmer Adjustments:

Adjustments will be made according to inputs made on the SmartFirmer OM Control Page. The setpoints assigned will make commanded adjustments to the population, hybrid, and/or rate attributes.

This process will be the same for vDrive, vSet Select, vApply, and vDrive insecticide.

Real Time Control commanded population based upon organic matter readings.



Blue	Less than 1% OM	Adjustment —4000	Adjusted Dyland Pop: 26,000	Adjusted Pivot Pop: 36,000
Green	1–2% OM	Adjustment —2000	Adjusted Dyland Pop: 28,000	Adjusted Pivot Pop: 38,000
Orange	2–3% OM	Adjustment 0	Adjusted Dyland Pop: 30,000	Adjusted Pivot Pop: 40,000
Red	3–4% OM	Adjustment +2000	Adjusted Dyland Pop: 32,000	Adjusted Pivot Pop: 42,000

Note: All products use the same principles for Real Time Control within a prescription.

Diagnose Page

For Troubleshooting please see troubleshooting section

There are 4 levels to the SmartFirmer diagnose page. To toggle between screens press the top level. (Example press OM% or Moisture %)-

Note: Refer to the Troubleshooting and Decision Trees in the Dealer service Manual on <https://cloud.precisionplanting.com/pubs/> .

OM Control Product Metrics: Individual row metrics for SmartFirmer's Real Time Control features for:

vDrive/vSet Select

vApplyHD (1 or 2 HD Modules)

vDrive Insecticide

SmartFirmer Level 2 Diagnostic Diagram											Home
Display		SmartFirmer		System Log		show error rows only		display as table			Reset Modules
Row	OM %	Pop Act	Pop Cmd	HD1 Act	HD1 Cmd	HD2 Act	HD2 Cmd	lb/ac Act	lb/ac Cmd		
1	3.2	35997	36000	2.9	3.1	6.9	6.1	6.6	6.3		
2	2.2	30509	30600	4.5	4.6	8.5	8.6	5.4	5.3		
3	2.5	30997	31000	4.8	4.2	8.8	8.2	5.7	5.5		
											Back
Lift State Lowered		Radar Speed Wait Signal		GPS Speed 5.4 mph		Fwd Accel 0.000 ft/s/s		Master Plant On		Turn Rate 0 deg/s	

SmartFirmer Metrics: This page displays metrics from SmartFirmer readings on a per row basis.

SmartFirmer Level 2 Diagnostic Diagram											Home
Display		SmartFirmer		System Log		show error rows only		display as table			Reset Modules
Row	Supply Volts	OM %	Moisture %	Uni Furr %	Cln Furr %	Temp deg F	Custom %				
1	13.09	1.7	19.5	95.5	100.0	56	42.0				
2	12.88	2.5	10.5	99.5	100.0	55	47.0				
4	12.88	1.6	6.0	99.5	100.0	56	43.5				
5	13.09	1.7	19.5	95.5	100.0	56	42.0				
6	13.09	1.7	19.5	95.5	100.0	56	42.0				
7	13.09	1.7	19.5	95.5	100.0	56	42.0				
8	13.09	1.7	19.5	95.5	100.0	56	42.0				
9	13.09	1.7	19.5	95.5	100.0	56	42.0				
10	13.09	1.7	19.5	95.5	100.0	56	42.0				
11	13.09	1.7	19.5	95.5	100.0	56	42.0				
12	13.09	1.7	19.5	95.5	100.0	56	42.0				
											Back
Lift State Lowered		Radar Speed Wait Signal		GPS Speed 5.6 mph		Fwd Accel 0.000 ft/s/s		Master Plant On		Turn Rate 0 deg/s	

Reflectance Percentages: Shows the percentage of light that is reflected back to the sensor for each wavelength.

SmartFirmer Level 2 Diagnostic Diagram											Home
Display		SmartFirmer		System Log		show error rows only		display as table			Reset Modules
Row	Supply Volts	Blue %	Yellow %	IR A %	IR B %	IR C %					
1	13.09	6.8	7.9	8.6	9.9	12.1					
2	12.81	9.0	10.3	10.6	13.9	11.4					
4	12.88	11.8	16.0	21.7	26.2	22.8					
5	13.09	6.8	7.9	8.6	9.9	12.1					
6	13.09	6.8	7.9	8.6	9.9	12.1					
7	13.09	6.8	7.9	8.6	9.9	12.1					
8	13.09	6.8	7.9	8.6	9.9	12.1					
9	13.09	6.8	7.9	8.6	9.9	12.1					
10	13.09	6.8	7.9	8.6	9.9	12.1					
11	13.09	6.8	7.9	8.6	9.9	12.1					
12	13.09	6.8	7.9	8.6	9.9	12.1					
											Back
Lift State Lowered		Radar Speed Wait Signal		GPS Speed 5.7 mph		Fwd Accel 0.000 ft/s/s		Master Plant On		Turn Rate 0 deg/s	

Sensor Voltages: Voltage created in the sensor from the percentage of light that is reflected back to the sensor for each wavelength.

SmartFirmer Level 2 Diagnostic Diagram							Home
Display		SmartFirmer		System Log	show error rows only	display as table	Reset Modules
Row	Supply Volts	Blue V	Yellow V	IR A V	IR B V	IR C V	
1	13.16	0.26	0.18	0.22	0.26	0.17	
2	12.81	0.36	0.33	0.42	0.42	0.30	
4	12.88	0.34	0.27	0.30	0.27	0.29	
5	13.16	0.26	0.18	0.22	0.26	0.17	
6	13.16	0.26	0.18	0.22	0.26	0.17	
7	13.16	0.26	0.18	0.22	0.26	0.17	
8	13.16	0.26	0.18	0.22	0.26	0.17	
9	13.16	0.26	0.18	0.22	0.26	0.17	
10	13.16	0.26	0.18	0.22	0.26	0.17	
11	13.16	0.26	0.18	0.22	0.26	0.17	
12	13.16	0.26	0.18	0.22	0.26	0.17	Back
Lift State	Radar Speed	GPS Speed	Fwd Accel	Master Plant	Turn Rate		
Lowered	Wait Signal	5.6 mph	0.000 ft/s/s	On	0 deg/s		

Interpreting SmartFirmer Data on FieldView Maps

SmartFirmer mapping resolution will vary depending on the metrics being viewed. The more SmartFirmers on a planter, the higher the data resolution. Organic Matter maps will interpolate data in between SmartFirmer rows presenting the data for a full planter. Furrow Moisture, Uniform Furrow, Soil Temperature, and Clean Furrow maps will not interpolate data between SmartFirmers. Readings can vary greatly row by row with these metrics, therefore we do not interpolate data sets to map full planter passes.

Resolution Example

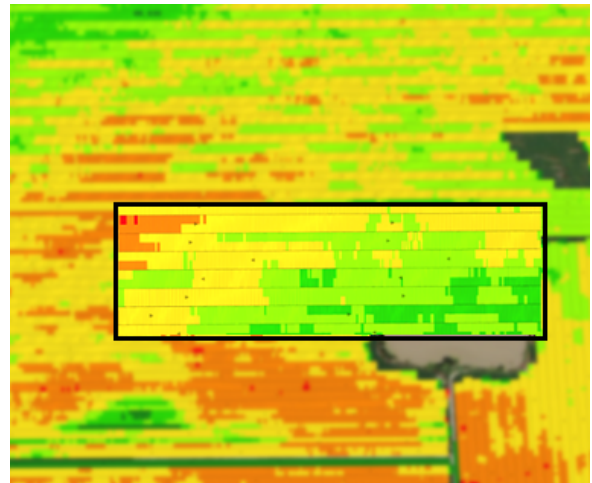
Organic Matter:

Definition: Percentage of Soil Organic Matter

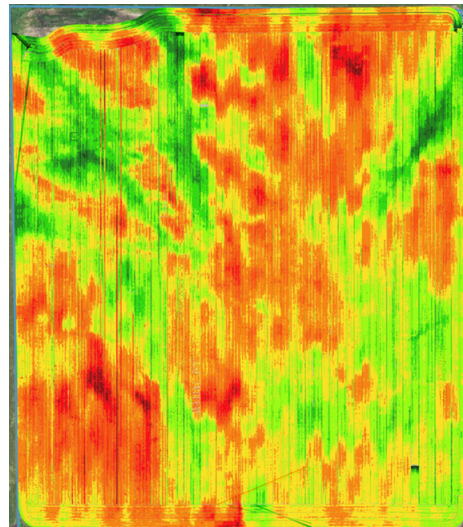
Range 0% — 60%

Note: Excellent spatial zone/variability mapping.

Organic Matter Map: Two SmartFirmers on Planter



Organic Matter Map: SmartFirmers on every row (High Resolution)

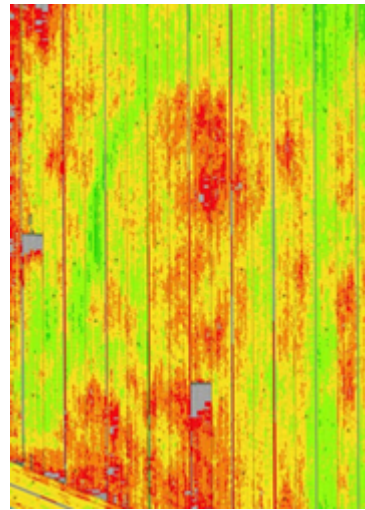


Furrow Moisture:

Definition: 3 day seed weight gain in that moisture.

Range: 0% — 60%

Goal: Above 20%



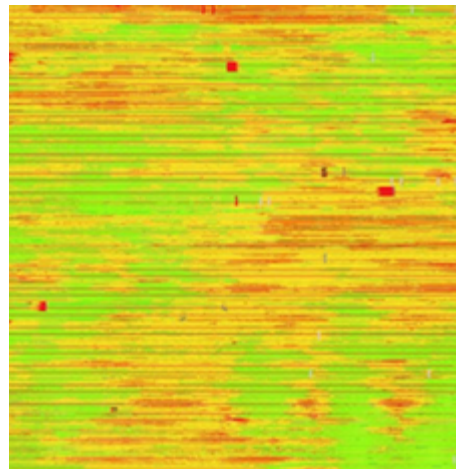
Note: Intended to guide depth decision, also use forecast in decision making (Rain or drought).

Uniform Furrow:

Definition: Variation in furrow (light, cloddiness, moisture changes).

Range: 0% — 100%

Goal: Above 95%



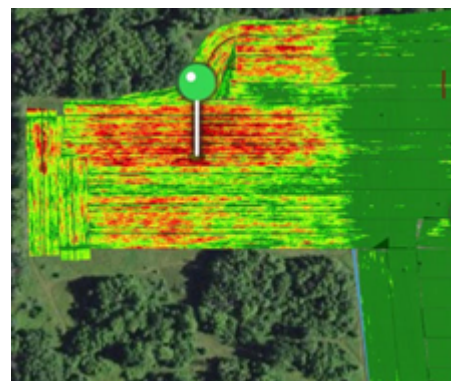
Note: Can indicate row unit mechanical problems, variation due to tillage patterns, windrowed residue.

Clean Furrow:

Definition: Absence of crop residue.

Range: 0 — 100%

Goal: above 95%



Note: Use information to set CleanSweep, also may help in management decisions for tillage and harvest.

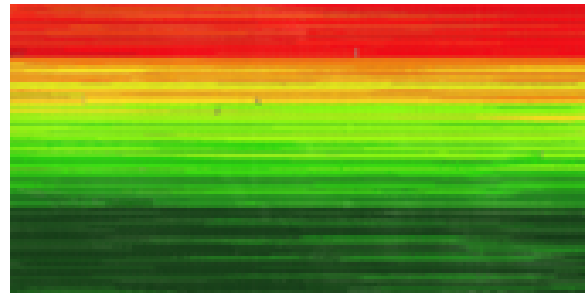
Temperature:

Definition: Real time soil temperature during planting.

Range: 32 – 100F

Goal: above 50F

Note: Use best judgement and look at upcoming weather forecast.

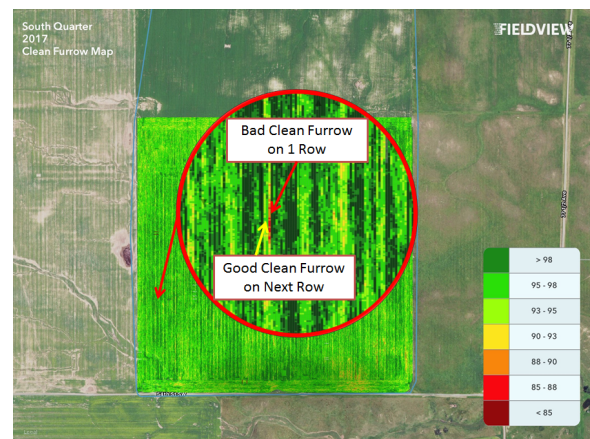
**Mechanical Issue Detection With SmartFirmer**

SmartFirmer readings can detect issues that are caused by mechanical failures on the row unit. Anytime readings vary dramatically between rows (Specifically neighboring rows), it is advised to stop and visually inspect the row for mechanical faults. The following maps are examples of mechanical failures detected in SmartFirmer readings.

Metric: Clean Furrow

Symptom: Poor clean furrow reading on single row, when neighboring rows were reading clean furrow.

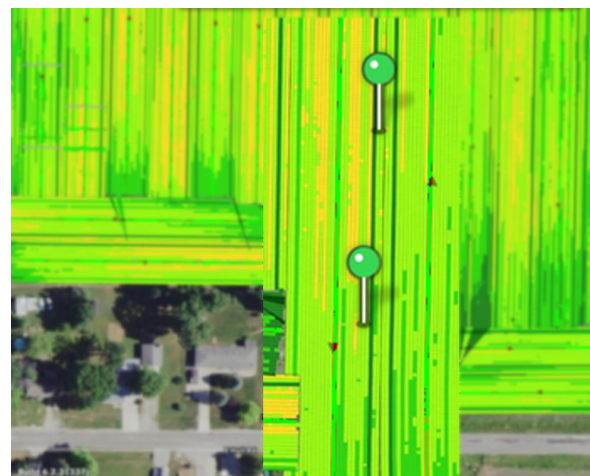
Mechanical Issue: stuck row cleaner causing row cleaner to plow.



Metric: Uniform Furrow

Symptom: Single row (row 3) reading higher uniform furrow than neighboring rows.

Mechanical Issue: Siezed opening discs plowing deeper than intended planting depth.



TroubleShooting

Note: Refer to the Troubleshooting and Decision Trees in the Dealer service Manual on <https://cloud.precisionplanting.com/pubs/>.

SmartFirmer diagnostics should begin by comparing readings to neighboring rows.

If user has 4 SmartFirmers on planter, and 3 out of 4 are showing similar readings, the 1 that is reading differently needs to be under investigation for deviated readings.

Thought Process for Diagnosing Issues

1. Does ground truth match SmartFirmer readings?

a. Dig in furrow to verify SmartFirmer readings are accurate. If SmartFirmer readings show lack of moisture, ensure planting depth is adequate to reach moisture line.

2. Is the issue found in the SmartFirmer

a. Visually inspect SmartFirmer for damage or obstruction to lens.

i. Soil buildup

ii. Inspect harness for damage

iii. Condensation inside lens

iv. Scratched lens.

3. Is the issue mechanical on planter

a. SmartFirmer can detect mechanical issues on a row unit. Inspect row unit for mechanical failures. Mechanical failures can be but are not limited to. Seized opening discs, plugged row cleaners, improperly shimmed gauge wheels/opening discs, worn opening discs. Etc.

4. Can the issue be fixed now?

a. Different metrics will alert user of various field conditions. If Furrow Moisture shows lack of available moisture, user may need to adjust depth to ensure moisture is adequate for germination. If Clean Furrow percentage drops, row cleaners may need to be used more aggressively.

5. What operationally could of caused the issue.

a. There are a wide array of situations that can affect SmartFirmer readings; i.e. Tillage, weather, residue management, combine mechanical components. Understanding how these factors correlate with one another can assist on making management decision in the current season or the following growing season.

Event Codes

Event Log Text	Pop Up Text	Action
SmartFirmer Not Detected	Lost Communication with SmartFirmer on row #____. Check connections:	Row # is showing an open input on the SmartFirmer input. This may indicate: damaged harness / connector; circuit failure of the SmartFirmer; or damaged SRM. Verify by plugging recognized SmartFirmer into row showing failure.
SmartFirmer Optics Damaged	SmartFirmer Signal Error Detected on row #____. Inspect for damage on lens and electronics housing:	Row # is showing an abnormal reflectance reading (relative to neighboring rows) for extended time period. Can indicate physical issue on row unit or a problem with one or more LED's, contamination inside of optics assembly, broken lens.
SmartFirmer Lens Blocked	SmartFirmer Lens Blockage detected on row #____.	Inspect SmartFirmer lens for build up, if lens is obstructed clean lens.
SmartFirmer Erratic Reading	Erratic SmartFirmer Readings on row #____ :	Inspect Row unit for potential ride issues and SmartFirmer for damage.