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Spray Technology and Application Considerations for Site-Specific Plant Growth and Weed Management

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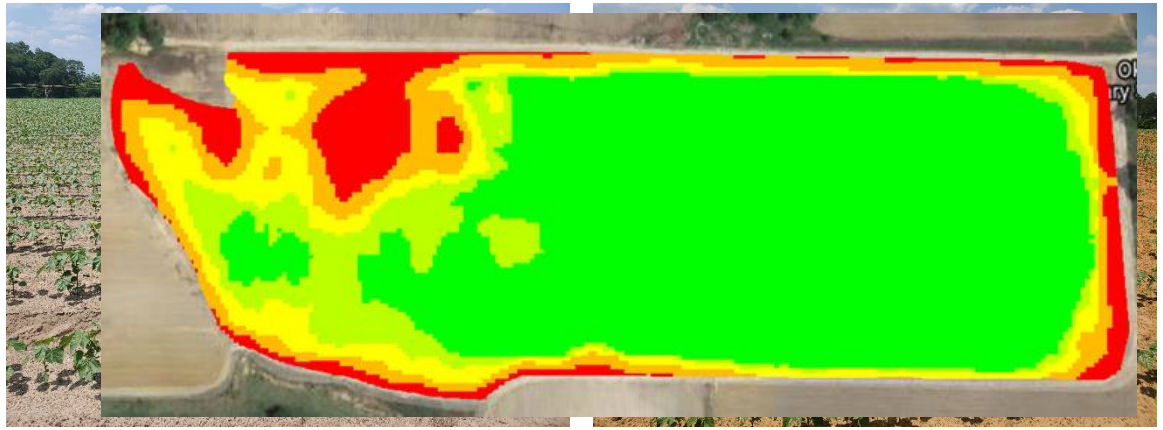
Site Specific PGR and Weed Management

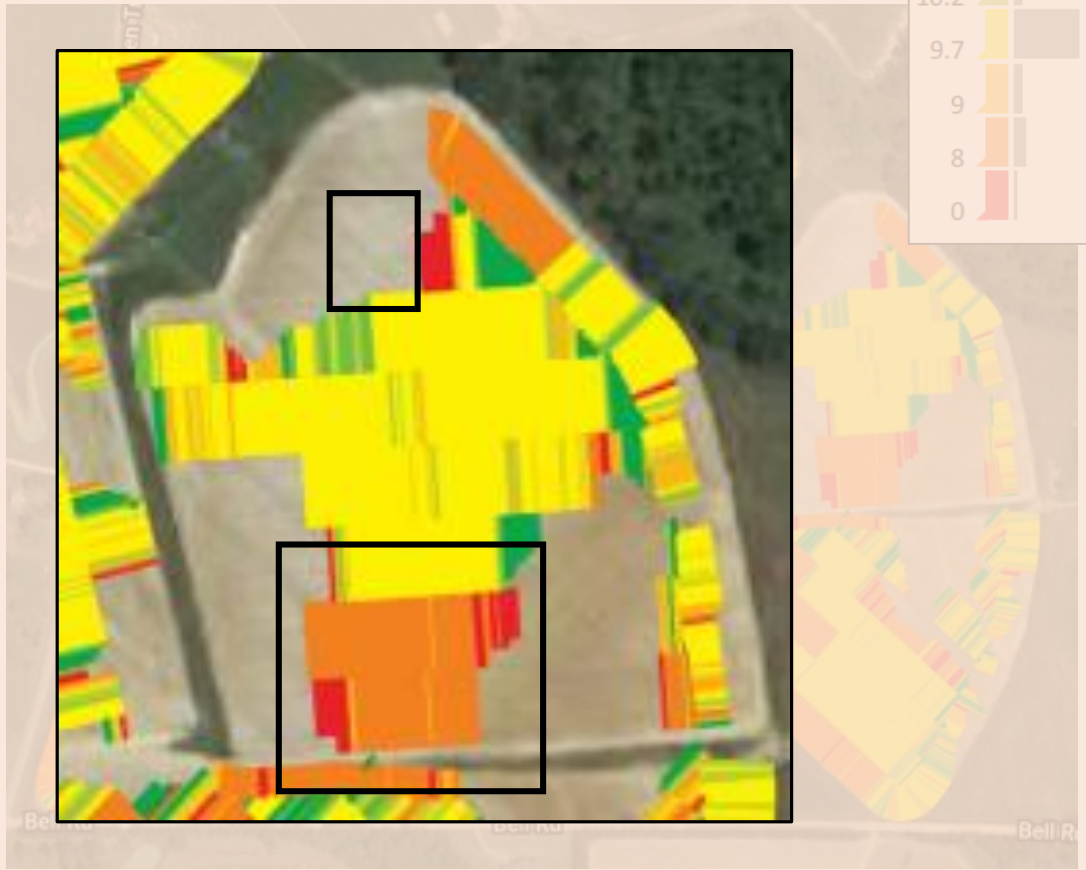
- Plant growth variability within cotton fields is common because of spatial variability in soil and/or crop features.
- Site-Specific (spot apply/VR) PGR applications is gaining interest to manage plant growth variability across the field.
- Pesticide application technology for site specific management is also advancing for efficient and judicious use of pesticides.



Site-Specific Plant Growth Management

How effective and accurately are target rates being applied and rate transitions occurring?

Zone delineation from in-season aerial imagery



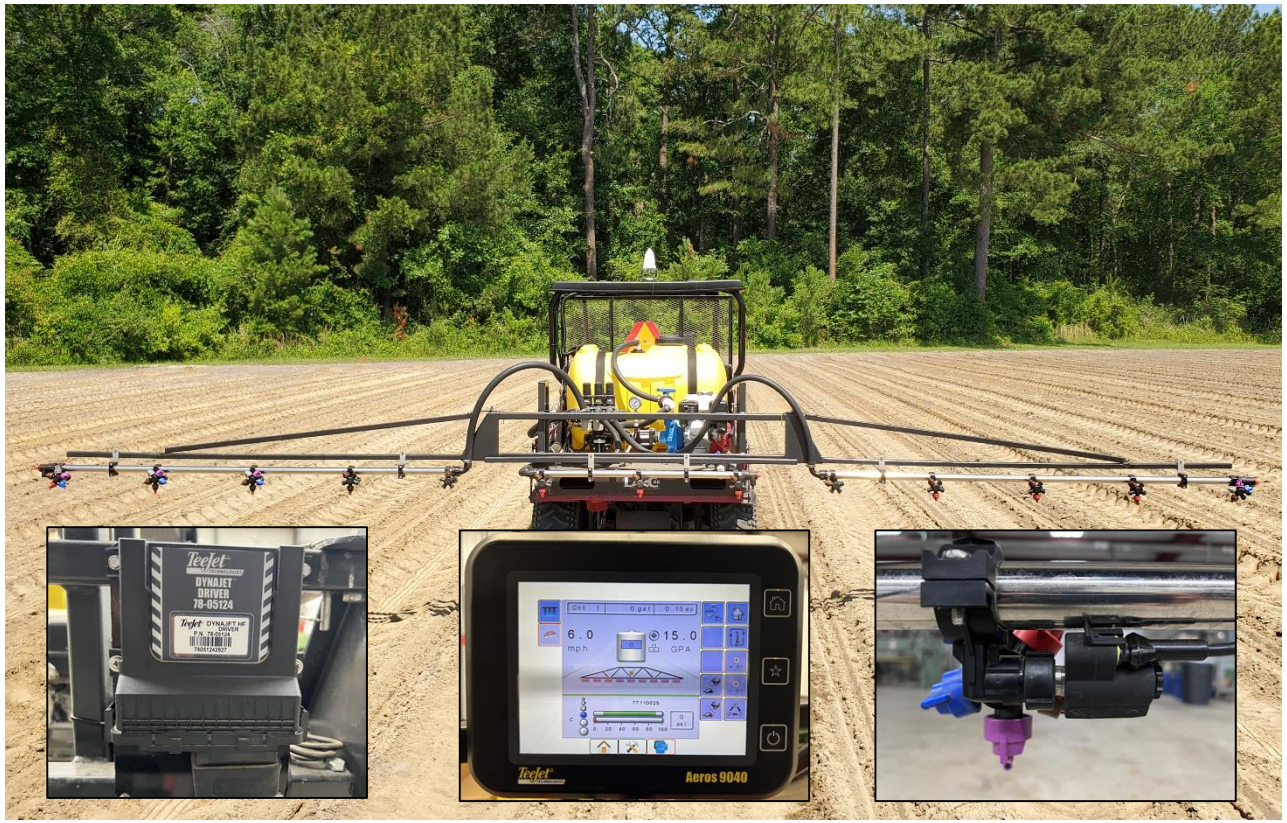
As-applied PGR Map

Research Questions

- How fast the sprayer is able to achieve the target rate during site-specific applications? (e.g. 0FF ---- 10 GPA)
- How long it takes for rate transitions to occur during variable-rate applications? (e.g. 10.0 to 12.5 GPA)
- Does rate transitions affect actual applied rate and efficacy of the product being applied?

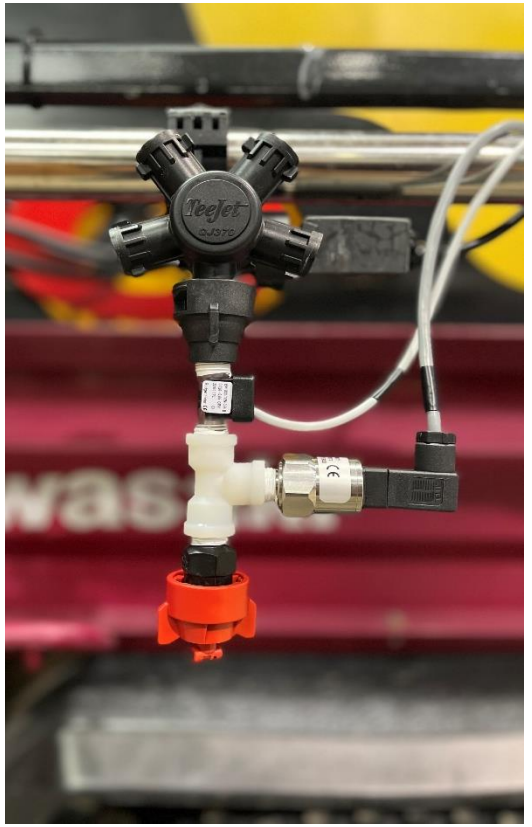
Sprayer and Instrumentation

Sprayer Setup and Technology

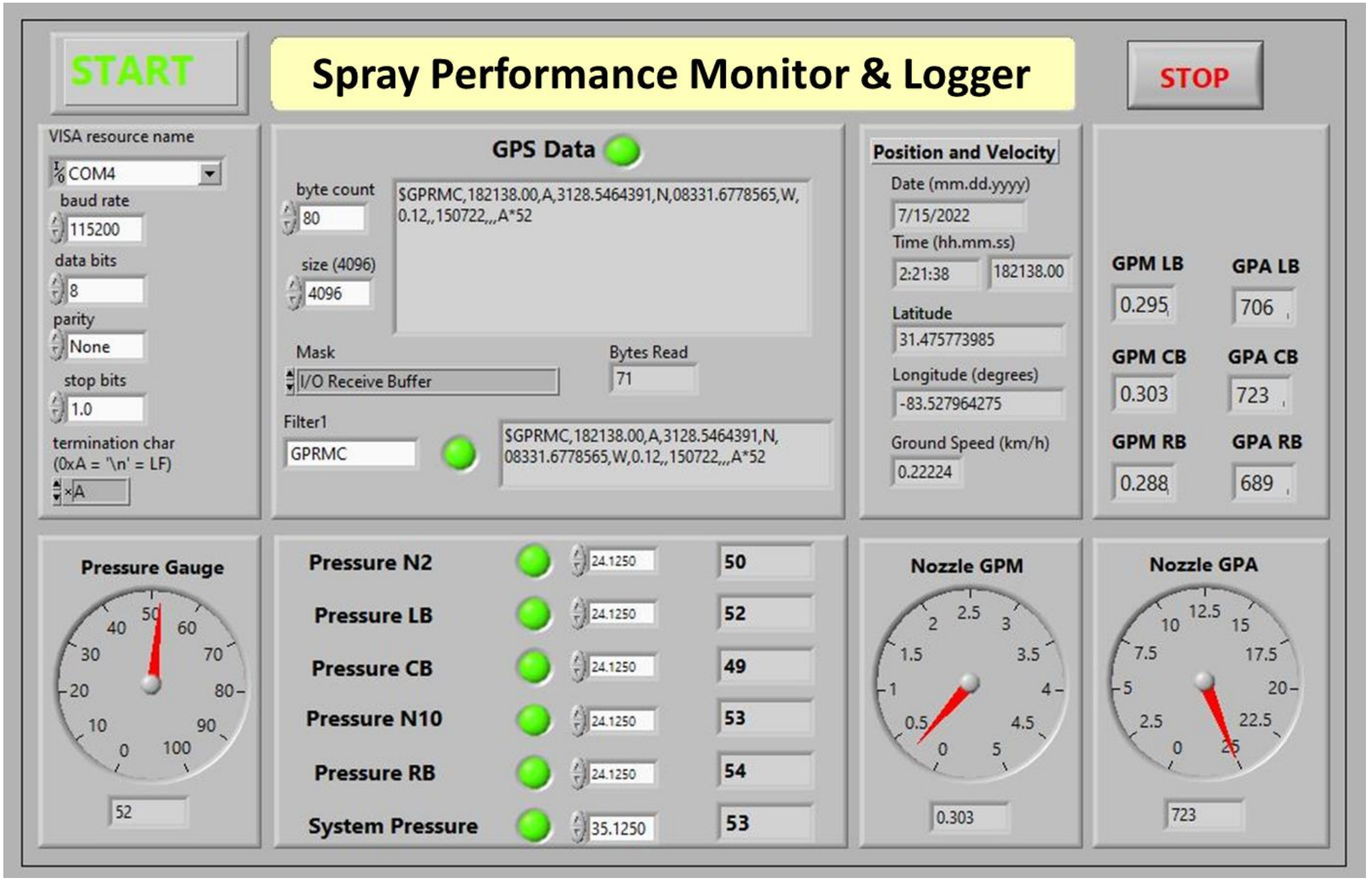


- Boom Length = 18 ft (representing one boom section)
- Rate Controller w/ AEROS 9040 (VR Applications)
- Individual Nozzle Control

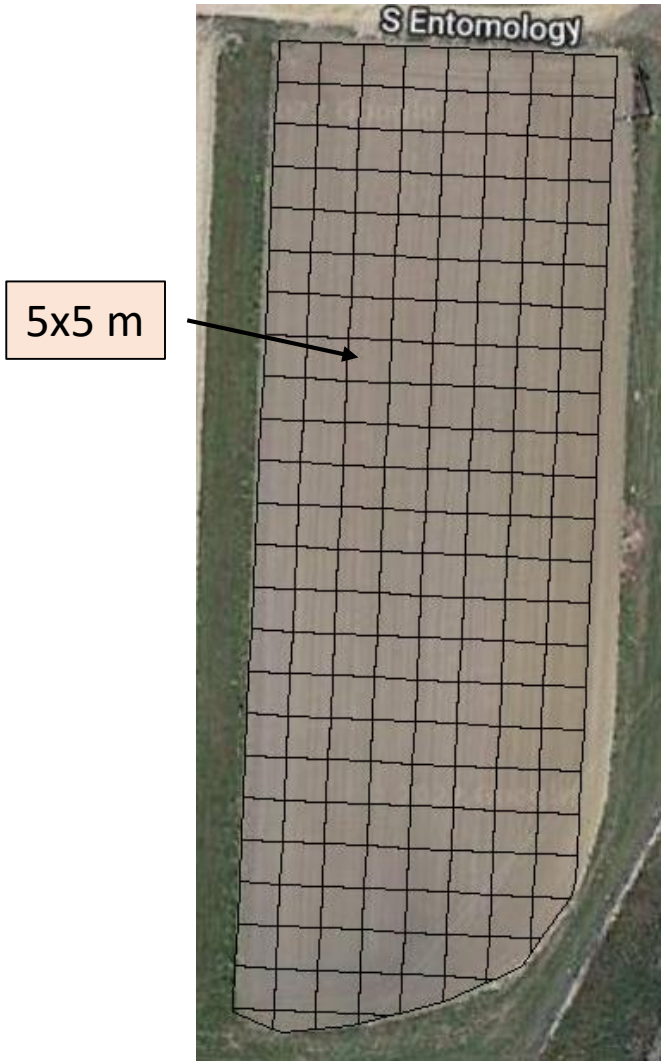
Sensors and Instrumentation



- System flow meter and pressure sensor
- High-res. flow meter and pressure sensor (nozzle)
- RTK GPS/GNSS receiver to geotag all spray data


START
Spray Performance Monitor & Logger
STOP
VISA resource name
COM4
baud rate
115200
data bits
8
parity
None
stop bits
1.0
termination char
(0xA = '\n' = LF)
×A
GPS Data
byte count
80
size (4096)
4096
SGPRMC,182138.00,A,3128.5464391,N,08331.6778565,W,
0.12,,150722,,,A*52
Mask
I/O Receive Buffer
Bytes Read
71
Filter1
GPRMC
SGPRMC,182138.00,A,3128.5464391,N,
08331.6778565,W,0.12,,150722,,,A*52
Position and Velocity
Date (mm.dd.yyyy)
7/15/2022
Time (hh.mm.ss)
2:21:38
182138.00
Latitude
31.475773985
Longitude (degrees)
-83.527964275
Ground Speed (km/h)
0.22224
GPM LB
0.295
GPA LB
706
GPM CB
0.303
GPA CB
723
GPM RB
0.288
GPA RB
689
Pressure Gauge
52
Pressure N2
24.1250
50
Pressure LB
24.1250
52
Pressure CB
24.1250
49
Pressure N10
24.1250
53
Pressure RB
24.1250
54
System Pressure
35.1250
53
Nozzle GPM
0.303
Nozzle GPA
723

Single Rate Application (ON/OFF)



<u>Site-Specific Prescription Map</u>: (ON/OFF)

Five Application Lengths:

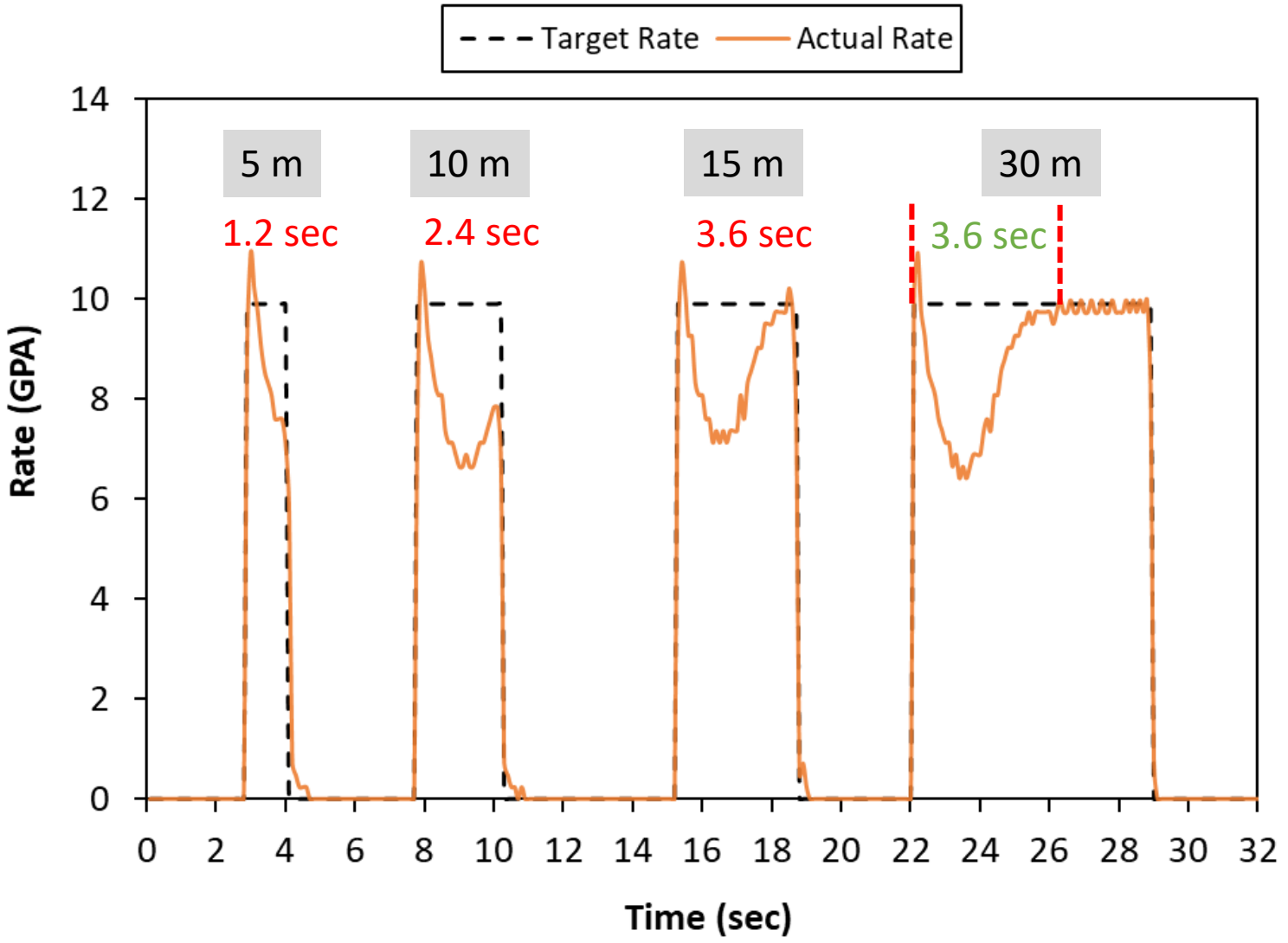
- 16 ft (5 m)
- 33 ft (10 m)
- 49 ft (15 m)
- 66 ft (20 m)
- 98 ft (30 m)

Each length replicated five times and randomized in the field.

Three maps with different target rates:

- 10, 12.5 & 15.0 GPA

Sprayer Response Time



10 GPA, 10 mph

App. Length (ft)	Time (sec)
16	NA
33	NA
49	3.6
66	3.6
98	3.6

*NA = rate not achieved

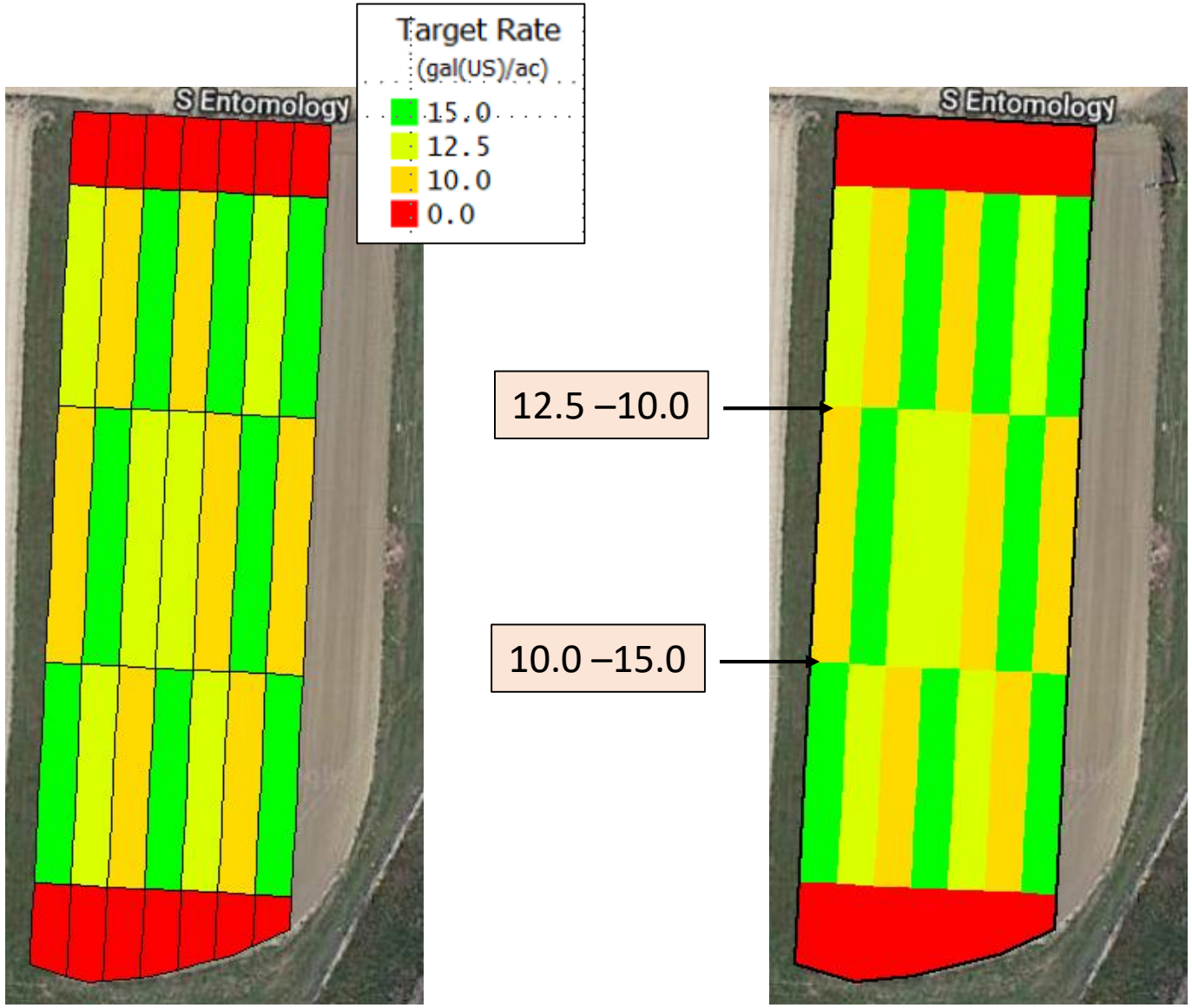
Response Time and Distance

Rate (GPA)	Time (sec)
10.0	3.2 – 3.8
12.5	3.3 – 4.0
15.0	3.5 – 4.2

10 GPA, 10 mph

Ground Speed (mph)	Response Time (sec)	Length required to achieve rate (ft)
8	3.4	40
10	3.4	50
12	3.4	60
14	3.4	70
16	3.4	80

Variable Rate Application



Six Rate Transitions:

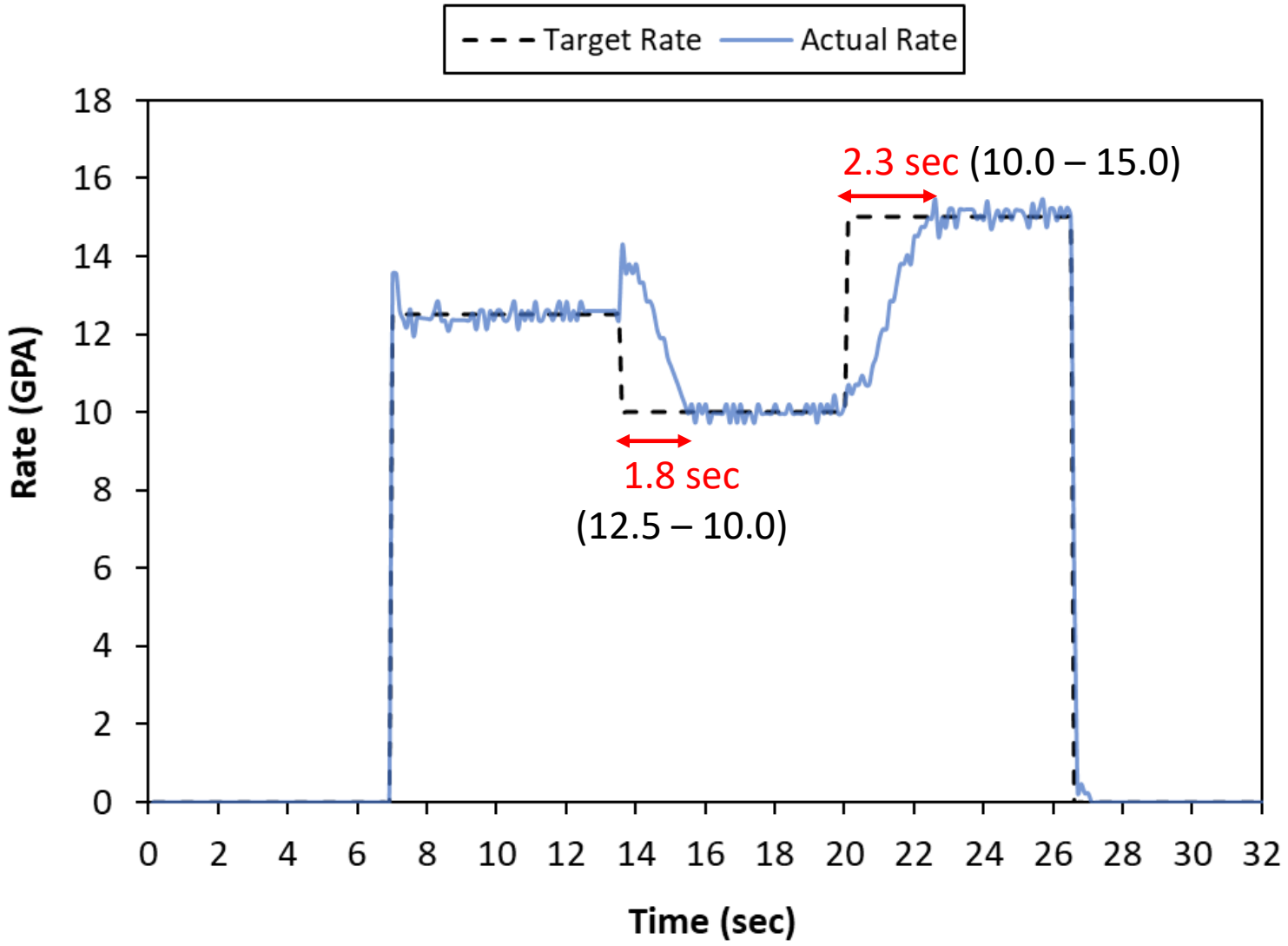
- 10.0 – 12.5 GPA
- 10.0 – 15.0 GPA
- 12.5 – 10.0 GPA
- 12.5 – 15.0 GPA
- 15.0 – 12.5 GPA
- 15.0 – 10.0 GPA

Application Length:

- 98 ft (30 m)

Each rate transition replicated three times and randomized within the field.

Transition Time – VR Application



10 mph

Rate Transition (GPA)	Time (sec)
10.0 – 12.5	1.6
12.5 – 15.0	1.8
12.5 – 10.0	1.8
15.0 – 12.5	1.7
10.0 – 15.0	2.3
15.0 – 10.0	2.5

Distance to Accomplish Rate Transitions

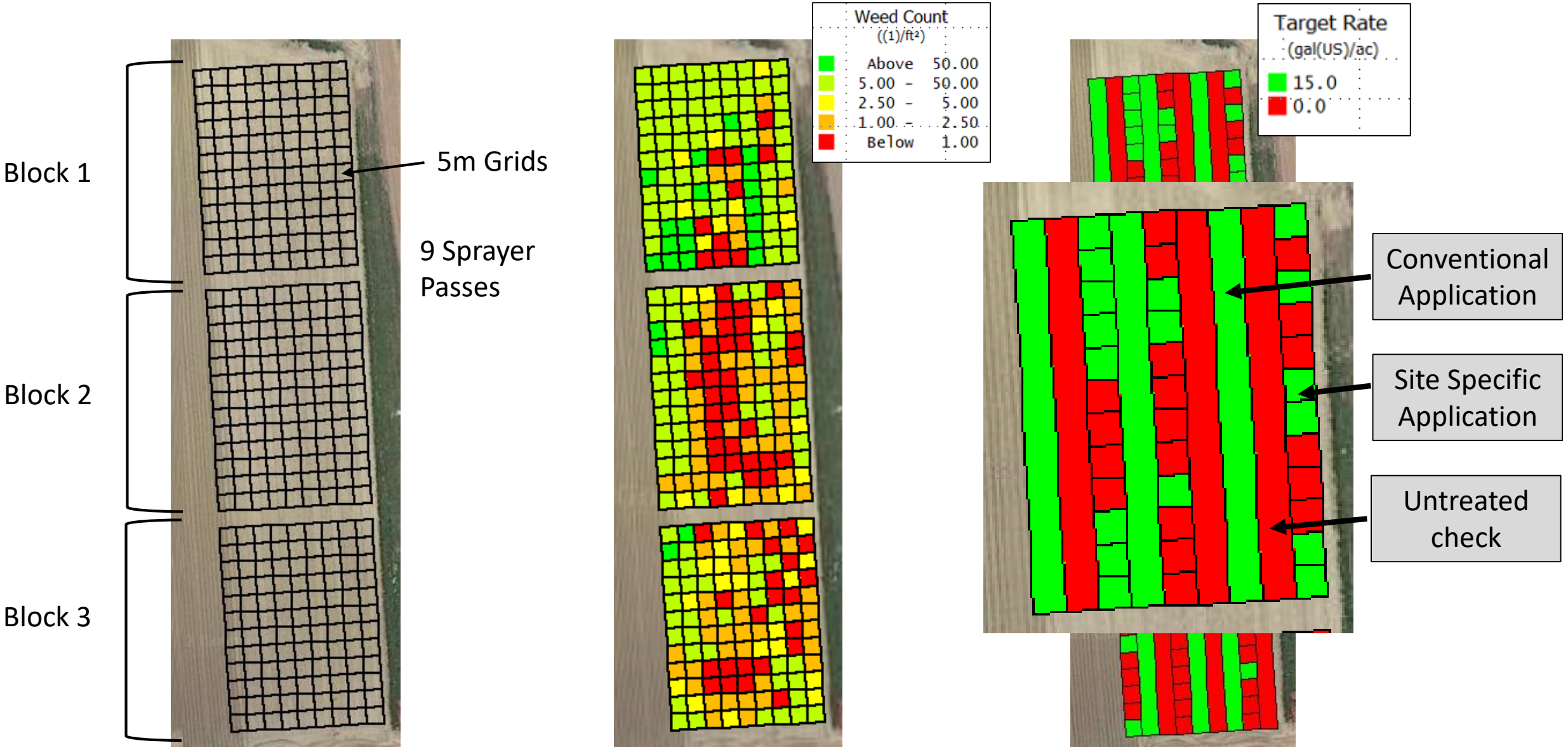
Rate Transition
2.5 GPA

Ground Speed (mph)	Rate Stabilization Time (sec)	Length required for rate stabilization (ft)
8	1.7	20
10	1.7	25
12	1.7	30
14	1.7	35
16	1.7	40

Rate Transition
5.0 GPA

Ground Speed (mph)	Rate Stabilization Time (sec)	Length required for rate stabilization (ft)
8	2.4	28
10	2.4	35
12	2.4	42
14	2.4	49
16	2.4	56

Site-Specific Weed Management

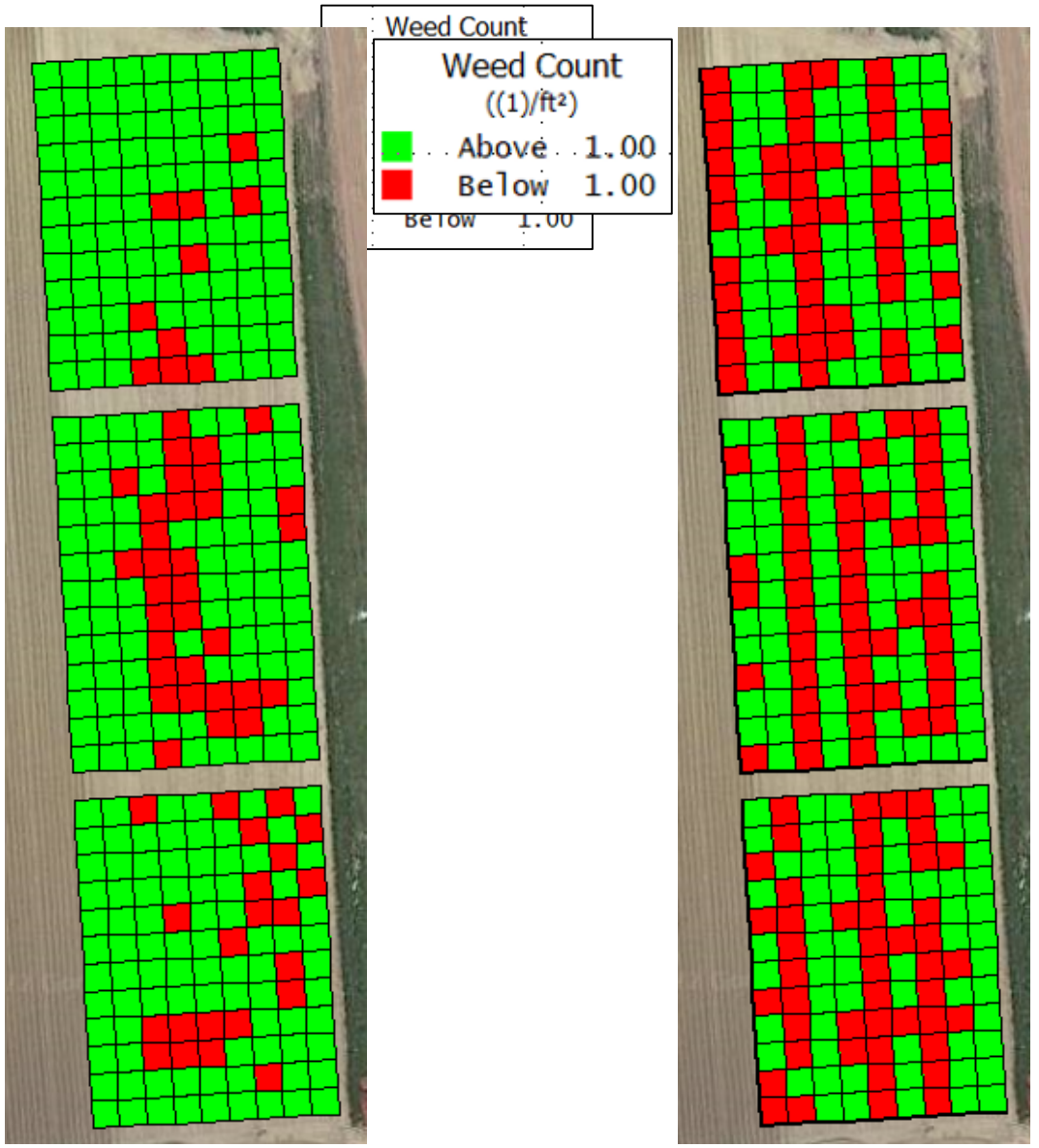


Efficacy :
Site-Specific Weed Management

Treatment	Efficacy (%)
Conventional	96.7
Site-Specific	67.4
Untreated	0

Before application

2 weeks after application



Site-Specific Application Considerations

- **Site-specific applications** – Target rate was achieved within 50 – 100 ft and rate transitions occurred within 20 to 56 ft (8 – 16 mph).

- **Spray Prescription map** - Sprayer rate controller setup (sensitivity) and response time (distance) should be considered.

- **Applied Rate & Efficacy –** Actual rates in the transition zones can be considerably lower and could result in reduced efficacy.

<u>Future Work</u>: Evaluate site-specific applications with sprayers equipped with PWM technology.

Thanks!

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