Variable Rate Potato Planting Trials 2021

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Why Variable Rate Planting?

- We now have planting equipment that can address in field variability. Shapefiles can be loaded onto controllers which will automatically adjust seed spacing based on defined zones within the field.

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advances in animal biosciences

Effects of precision potato planting using GPS-based cultivation

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Site-specific management provides the ability to align the production intensity to demand and thus adjust the expenses to the necessary level. So it is possible to increase the proportion of marketable commodity in the normal sort–size of 40 mm to 60 mm. Planting distances adapted to the soil properties seem to achieve this objective. It is possible to further optimize the proportion of marketable commodity especially in the potato regions where irrigation and fertilization already contribute to a consistently high yield. Different planting distances on the soil sites by EM38 were tested in field trials. Planting distances of 31.50 cm in the row on the light (sandy) soil, 24.50 cm on middle and 27.50 cm on the heavy soil sites seems the best for these three years. There is a yield impact in total, as well as in the proportion of marketable commodity. Depending on the planting strategy, increases in income up

"depending on planting strategy, increases in income up to 153 euros per hectare ($93/ac CAD) can be obtained." Reckleben, Grau, Schulz & Trumpf 2017

ing on the soil quality and analysed scientifically under practical conditions (Heege, 2013). The potato planting machine

additional 200 mm of irrigation was provided in July and August. The temperatures in this period were on average 16.2 °C.

For the trial the EM38 measurements, which fluctuated on the field in a range of 11 to 29 mS/m, were interpolated in a

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Check for updates

Multi-sensors data fusion approach for site-specific seeding of consumption and seed potato production

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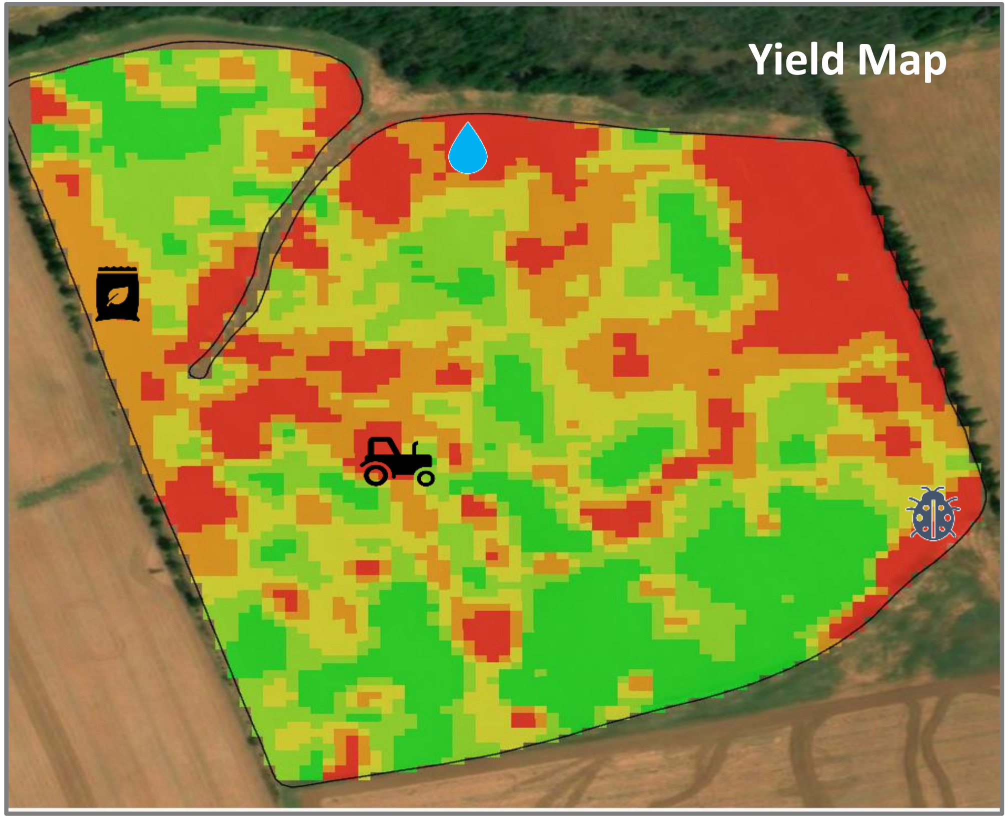
Abstract

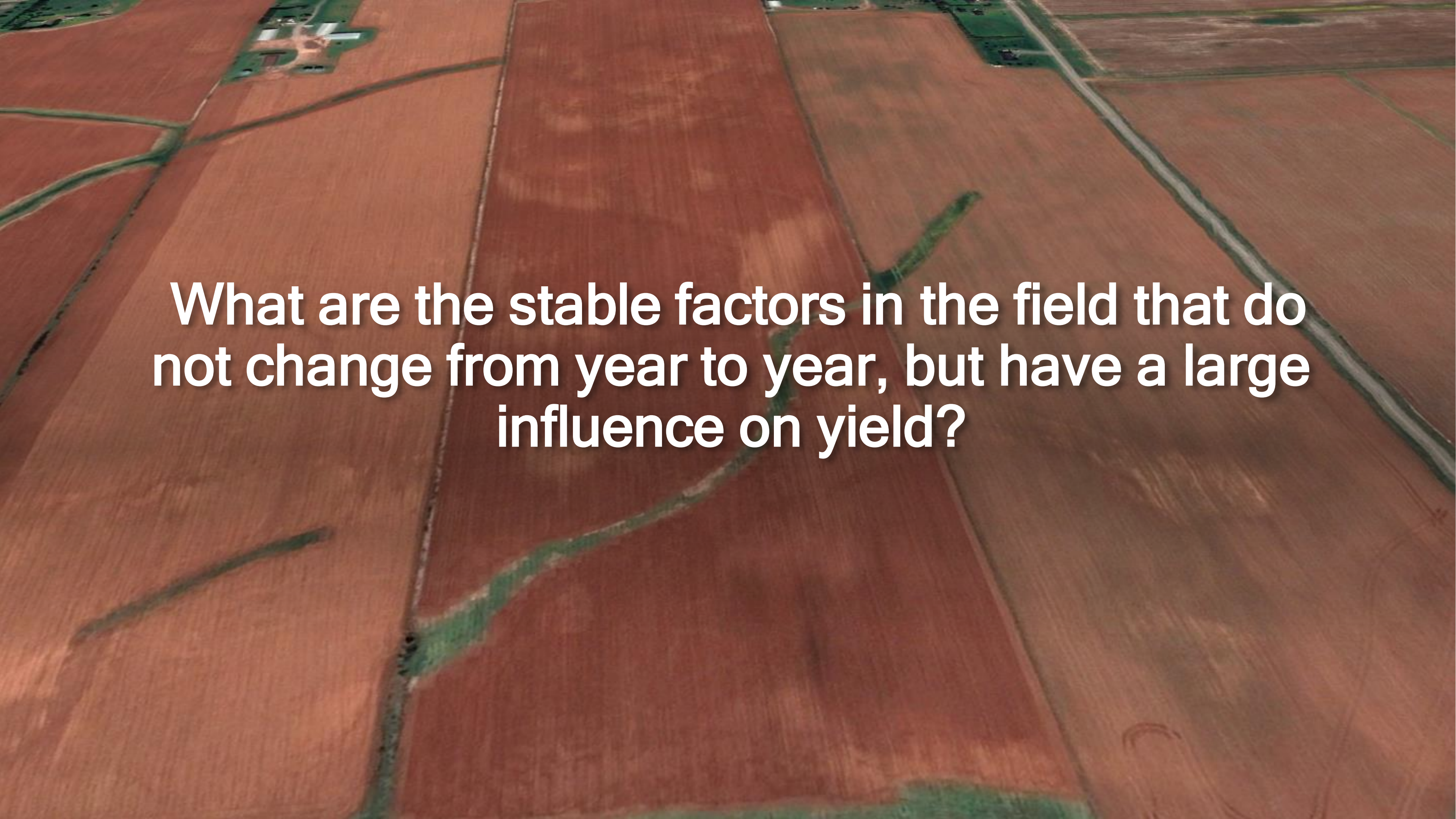
This study evaluated the agronomic and economic prospects of Site-Specific Seeding (SSS) for consumption and seed potato production based on Management Zone (MZ) maps delineated with the fusion of multiple soil and crop attributes at four experimental sites in Belgium. Soil pH, organic carbon, P, K, Mg, Ca, Na, moisture content, cation exchange capacity, apparent electrical conductivity and crop normalized difference vegetation index were measured with an on-line visible and near-infrared reflectance spectroscopy sensor, electromagnetic induction sensor, and Sentinel-2 constellation, respectively. Spatial alignment of the different data layers generated a co-georeferenced data matrix for data fusion by k-means clustering. Per field MZ classes were ranked according to their fertility status and the prescription rule of sowing more seeds to the more fertile zones and vice versa was adopted and compared against a Uniform Rate Seeding (URS) treatment in a strip plot experiment. Cost–benefit analysis revealed that the SSS improved tuber yields, hence, increased gross margin (137.81 to 457.83 €/ha) of production compared to the URS, although SSS consumed relatively higher amount of seeds. The percentage of gross margin increase varied between 2.34 and 27.21%, with the highest profitability in fields with low productivity. Larger seed-to-seed spacing than the control increased the proportion of the most demanded and profitable tuber category, suggesting the seeding interval is a key determinant of tuber size distribution. It is suggested to adopt SSS for potato production using the proposed multi-sensor data-fusion approach to manage in-field soil and crop variabilities, and improve productivity and profitability.

How to determine “Zones” for VR planting?



Yield maps? They provide a report card at the end of the season and can help a farmer understand which areas of the field performed best that particular year. But yield maps are dynamic and change from year to year. Yield maps can be influenced by many factors including:

- Weather
- Pests
- Weeds
- Equipment issues
- Nutrient deficiencies
- and many more



What are the stable factors in the field that do not change from year to year, but have a large influence on yield?

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Soil Factors Related to within-Field Yield Variation in Commercial Potato Fields in Prince Edward Island Canada

Bernie J. Zebarth, Sherry Fillmore, Steve Watts, Ryan Barrett & Louis-Pierre Comeau

American Journal of Potato Research **98**, 139–148 (2021) | Cite this article

Abstract

Stagnating potato tuber yields in Prince Edward Island (PEI) are a major economic concern.

soil texture. Under the rainfed potato production on sandy-loam soils in PEI, finer soil texture is likely related to increased yield through its effect on improved soil water holding capacity.

measures of soil physical and chemical properties and soil pathogens were measured. Principal component analysis identified three principal components (PCs) which accounted for 85.6% of the total variation. The PC1 (reflecting 42.3% of the total variance) was associated primarily with soil texture (i.e., sand, clay) and parameters which were highly correlated with soil texture. Under the rainfed potato production on sandy-loam soils in PEI, finer soil texture is likely related to increased yield through its effect on improved soil water holding capacity. The PC2 (reflecting 29.0% of the total variance) was primarily associated with soil fertility and the PC3 (reflecting 14.4% of the total variance) was associated primarily with soil organic matter quality and soil structure. Although soil pathogens were measured at levels high enough to impact yield, they did not differ significantly between high and low yield locations. The findings of this study highlight the value in using multivariate approaches to overcome the challenges in identifying factors which control within-field yield variability.

3.1. Potato yield variability

Visual observations during harvest indicated substantial reductions in yield on the highly eroded sections of the field. Along with the reduced yields, highly eroded areas appeared to have smaller tubers and a higher population of stones.

Relating potato yield to the level of soil degradation using a bulk yield monitor and

residue management having the higher value. It could be interpreted that improved management on the entire field after years of degradation may result in better overall yields but the area with higher LS may never again be as productive as the remainder of the field. It must be remembered that this field has undergone a

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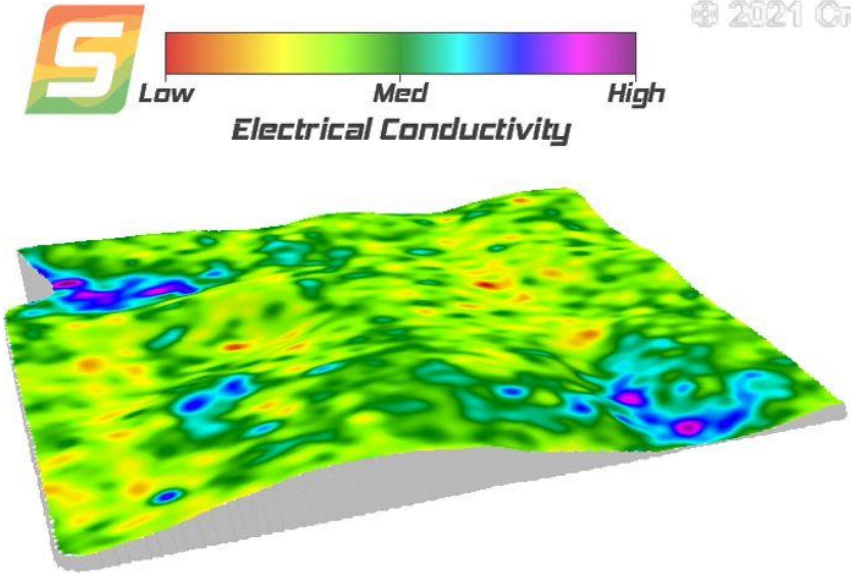
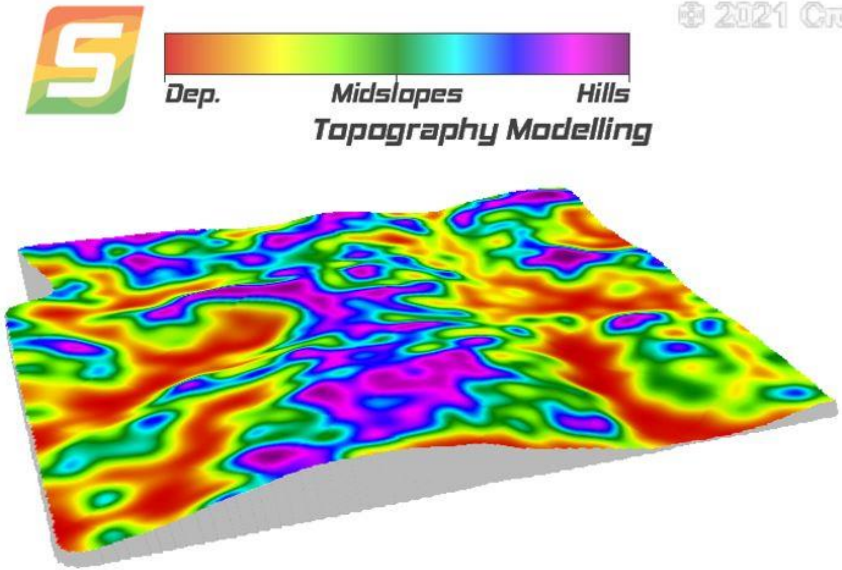
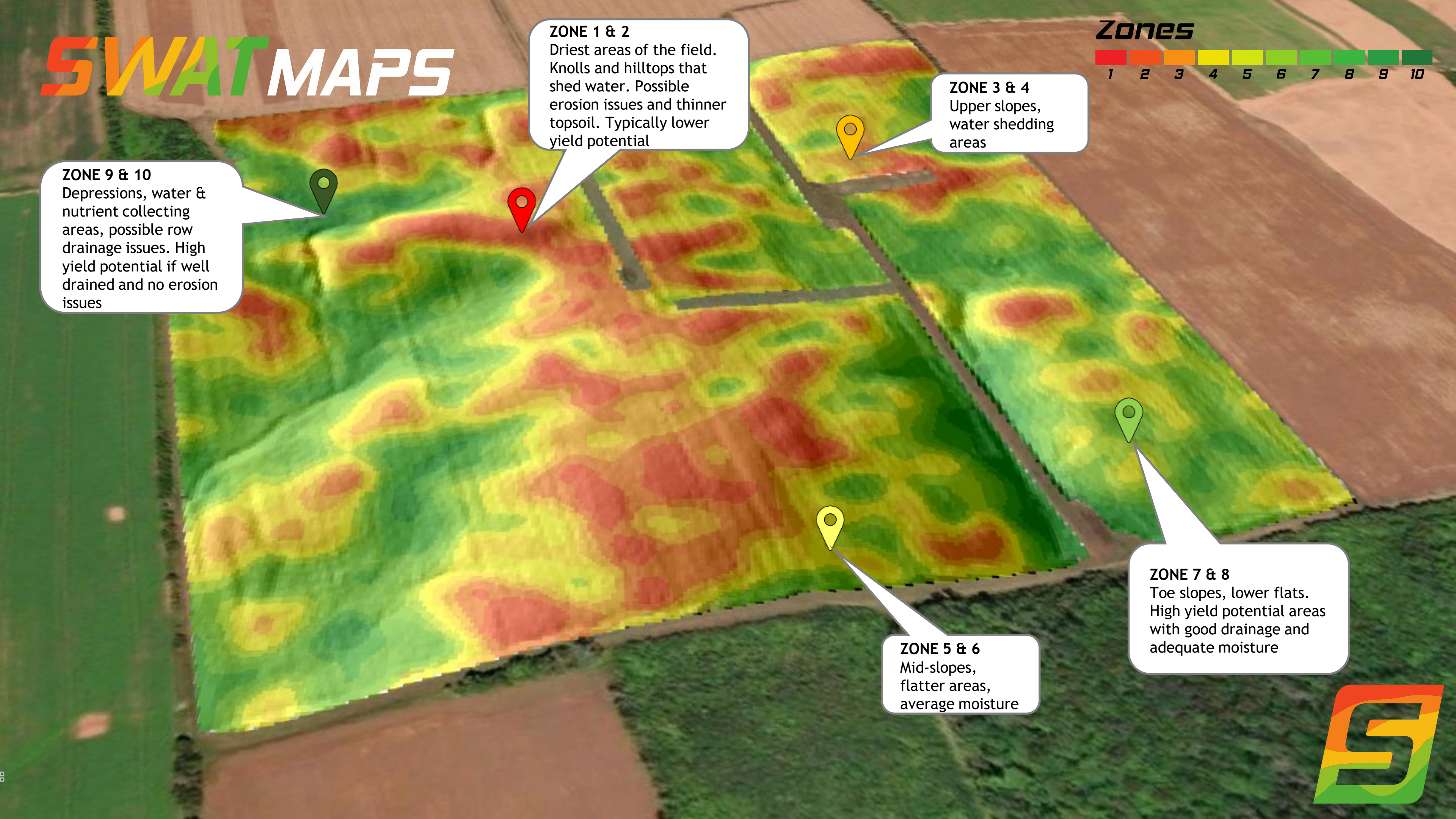
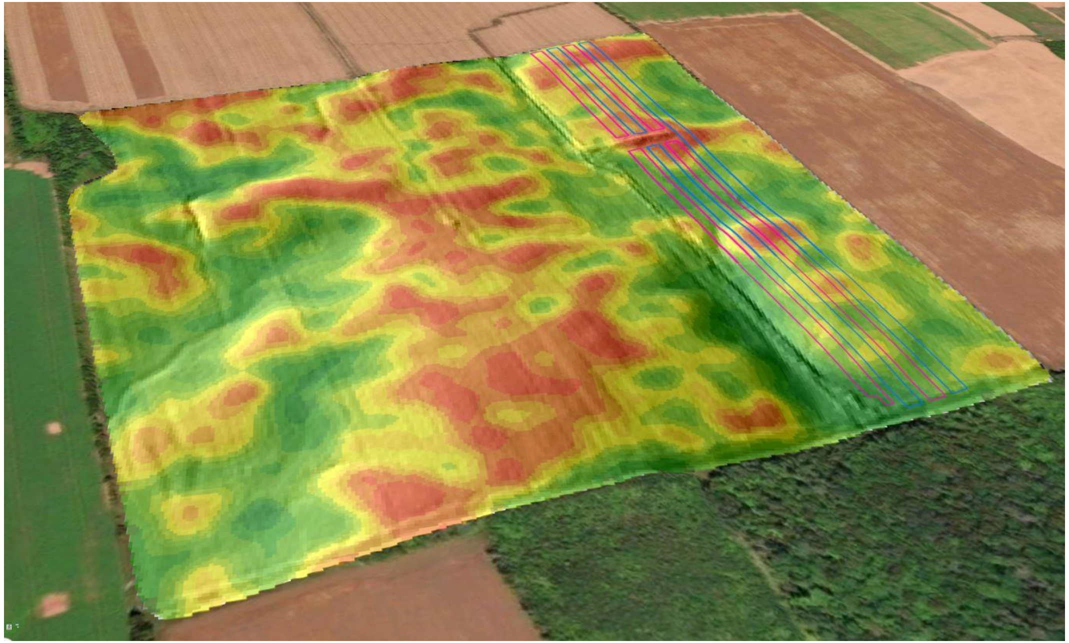

Low
Med
High
Electrical Conductivity


Dep.
Midslopes
Hills
Topography Modelling

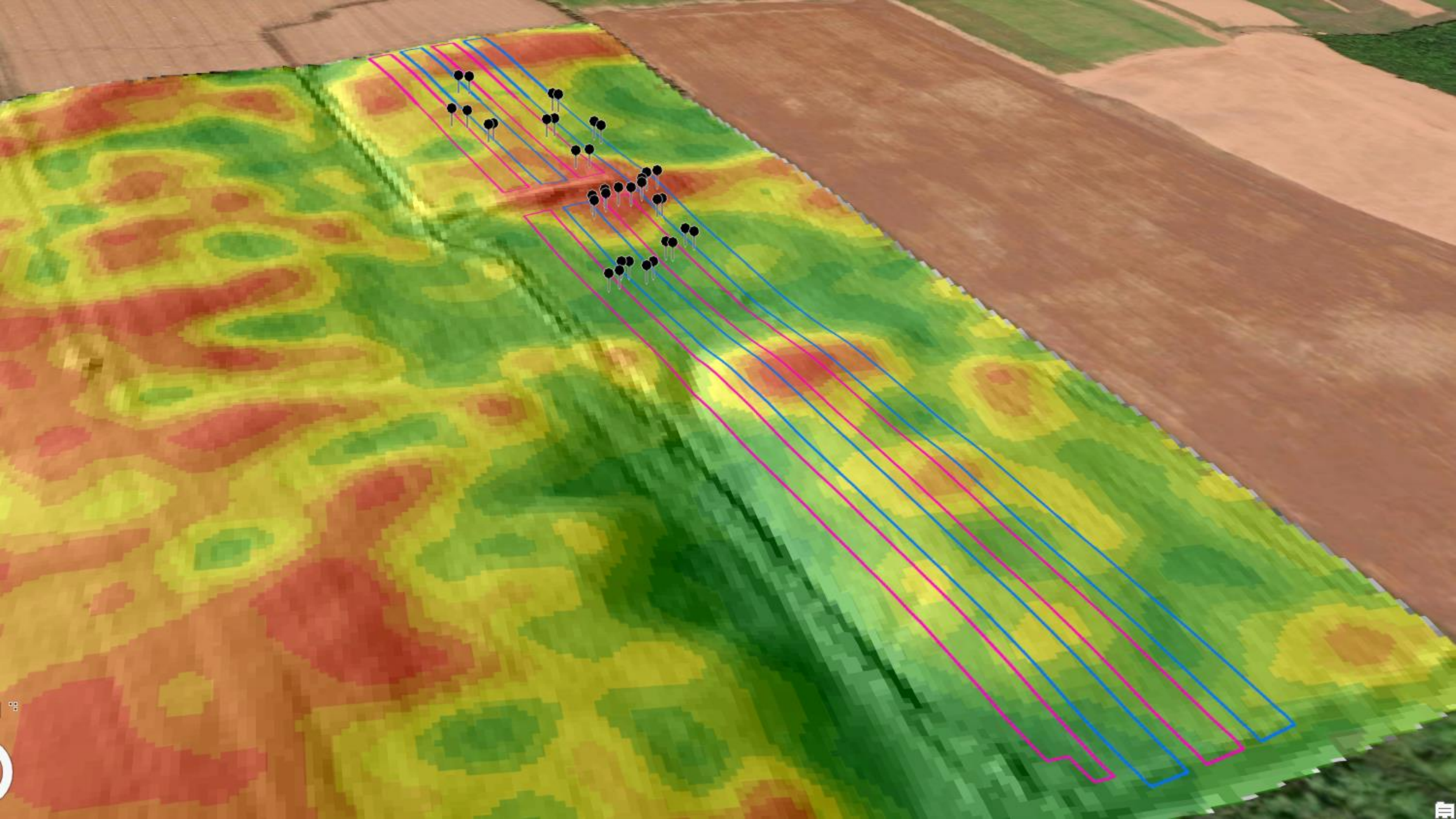

SWAT MAPS
Zones
1 2 3 4 5 6 7 8 9 10
ZONE 1 & 2
Driest areas of the field. Knolls and hilltops that shed water. Possible erosion issues and thinner topsoil. Typically lower yield potential
ZONE 3 & 4
Upper slopes, water shedding areas
ZONE 9 & 10
Depressions, water & nutrient collecting areas, possible row drainage issues. High yield potential if well drained and no erosion issues
ZONE 5 & 6
Mid-slopes, flatter areas, average moisture
ZONE 7 & 8
Toe slopes, lower flats. High yield potential areas with good drainage and adequate moisture

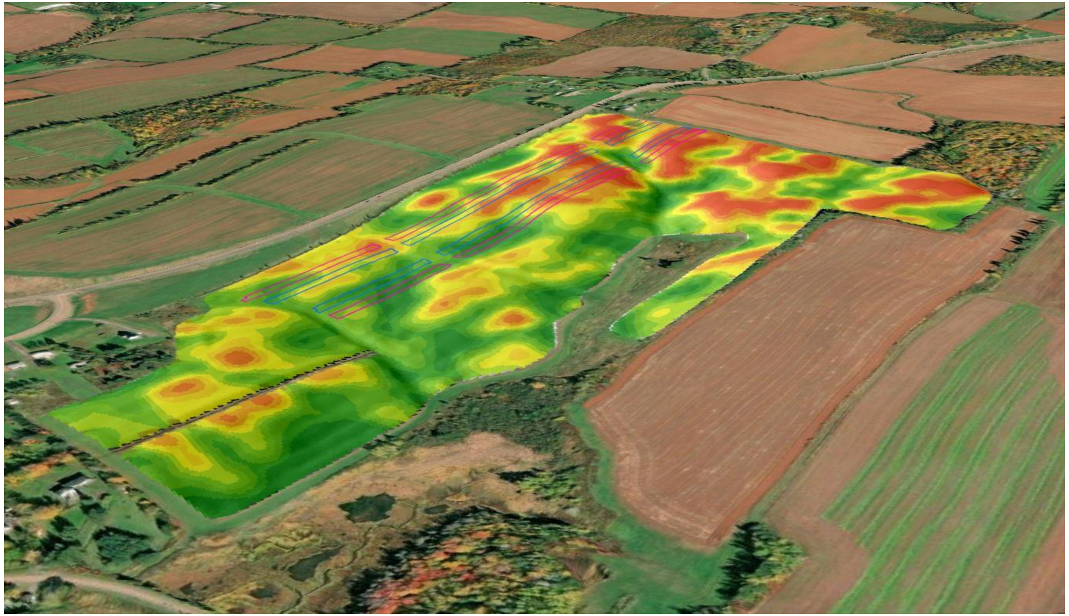

Zone 1
Zone 7
Zone 10



1 Site 1: Springfield West, PE

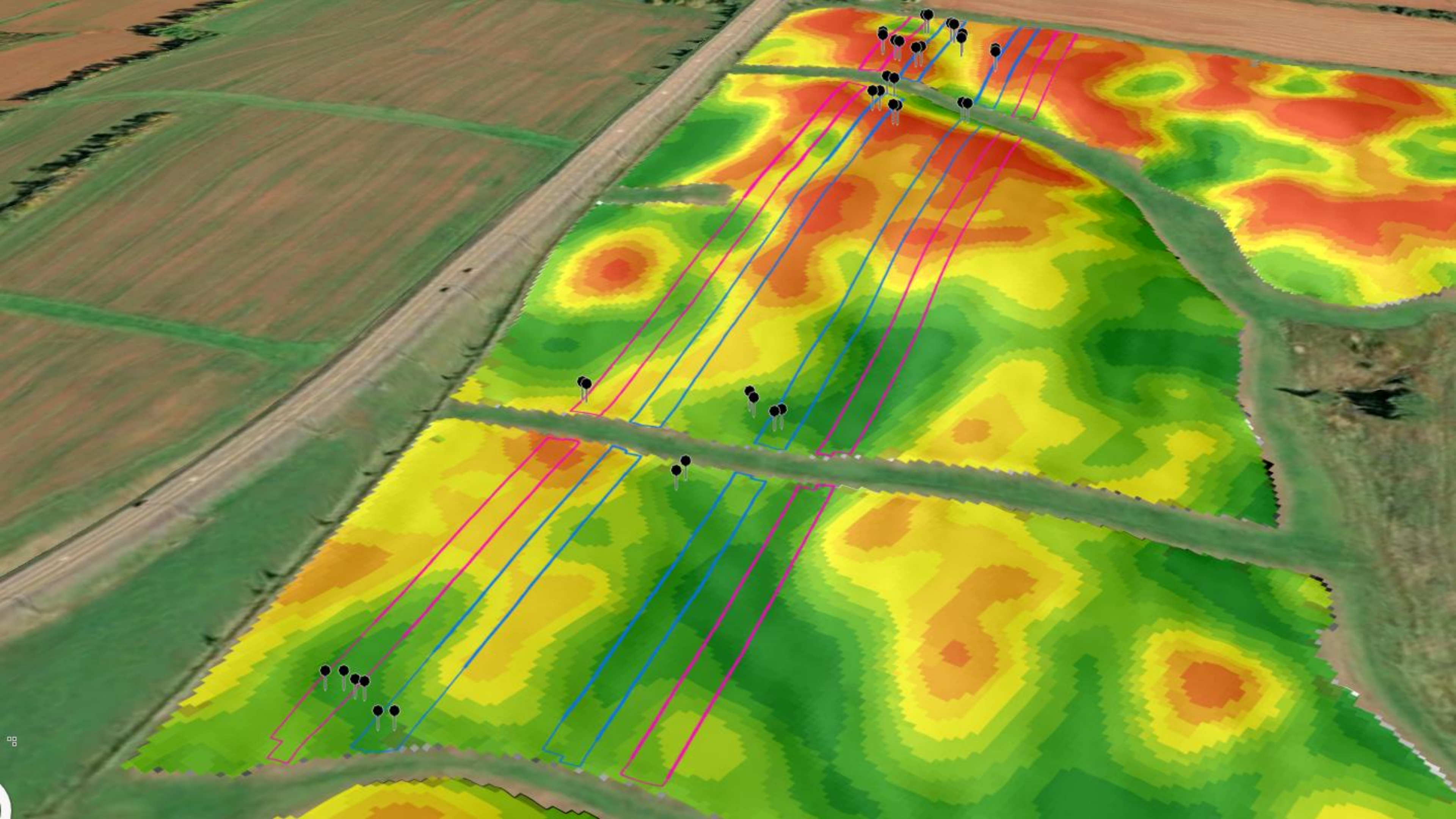
Site 1 is part of a 32-ha field in Western Prince Edward Island (46°40'7.96"N, 64°21'17.87"W). This field was planted with Clearwater Russet potatoes on May 29, 2021. These potatoes were grown for French fry processing. Target spacing, or grower standard practice (GSP), was 36cm. Wide target spacing (pink on the map) was 41cm and tight target spacing (blue on the map) was 30cm. Each strip on the map was 12m wide (two planter passes) wide and 560m long.





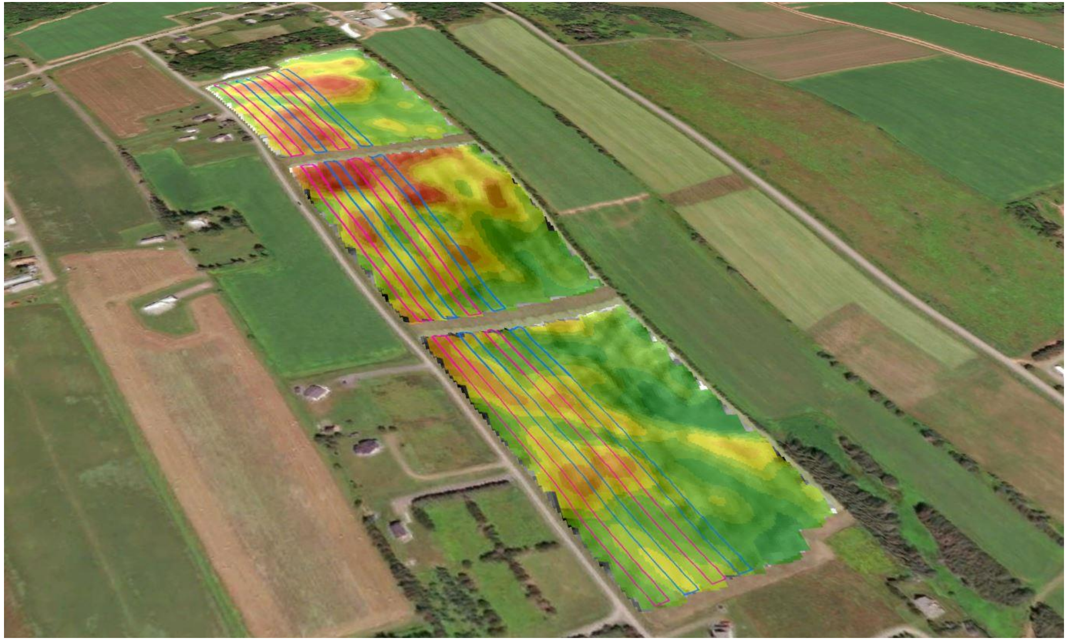
② Site 2: Tryon, PE

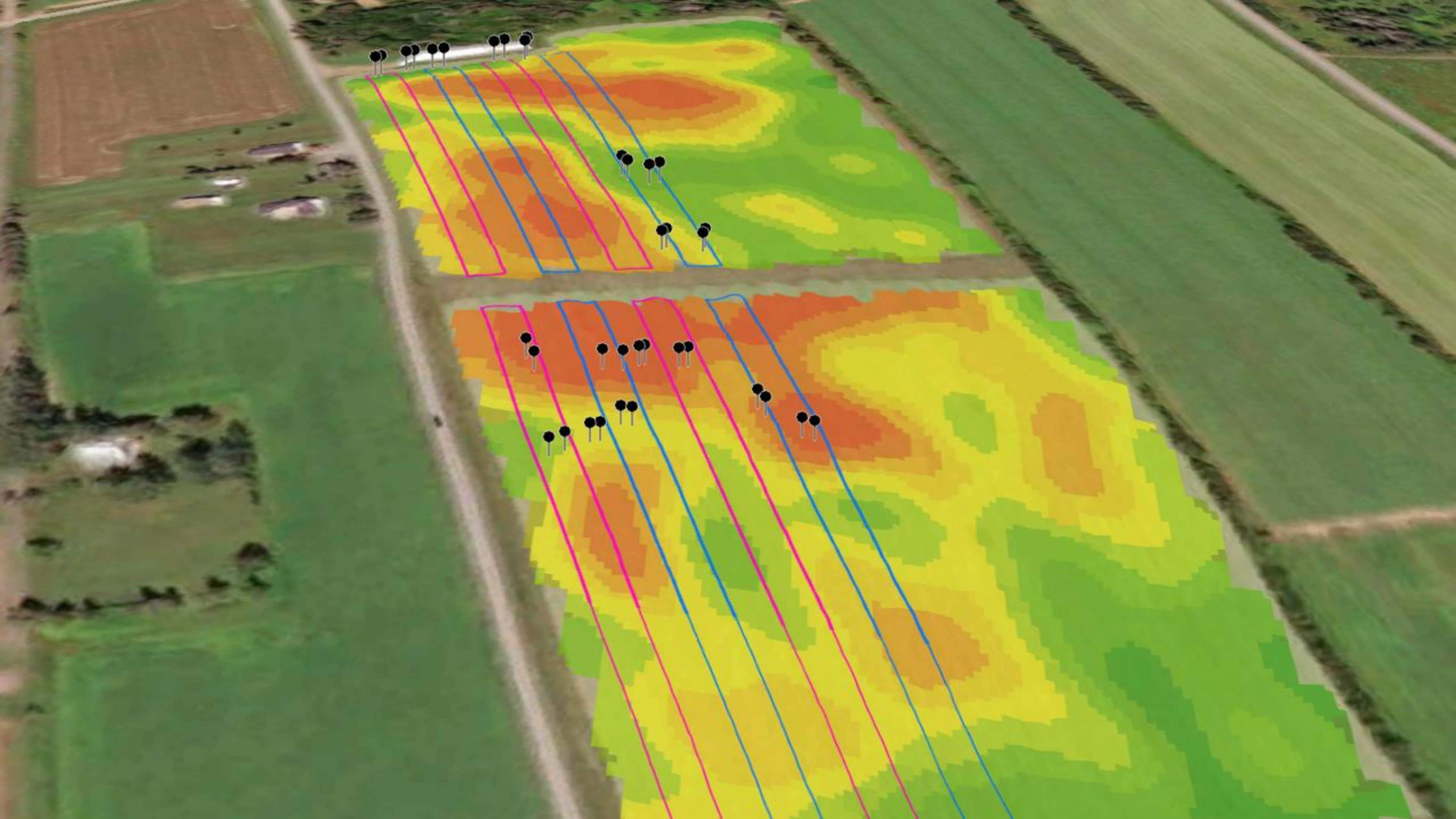
Site 2 is part of a 32-ha field in Central Prince Edward Island (46°14'25.91"N, 63°32'9.71"W). This field was planted with Waneta potatoes on May 20, 2021. These potatoes were grown for potato chip processing. Target spacing, or grower standard practice (GSP), was 23cm. Wide target spacing (pink on the map) was 27cm and tight target spacing (blue on the map) was 19cm. Each strip on the map was 12m wide (two planter passes) wide and 700m long

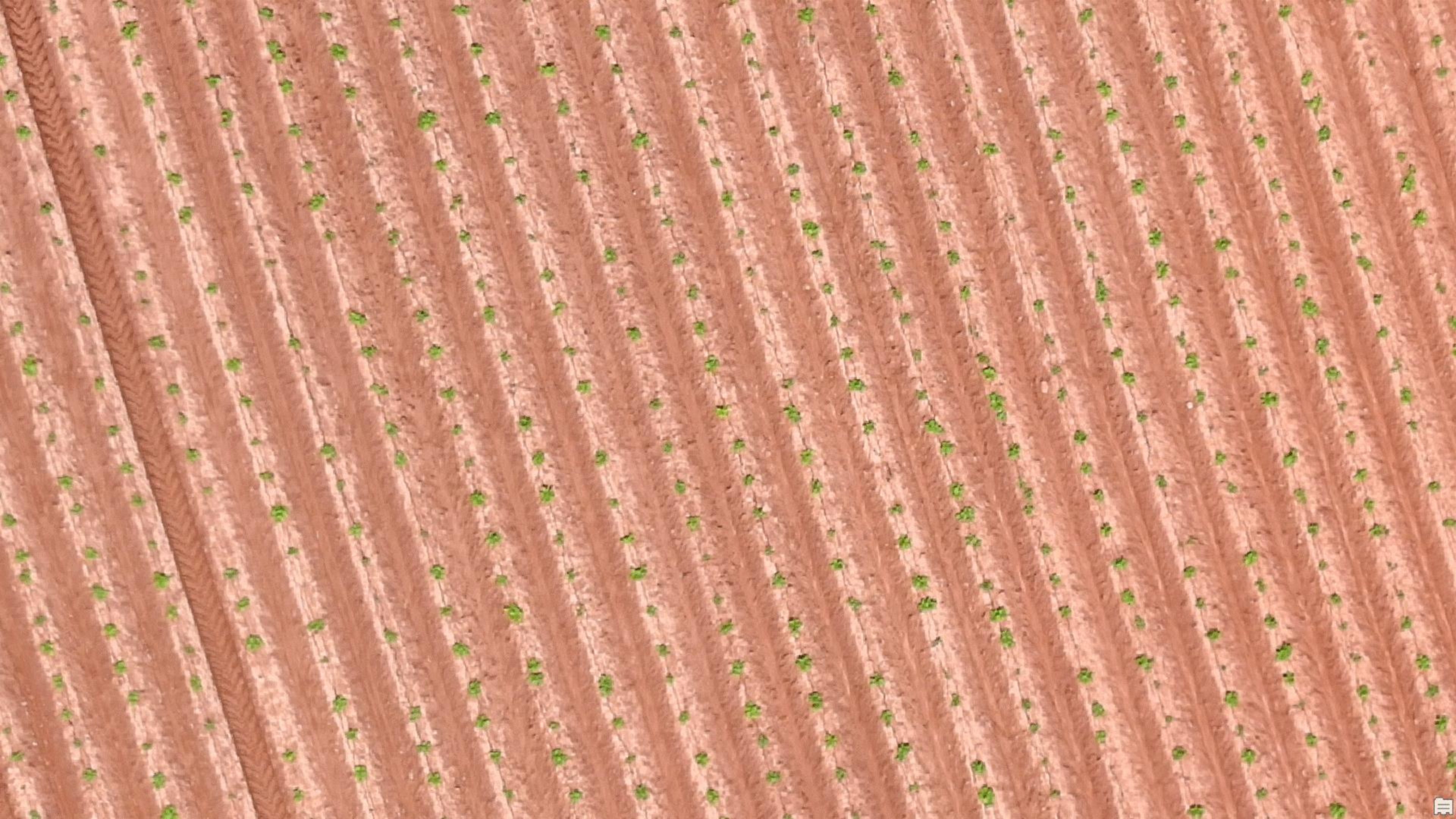


Site 3: Red Point, PE

Site 3 is part of a 13-ha field in Eastern Prince Edward Island (46°22'22.10"N, 62° 8'27.66"W). This field was planted with Russet Burbank potatoes on May 26, 2021. These potatoes were grown for French fry processing. Target spacing, or grower standard practice (GSP), was 41cm. Wide target spacing (pink on the map) was 36cm and tight target spacing (blue on the map) was 30cm. Each strip on the map was 12m wide (two planter passes) wide and 750m long.







Site 1: Springfield West, PE Planter Accuracy Assessment			
Spacing Treatment (n)	**Target Spacing (cm)**	**Measured Spacing (cm)**	**Difference**
Tighter (28,908)	30.5	31.8	-4.0%
GSP (41,568)	35.6	35.1	1.0%
Wider (21,945)	40.6	38.6	4.9%

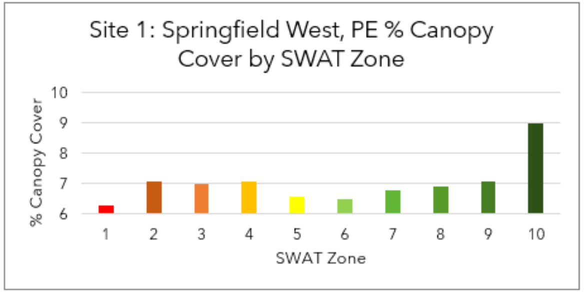
Site 2: Tryon, PE Planter Accuracy Assessment			
Spacing Treatment (n)	**Target Spacing (cm)**	**Measured Spacing (cm)**	**Difference**
Tighter (42,529)	19	22.5	-15.6%
GSP (111,074)	22.9	23.3	-1.7%
Wider (32,800)	26.7	25.2	6.0%

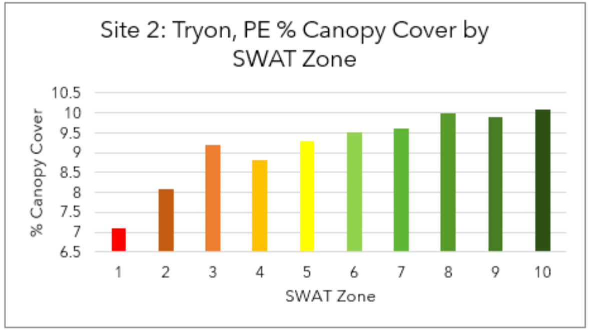
Site 3: Red Point, PE Planter Accuracy Assessment			
Spacing Treatment (n)	**Target Spacing (cm)**	**Measured Spacing (cm)**	**Difference**
Tighter (35,003)	35.6	34.5	3.1%
GSP (191,750)	40.6	39.9	1.7%
Wider (26,538)	45.7	45.2	1.1%

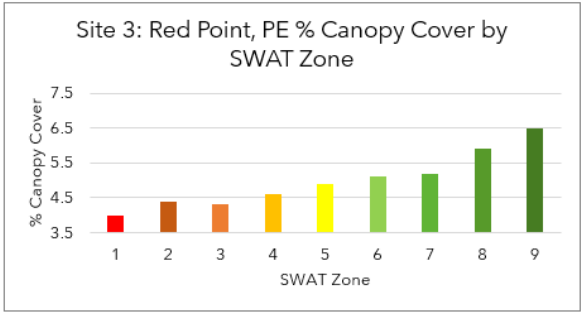
Site 1: Springfield West, PE Canopy Cover and Size Profile by Spacing Treatment			
Spacing Treatment	**Percent Canopy Cover**	**Percent Smalls**	**Percent > 10oz**
Tighter	7.7%	8.8%	22.5%
GSP	7.1%	7.4%	23.8%
Wider	5.7%	6.0%	32.5%

Site 2: Tryon, PE Canopy Cover and Size Profile by Spacing Treatment			
Spacing Treatment	**Percent Canopy Cover**	**Percent Smalls**	**Percent > 10oz**
Tighter	10.2%	7.4%	N/A
GSP	8.3%	6.8%	N/A
Wider	7%	4.3%	N/A

Site 3: Red Point, PE Canopy Cover and Size Profile by Spacing Treatment			
Spacing Treatment	**Percent Canopy Cover**	**Percent Smalls**	**Percent > 10oz**
Tighter	5.7%	6.5%	23.5%
GSP	5.1%	6.6%	24.2%
Wider	3.9%	4.6%	37.2%







Site 1: Springfield West, PE Size Profile by Management Zone		
Management Zone	**Percent Smalls**	**Percent > 10oz**
1,2,3	8.2%	23.5%
4,5,6	7.4%	23.5%
7,8,9,10	6.6%	31.7%

Site 2: Tryon, PE Size Profile by Management Zone		
Management Zone	**Percent Smalls**	**Percent > 10oz**
1,2,3	7.9%	N/A
4,5,6	5.6%	N/A
7,8,9,10	7.6%	N/A

Site 3: Red Point, PE Size Profile by Management Zone		
Management Zone	**Percent Smalls**	**Percent > 10oz**
1,2,3	6.5%	20.3%
4,5,6	5.3%	30.7%
7,8,9,10	5.8%	34.0%

VR Planting Results

- All $ values include factors such as seed costs, smalls dockage, 10 oz bonus (if applicable), contract prices

Site 1: Springfield West, PE Variety: Clearwater GSP: 14“ Average cwt/ac: 376	Average crop value per acre considering seed costs and size profile			
		Tight (12")	GSP (14")	Wide (16")
	Zone 1	$ 3,610	$ 4,726	$ 4,473
	Zone 2	$ 4,035	$ 4,341	$ 4,232
	Zone 3	$ 4,878	$ 4,412	$ 4,726

Site 2: Tryon, PE Variety: Waneta GSP: 9“ Average cwt/ac: 418	Average crop value per acre considering seed costs and size profile			
		Tight (7 3/4")	GSP (9")	Wide (10 1/4")
	Zone 1	$ 5,933	$ 6,618	$ 6,885
	Zone 2	$ 6,788	$ 6,414	$ 6,445
	Zone 3	$ 6,695	$ 6,713	$ 7,917

Site 3: Red Point, PE Variety: Burbank GSP: 16“ Average cwt/ac: 417	Average crop value per acre considering seed costs and size profile			
		Tight (14")	GSP (16")	Wide (18")
	Zone 1	$ 5,417	$ 5,307	$ 6,026
	Zone 2	$ 5,023	$ 4,231	$ 4,840
	Zone 3	$ 5,019	$ 4,842	$ 4,744

Discussion after Year 1:

In 2 of 3 fields wide spacing worked best in Zone 1
In 2 of 3 fields tight spacing worked best in Zone 3

Across all 3 fields, Wider spacing in Zone 1 resulted in $210/ac more value than GSP
Across all 3 fields, Tighter spacing in Zone 3 resulted in $210/ac more value than GSP

Average profit per ac gain using VR method (considering all acres and mapping costs of $10/ac) = +$106/ac

Example: 1800ac farm * $106/ac = **$190,800 over 3 years**

This trial is assuming that GSP spacing is the right one, but more work can be done to dial in plant spacing

This trial did not include any VR fertilizer treatments. It will be possible to further increase ROI by using a VR fertilizer approach

VR planting in a dry year may have more benefits than an average/good year

VR planting can be implemented with other crops in the rotation (cereals, cover crops, etc.) using the same maps, but a different strategy

It’s not about chasing “perfect”… it’s about chasing “better”

Flat rate planting may be right in 50% of the field. VR may be right in 85% of the field. It’s never going to be perfect

Thank You!