CASE STUDY

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Highland Precision Ag Uses ENVI® Crop Science to Detect Plant Stress and Target Remediation

Tight profit margins are nothing new to growers. Fertilizers and crop protection chemicals can amount to up to half of seasonal expenses in large-scale agribusinesses. Crop losses due to disease and pests can take another big bite out of yield. And, with a large portion of budgets tied up in fixed costs, remote sensing applications in precision agriculture are being looked to as one way to optimize those costs and improve margins.

HIGHLIGHTS:

- Monitor crop health down to the individual plant level
- Detect plant stress and target specific field locations for remediation
- Monitor crop growth for harvest and yield predictions

EFFECTIVELY USING REMOTE SENSING IN PRECISION AGRICULTURE

To realize the potential that remotely sensed data offers, advanced analysis tools like ENVI® can be used to extract actionable information. For example, when multispectral imagery is analyzed, patterns become visible that are not clearly discernable to the human eye. This offers a window into the growth cycle that enables early stress and disease detection, and provides information so interventions can be implemented before a crop becomes permanently impaired. The good news for growers is that ENVI® Crop Science now makes the information from these advanced techniques available to anyone, regardless of their prior experience with remote sensing.

IN NEED OF A NEW PERSPECTIVE

When dealing with large spatial patterns, it is sometimes difficult to see the forest for the trees. Highland Precision Ag (HPA), a company that assists growers in using precision agriculture, found this to be especially true while working with one strawberry grower in Florida. The farmer had noticed that some areas in his fields appeared to be dying, but there was not an obvious reason as to why. He first investigated the normal culprits, but all the plants in the field were being treated with the same amounts of crop inputs. There also did not appear to be any environmental factors at play, such as fungus, mildew, or pests.

The problem also did not appear to be related to fertigation, given that the ailing plants were in different beds, were not connected to the same fertigation lines, and were even in the middle of some of the lines. Even more confounding, the plants on either side of the ailing plants were fine.

HPA collected satellite imagery over the affected area to gain a different perspective. After downloading the Airbus imagery from the Harris Geospatial Marketplace, they began their analysis. HPA noticed that the pattern of senescence patches appeared sporadic and could barely be distinguished (Figure 1).

ENVI CROP SCIENCE CHANGES THE EQUATION

HPA then applied the Hotspot Analysis tool in ENVI Crop Science. The tool uses a single band of input data to look for statistically significant regions within an image, but true-color imagery has three bands (red, green, blue). That meant the Airbus imagery had to be distilled down to a single input layer before the analysis could be run.

A Normalized Difference Vegetation Index (NDVI) is a single band and can be used as an indicator of plant health. By creating an NDVI image in ENVI and then using the Hotspot tool, HPA was able to resolve this senescent pattern with much higher fidelity.

The output of the Hotspot tool was a classification image with red, green, and yellow regions. In this case, the red regions revealed low NDVI values (senescent plants), green regions were higher NDVI values (above average healthy plants), and the yellow regions revealed areas that were neither exceptionally senescent nor extremely healthy (an area without a contiguous spatial pattern). A comparison of figures 1 and 2 revealed that these senescent regions were occurring in a straight line across this field. Knowledge of this spatial pattern was taken back to the field and investigated on the ground.

The field scout determined that early in the season, the sprinkler system that was being used had been miscalibrated. Figure 3 shows a representation of the sprinkler layout. The miscalibration resulted in inadequate head-to-head coverage. The areas with single coverage did not receive enough water after being transplanted, and consequently these areas underperformed later in the season. On the other hand, the areas with quadruple coverage received the most water and therefore thrived.

Figure 1: True-color image of strawberry field

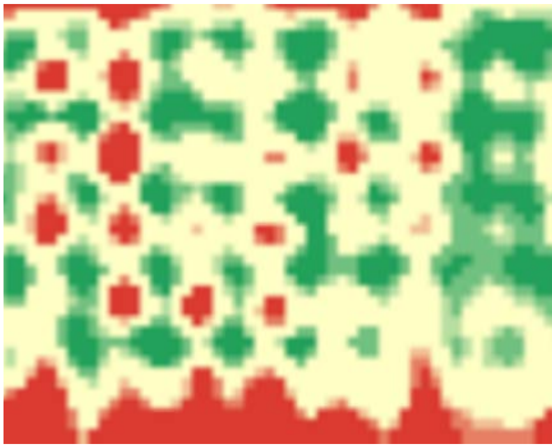

Figure 2: Hotspot results derived from NDVI image

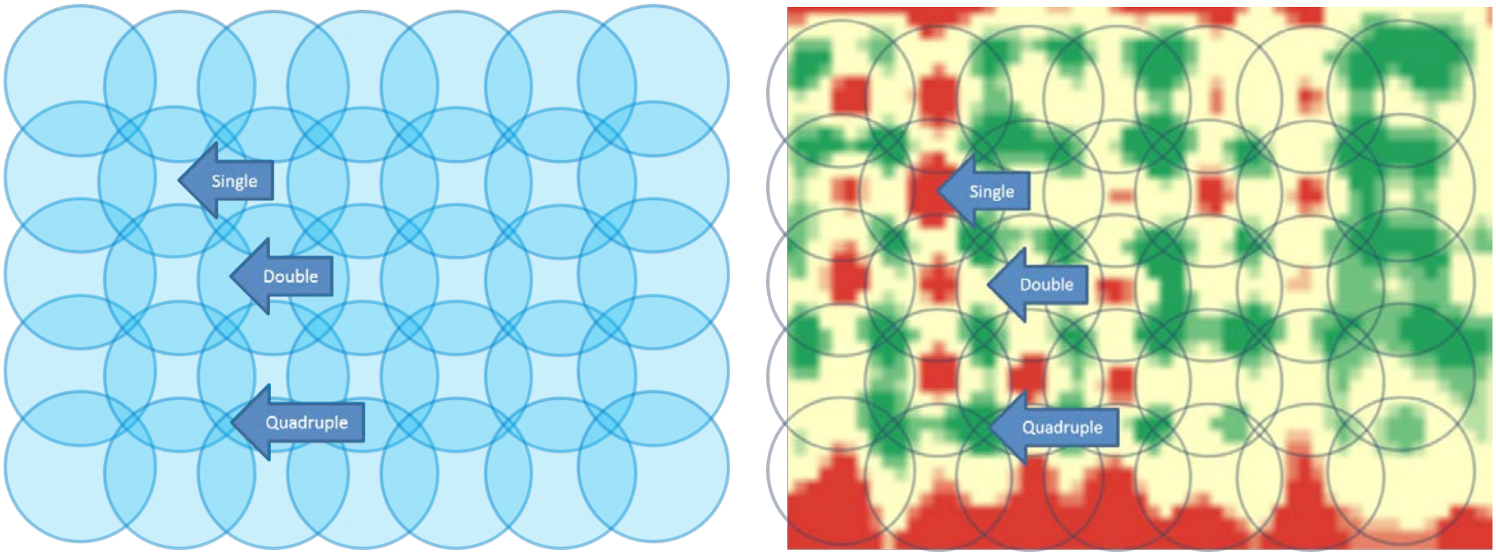

Figure 3: The sprinkler coverage map(left) and hotspot imagery (right) overlaid with sprinkler coverage patterns shows single, double, and quadruple coverage areas.

CONCLUSION

According to the HPA field scout, without ENVI Crop Science, this analysis and discovery would not have been possible. The results from this analysis gave HPA the information and confidence to approach the farm operators with recommendations about the best spacing of their sprinklers for next season to get the highest yield from their land.

FOR MORE INFORMATION:

www.harrisgeospatial.com
Email: geospatialinfo@harris.com
Phone: 303.786.9900