

GIS Tools for Layout and Analysis of Agronomic Research Trials

Opportunity to Learn

Precision farming provides tools for farmers and their consultants to set up and analyze on-farm trials. With the proper design farmers can learn more about their crop management decisions, test new products, try new equipment, and identify ways to farm more efficiently on the acres. We have created a suite of tools and processes in ArcGIS 10.x to establish plots and analyze yield and other data.

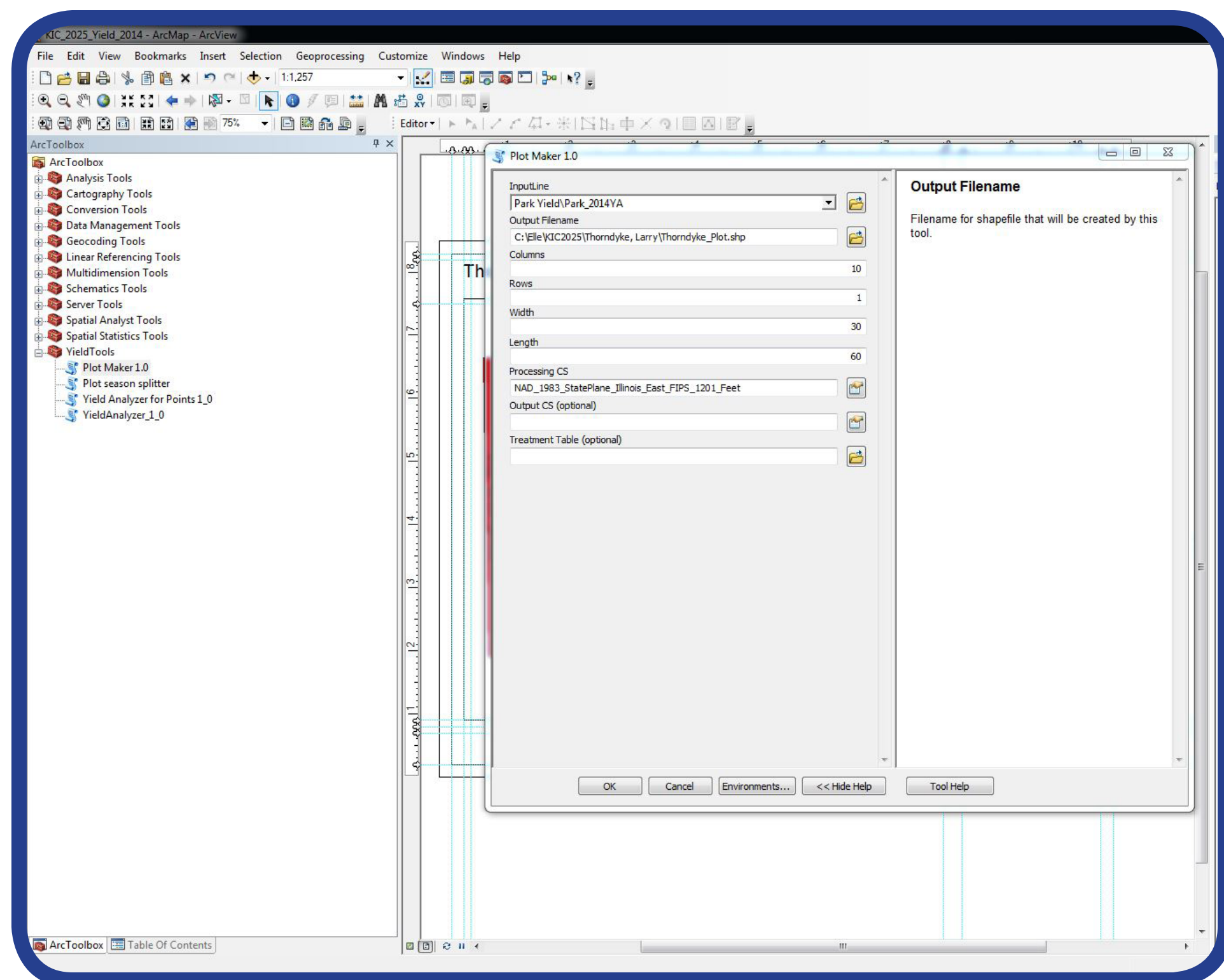
Framing the Question

First step is to identify the question. When we know what question the farmer wants to address we can suggest some trial designs that would help generate the data to provide an answer. It is necessary for success.

Designing the Trial

Once we have the question identified we can suggest some trial designs. We encourage farmers to lay out as many reps as practical.

We collect information on the size of farmer's equipment (and that of their supplier) to create a plot size that will ensure at least one full harvest pass through each plot.



Identifying the Locations

Usually, farmers have a field in mind for the question. We pull up the field location and look at old imagery via Google Maps to determine if there are areas of the field to avoid, (past down out areas or other known issues).

With the plot design: number of treatments, number of reps, plot width and length (based on the farmer's field equipment), we can site the trial in the field.

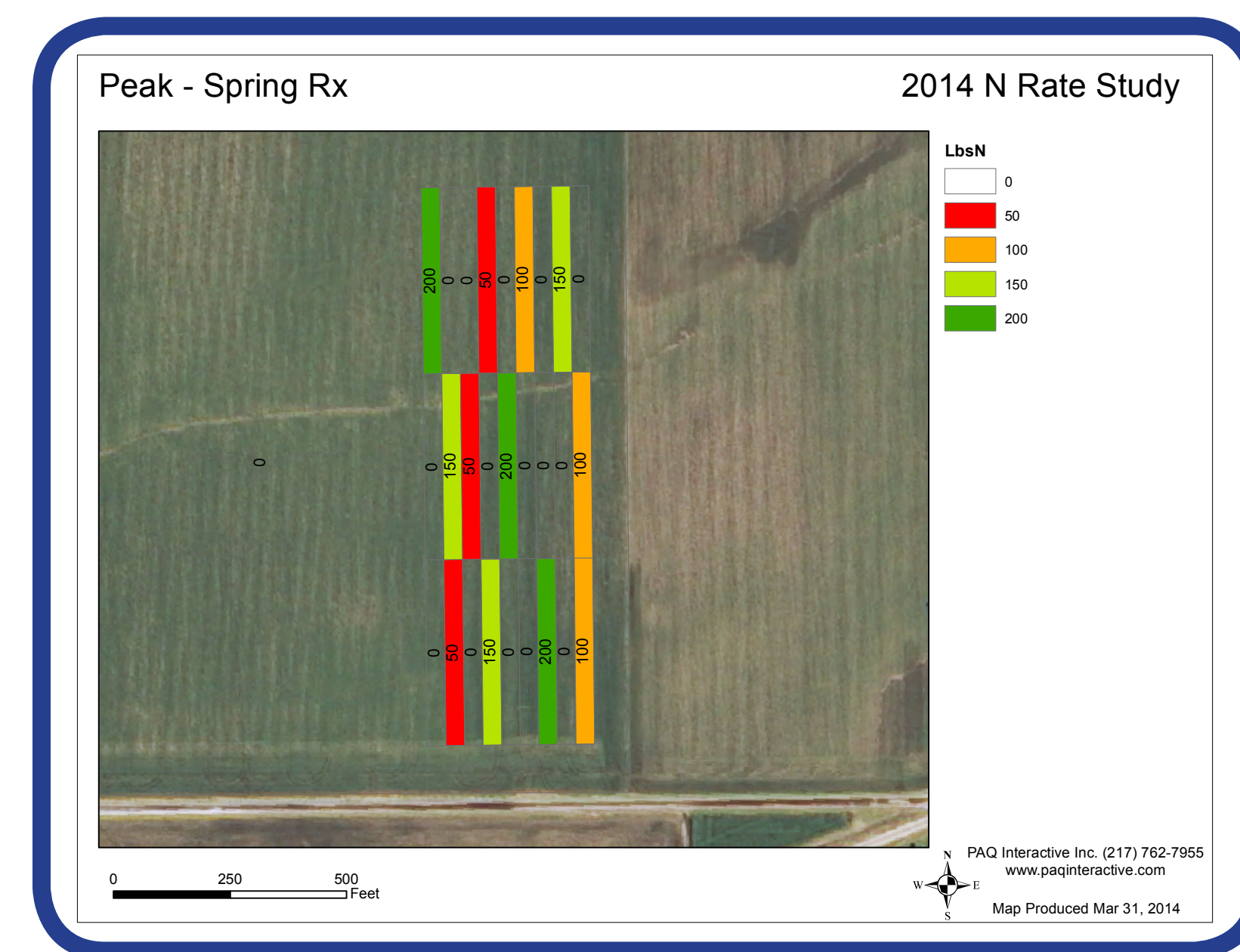


Abstract

Beginning with Farm Research Analyst and Enhanced Farm Research Analyst, we have been involved in working with precision ag tools for crop production research for 15 years. PAQ worked with ArcGIS to create a set of tools for laying out and establishing trials in a GIS, preparing associated treatment application maps, analyzing as-applied maps, and harvest maps in the process of conducting research trials. With the latest tools in precision ag combining GIS with high-accuracy GPS and application information anyone can put out a properly developed replicated trial. This poster steps through our GIS tools and analysis steps for conducting on-farm research.

Creating Treatment Maps

When we have the trial placed in the field, we next create the application map or treatment map. We provide the farmer or their supplier the treatment map which usually includes the recommendation for the whole field. This step is critical because, if the application map is difficult to work with or doesn't include all the information about the products, rates, or timings, it can lead to improperly applied trials.

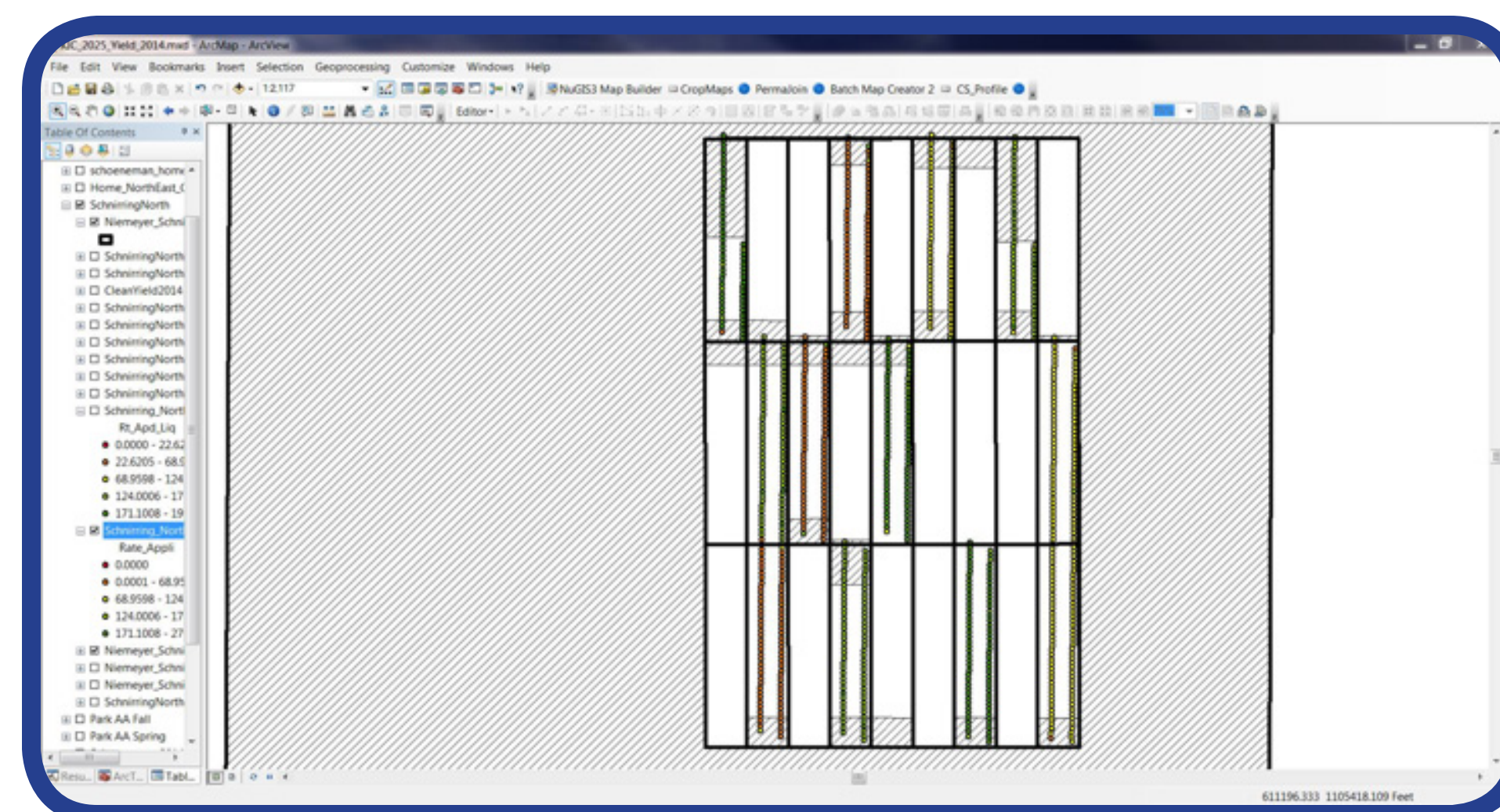


Collecting As-Applied Data

After the treatment is applied we request the as-applied maps. Most of the time, the application or planting rate was done properly within the plots as prescribed. But our experience shows that application sometimes varies from the prescription. As-applied maps necessitate adjusting the plot boundaries somewhat to capture the true treatment as (and where) it was implemented.

We then share our comparison of the planned plots to the as-applied maps and if we needed to adjust the plots we show how and explain why the adjustment was made.

In many cases the next step is simply waiting for harvest to happen. But in some trials additional measurements are taken throughout the season. We can add these data to the plot maps and include them in the final analysis as well.



Harvesting Yield Data

Before harvest we remind the farmer of their investment in the trial and stress the importance of good yield data as the key ingredient for a successful trial.

When the field is harvested, the farmer sends us the yield data file. We import the yield data into the GIS and review the raw data. Usually our careful placement of the trial in the field will allow us to use all the yield data, but occasionally extra passes or proximity to the end rows or problem area may require us to process the yield data to exclude obvious flaws.

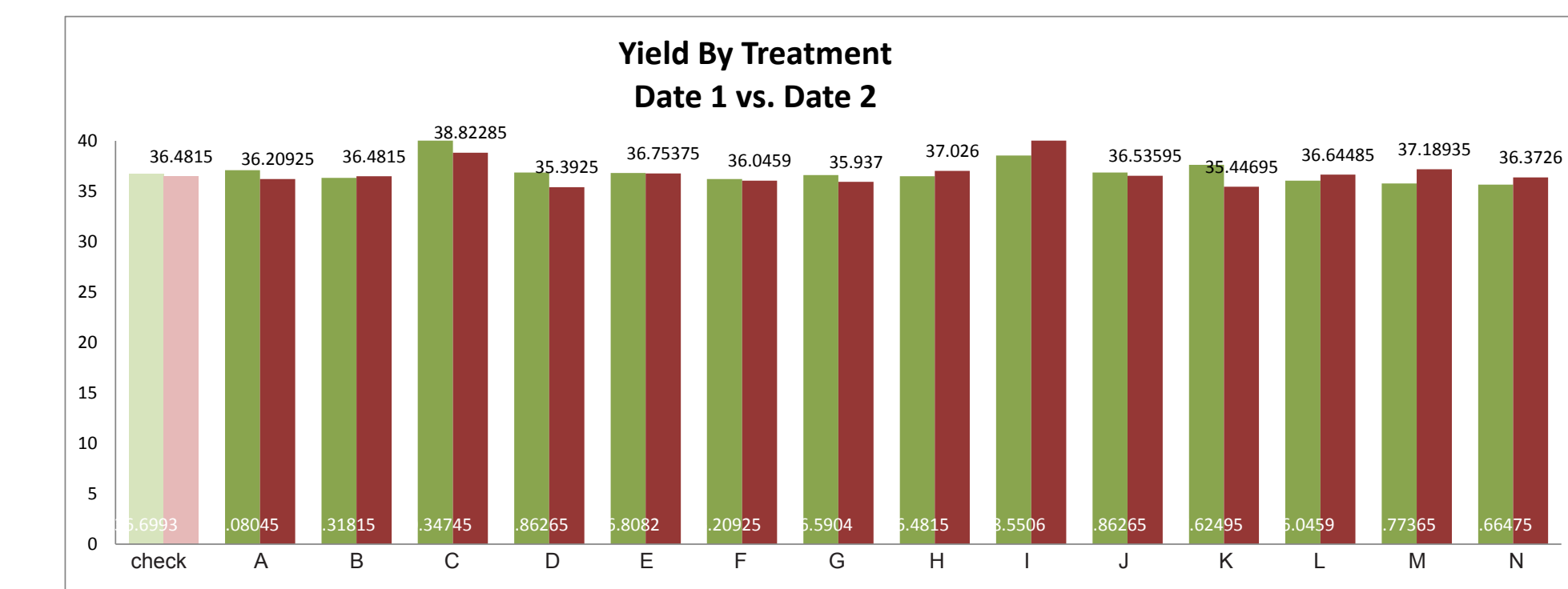
Next we select yield data from the trial. We only want to select the yield data where the whole harvested pass falls completely within the plot. We use buffers and the information about the width of the harvester to select just the appropriate yield data.



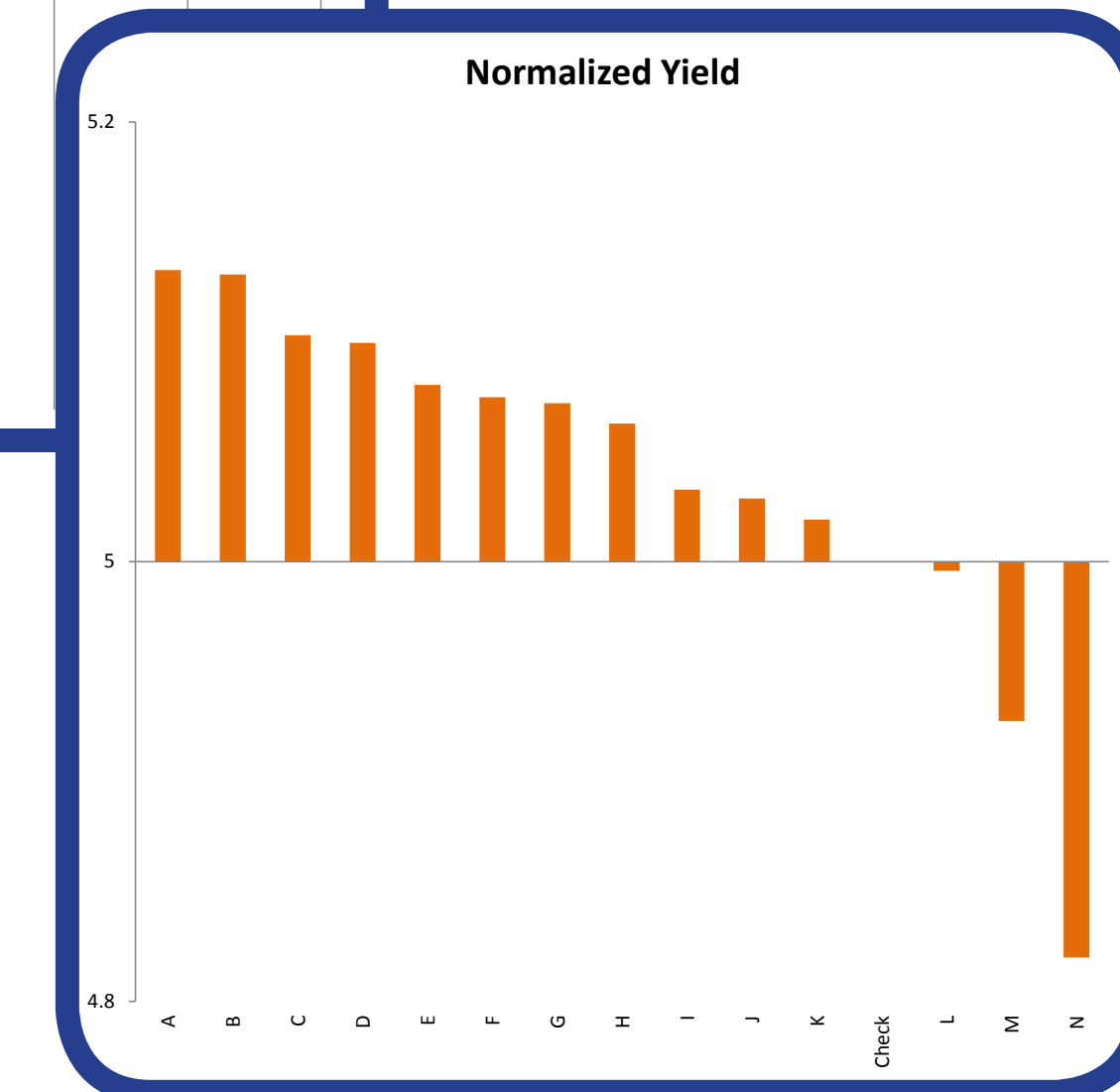
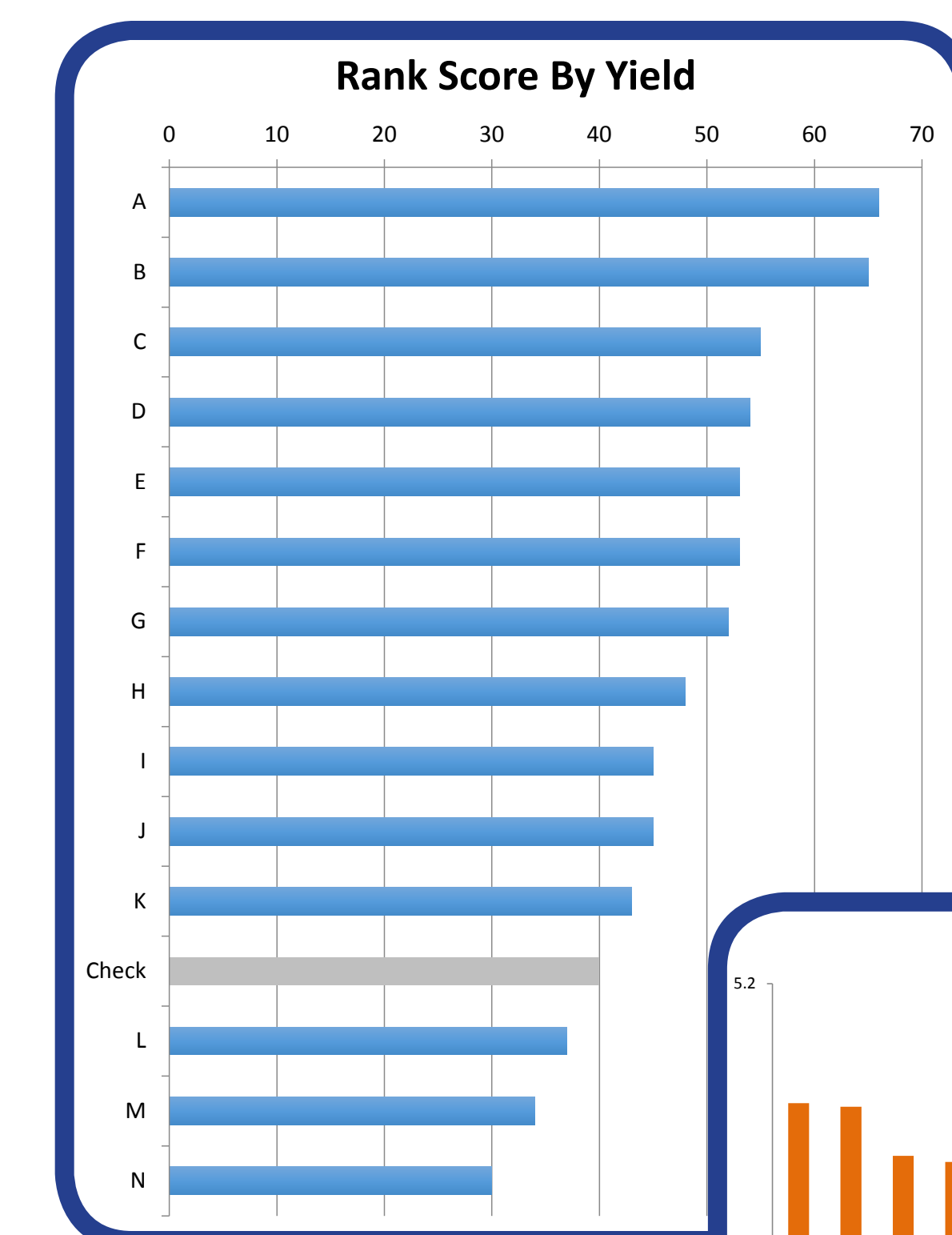
Analyzing Trial Data & Results

When the appropriate yield data are selected we can intersect these data with the plots and calculate statistics of yield on each plot. We then export the data into Excel and calculate statistics for each rep and the overall treatment.

Below are a samples of the types of charts we produce to help interpret the data.

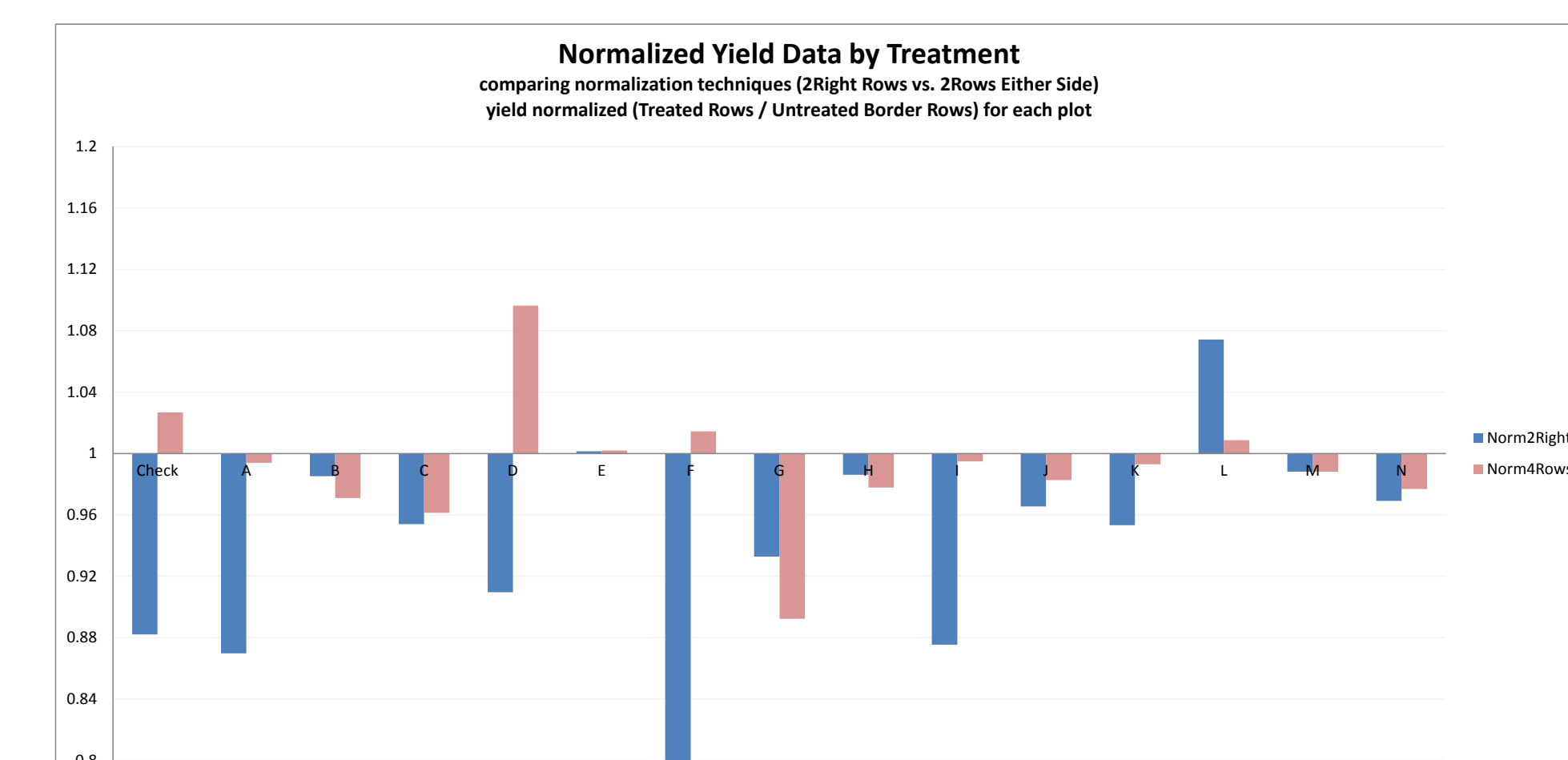


Comparison of treatments by replications in the field.



Different ways of comparing treatment means across reps. The "blue chart" simply compares the treatment mean to the check (in gray).

In the "orange chart" the check is expressed as 1 and the treatments are ranked as they compare to the check - normalized by treatment mean/check mean.



This final chart compares treatment data normalized by untreated rows on either side of the plot.

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