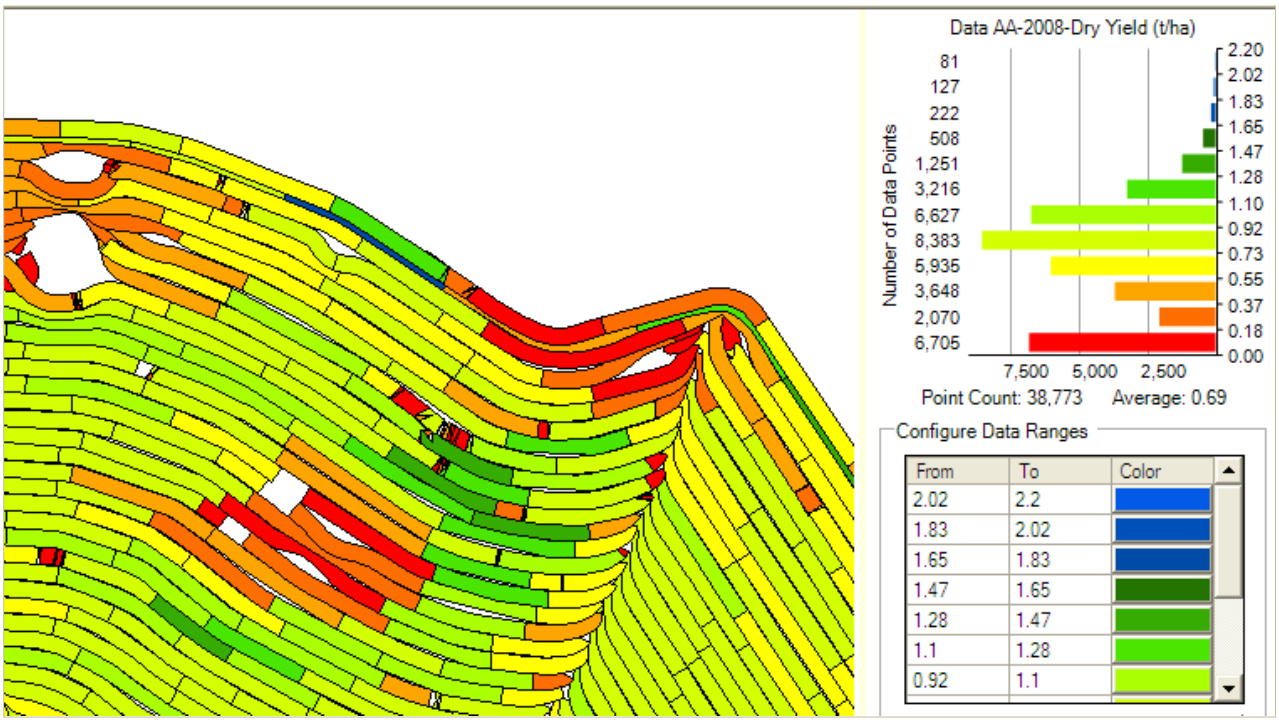
Precision Data Processor

Last updated: Wednesday, 25 September 2013



Contents

Overview

Precision farming tools enable you to make sense of sets of geo-located data.

You can create a coloured image of large sets of data (eg. Yield data) to make interpretation of the data easy or you can take a small dataset of 15 soil samples and image it just as well. In addition, you can label each point with up to 8 individual data value labels. You may want use this facility to display the soil test values for eight test items

Many precision agriculture data sources (yield monitoring and spray and fertiliser rate controllers) are supported, as well as a generic comma delimited format which you can create in a variety of third party programs.

FarmStar - vs - PAM PDP

The precision farming features of both of these Fairport products are the same.

In PAM PDP (Precision Data Processor)

- There are links between your PAM data and the precision farming features. These links will become more powerful as the program develops.
- You access the precision farming tools via the *Precision Data* menu option.
- The lists of farms, paddocks, nutrients, consumables and crops are used to populate pick lists when using the precision farming tools.

In FarmStar

- You access the precision farming facilities from the *File, Show* and *Tools* menus.
- You establish the lists of consumables and nutrients as you use the program.

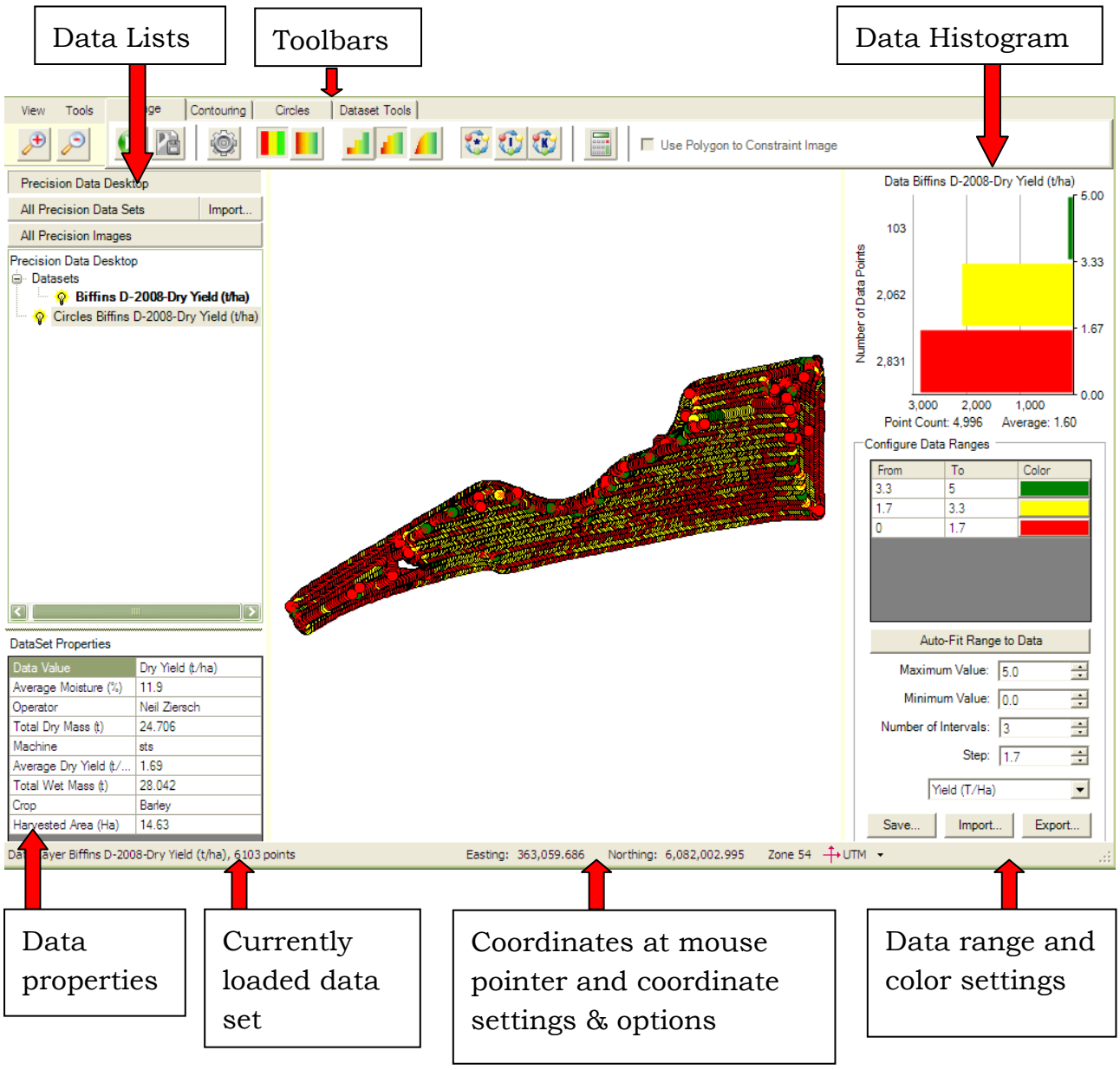
Mapping Terms

Mapping concepts and jargon can be difficult to understand. With the proliferation of GPS units, Google Earth, Google Maps and the like, these concepts are becoming more familiar to us. If you would like to read a brief description of these concepts, please refer to page 41.

Visualizing Your Data - Some Background Information

If you would like to read a brief description of these concepts, please go to page 43.

The PDP Screen Layout



Getting your data into PDP

File Requirements

The very minimum that a file needs in order to load it into the system is two fields describing the geo-location of each point. That is, either a Northing or an Easting, or a Longitude and a Latitude. The visualising tools for display can interpret any additional columns of data. All geo-located data files will contain at least an easting and a northing and usually an altitude. Specialised files such as yield data files contain other data values such as Area, Mass, Moisture, Yield, LoadID and more.

If you are generating your own files then we suggest you use a comma delimited format, and ensure that the first line of the file contains the field names of each column. The program will recognise the field names “Northing”, “Easting”, “North”, “East’, “Longitude”, ”Latitude”, “Long”, ”Lat” as meaning that the column contains real world coordinates.

The Data Manager – “All Precision Data Sets”

Your precision data is imported into PDP and the dataset is registered (meaning – the location of the data is saved to the database and a folder is created inside the main folder called “Precision Data” (which in turn, lives inside your main program folder (PAM or FarmStar). You have to let the program know where your data is, and what format it is in.

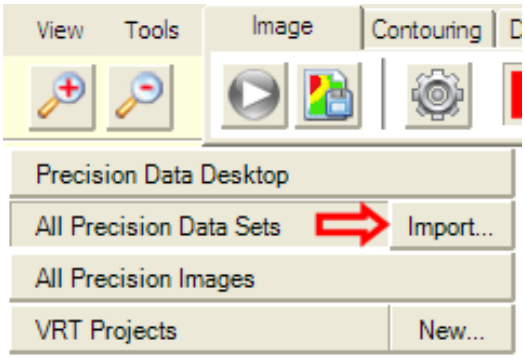
From the File menu in FarmStar, choose Precision Data Processor.

In PAM choose Precision Data Processor from the Precision Maps menu.

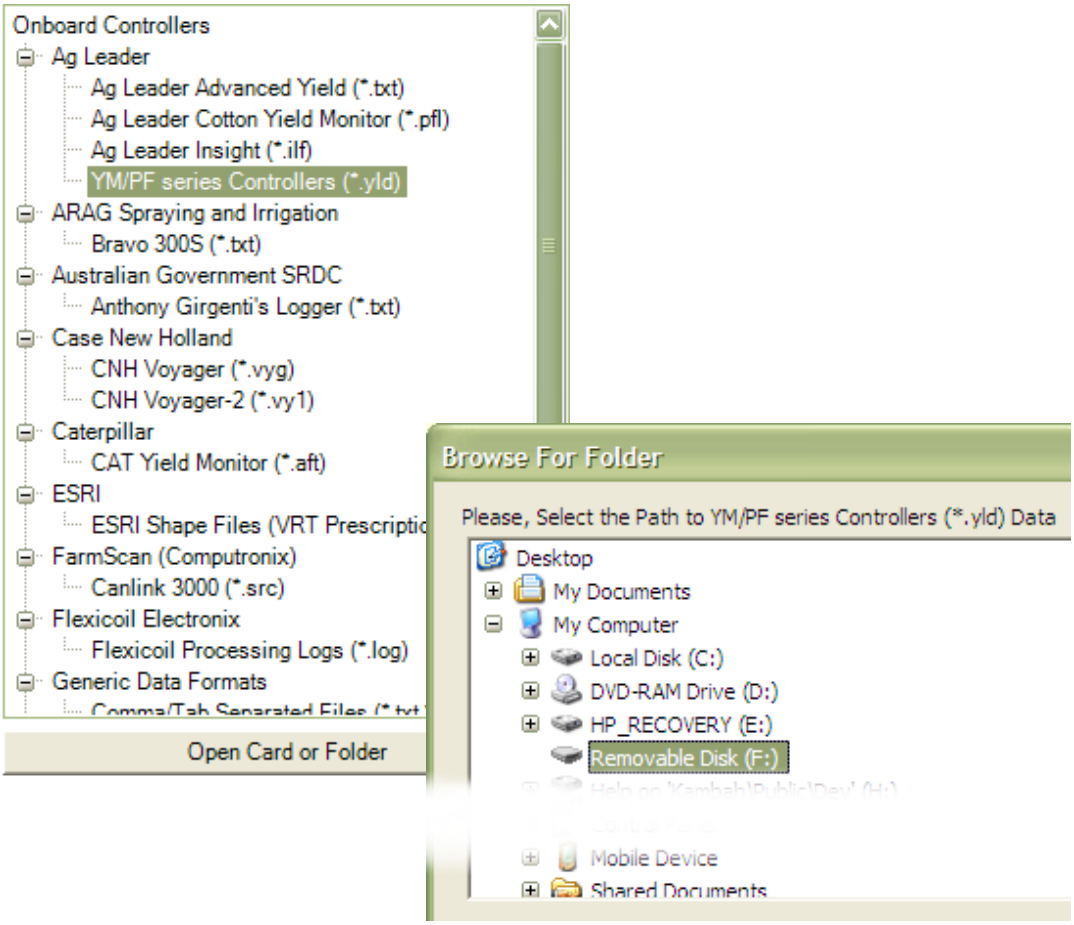
Getting your data from a data card or a folder or removable drive

Yield data and other datasets are often brought in from your harvester or tractor on a memory card. These cards, when inserted into the card slot on your computer, behave just like a removable disk. That is, you

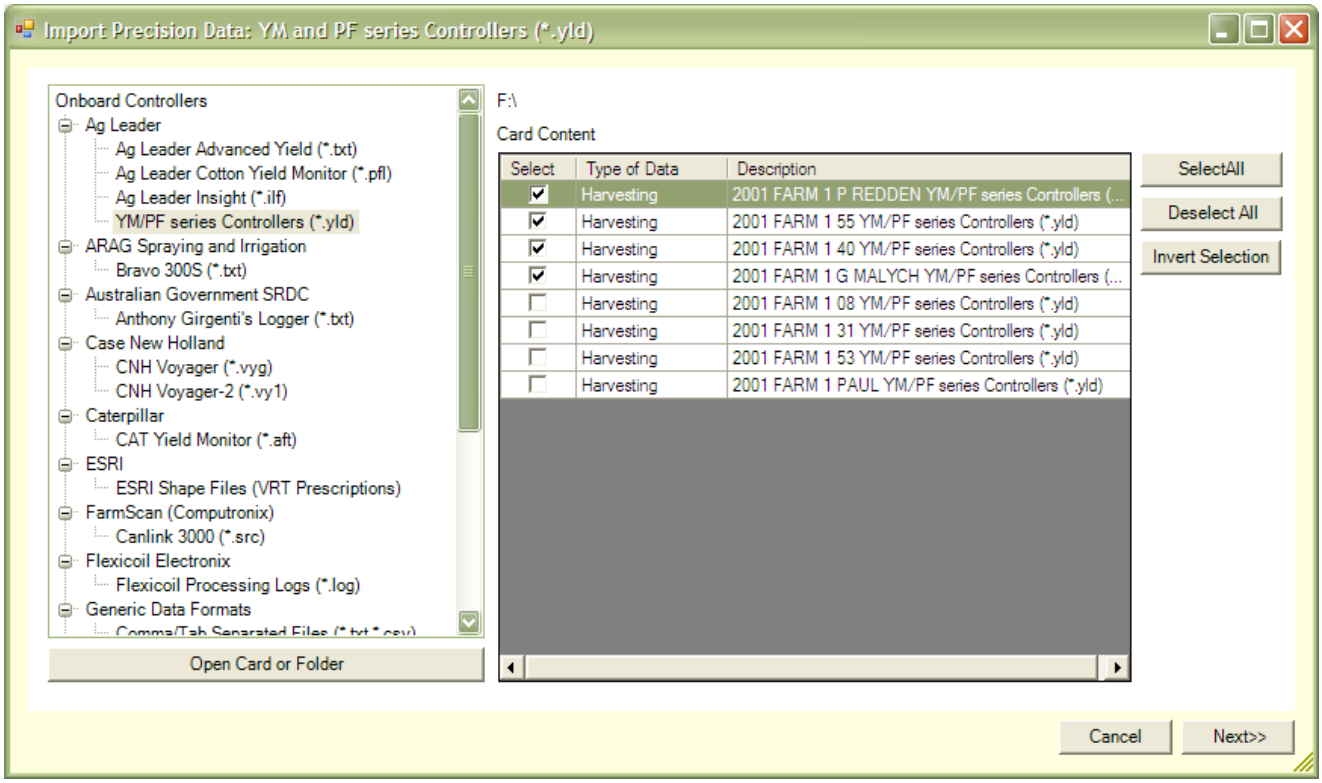
can access the file(s) on the card through Windows Explorer by clicking on the card's "Drive" …
However, PDP can read the data directly from your card. It can also read your data from a folder on your computer's hard disk, or from a removable drive (e.g. a USB drive)
The steps are the same either way:
Click on the "Import" button
Choose the Data Type that you are importing.



Having chosen the data type, click on the **Open Card or Folder** button. Navigate to the folder or card (or removable drive) where you data is located. In the screen shot below, I have clicked on the Removable Drive (F:)



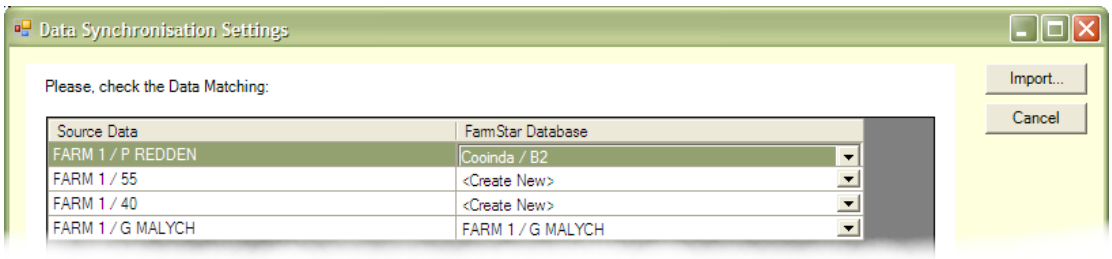
Please Note: For tips on dealing with many of the file types imported by PDP, please refer to page 58.



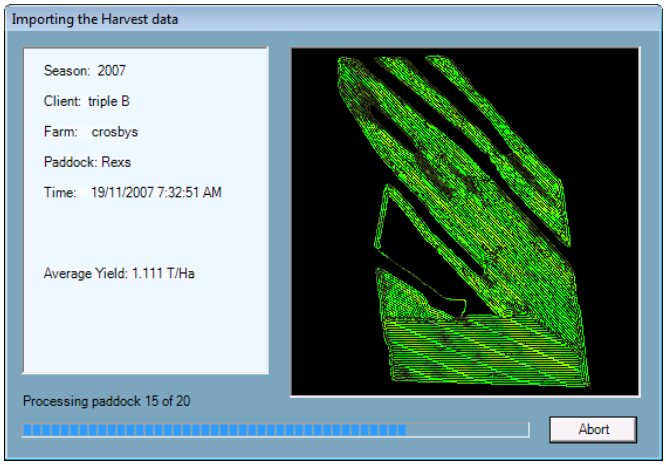
PDP now displays the contents of the selected location on the right hand side of the window... What PDP displays depends on the type of data you are importing and the type of on board device that may have created the data.

You may want import all the data or just some of it. PDP has buttons to assist you in making your selection. The datasets that PDP will attempt to import will be those that have a tick in the "Select" column. In my example above, I have chosen to import 4 datasets and leave 4. Having made your choices, click **Next** to proceed to the "Data Matching" window.

PDP will attempt to match the incoming datasets to your paddock list. The Data Matching windows enables you to associate the incoming datasets with your paddocks. If you choose the "<Create New>" option on the paddock pick list, PDP will create a new farm and



paddock for you (based on the farm and paddock name in the incoming data - if they exist) that you may rename later.



When you're done with Data Matching, click the **Import** button to begin the importing process.

The screen shown here will display the progress of the import process. If you are importing a very small data set, you may not even get to see this progress screen. If on the other hand you are importing a lot of yield data, you will definitely see it.

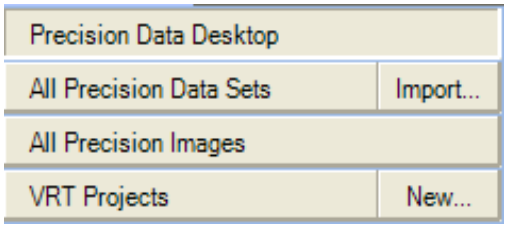
On completion of importing, PDP will display the datasets in the "All Precision Datasets" list.

Tips on Importing Files

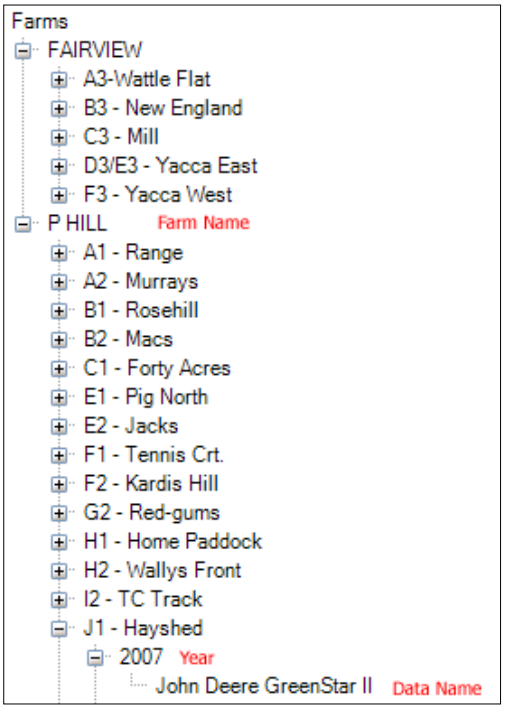
There is a huge range of data file types that people need to import. Unfortunately some manufacturers often change the file format of their files without notifying us. This causes error messages to appear in PDP. Please notify us of any file types you are having trouble importing and if possible send us a sample.
For tips on dealing with many of the file types imported by PDP, please refer to page 58.

If possible it is best to import yield data directly from the card or make a complete copy of the card into a folder on your computer (including ALL subfolders) and import from there.

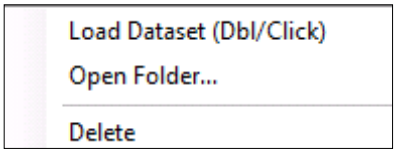
Selecting a Data Set for Analysis



Clicking on the "All Precision Data Sets" button, you will see the list of datasets that you have imported, organised into a "tree" and sorted by Farm, Paddock and Year.

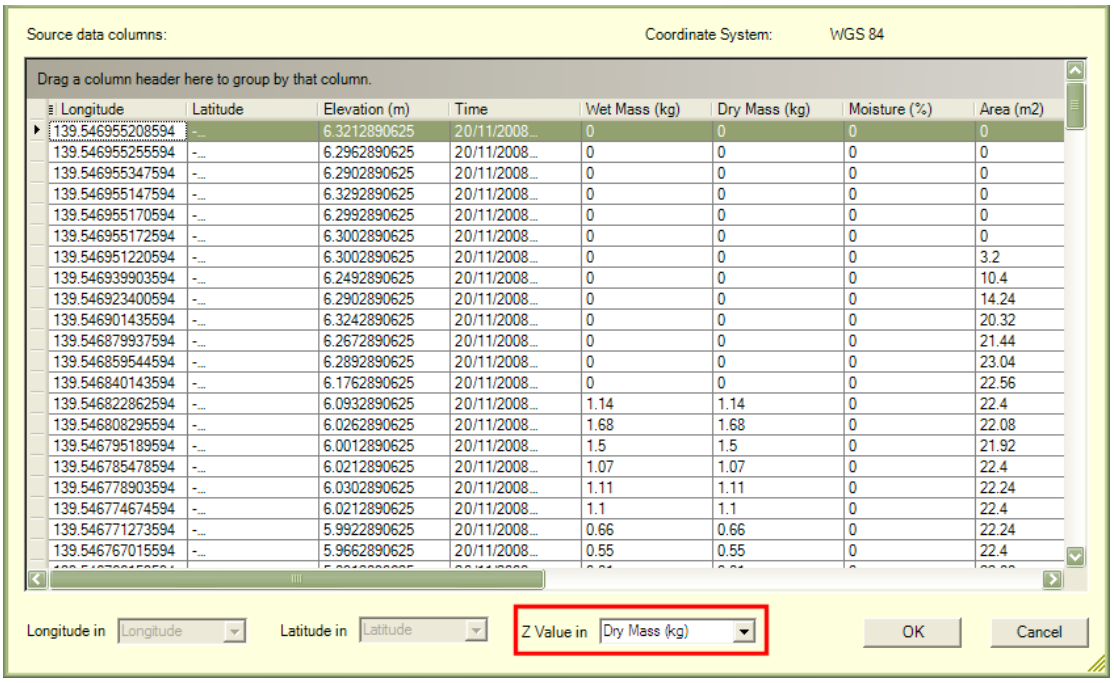


If you Right Click on a data set on the "tree", set you will get an options menu.



You can the select the data set to work with by double clicking on the list or by selecting *Load Dataset* on the menu. It will then bring up a window (see below) to allow you to select which data field (heading) you want to use for your analysis.

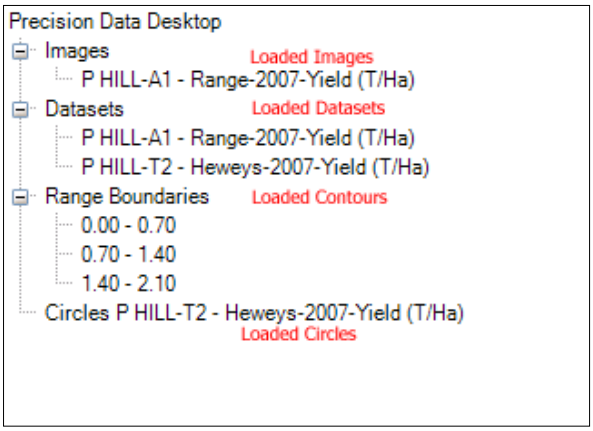
Choose the data column ("Z Value") that you want to work within the precision Data Desktop. This will be a **Yield** column if you are importing yield data.



Longitude	Latitude	Elevation (m)	Time	Wet Mass (kg)	Dry Mass (kg)	Moisture (%)	Area (m2)
139.546955208594	-...	6.3212890625	20/11/2008...	0	0	0	0
139.546955255594	-...	6.2962890625	20/11/2008...	0	0	0	0
139.546955347594	-...	6.2902890625	20/11/2008...	0	0	0	0
139.546955147594	-...	6.3292890625	20/11/2008...	0	0	0	0
139.546955170594	-...	6.2992890625	20/11/2008...	0	0	0	0
139.546955172594	-...	6.3002890625	20/11/2008...	0	0	0	0
139.546951220594	-...	6.3002890625	20/11/2008...	0	0	0	3.2
139.546939903594	-...	6.2492890625	20/11/2008...	0	0	0	10.4
139.546923400594	-...	6.2902890625	20/11/2008...	0	0	0	14.24
139.546901435594	-...	6.3242890625	20/11/2008...	0	0	0	20.32
139.546879937594	-...	6.2672890625	20/11/2008...	0	0	0	21.44
139.546859544594	-...	6.2892890625	20/11/2008...	0	0	0	23.04
139.546840143594	-...	6.1762890625	20/11/2008...	0	0	0	22.56
139.546822862594	-...	6.0932890625	20/11/2008...	1.14	1.14	0	22.4
139.546808295594	-...	6.0262890625	20/11/2008...	1.68	1.68	0	22.08
139.546795189594	-...	6.0012890625	20/11/2008...	1.5	1.5	0	21.92
139.546785478594	-...	6.0212890625	20/11/2008...	1.07	1.07	0	22.4
139.546778903594	-...	6.0302890625	20/11/2008...	1.11	1.11	0	22.24
139.546774674594	-...	6.0212890625	20/11/2008...	1.1	1.1	0	22.4
139.546771273594	-...	5.9922890625	20/11/2008...	0.66	0.66	0	22.24
139.546767015594	-...	5.9662890625	20/11/2008...	0.55	0.55	0	22.4

This data will then show as a new item on the **Precision Data Desktop** List

Precision Data Desktop



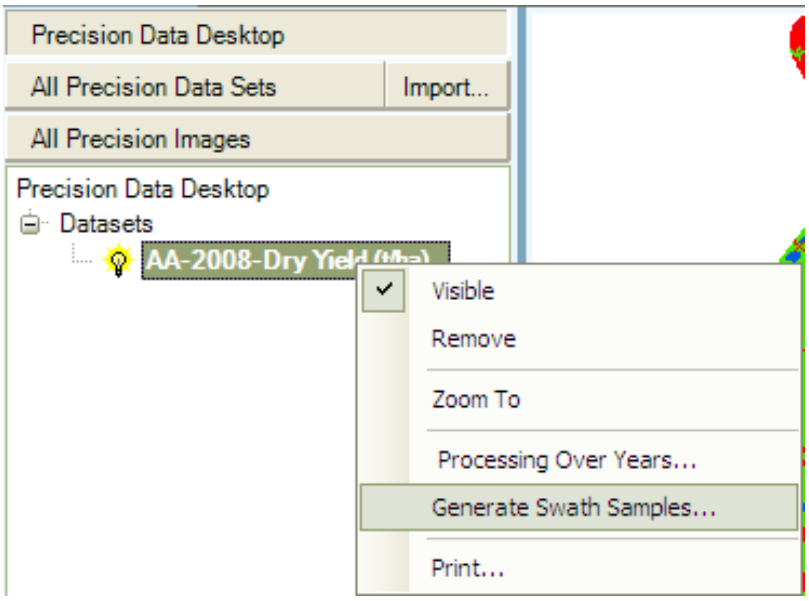
Items in this list are the data sets that you've chosen from the "All Precision Data Sets" list or layers of images, contours etc which have been generated. That is, it includes Images (that have just been created or those re-loaded from the "All Precision Images" list) loaded Datasets, Range Boundaries (Contours just created) and Circles.

Also, if you have created or selected a polygon to be used in your data processing and analysis, you will also see a layer called "Constraint Polygon" on this list. For more information see pages 28 - 30.

Precision Data Desktop – Right Click Menu

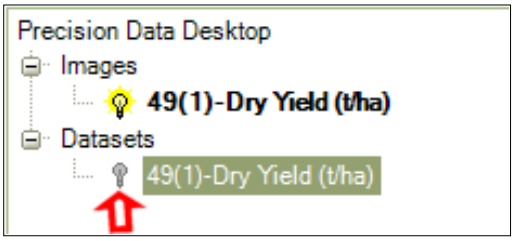
If you right click on an item (a layer of data or an image, or a layer of circles or a layer of contours or the Constraint polygon layer) you will get an options menu.
The number of menu options that you will see depends on the item type you've selected. All items have the options:

- Visible - (Hide / Show layer)
- Remove – (Remove layer from the list)
- Zoom To – (Make the layer fill the map view window)
- Print – to print an image, or the raw data layer (this option will only appear when you have selected a map that PDP can print)



If you've selected a Data Set you will see the additional options on your Right Mouse menu: *Processing Over Years* and *Generate Swath Samples*.

Processing Over Years : This enables you to select one or more additional years to process for the purpose of creating a Maximum, Minimum or Average image.
See Page 57 for more information.
Generate Swath Samples: to create a layer of polygons that represent the path of the machine used when the data was collected. See Page 20 for more information.



Removing a layer / Hiding a layer

By Right Mouse clicking on any of the layers in the Precision Data Desktop, you can choose "Remove" to delete that layer from the screen. You may want to just hide the layer. In this case, click on the light globe icon to turn off the layer

Zoom to

To zoom into the area that the data occupies, right click on the data layer and choose "Zoom To" from the menu.

Working with Data Sets in the Precision Data Desktop

Imaging

Overview

Imaging is by far the most powerful function, and there are many options available to ensure that you can generate the most accurate representation of your data. A good understanding of these options will ensure that you don't make mistakes and potentially misinterpret your data.

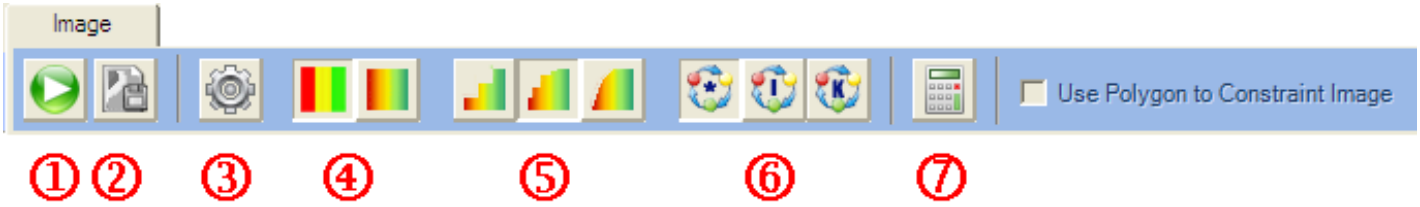


Image Toolbar

This is used for processing data to create Images

1. The "Generate Image" button
2. The "Save Image" button – images can be saved and reviewed later via the "All Precision Images" list. Images can also be used in some VRT projects (depending on the on board device type)
3. Settings. Click this button make changes to the default settings. There are image generation settings that can be "tweaked" and also naming conventions for saved images.
4. Solid (an image with discreet or solid colour areas will be created) or Blended (an image with blended colours will be created) Images options.
5. Smoothing options. Data can be quite "noisy" – you may want to smooth out the noise in your data. Try experimenting with these button to get a feel for their effect on the images being created.
6. PDP has 3 "Interpolation" methods. **"*"** Fairport Optimised, **"I"** Inverse Distance, **"K"** Kriging. If you are in any doubt about which you should use, always choose **"*"** Fairport Optimised

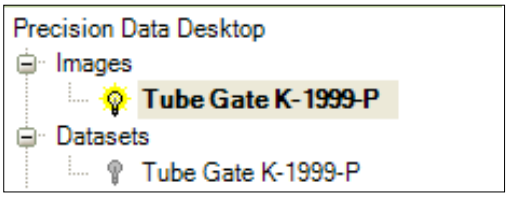
7. The Advanced Image Analyzer which can be used to create derived images from one or more images and by applying calculations. For example, you can quickly create a nutrient depletion image from a yield image. See page 49.

To go directly to the steps for creating a Yield Image, go to page 19.

For a "crash course" on the technology behind imaging, please refer to page 45.

For information on using the Advanced Image Analyzer, please refer to page 49.

When you have created an image and you have it selected on the Precision Data Desktop list…



… you will notice 2 buttons appear in the data range setting area (bottom right of the screen)…

Linear – vs – Equalized images

To learn about these options and what they can do for you, please refer to page 54.

Pixel Size

Pixel size effects the speed to generate your image, and resolution of the image. It can be adjusted through the "Settings" button on the Image tab.

If you increase the pixel's size up to 10 metres a pixel, you may get a very "blocky" image, however, this also substantially reduces the amount of time required to process the data.

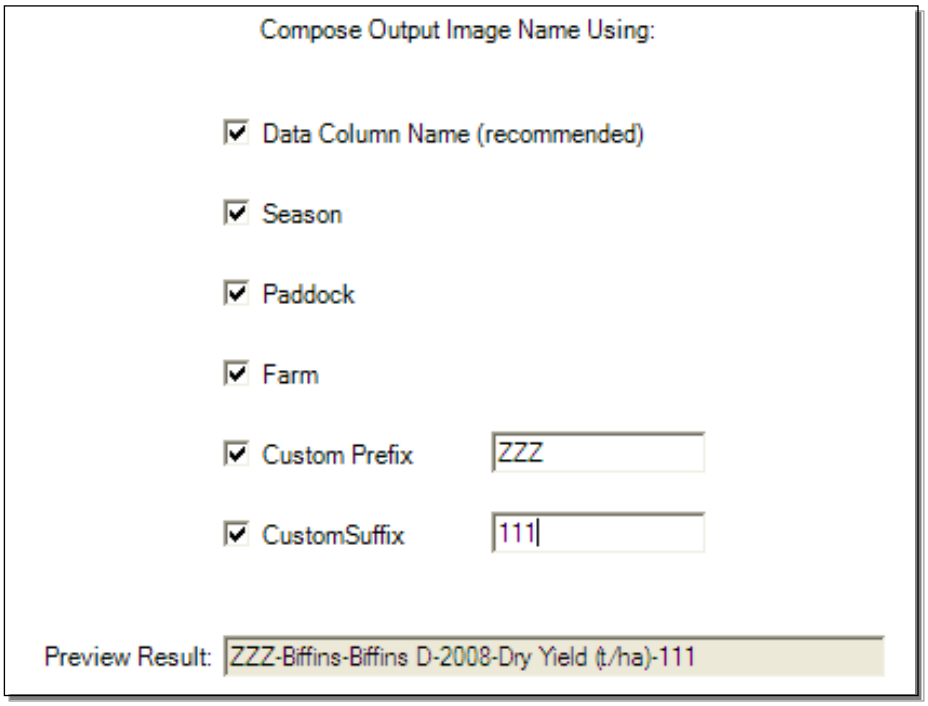
The best advice for pixel size is to experiment. Sometimes, it's handy to choose a fairly large pixel size to generate a quick view of your data. As you adjust various parameters, you can reduce the pixel size to generate a more finely detailed image.

Naming Conventions for Saved Images

It is worthwhile becoming familiar with the image naming convention settings. The way you choose to name your images can be adjusted by clicking on the "Settings" button on the Image tab. 

On the form that pops up, click on the "Naming Convention" tab.

Below is an example of how the image name would look if we choose every option.



Circles

The Cicles Tab

This is used for processing data to create Circles

1. The “Generate Circles” button
2. Optionally choose to display your circles filled with colour or with coloured circumferences only.
3. Size Settings. Chose the size of the circles.
4. Size your circles based on the values of a chosen data column.
5. Select the data column to be used to size your circles (this list becomes available if you chose to size your circles by the values in a data column).

Circle Colour

For each circle generated for each point, it is coloured according to the original field you chose. It is coloured according to your clip range and palette.

Circle Size

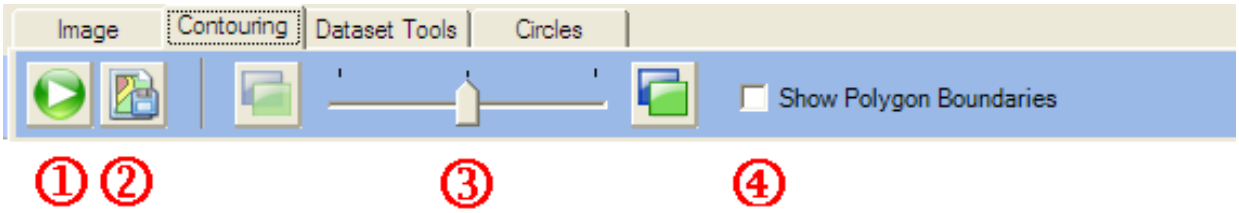
For just knowing where your data is, choosing Small circles, and choosing the ‘Filled’ option is a quick technique. If you want to have the circle sizes represent the changing values of another data field, choose “Size by selected field value”… choose the data field from the pick list. The larger the data value, the larger the circle size will be.

For more information on visualizing your data using circles, go to page 26.

Contours

Contouring Toolbar

This is used for processing data from the current Image to create Management Zones.



1. The “Generate Contours” button
2. The “Save Contours” button – contours can be saved and reviewed later via your farm mapping layers. Contours can also be used in some VRT projects (depending on the onboard device type)
3. Transparency slider. Use this to view through the contour polygons to an image below.
4. Polygon boundaries can be hidden or displayed.

Note : The image should have minimal colours and detail for this to work. If it cannot create the contours try reducing the number of colours in the image or make the image smoother.

Data Set Tools Toolbar

There are three main purposes for the buttons on this toolbar.

1. To select or draw a polygon to limit the area of a generated image (“Image Constraint Polygon” … See Page 28)
2. To sub-set data. Using a selected or drawn polygon, you then choose to exclude data from inside or outside the polygon – then save the remaining data to your Precision Data Set list. This can be useful when yield data is collected over more than one paddock accidentally.

3. To view data statistics for a selected or drawn polygon.

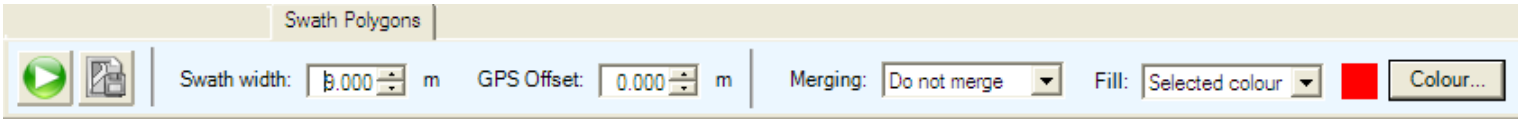
	Button to select a polygon from your farm mapping layers
	Button to commence drawing a polygon
	Button to commence drawing a hole in your drawn polygon
	Edit Button – remove, add or move points on a polygon boundary
	Undo Button – Undo your drawing actions
	Panning Tool – Your mouse cursor becomes a panning or dragging tool to move your image or data display around the screen
	Selection Tool – Use this tool if you have finished using your polygon and need to delete it. Select polygon, then press Del, or right click for the menu
	Display Data Statistics – click on this button to display a spreadsheet of data statistics for the data inside your drawn or selected polygon
	Data Subset tool – Exclude the data outside the polygon
	Data Subset tool – Exclude the data inside the polygon
	Data Subset tool – Revert back to including the entire data set. (Switches off the data exclusion modes)
	Data Subset tool – Save the remaining data to a new data set.

For a full explanation of how to use the drawing tools, see page 47.

Creating a "Swath Polygon" layer

Most data that is imported into PDP has been derived from an on board device that has logged data from a machine which has a swath width. To see the display of the machine's swath follow these steps:

1. Select a Dataset on the Precision Data Desktop and then click on the "Swath Polygons" tab to display the options



2. Set the appropriate options for the swath layer. The "Merging" options are provided due to the fact that sometimes there is a vast number of data points in a dataset. The "Do not merge" option will result in one polygon for each data point. "Merge samples by ten" will combine 10 data points into one polygon. The "Auto-Merge" option will result in long polygons where your machine has been traveling in a straight line. That is, this option will create the least polygons to represent the job.

3. GPS Offset – If the GPS is not mounted centrally on the machine, the swath will appear offset. Use

4. To flood-fill the polygons using the data values of the dataset in use, choose that option, otherwise you can choose to leave the polygons unfilled, or filled with a color of your choosing.

5. To save the layer of polygons to an ESRI SHP (Shape) file click on the Save button. You will need to have the Swatch Polygon layer selected in the "tree" first.

Working with Yield Data

Getting your data from a card

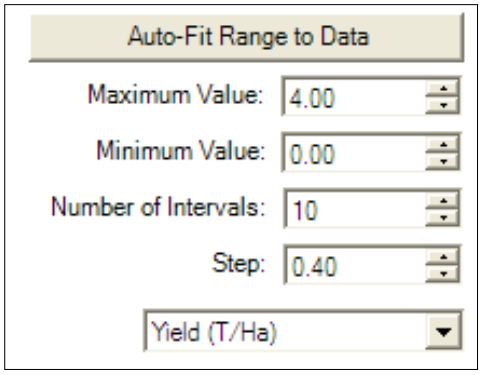
See Page 5.

Steps to import your yield data

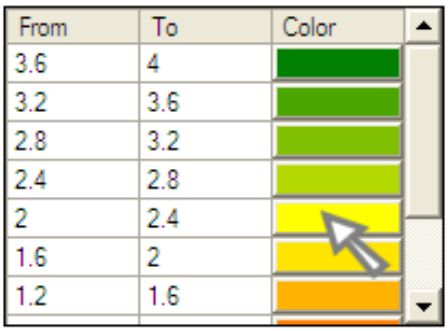
Follow the steps outlined for you in the topic “Getting your data into PDP” on Page 7.

Steps to create a yield image

When you have a dataset loaded & have clicked on the **Image Tab**, create an image using the following steps:



Choose the range of data and colouring that you would like use for the image. Data ranges and colours can be saved and re-used. Choosing a previously saved palette will instantly set up your ranges. In the image at left, I have chosen my palette “Yield (T/Ha)”.
You can click on “Auto-Fit to Data” and PDP will set up the minimum and maximum for you to match the data.
You can manually specify the Min & Max value to trim the data. This is to remove zero or false low readings and inaccurate high readings.
To set the number of colours used in the range selected, set the Number of Intervals or the Step value, the coloured circles displaying the raw data (in the centre of the screen) will change automatically.



You can edit the colours manually by clicking in the coloured box in the table. The colour chooser will pop up.
You can save and name these palette settings by clicking on the “Save” button at the bottom. These can be re-used at anytime by picking from the pick list.

Palettes can also be exchanged with other uses. To exchange saved palettes, use the “Export” and “Import” buttons

Choose for the type of colour range change. (Solid or Blended colour changes)

Choose for the amount of detail in the image. (Smoother for VRT use)

Choose the interpolation method. Leave on Optimised if unsure. See Page 45 for more information.

You are now ready to generate the data image… click the "Generate" button.

If you are satisfied with the image, click "Save" and name the image for future reference. You may choose to save the image file into a special folder that you have made for the purpose. If you let

PDP manage your images, it will. The "All Precision Images" image manager will list all images created and saved using the precision farming tools. To display the Image Manager, click on the "All Precision Images" button

If you want to abandon the image you created and create another with different settings, simply click on the "Generate" button again

Imaging Tips and Options

Unrealistic High Values

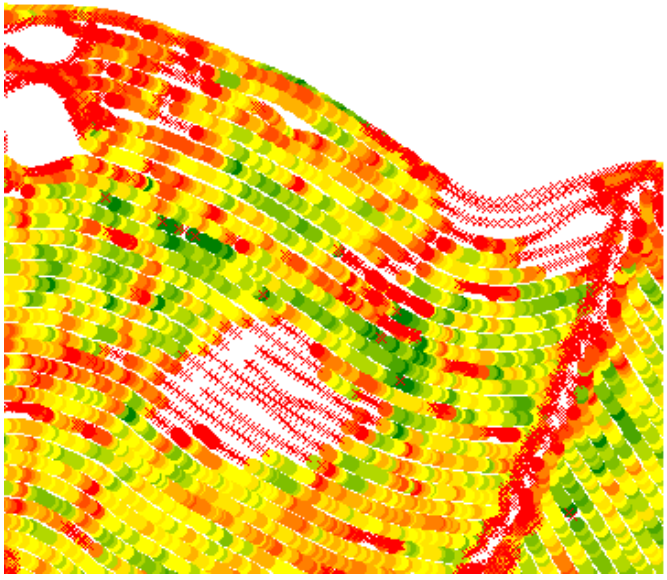
Sometimes your yield data can have some unrealistic, very high values in it. Usually there will be an insignificant number of these unrealistic values and they can be excluded. You are advised to reset

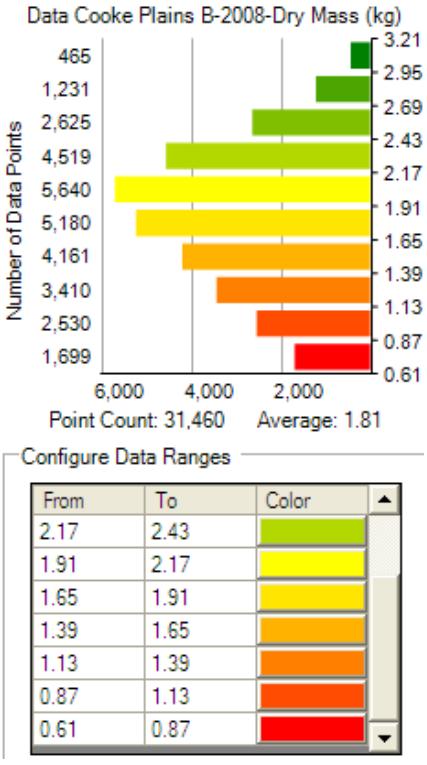
the range of the data under these circumstances as the image colour range can be effected by stray high data values. You should also exclude any unrealistic low values.

Unrealistic Low Values

Sometimes it may be difficult to ensure that the harvesting machine is always totally in the crop and harvesting a full swath. On such occasions the yield monitor may record unrealistic low values for an area. By excluding these low values, you avoid displaying these unrealistic low yielding areas. For example, if you know that the crop did not yield below 0.5 Tonnes per Hectare at any point, then use this value (or an even higher value) as your minimum.

PDP will display an "X" on the raw data set view of the data where you have excluded values. This will indicate to you that you might have excluded genuine values. See the screen shot below. I have excluded genuine values from my yield map by setting my minimum too low.





Tip: Once you become familiar with the normal range of your yield data, it is a good idea to save a "Palette" for each crop type. This will enable you to select these pre-set parameters

from the Palette pick list.

To change the size of the yield map and the way that the program searches for data click on the "Settings" button.

Please Note: Setting the search radius to less than the swath width will result in gaps in your yield image. Setting a large search radius will slow down the imaging process and could result in 'over smoothing' the data.

Tip: If you have two harvesters working in the one paddock and only one is equipped with a yield monitor and they are harvesting alternate swaths, set your search radius to slightly more than two times the swath width. This will make the yield image fill in the gap... the missing data will be "interpolated".

Changing the pixel size will have two effects… The smaller the pixel size, the larger (in Kilobytes) the image will be and the smoother the image will be.

Tip: If you want to create an image very quickly, select a large pixel size (eg. 10 metres) and use a small search radius (just over or exactly the swath width.

What can you do with a yield image?

Now that you have a yield image on your screen you can do the following:

- Move your mouse around on it to see the yield value at any point. The result is displayed on the Status Bar at the bottom of the PDP screen.

- Use the Contouring tab to create a set of contour polygons which can be saved to your farm mapping layers and also used for variable rate projects.

- Using the Dataset Tools tab, choose the polygon drawing tools, draw polygons around areas of interest to measure the area and to display a statistical analysis of the yield data (and any other data

that is included with the yield … eg. Moisture, Height) within the drawn polygon.

- Using the Dataset Tools tab, extract sub sets of the data by drawing polygons around the areas you want to include in, or exclude from the data. Again, perhaps you could create a layer called “Temp” for these purposes. You can always delete the layer before closing down the program. This can be useful for both research purposes and to resolve a situation where you have collected data from more than one area (paddock or field) by mistake. The data can be separated into two or discreet new data sets.

- Use the “Advanced Image Analyzer” to perform calculations on the underlying data and to generate derived images. See page 49.

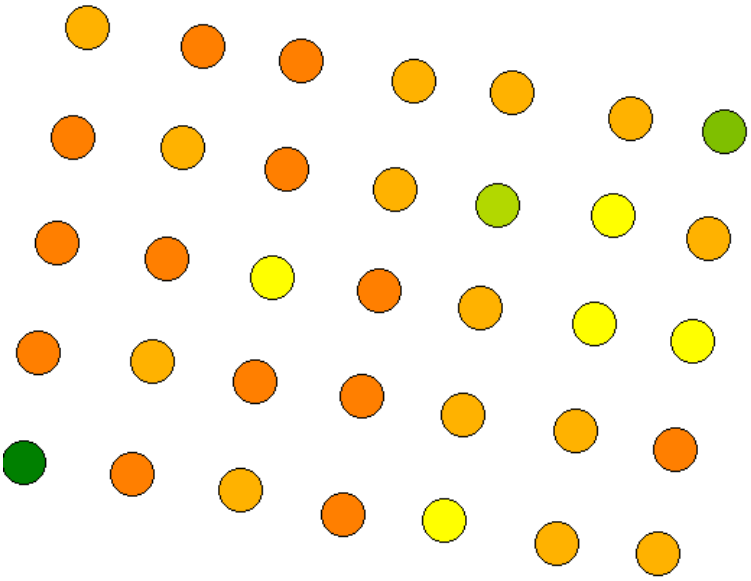
Using circles to plot data

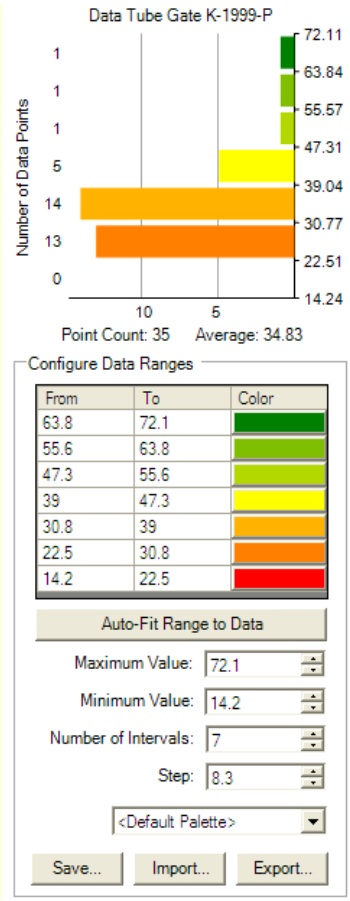
Circles are useful for plotting data that doesn't have sufficient data for a good image plot, or for overlaying more information on an image. Circle plots are also excellent for soil test results.

After you have loaded some data, select the ***"Circles"*** tab.
For information on each of the options on the Circles tab, go to page 44.

The **sizing options** are easily selectable via the option buttons.

- **Small, Medium, Large** will give all circles a constant size. This can be useful when you are representing soil test results by coloured circles as shown here. This is a map of Phosphorus values for soil samples taken 100 m. Apart (1 sample per Hectare)





- **Size by selected field value.** Choose this option when you want to show the value of a field using the circle size. In the example below we are still showing the circles coloured by Phosphorus, but we are also showing them sized relative to the Organic Carbon (%) values ...

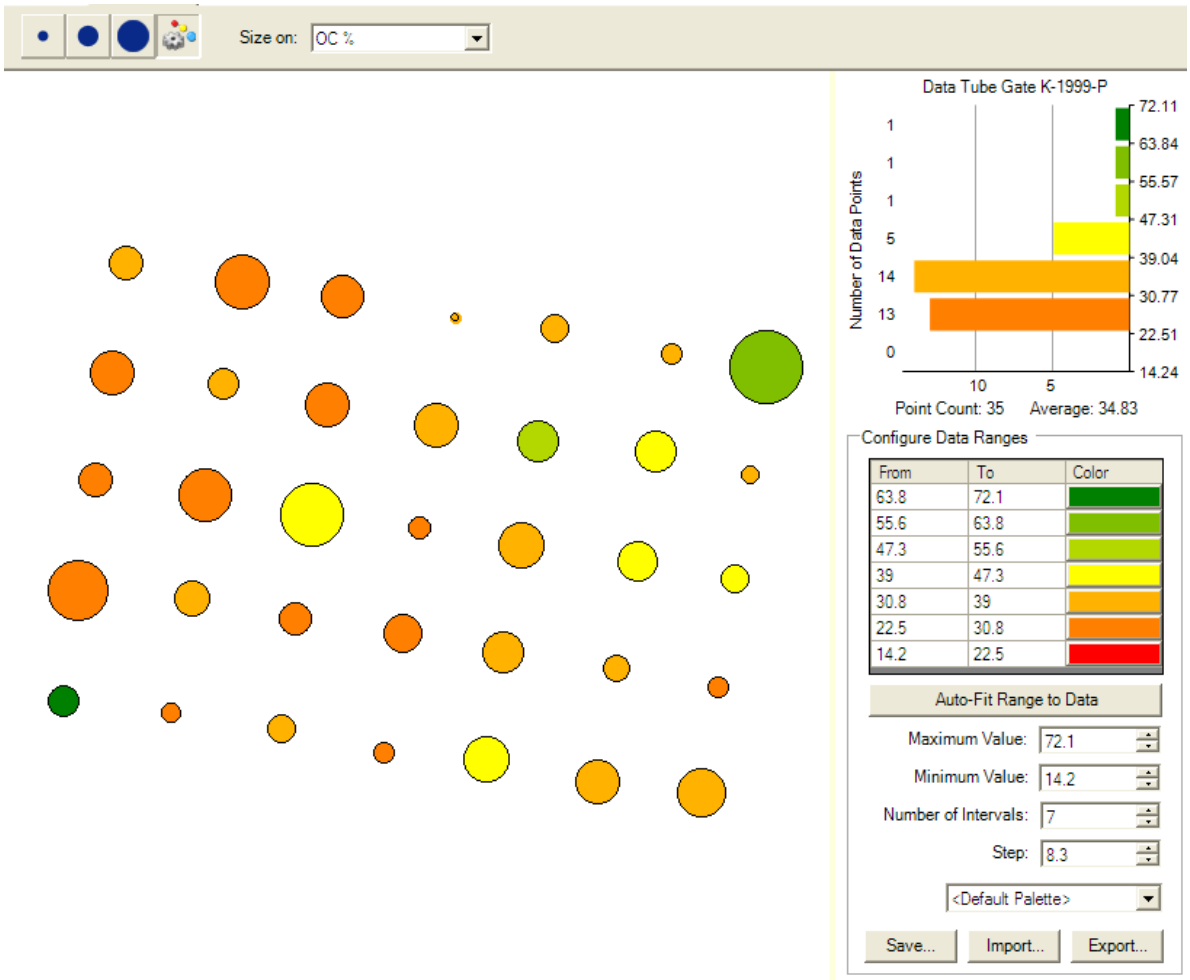
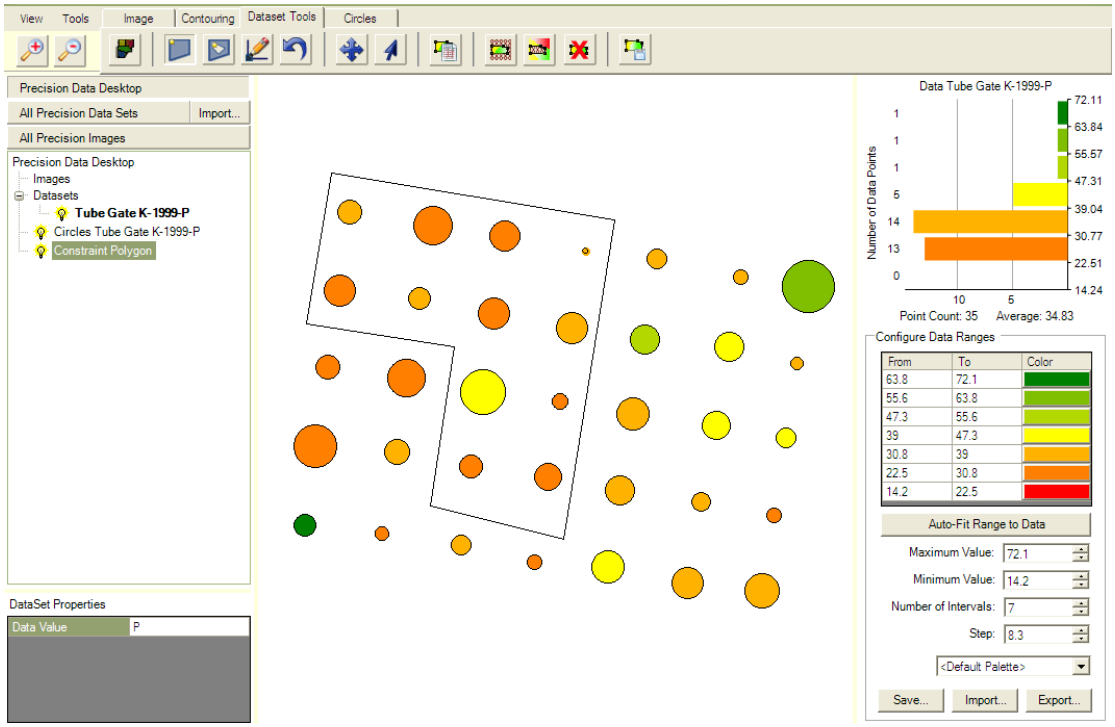


Image Constraint Polygons

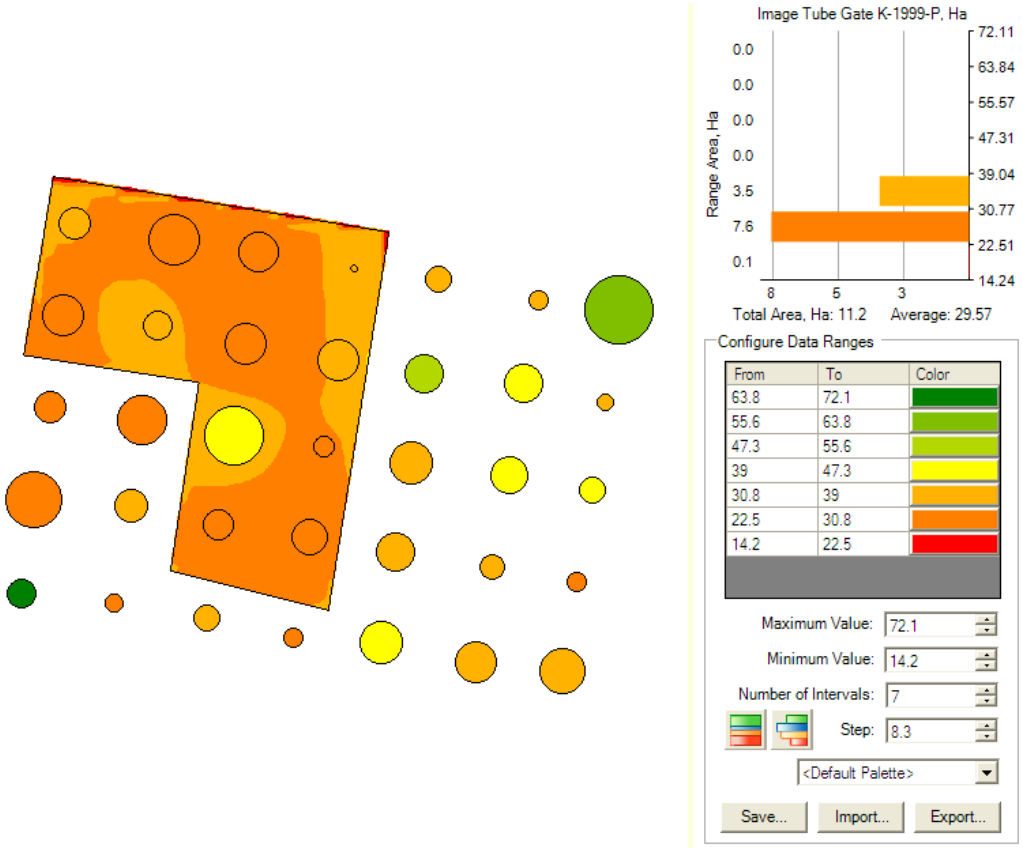
A side effect of the image creation process is that the search radius you opt for will cause the image size to sometimes extend beyond the area where the data was collected… For example, it is possible for a yield image to extend outside the boundary fence of the paddock.

To ensure your image remains within the boundaries of the area being analysed you can use an image constraint polygon. The polygon can be a pre-existing polygon (eg. a paddock boundary) or you can opt to draw an appropriate polygon for the purpose. Either way, the steps to constrain your image to within the area of a polygon are these:

1. Either draw a new polygon or select an existing one from your farm mapping layers. See the Dataset Toolbar options here on Page 18.
2. The current "Constraint Polygon" will be displayed or hidden by means of the 'light globe' on the Precision Data Desktop list.
3. When you generate a new image using the Image Toolbar as per normal, to make use of the image constraint polygon, be sure to tick the check box: "Use Polygon to Constrain Image"



In the screen shot above you can see that we have drawn a polygon around a section of the data. We will now create an image using our constraint polygon...



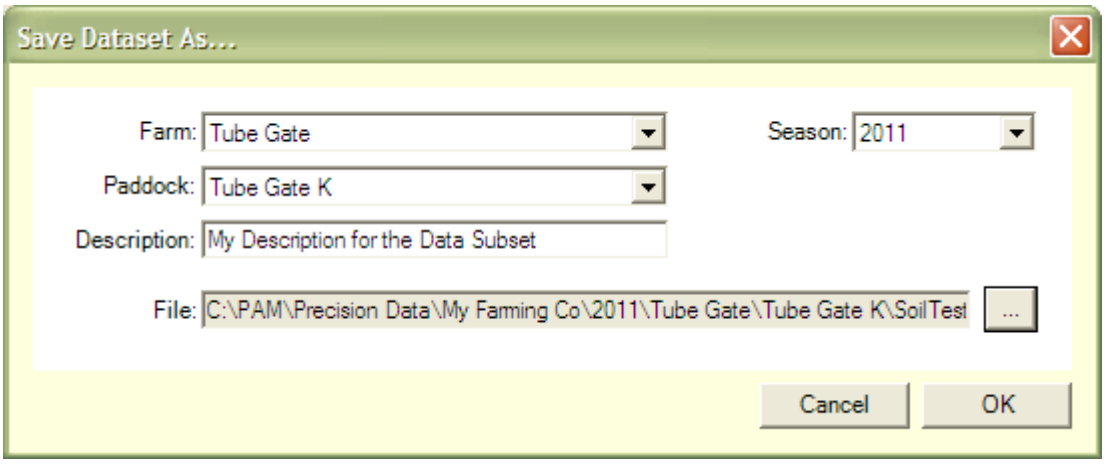
Subset Data

The subset data option can be useful for two reasons. Firstly, if you have collected data from two or more discreet areas in the one dataset, you will most likely want to separate those discreet areas into discreet datasets.
Secondly, you may from time to time want to extract from a large dataset the data from a discreet area within the larger area for further analysis.

For either of these purposes the steps you must take for achieving the desired result are these:

Display the whole dataset using one of the normal methods of visualising your data (Image, Path, Circles) … Let's use an image for our example.
Using your normal Drawing Tools, draw a polygon using the tools on the Datasets tool bar (See Page 18). Draw the polygon to include the area on the image that you want to extract (that is, draw the polygon to enclose the data sub set that you want to remove) or… Draw the polygon to exclude an area.

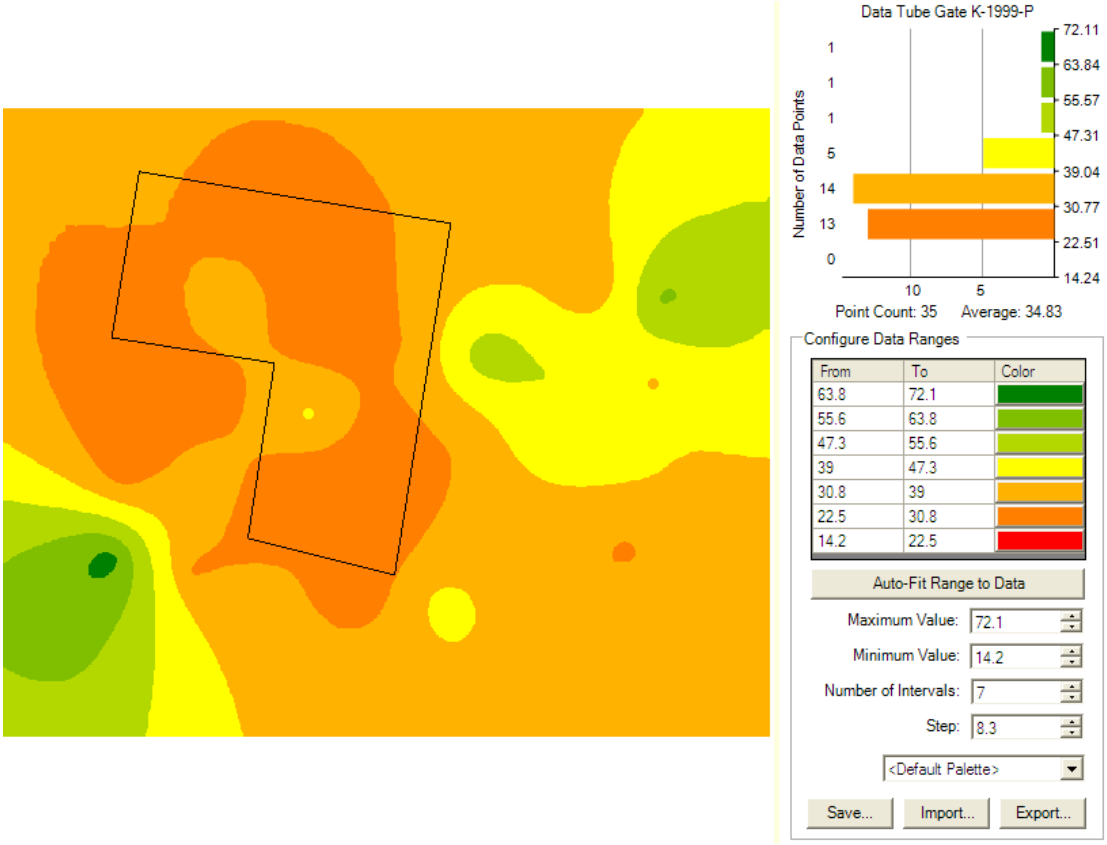
Now choose Discard points inside the selected polygon or Discard points outside the selected polygon as appropriate using the buttons on the tool bar.
Save the resulting dataset by clicking on the Save button.
The Save DataSet As … form looks like this…



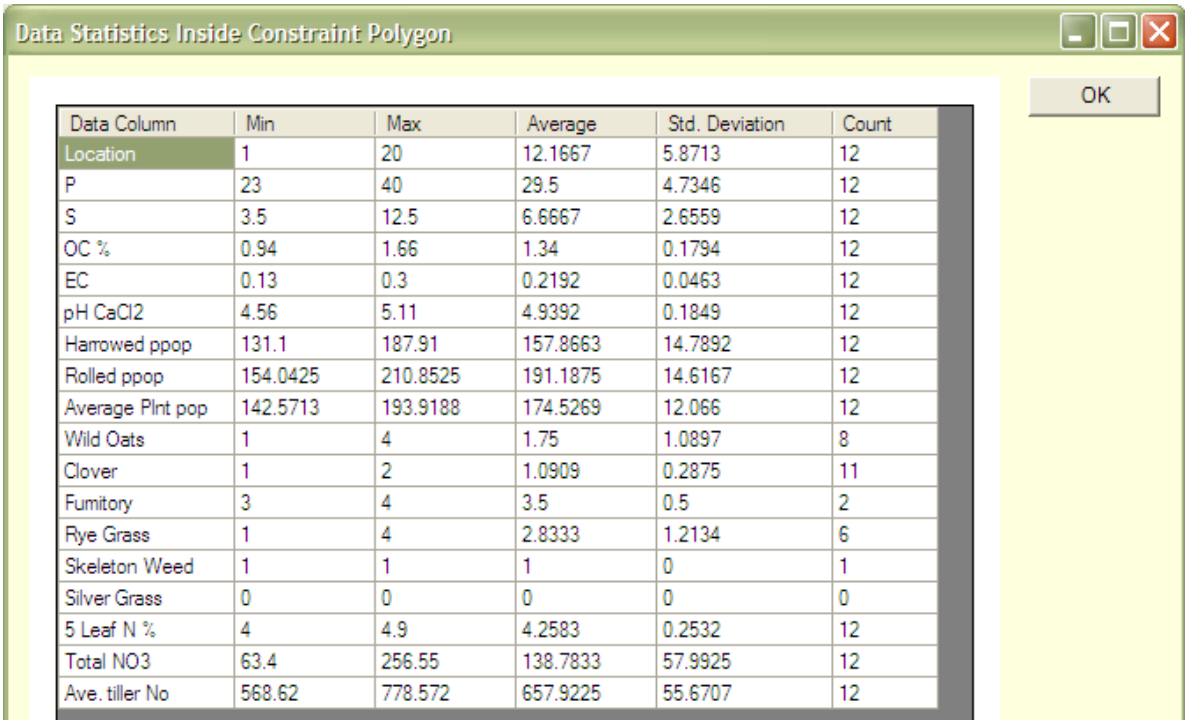
Data Statistics

The data that you load into PDP can be analysed to determine averages and other statistics. Sometimes you may want to know the statistics of a subset of the entire dataset.
Display the whole dataset using one of the normal methods of visualising your data … Let's use an image for our example.

The simplest way to achieve this is to:
Draw a polygon that encloses your area of interest on the image.



Click on the *Data Statistics* button on the *Data Sets* toolbar (See Page 18) to display the data statistics.

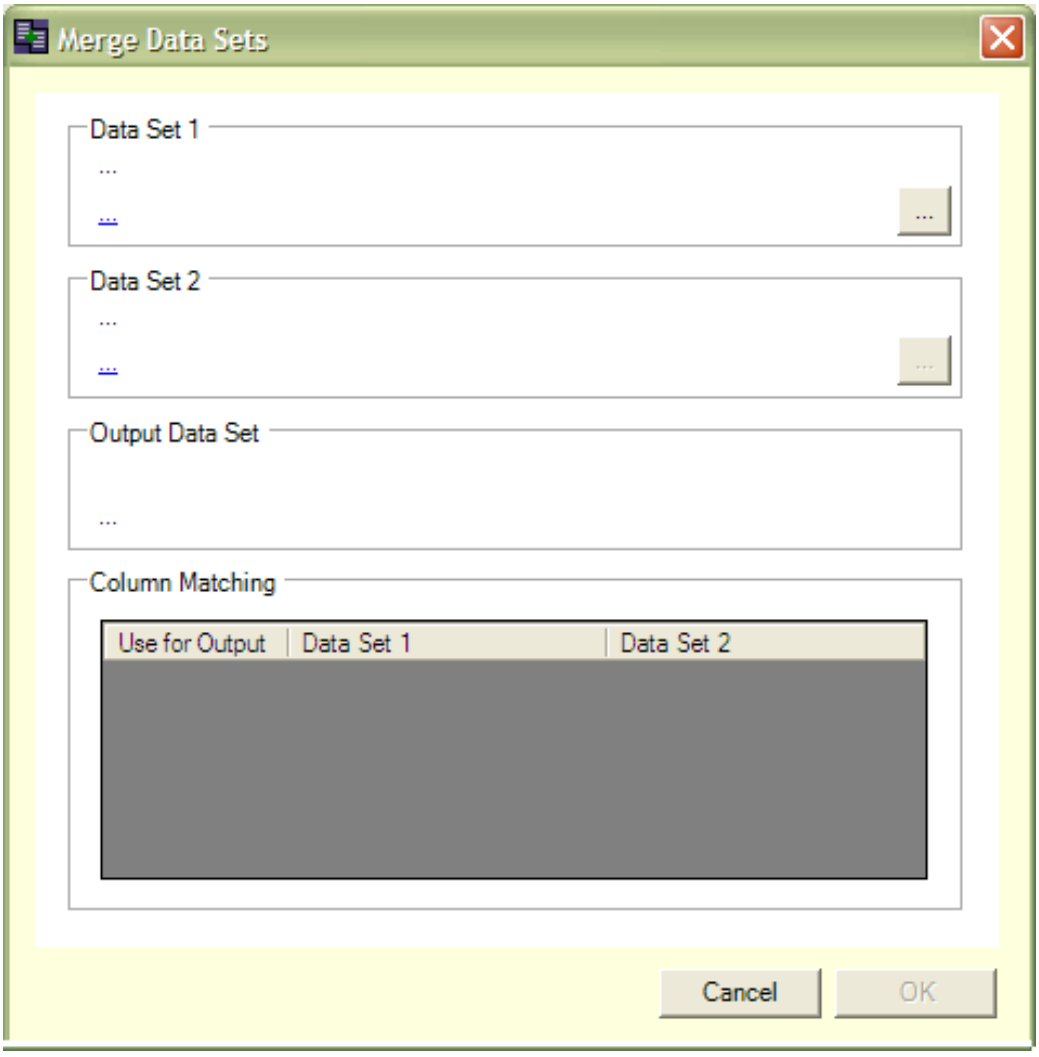


Data Column	Min	Max	Average	Std. Deviation	Count
Location	1	20	12.1667	5.8713	12
P	23	40	29.5	4.7346	12
S	3.5	12.5	6.6667	2.6559	12
OC %	0.94	1.66	1.34	0.1794	12
EC	0.13	0.3	0.2192	0.0463	12
pH CaCl2	4.56	5.11	4.9392	0.1849	12
Harrowed ppop	131.1	187.91	157.8663	14.7892	12
Rolled ppop	154.0425	210.8525	191.1875	14.6167	12
Average Plnt pop	142.5713	193.9188	174.5269	12.066	12
Wild Oats	1	4	1.75	1.0897	8
Clover	1	2	1.0909	0.2875	11
Fumitory	3	4	3.5	0.5	2
Rye Grass	1	4	2.8333	1.2134	6
Skeleton Weed	1	1	1	0	1
Silver Grass	0	0	0	0	0
5 Leaf N %	4	4.9	4.2583	0.2532	12
Total NO3	63.4	256.55	138.7833	57.9925	12
Ave. tiller No	568.62	778.572	657.9225	55.6707	12

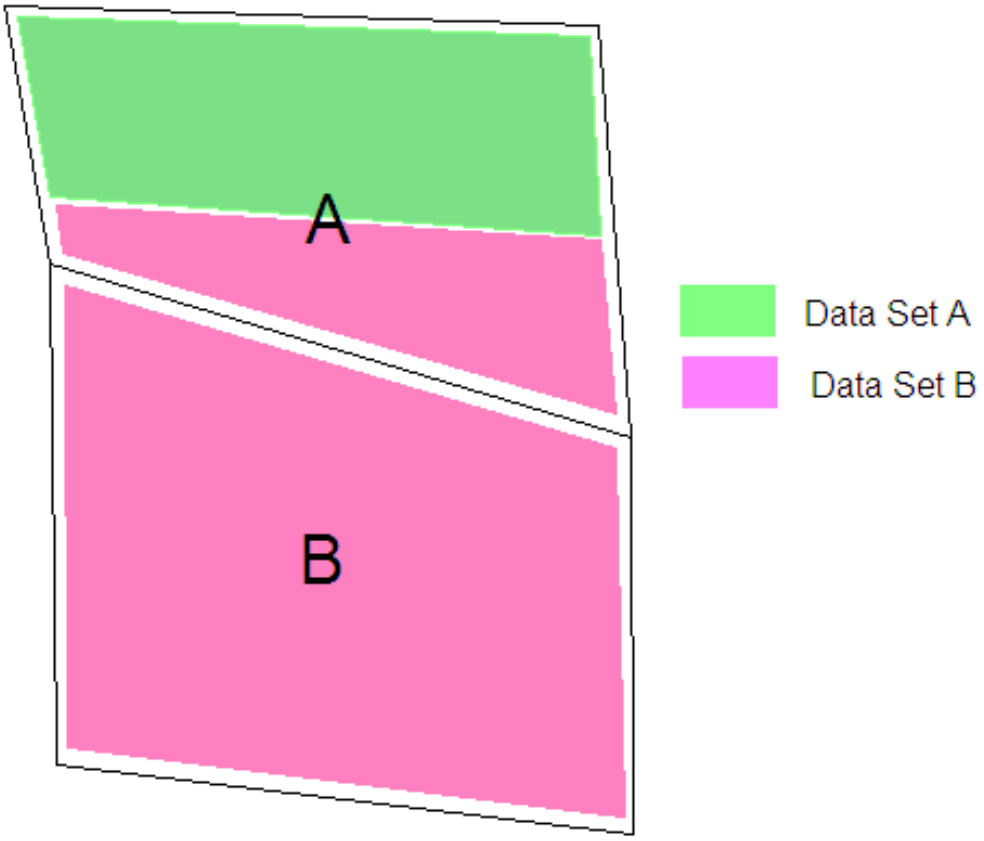
Merging Two Data Sets

The way you record data on your farm (in particular Yield data at harvest time) may not suit the Farm/paddock/Season/Date hierarchy system that we have provided you in PDP. So, when you initially register your data it may not be the way you actually want your data structured.
Apart from the Data Subset options that enable you to exclude data subsets from a big dataset, we have provided you with the facility to merge two datasets together

This could also be used in situations where you have two harvesters working in one paddock.



Let's say you have two datasets. One contains some of the yield data from Paddock A (the top Paddock) … the other contains all the yield data from Paddock B (the bottom paddock) but also some from Paddock A!



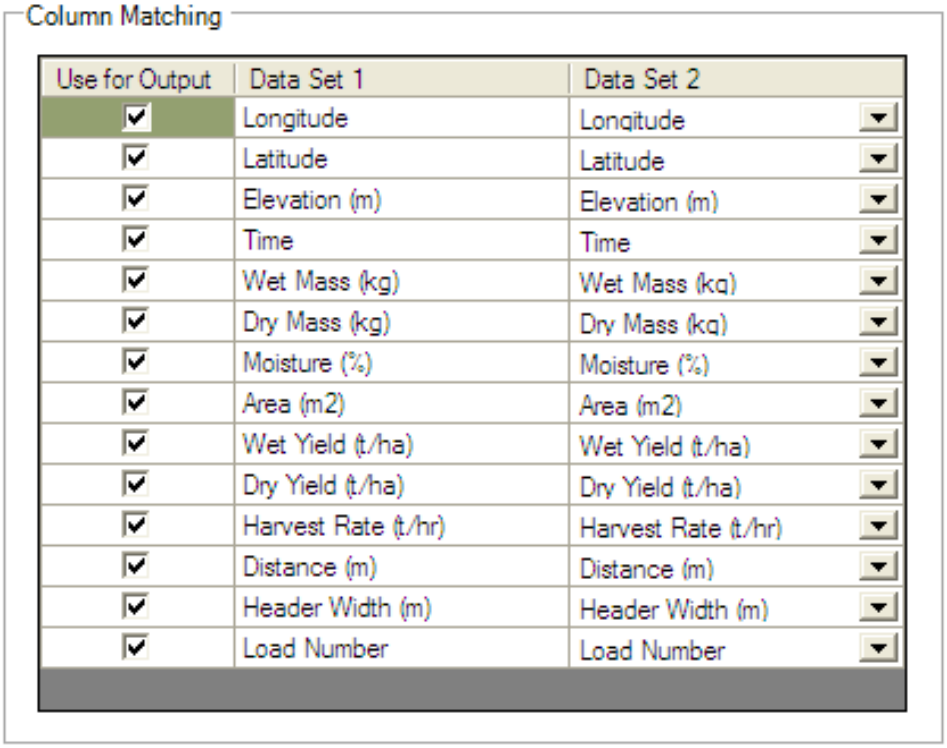
What we'll need to do is:
Select *Merge Datasets …* from the *Tools* menu.
The form displayed above will appear.
Starting with Data Set 1…

Click on the button to display the PDP Datasets list.
Choose the first data set (click "OK")

Repeat the steps to select Data Set 2
The screen will now look like this:

PDP will nominate a default name of the output dataset. It will use the first data set. In this case Paddock A, however, as you click “OK” to perform the merge, PDP provides a “Save As…” form.

Next we must make sure that we are merging data of the same type. Check the “Column Matching” section.



Click on the “OK” button to perform the merge, next choose an appropriate name for the merged dataset on the “Save As…” form … then click “OK”

Now PDP will list you newly created data set on the “All Precision Data Sets” list.

The next part of this task is to

a) Load the data into the Precision Data Desktop
b) Use the Data Set Tools tab. Draw a polygon around Paddock A’s area and…
c) Using the Subset Data tools, exclude all the Paddock B data.

d) Save the Paddock A data.
e) Using the other Subset Data option, exclude the Paddock A data
f) Save the Paddock B data.

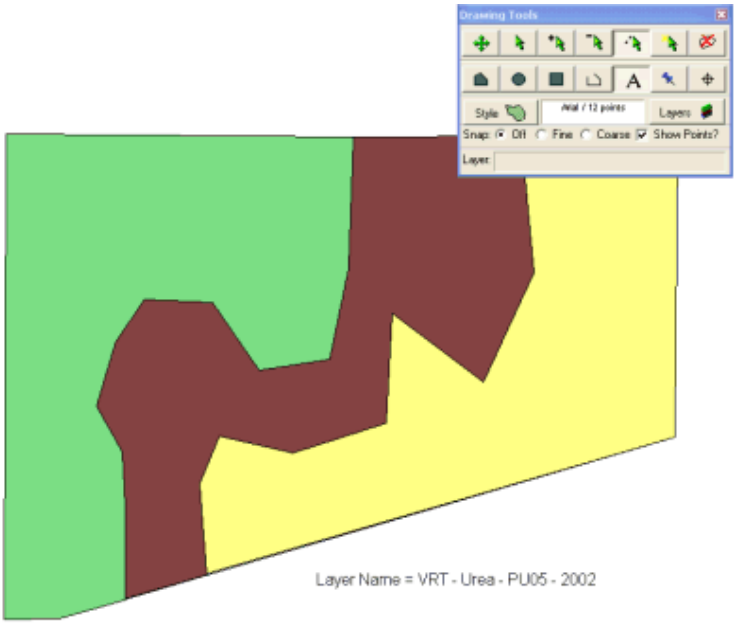
Variable Rate Control Output

PDP produces variable rate application recipe files using both Polygons and Images as its source. Some controllers can only work with polygons as the map source. For those controllers you are bound to use polygons as your starting point, for all others you can choose to use either an image or a set of polygons as your starting point. If you are using a layer of polygons, ensure you colour the polygons differently in line with the rates you will be using for each polygon (management zone).

Using a Polygon or Region map for your VRT project

If you are using the region or polygon method to define the rate areas, you must first draw the areas and use fill colours to define the discreet rate areas.

Each bin or tank or applicant (seed, fertiliser or chemical) will have its own discreet layer.



I have drawn these three discreet areas using the Mapping drawing tools on a new layer I created called "VRT – Urea – PU05 – 2014"

See the farm mapping manual for

information on drawing objects and layer creation.
Using PDP's contouring facilities, it is a very quick and simple job to create a layer of polygons from an image (yield, nutrients removed etc) See Page 18.

Using an image for your VRT project

If you are using a Bitmap as your method to define the rate areas, you must first ensure that you have generated the image in PDP.

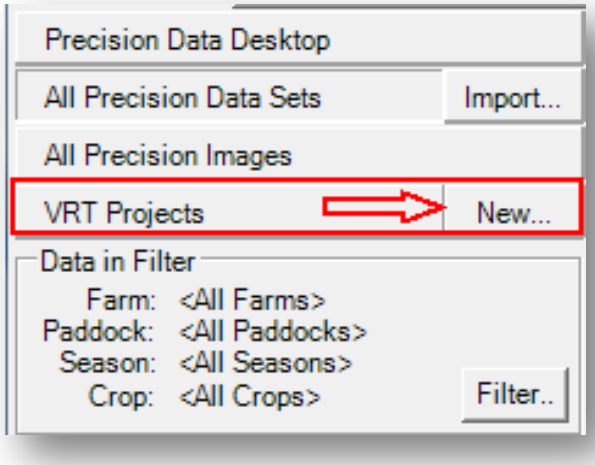
Using images VRT that are not generated by PDP

If you would like to use an image from another source (e.g. a NDVI satellite image) you are advised to do the following:

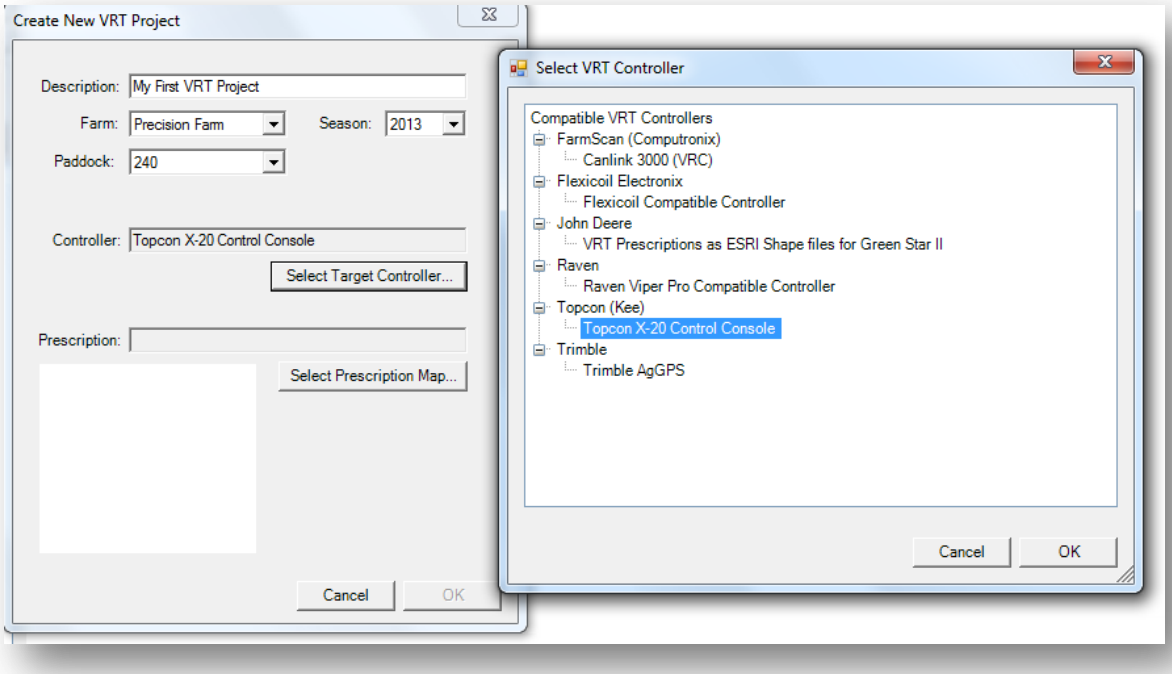
1. Import that image into your PAM Mapping or FarmStar Lite mapping layers.
2. Using the drawing tools, draw management zone polygons over the top of the image, filling those polygons with colours – ensure that you use the same fill colour for each area that share the same application rates.
3. When creating the VRT Project in PDP, use that drawn layer

Creating the VRT Project

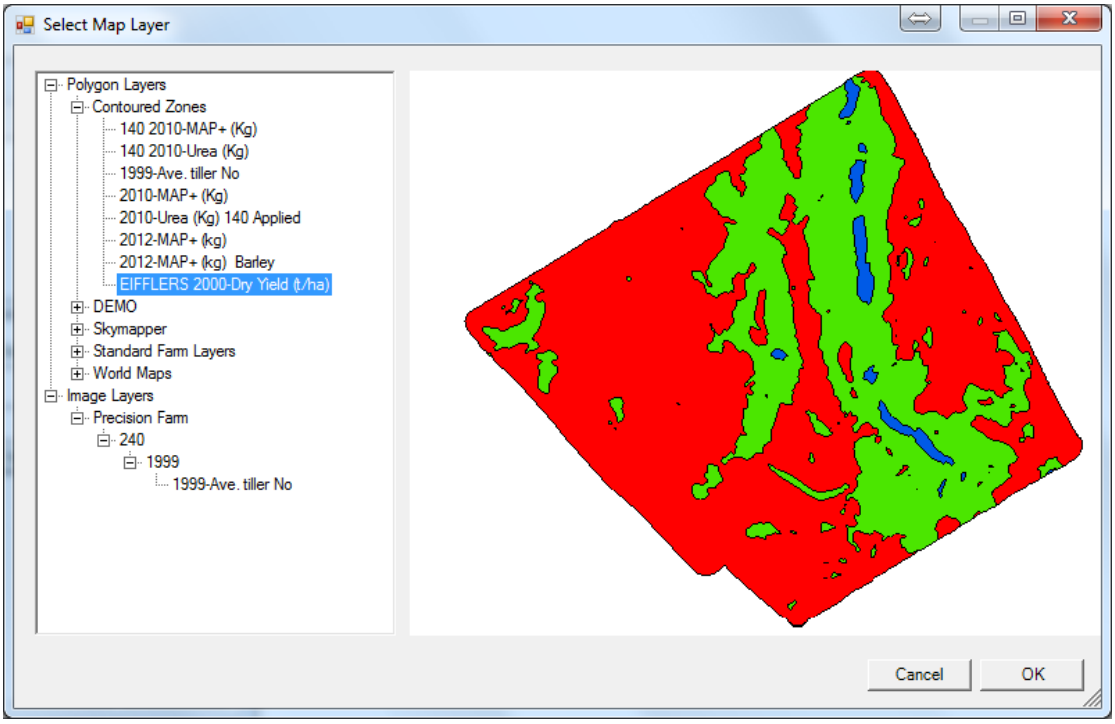
Start here:



1. Click on “New” button.
2. Enter in the project name
3. Select the Farm/Paddock/Season
4. Choose the variable rate controller…



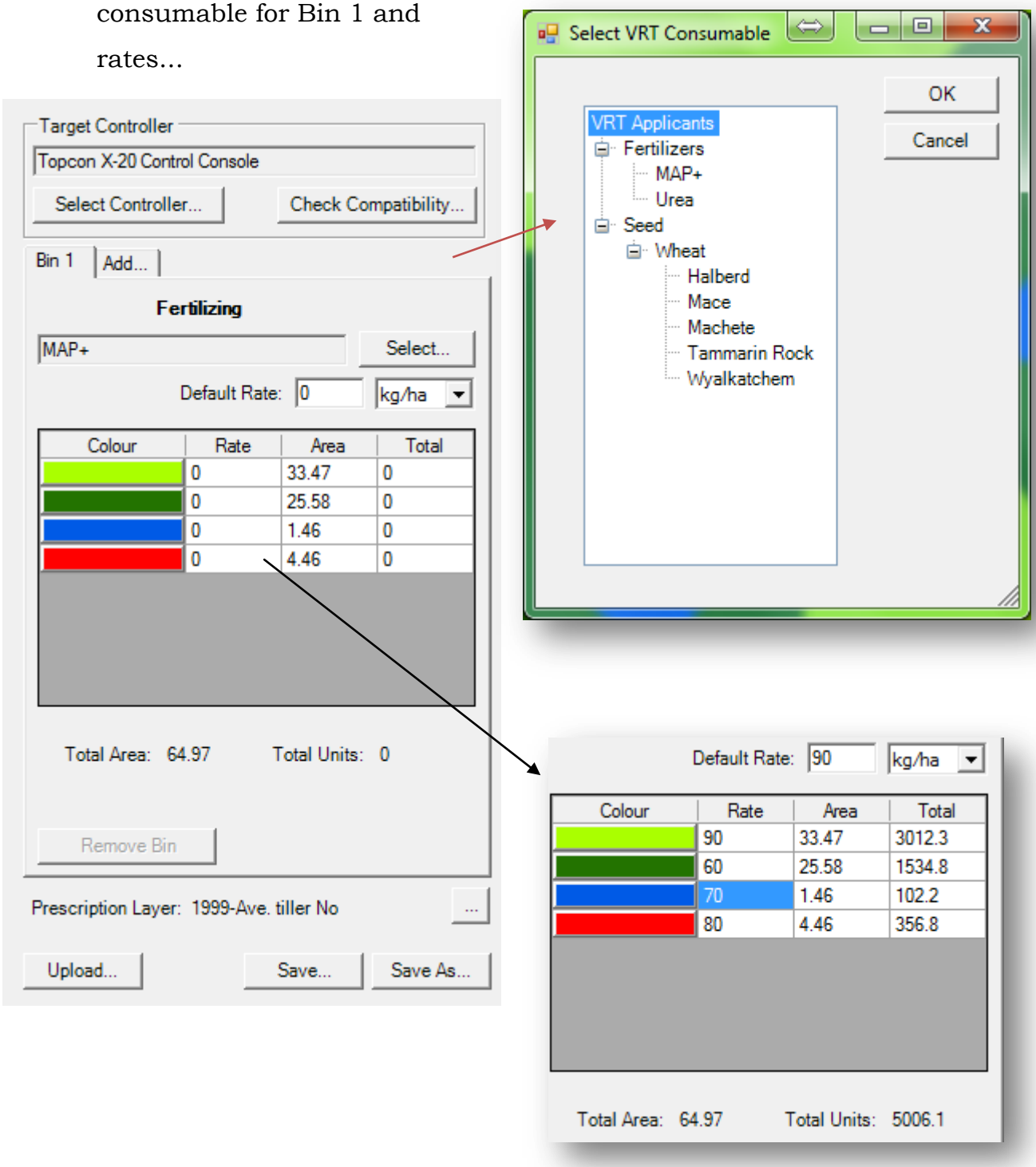
5. Select the “Prescription Map” … Either a polygon layer



Or an Image … (I am choosing this image [below])

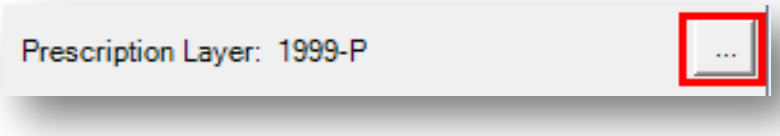
Then click OK…

6. Having chosen the initial presciption map, click OK to save the project.
7. Now to choose the consumable for Bin 1 and rates…

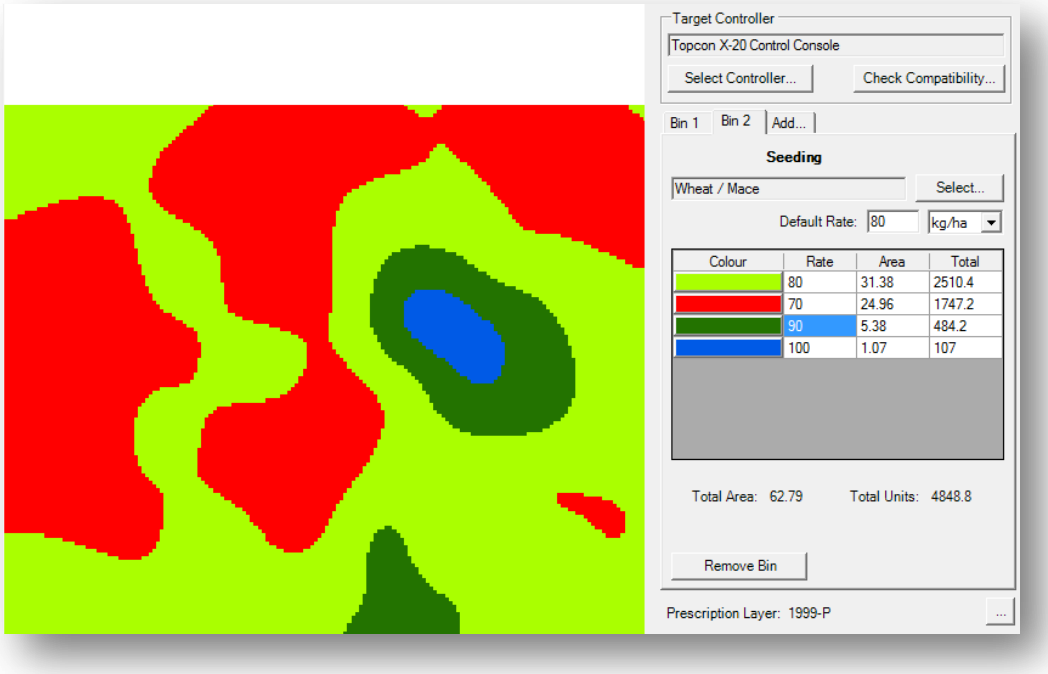


8. If you are using more than 1 bin, click on the “Add” label on the next “tab” after Bin 1

9. For Bin 2 … I selected Mace Wheat as my cobsumable and I chose a different prescription map layer (I used another image “1999 P”) … I did that by clicking on this button found below the section of the screen where you enter the rates…



Then simply enter the rates for each colour … as I did for Bin 1.

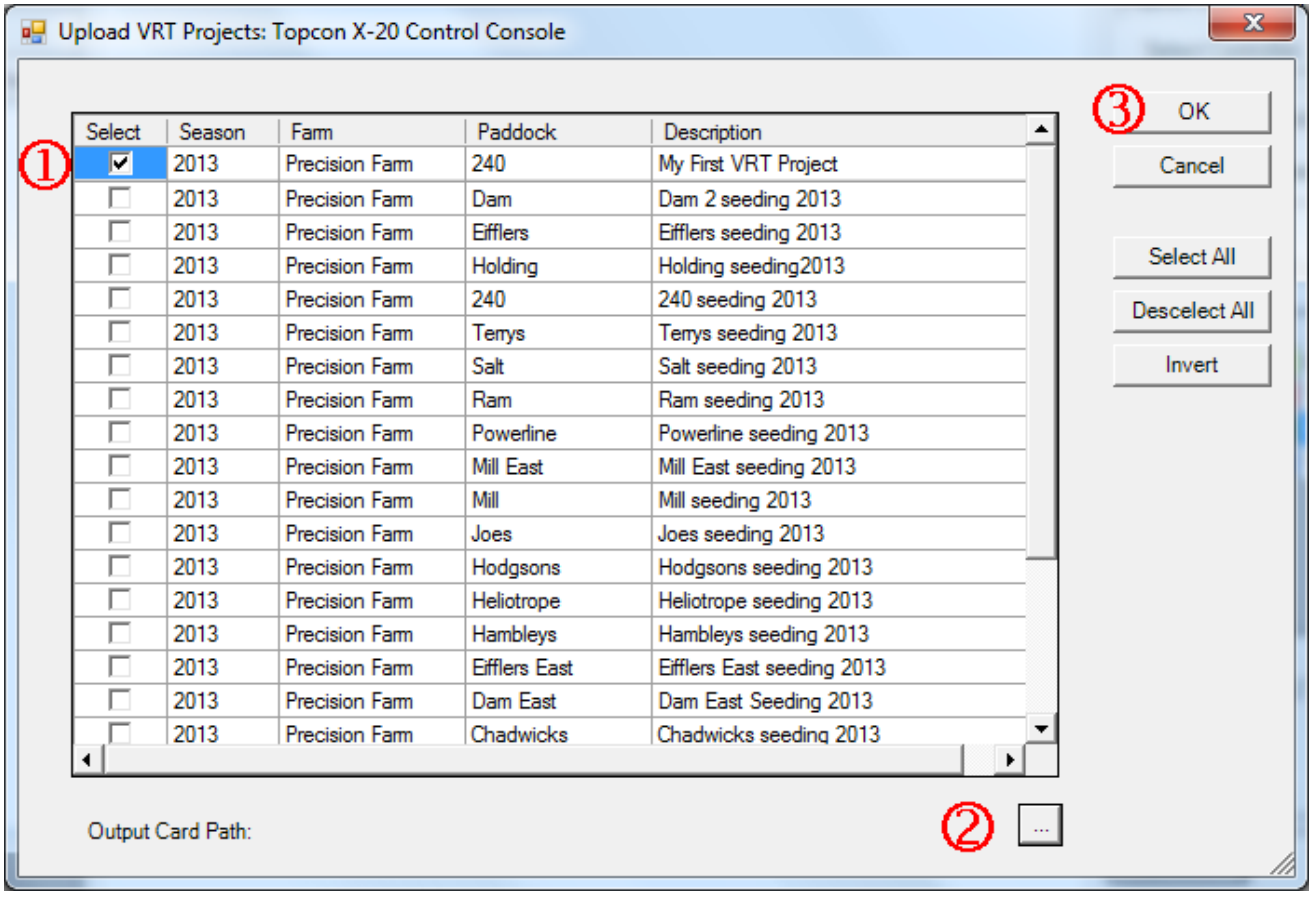


To add more bins, follow the same process. You can choose a different prescription map for each bin if you want to.

10. When the VRT Project is completed, or at any stage you can “Save” the project. You can always return to this project and add more bins, alter rates .. whatever.

You can also choose “Save As” and save the project under a different name, then edit the project (add more bins, remove bins, change rates, choose different prescription maps .. whatever).

11. When you are ready to export the vrt recipe to a controller, click on “Upload” … then
    1. Select the Projects to upload to the controller
    2. Choose the destination (usually the Card or USB device)
    3. Click OK.



That’s it.

Mapping Concepts

Coordinate Systems

In PDP we use the two most popular coordinate systems. Two things to understand here. One is the Datum, and the other is the Projection.

Datum

Datum describes the coordinate system that data is stored in. Over the years, there have been many datum's to describe the location of a single point. There are many systems because the world is not a perfect sphere, and the various representations have been invented to afford better accuracy within local regions, and also updated with technological advances. In PDP, WGS84 is the Datum used to store all coordinates.

If you've ever used a GPS (Global Positioning System) these are the coordinates that they use. It's a system where a position North to South is called Latitude and is in the range of –90 (South Pole) to +90 (North Pole). East to West is called Longitude and is in the range –180 to 180, Locations to the West are negative, to the East are positive. A coordinate of this type is made of up degrees, minutes and seconds. i.e. 13 degrees, 45 minutes, 34 seconds. The physical distance between 1 degree of longitude varies depending on how far you are from the equator, with the widest point being the equator, and the shortest point being the north and south poles when all longitudes meet.

Projection

Projection defines the way that coordinates are displayed on a flat surface. Because the world is a sphere, north south lines (longitudes) may be bent or straight depending on where you are (as a view) when you view them. A man called Mercator developed a system called isotropic to ensure a view of an area of the earth's surface. That is, it takes longitudes and latitudes and transforms them so that it displays your map in a square grid. Visually, a metre east to west is visually the same size as a metre north to south.

The Mercator system was devised to enable more efficient mapping on a flat surface and is excellent for doing localised work, rather than on a continent scale. Mercator coordinates work by taking 6 degree vertical strips of earth and assigning each one a Zone number. A point on the earth's surface can be referenced by a Zone number and then the number of metres east west (called Easting) and metres north south (called Northing). A Zone is about 800,000 metres (800km) wide and slightly overlaps each other at the edges. The westmost coordinate of a zone starts at about 200,000 metres and measures to an eastmost coordinate of around 800,000 metres. At this point the next zone begins at around 200,000 metres again.

There are many interpretations of the Mercator grid, all are very similar and PDP uses the Australian Map Grid, formalised in 1984, and called AMG84 and the Map Grid of Australia (MGA 1994) which is the Universal Transverse Mercator projection of the GDA94 latitudes and longitudes. The GDA94 longitudes and latitude co-ordinates are extremely close (within a metre) to the WGS84 (the system used in GPS units).

PDP stores all mapping vector data in WGS84, and translates into AMG84 or MGA94 for drawing, depending on the task on hand.

When doing any precision mapping tasks, PDP handles all the source data in MGA94, which provides for faster and accurate imaging.

Visualising your Data

Data Fields

Data Fields, in PDP terms, are the names of columns of data, not paddocks! A soil sample file may contain Fields "Easting", "Northing", "Altitude", "pH", "N", "P" and "K".

Overview

PDP provides the following methods for representing your data. You decide the methods to use depending on what you want to achieve…

trial and error will be needed to guide your choices. Following are some suggestions:

Palettes

Precision mapping is all about representing data visually so you can interpret it. Colour plays a big role in this. For example, using dark colours for low values, and bright colours to represent high values. In a grey scale from white to black for low to high, or, if you prefer, from black to white for low to high. PDP provides the facility to make custom palettes.

Raw Data

When PDP first loads a dataset, it will always display your data in its raw form. The data is represented by coloured circles of a consistent size. A histogram of the data is displayed. This is your starting point from which you can create more sophisticated views of the data.

Circles

Circles are handy for getting a visual impression of the geographical layout of your dataset, and also for colour and simple representation. PDP will generate a circle for each point in your dataset.

Generally appropriate for small to medium size datasets. Coloured circles are useful to display soil test results. A layer of circles can be displayed over an image of yield. Circles can be created with the size of the circles determined by the values of the data.

Images

Using sophisticated algorithms, images can fill in the missing values between data points… a process called interpolation making them suitable for most datasets.

By using the settings available to you in creating an image, this can be the quickest way to see where your data is located. See the topic on Pixel Size on Page 15. We mentioned above that circles could be used for this purpose also.

Contours

Having created an image, you can then create a contour map from that image. The contours are created using polygons that can be subsequently used in your general farm mapping area and as recipe maps for variable rate applications.

Items common to all visual tools

Where does the output go?

When you generate visual results from your data, such as circles and images, they are displayed as "layers" on the Precision Data Desktop. These layers can be removed and hidden at any time.
All layers in the Precision Data Desktop are not saved with your normal farm mapping data, and are discarded when PDP is closed.
A separate layer is generated for each output type. Objects on these layers cannot be edited.
Images and contours can be saved and those saved objects (or layers) are made available for you to view in the general farm mapping area.

"Crash Course" on how imaging works

A crash course on how "Imaging" works using soil sampling as an example.

For the steps to create an image from yield data go to Page **Error! Bookmark not defined.**

Imagine an area that is 500 metres square. Let's say we divide this up into a grid where each grid cell is 5 meters square. That would give us 100 cells x 100 cells. Let's also say that we have a pH value taken every 50 metres. That would mean we have a pH value for every 10th cell vertically and horizontally. What we now want to do is generate what we think the values in all the other cells should be (that is interpolation).

One of the most important factors is the *search radius*. You can find this parameter on the "Data Processing Options" form, which you access by clicking on the "Settings" button on the Image tab 

... and it's used as follows:

Let say we start at the first cell of our 100x100 cell grid. We look in all cells around us that are *within the search radius* distance. If any of these cells contain a pH value (remember one every 10th cell, which is one every 50 metres), then we add that value to *this cells* value, but *scale the value according to how far away it is* from the known value. The further away it is, the less it's 'value'. This process is repeated for every cell in our grid.

You might guess that the bigger the search radius, the more 'known' cells will be included when considering each 'unknown' cell. If it's too small, then your image will contain holes, if it's too large, then you whole image may wash out to one colour due to it including just about every value when computing each unknown cell.

Generally the program will calculate a fairly reasonable search radius for you, but you may want to override this if your dataset is an odd shape, or you are getting holes, or not enough detail. Sometimes, only you, with the insight of your data can make these decisions.

You can also adjust how much each value is scaled. These are on the Image Tab and are 'Detailed', 'Smooth' and 'Smoother'.

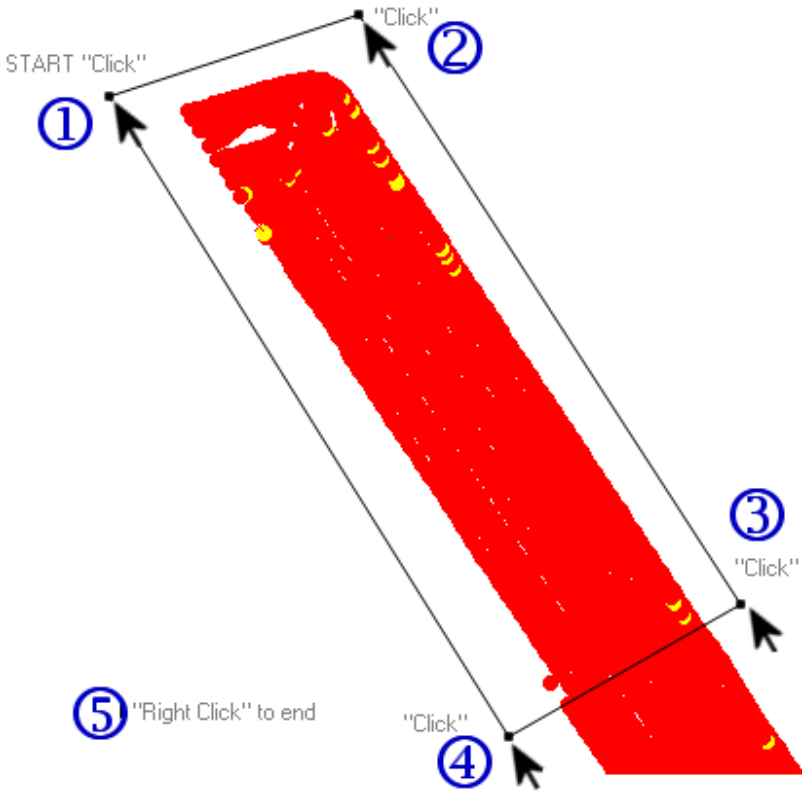
- Detailed means that the further away a cell is from the known cell, the less affect the known cell has on unknown cells.
- Smooth is similar to detailed, but each known cell has more effect.
- Smoother means that distance between the known and unknown cell does not diminish the value at all.

Drawing Tools Explained

In PDP you will find a set of drawing tools to enable you to draw polygons. Polygons are used for three purposes in PDP. See pages 28 to 30 for details.

Button to commence drawing a polygon

Click on this button to put your mouse into polygon drawing mode.

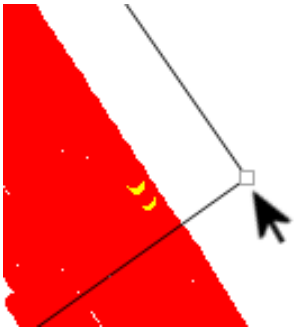


Then …

1. Left Click in the Map View window to start drawing your polygon.
2. Click on the next corner/point…
3. Click on the next corner/point…
4. Continue until you need to end the process, then
5. Right Click to Close the polygon.

Edit Button

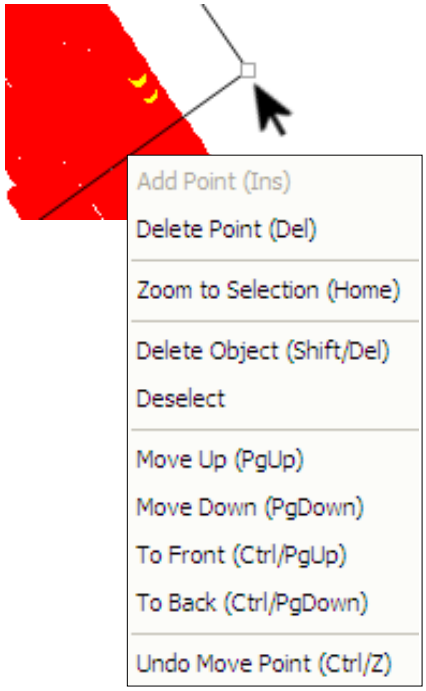
Click on this button to put your mouse into polygon editing mode.
For example, I want to move the points I drew above to make the polygon fit tightly around the data boundaries…
I click on this tool button then
Click inside the polygon to display the “Drag Handles”
… now we’re ready to begin moving the points (Drag handles) into their correct positions…



To Move a point:
When the mouse gets near a drag handle (point), the black drag handle turns into a small empty black square.
This means it is "ready" to be moved.
Hold down the left mouse button and drag the point to the correct position

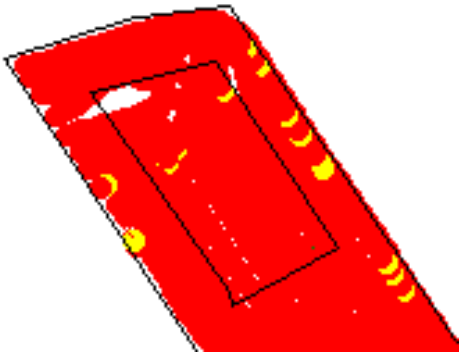
To Add a new point along the boundary, move the mouse to the position and you will notice a small empty black circle will appear. When you are satisfied with the position, left click your mouse.

Please Note: If you want to create a new point AND move it, make sure you a) left click to create the point b) release the left button, c) click on the left button and hold it down to drag the point.



To Delete a point:
When the mouse gets near a drag handle (point), the black drag handle turns into a small empty black square.
Then, either click your Right Mouse to show the options menu
choose *Delete Point,* or press the Del key on your keyboard

Button to commence drawing a hole



Use this tool to draw an exclusion hole in your polygon.
Click on the button to put your mouse into “polygon hole mode”.
Now click inside the polygon and using the same polygon drawing steps as above, draw the hole. Click Right Mouse button to close it.

Undo Button – Undo your drawing actions

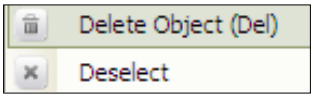
To undo your drawing actions, one by one, either click on this button or press Ctrl+Z on your keyboard.
Each of your drawing actions will be undone in order.

Panning Tool

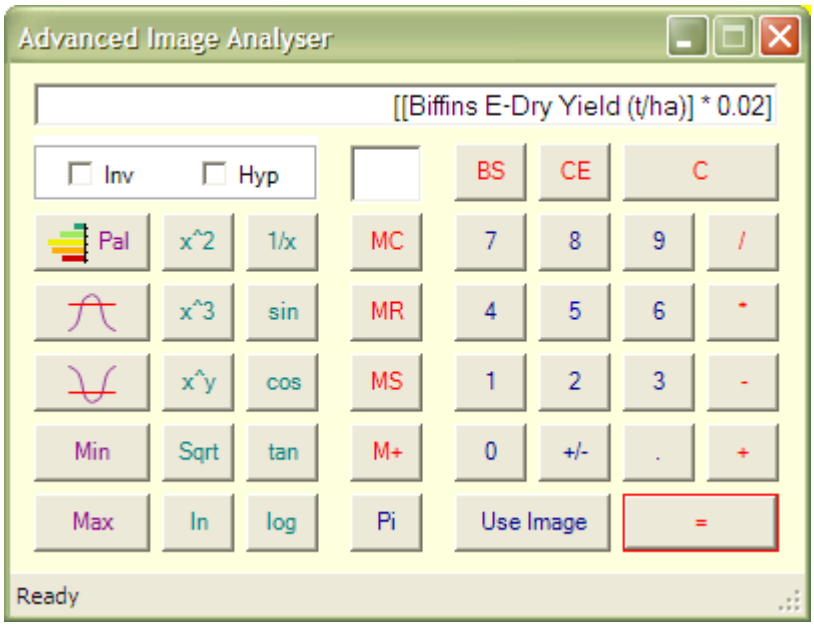
Use this button to turn off the drawing modes. By default in PDP, holding down your left mouse puts it into panning mode, so there is no need to click on this button except to revert your mouse behaviour back to its default.

Selection Tool

Use this button to turn on Selection Mode. Click inside a polygon to select it. Then either click your Right Mouse button for options. To delete the polygon you can press the Del key on our keyboard.



Advanced Image Processing



The Advanced Image Analyzer ("AIA") is a powerful tool for applying calculations to the data which underlies images.

To operate on an image, have that image selected in the "Precision Data Desktop", then click on the "Use Image" button.

AIA –Example #1

To create a Nitrogen replacement image from a yield image, where that crop removes 20Kg/Ha of N, use the formula

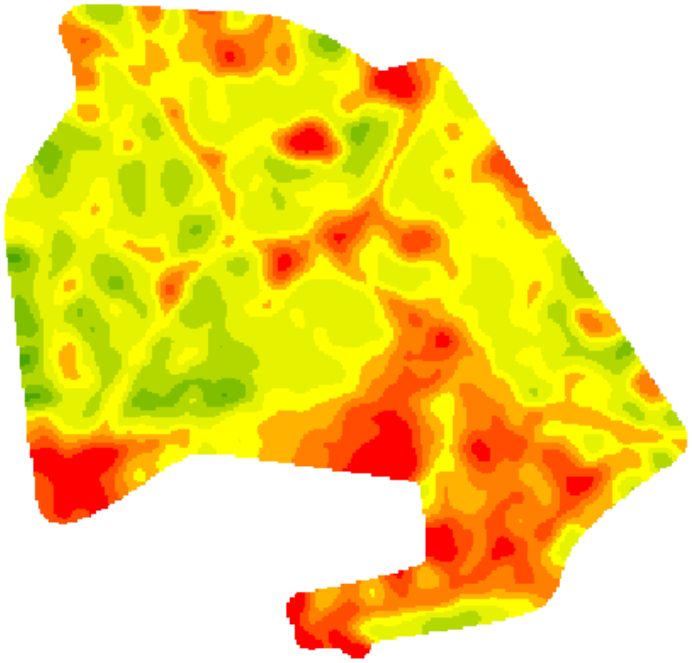
1. Use Image
2. Click on the * button (Multiply)
3. Enter 20 (by clicking on the numbers on the calculator)
4. Click "="

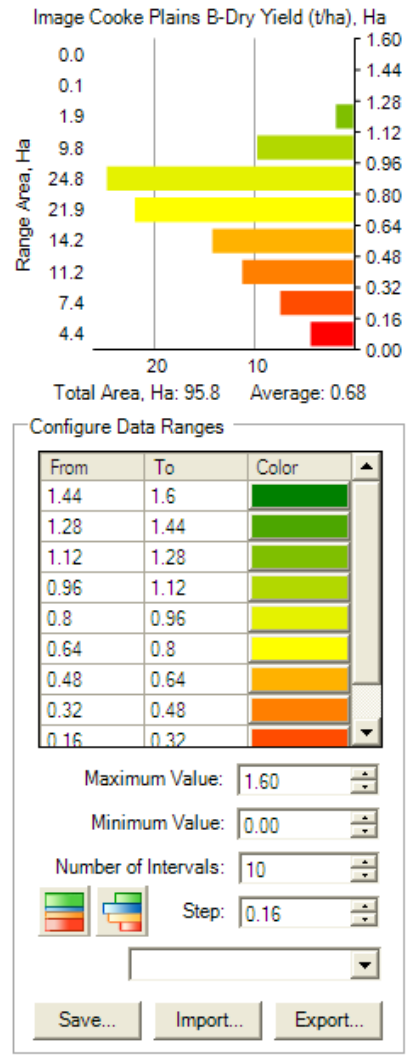
The resulting image will show the replacement N required in Kg/Ha

AIA –Example #2

Turn a map of yield values into the square root of those values.

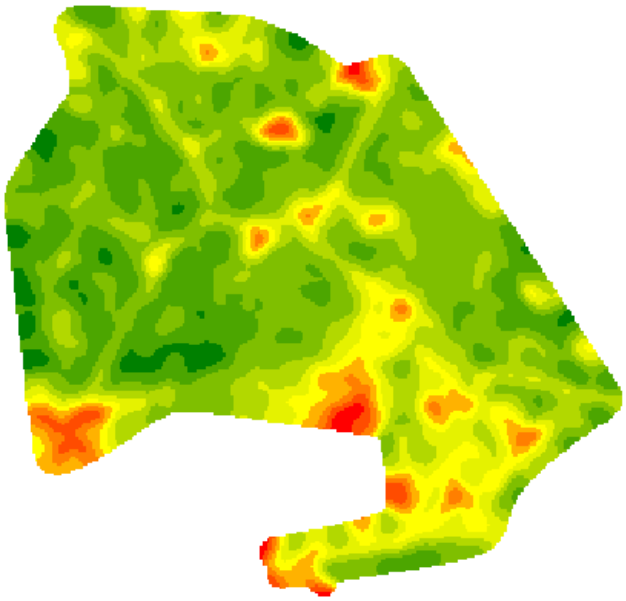
Step 1 – I click on the “All Precision Images” button to list previously created images
Step 2 – I select an image (a yield map) …

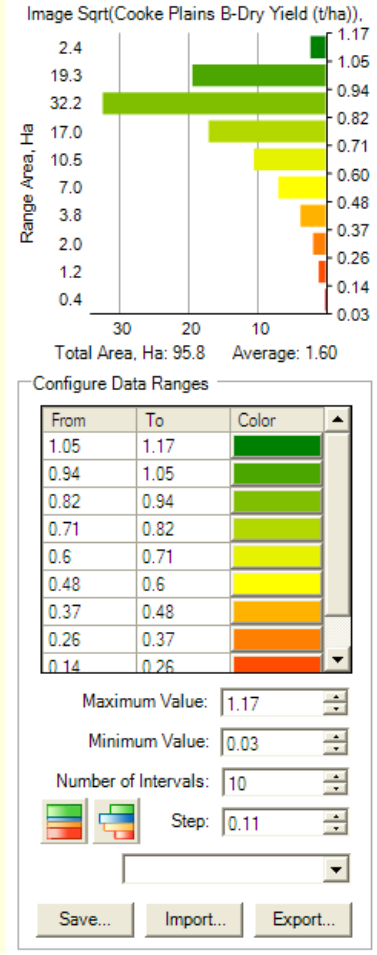




Step 3 – Click on the AIA button

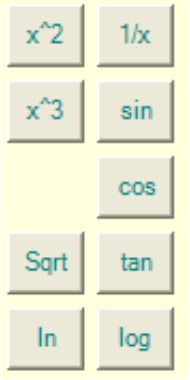
Step 4 – Click on the “Use Image” button
Step 5 – Click on the “Sqrt” button – the result below (Yield Map of the Square Root of the Yield)…





AIA – Other options explained

For the example above we used the Square Root button
The same process is used for any of these buttons…



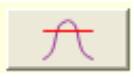
Clicking on any of these buttons will instantly update the image and the histogram.

Tip: Hover your mouse over any button for hints.

This button enables you to increase the values of the data behind an image by "the power of" a user specified amount.

Steps

1. Having selected an image, click on this button
2. Using the numeric buttons, enter your "Y" value.
3. Click on the "=" button



This button enables you to remove values from the data behind an image which are greater than a value of your choosing.

Steps

1. Having selected an image, click on this button
2. Using the numeric buttons, enter your threshold or limiting value.
3. Click on the "=" button

This button enables you to remove values from the data behind an image which are less than a value of your choosing.

Steps

1. Having selected an image, click on this button
2. Using the numeric buttons, enter your threshold or limiting value.
3. Click on the "=" button

Using this button you can derive an image that is made up of the smallest values behind each pixel in 2 or more images. For example, if you have 2 images of wheat yield for a paddock, you can derive an image of the worst yield for each pixel by following these steps.

Note: You will need both of the images loaded and displayable on the Precision Data Desktop ("PDD")

Steps

1. Having selected an image, click on this button
2. Now choose the other of the two images (by simply clicking on the image name in the PDD list)
3. Click on the "=" button

Using this button you can derive an image that is made up of the largest values behind each pixel in 2 or more images. For example, if you have 2 images of wheat yield for a paddock, you can derive an image of the best yield for each pixel by following these steps.
Note: You will need both of the images loaded and displayable on the Precision Data Desktop ("PDD")
Steps

1. Having selected an image, click on this button
2. Now choose the other of the two images (by simply clicking on the image name in the PDD list)
3. Click on the "=" button

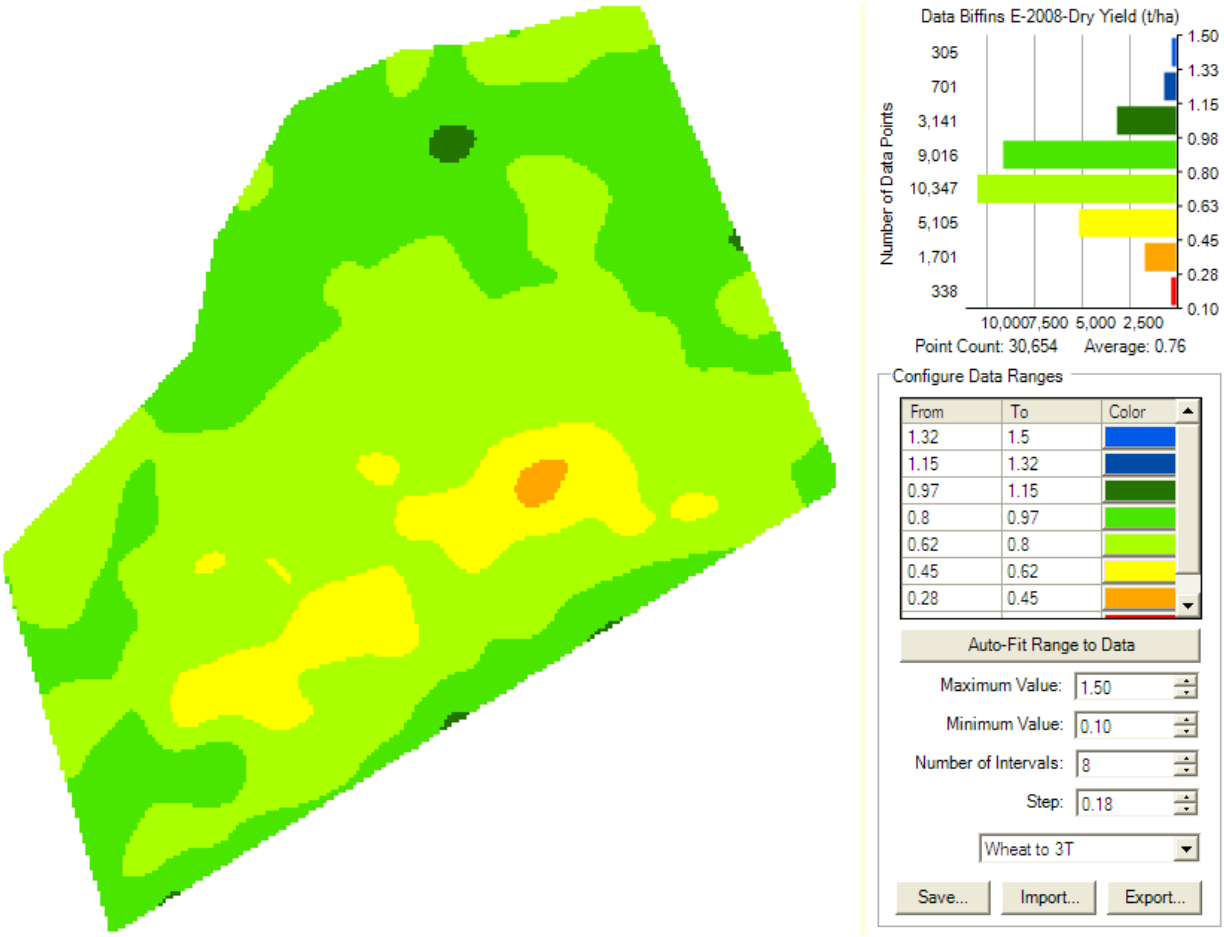
Use this button to assign the currently displayed palette to the selected image.

Linear -v- Equalized Images

Let's say you've got some yield data that contains 30,654 values between 0 T/Ha and 1.5 T/Ha. Over an area of 80 Ha. (approximately).
Over 80% of the values lie in the range 0.45 T/Ha to 0.97 T/Ha with the remaining 20% being less that 0.45 T/Ha or more than 0.97 T/Ha.

When you first generate an image, PDP uses the Linear method. It apportions each of the chosen colours (in my case 8) an equal data range (in my case 0.18 T/Ha) based on the number of data intervals (8) between 0 T/Ha and 1.5 T/Ha.

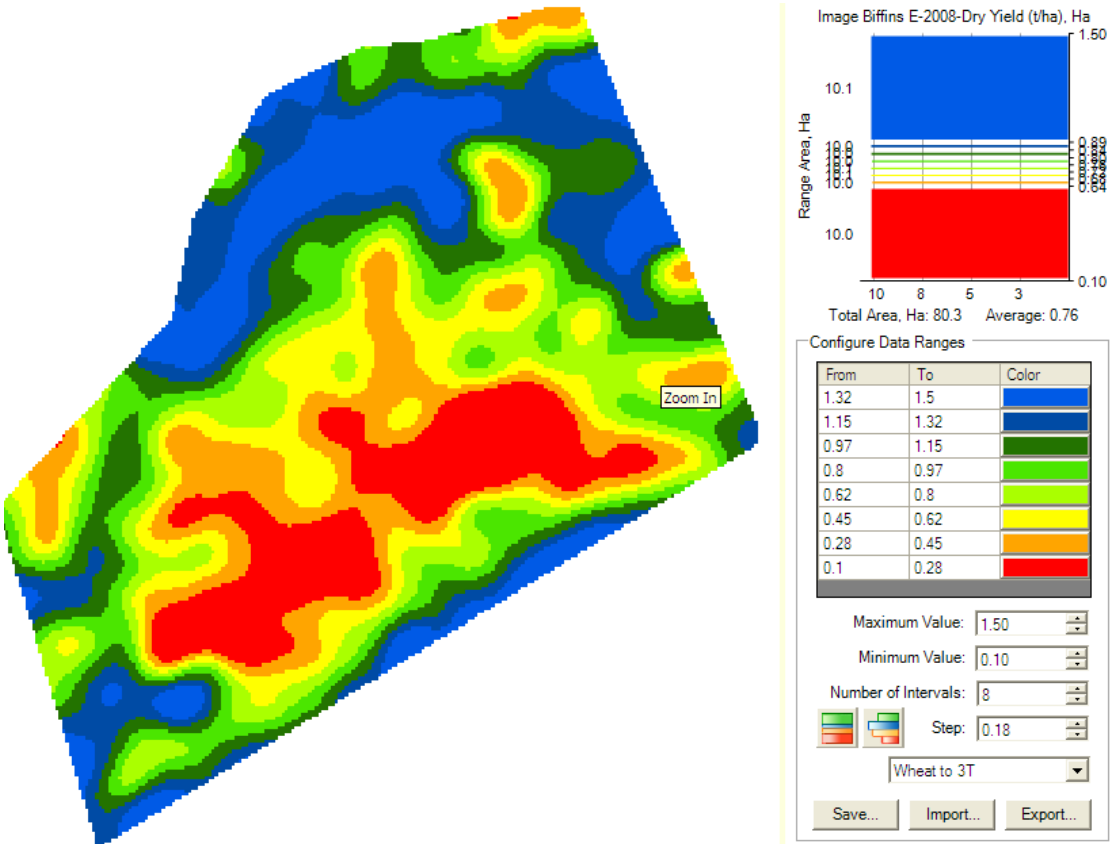
Using Linear, 80% of our data is in the 0.45 - 0.97 T/Ha range, so the image will be dominated by the colours you have chosen for this part of the overall data range.



When you click on the "Equalize" button, PDP will rearrange the histogram so that each colour in your chosen colour range is represented by an equal area on the image. By doing so, your image will amplify the variability across the area of the data.

Here is the result of clicking on the Equalize button. Each of the eight colours in my initial set of colours is used and each colour is used to represent an equal area on the image. In this case 10 ha.
The large blue section on the top of the histogram represents all data values between 0.89 and 1.5 T/Ha. (10.1 Ha)
The next colour (darker blue) represents all the data values between 0.84 and 0.89 T/Ha (10 Ha).
The next colour (dark green) represents all the data values between 0.80 and 0.84 T/Ha (10 Ha).

And so on …



Please note: the configured data range colour grid relates to the Linear view of the image only.

Processing Data Over Years - Aggregate Functions

PDP will create an image of the years of data chosen and based on your selection it will

Maximum Data Value

- find the maximum value at each pixel of the image and use that value to colour the pixel.

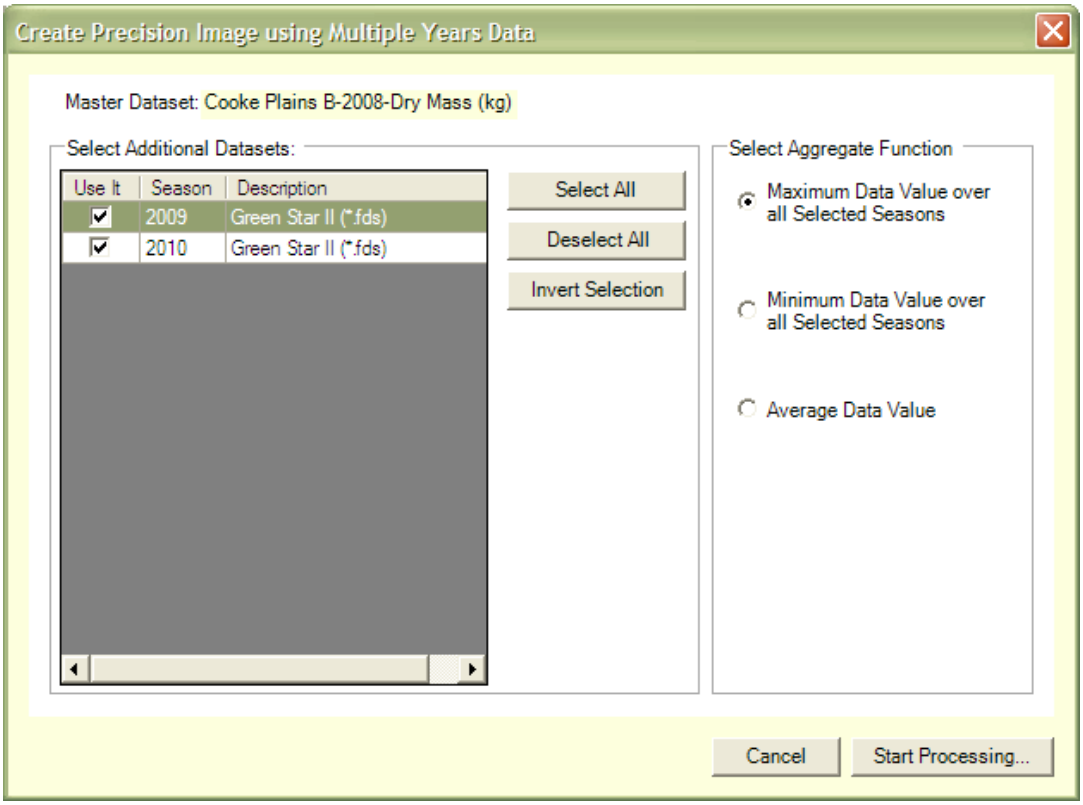
Minimum Data Value

- find the minimum value at each pixel of the image and use that value to colour the pixel.

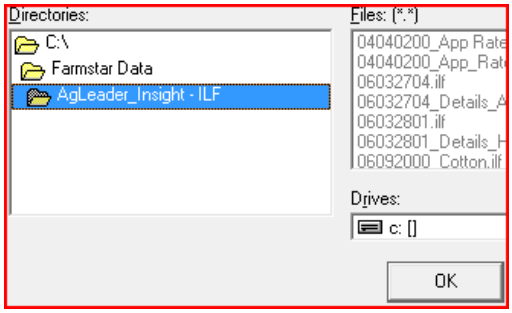
Average Data Value

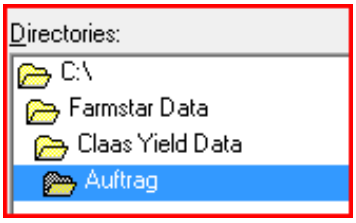
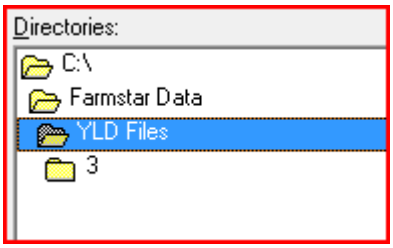
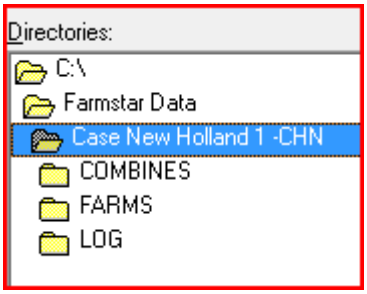
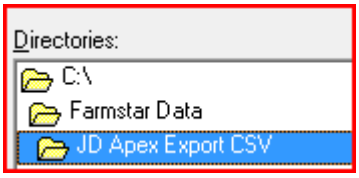
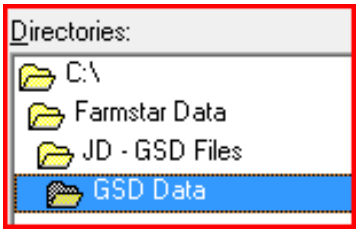
- calculate the average value at each pixel of the image and use that value to colour the pixel.

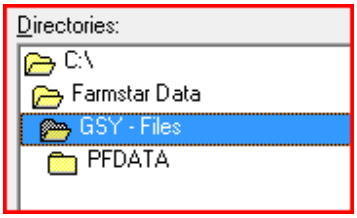
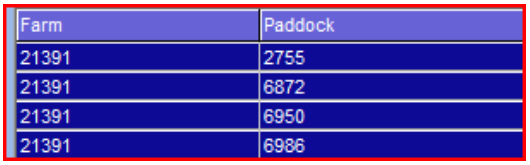
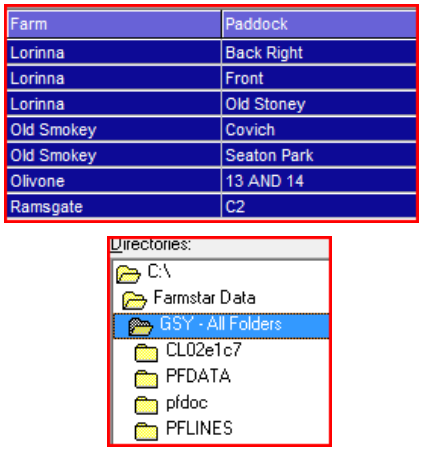
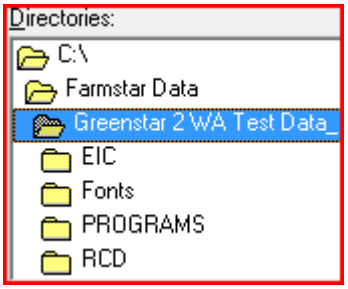
To access these features, Right Click your mouse on the Dataset Layer in your Precision Data Desktop. See Page 12.



Tips for Importing Yield Data

	**ILF Files –** Select the folder (or Card Reader Drive) that contains the ILF files (do not select a file)

	**Caterpillar Claas CHN Files –** Select the folder Auftrag that contains the AFT files (do not select a file)
	**Agleader Case YLD Files –** Select the folder (or Card Reader Drive) that contains the YLD files (do not select a file)
	**Case New Holland, Agleader CHN Files –** Select the folder (or Card Reader Drive) that contains the Combines, Farms, Log Folders & the Index.vyg or index.vy1 (do not select a file)
	**John Deere Apex Export CSV Files –** Select the folder (or Card Reader Drive) that contains the CSV files (do not select a file)
	**John Deere GSD Files –** Select the folder (or Card Reader Drive) that contains the GSD files (do not select a file) Only Numbers show for Farms & Paddocks

	**GSY Files** – Make sure they are in a PFDATA folder below the folder you select. If not you will get the error message "No Files were Found" Select the folder above the PFDATA folder when importing.
	If only GSY Files are available No Farm or Paddock names come up only Numbers that are stored in the monitor. This makes it difficult to match with PAM.
	If the full list of folders are there the Farm and paddock name show.
	**Greenstar 2 Files –** Select the folder (or Card Reader Drive) that contains the EIC, Fonts Programs, RCD Folders (do not select a folder or file below that)