



Determining Stable Yield Zones

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Methods

1. Clean/Filter raw yield monitor data and create grid/cell data
2. Normalize data for each individual field/year/crop
3. Average normalized data over years/time
4. Determine consistency across time
5. Aggregate cells into zones

USDA Yield Editor

Yield Editor

Load/Import File **Filtering, Mapping and Editing** Save/Export File

Filter Selection

| Use? | Show? | Deleted |
|-------------------------------------|--|---------|
| <input type="checkbox"/> | <input type="radio"/> Flow Delay | 0 |
| <input type="checkbox"/> | <input type="radio"/> Moisture Delay | 0 |
| <input type="checkbox"/> | <input type="radio"/> Start Pass Delay | 0 |
| <input type="checkbox"/> | <input type="radio"/> End Pass Delay | 0 |
| <input type="checkbox"/> | <input type="radio"/> Max Velocity (mph) | 0 |
| <input type="checkbox"/> | <input type="radio"/> Min Velocity (mph) | 0 |
| <input type="checkbox"/> | <input type="radio"/> "Smooth" Velocity | 0 |
| <input type="checkbox"/> | <input type="radio"/> Minimum Swath (in) | 0 |
| <input type="checkbox"/> | <input type="radio"/> Maximum Yield | 270 |
| <input checked="" type="checkbox"/> | <input type="radio"/> Minimum Yield | 0 |
| <input type="checkbox"/> | <input type="radio"/> STD Filter | 0 |
| <input checked="" type="checkbox"/> | <input checked="" type="radio"/> Header Down Req | 4479 |

Position Filter To 0

| Easting | 581641.62 | 582398.54 | Manual Deletes |
|----------|------------|------------|----------------|
| Northing | 4183945.83 | 4184721.01 | 0 |

Adjust for Moisture?

<F10> Apply Filters

Map and Manual Editor

| Easting (m) | Northing (m) | Yield | Flow | Speed | Moist | Swath | Up/Dn | Nsecs | RmCode | Pass | Point |
|-------------|--------------|-------|------|-------|-------|-------|-------|-------|--------|------|-------|
| 582558 | 4184562 | | | | | | | | | | |

Zoom Tools Manual Editing Tools

<< Advanced

Display Symbol Size (m) 1.25

Yield Statistics

| | Mean | STD | CV | N | Range |
|-------|--------|-------|-------|-------|---------|
| Clean | 195.99 | 65.45 | 33.4 | 48784 | 0-300 |
| Raw | 189.52 | 279.6 | 147.6 | 53485 | 0-19011 |

Filtering, Mapping and Editing

Save/Export File

Editor

| Nothing (m) | Yield | Flow | Speed | Moist | Swath | Up/Dn | Nsecs | RmCode | Pass | Point |
|-------------|-------|------|-------|-------|-------|-------|-------|--------|------|-------|
| | | | | | | | | | | |

Zoom Tools Manual Editing Tools

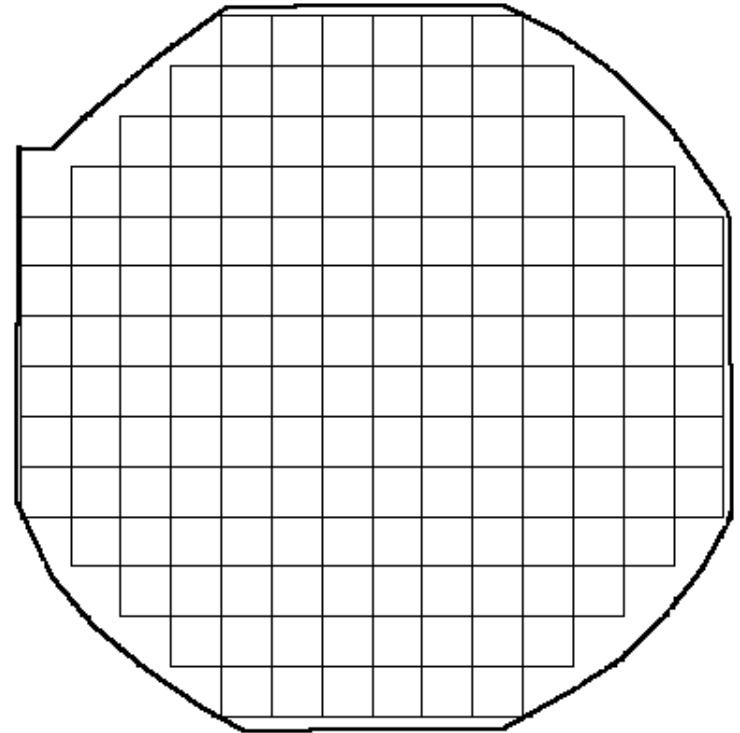
<< Advanced

Display Symbol Size (m) 1.25

| Haw | 189.52 | 279.6 | 147.6 | 53485 | 0-19011 |
|-----|--------|-------|-------|-------|---------|
|-----|--------|-------|-------|-------|---------|

Filter and Convert to Cell Data

- Filter to remove unrealistic yield values
- Determine an appropriate cell size to aggregate data
 - Averaging
 - Interpolation

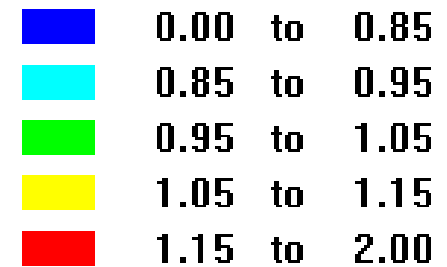
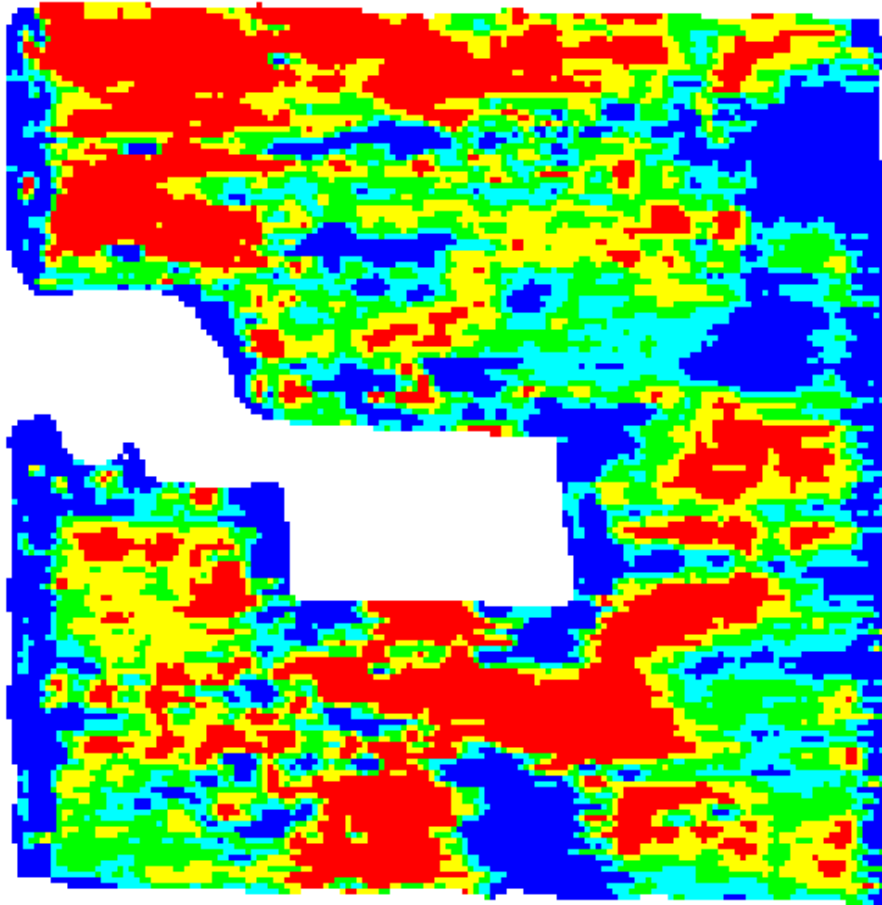


What is a normalized yield map?

- A normalized yield map is created by dividing actual yield values by the average
- Average yielding areas are 100%
- Allows comparison of different crops and different years



Normalized Yield (96-97)





Mean Relative Difference

- A relative difference ($\delta_{i,j}$) was calculated for each cell and year.
- The mean relative difference **Now average cells are zero** calculated across years

$$\delta_{i,j} = \frac{Y_{i,j} - \bar{Y}_j}{\bar{Y}_j}$$

$$\delta_i = \frac{1}{n} \sum_{j=1}^n \delta_{i,j}$$

\bar{Y}_j is average yield for year j

The screenshot shows an Excel spreadsheet with the following data:

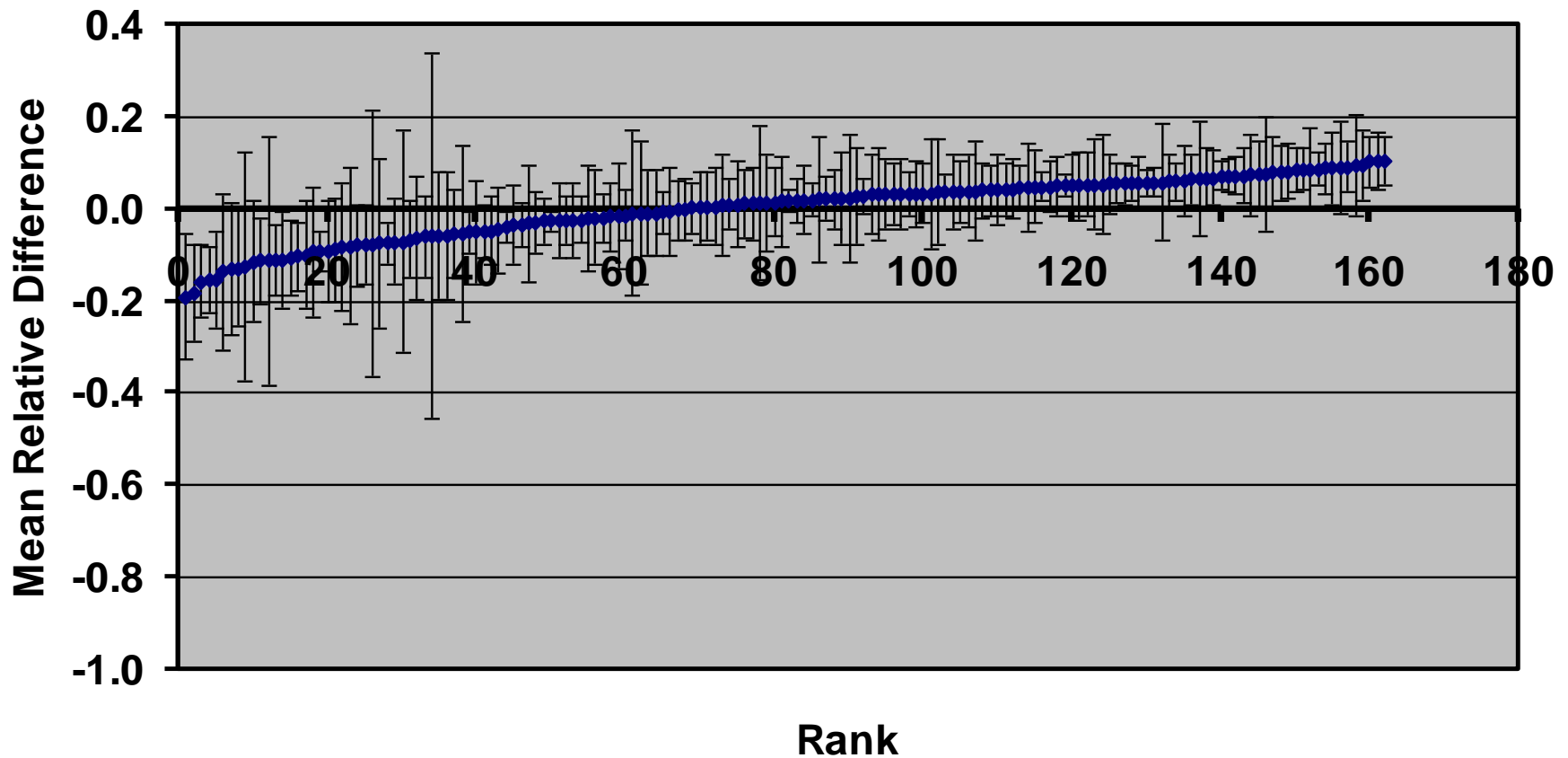
| | A | B | C | D | E | F | G |
|----|-------------|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | Easting, ft | Northing, ft | 1996 Cell Yield | 1997 Cell Value | 1998 Cell Yield | 1999 Cell Yield | 2000 Cell Yield |
| 2 | 90 | -810 | 191.3 | 161.5 | 117.6 | 144.3 | 157.1 |
| 3 | 450 | -630 | 228.3 | 189.2 | 137.1 | 109.3 | 162.1 |
| 4 | -270 | 630 | 235.0 | 186.4 | 146.8 | 117 | 168.7 |
| 5 | 270 | 990 | 234.0 | 185.8 | 144.4 | 131.6 | 170.8 |
| 6 | -90 | 630 | 211.3 | 193.8 | 133.7 | 153.8 | 168.2 |
| 7 | 90 | -630 | 177.5 | 169 | 109.9 | 145.6 | 168.5 |
| 8 | -810 | 270 | 212.1 | 152.8 | 124.4 | 152.2 | 156.8 |
| 9 | -270 | -810 | 210.8 | 182.1 | 149.7 | 161.9 | 157.6 |
| 10 | 630 | 270 | 171.8 | 182.3 | 148.3 | 156 | 162.5 |
| 11 | 810 | -630 | 220.7 | 196.4 | 162 | 145.9 | 165.9 |
| 12 | 810 | 90 | 221.7 | 195.2 | 164.8 | 113.6 | 154.4 |
| 13 | -90 | -1170 | 214.9 | 197.2 | 164.1 | 148.3 | 166.3 |
| 14 | -810 | -630 | 214.6 | 203.1 | 161.1 | 156.4 | 169.5 |
| 15 | -90 | -270 | 210.6 | 210.3 | 152.7 | 152.4 | 168 |
| 16 | 810 | -90 | 200.4 | 217.3 | 149.9 | 144.1 | 170.2 |
| 17 | 450 | -270 | 166.7 | 167.7 | 115.2 | 139 | 170.6 |
| 18 | 270 | -990 | 152.4 | 120.6 | 95.54 | 82.85 | 144.6 |
| 19 | 990 | 270 | 220.0 | 178.9 | 144.7 | 128.4 | 169.6 |
| 20 | -270 | -990 | 216.7 | 182.5 | 145.7 | 131.3 | 174.9 |
| 21 | 990 | 90 | 206.7 | 199.3 | 147.6 | 137 | 168.5 |
| 22 | 450 | -990 | 217.6 | 206.3 | 145.2 | 121.2 | 176 |

$Y_{i,j}$ is the yield for cell i in year j

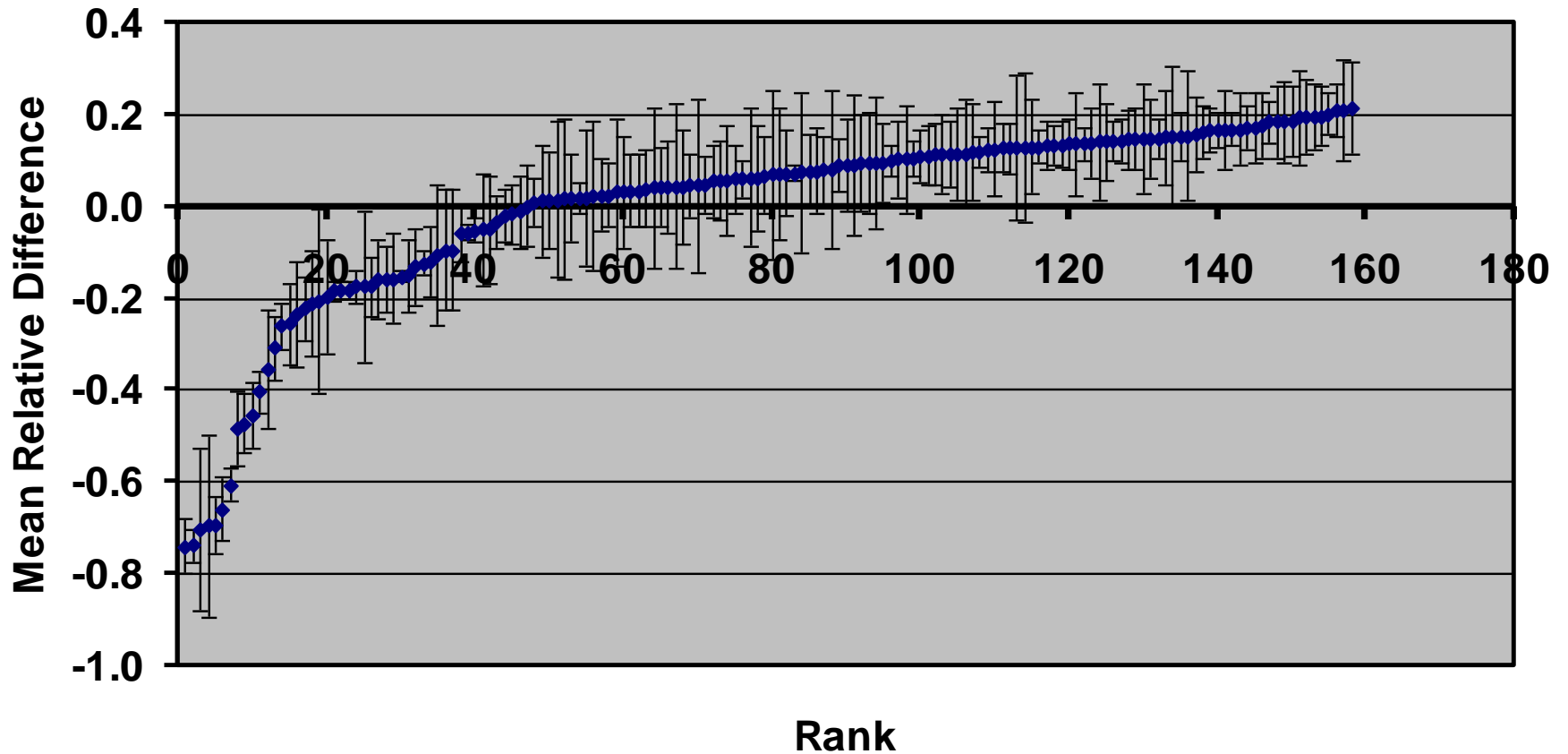
Mean Relative Difference

| | N | O | P | Q | R | S | T | U | V | W | X | Y |
|----|----|---------|---------|---------|---------|---------|------|---------|---------|--------|--------|-------|
| 1 | | delta96 | delta97 | delta98 | delta99 | delta00 | rank | meande | deltaSD | CV | RankSD | Class |
| 2 | 1 | -0.0796 | -0.1480 | -0.1970 | -0.0021 | -0.0932 | 75 | -0.1040 | 0.0847 | 0.9826 | 1 | 1 |
| 3 | 2 | 0.0984 | -0.0018 | -0.0638 | -0.2441 | -0.0644 | 163 | -0.0552 | 0.144 | 1.0191 | 2 | 0 |
| 4 | 3 | 0.1306 | -0.0166 | 0.0024 | -0.1909 | -0.0263 | 92 | -0.0201 | 0.1321 | 1.0123 | 3 | 0 |
| 5 | 4 | 0.1258 | -0.0198 | -0.0140 | -0.0899 | -0.0141 | 157 | -0.0024 | 0.0904 | 1.0148 | 4 | 0 |
| 6 | 5 | 0.0166 | 0.0224 | -0.0871 | 0.0636 | -0.0291 | 130 | -0.0027 | 0.0641 | 1.0235 | 5 | 0 |
| 7 | 6 | -0.1460 | -0.1084 | -0.2496 | 0.0069 | -0.0274 | 111 | -0.1049 | 0.1059 | 0.9145 | 6 | 0 |
| 8 | 7 | 0.0204 | -0.1939 | -0.1506 | 0.0526 | -0.0949 | 103 | -0.0733 | 0.1225 | 1.0182 | 7 | 0 |
| 9 | 8 | 0.0142 | -0.0393 | 0.0222 | 0.1196 | -0.0903 | 127 | 0.0053 | 0.0662 | 1.094 | 8 | 0 |
| 10 | 9 | -0.1734 | -0.0382 | 0.0126 | 0.0788 | -0.0620 | 35 | -0.0365 | 0.1069 | 1.0103 | 9 | 0 |
| 11 | 10 | 0.0618 | 0.0361 | 0.1062 | 0.0090 | -0.0424 | 160 | 0.0341 | 0.0413 | 1.074 | 10 | 0 |
| 12 | 11 | 0.0666 | 0.0298 | 0.1253 | -0.2144 | -0.1088 | 124 | -0.0203 | 0.1494 | 1.1006 | 11 | 0 |
| 13 | 12 | 0.0339 | 0.0404 | 0.1205 | 0.0256 | -0.0401 | 79 | 0.0361 | 0.044 | 1.0713 | 12 | 0 |
| 14 | 13 | 0.0325 | 0.0715 | 0.1000 | 0.0816 | -0.0216 | 137 | 0.0528 | 0.0285 | 1.0675 | 13 | 2 |
| 15 | 14 | 0.0132 | 0.1095 | 0.0427 | 0.0539 | -0.0303 | 58 | 0.0378 | 0.0403 | 1.0643 | 14 | 0 |
| 16 | 15 | -0.0358 | 0.1464 | 0.0236 | -0.0035 | -0.0176 | 59 | 0.0226 | 0.0796 | 1.0363 | 15 | 0 |
| 17 | 16 | -0.1980 | -0.1153 | -0.2134 | -0.0387 | -0.0153 | 134 | -0.1161 | 0.0808 | 0.89 | 16 | 1 |
| 18 | 17 | -0.2668 | -0.3638 | -0.3476 | -0.4270 | -0.1654 | 89 | -0.3141 | 0.066 | 0.8243 | 17 | 1 |
| 19 | 18 | 0.0585 | -0.0562 | -0.0119 | -0.1120 | -0.0211 | 141 | -0.0286 | 0.072 | 0.9925 | 18 | 0 |
| 20 | 19 | 0.0426 | -0.0372 | -0.0051 | -0.0920 | 0.0095 | 80 | -0.0164 | 0.0565 | 0.9732 | 19 | 0 |
| 21 | 20 | -0.0055 | 0.0514 | 0.0079 | -0.0526 | -0.0274 | 108 | -0.0052 | 0.0428 | 1.0197 | 20 | 0 |
| 22 | 21 | 0.0469 | 0.0884 | -0.0085 | -0.1618 | 0.0159 | 135 | -0.0038 | 0.1095 | 0.9844 | 21 | 0 |

Seven Years of YM Data – Field B



Fours Years of YM Data - Field A



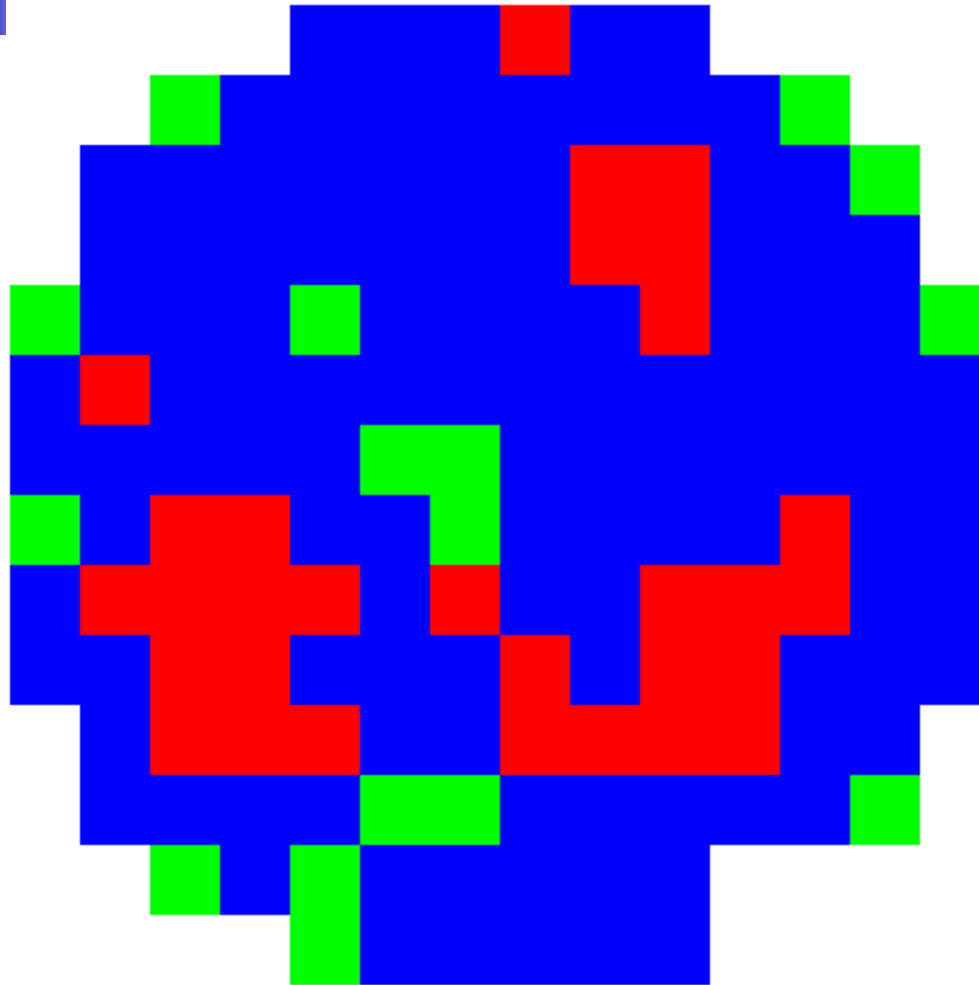


Data Classification

- If the mean relative difference was greater than the temporal standard deviation, the cell yield was deemed consistently different than the mean. These cells were then classified as high or low if they were greater or less than the mean.
- Cells with a standard deviation greater than the mean relative difference were classified as average or unstable.



Classification Map - Field B



**I grouped
Unstable cells
with average
because that is
how I would
treat them.**