

Hydration and Watering Graph in Google Sheets

1. Organizing data:

When analyzing data the first step is to clean up and organize the spreadsheet so it is easier to do the calculations and then statistical analysis.

a. Copying/Duplicating your Worksheet

- It is best to copy/duplicate your entire worksheet into a new worksheet so that if you make mistakes you have the original copy of your work to refer to.
- This link has instructions about how to [duplicate a sheet](#) (around ½ way down the webpage are the specifics for duplication. The rest are basic instructions about how to work with multiple worksheets)

b. Get rid of your formulas;

- In your duplicate worksheet, you want to get rid of the formulas that you used to calculate % hydration and just have the values (numbers).
- Press **Ctrl +A (windows)** or **Command + A (Mac)** and you will select the entire sheet.
- Press **Ctrl +C (windows)** or **Command + C (Mac)** and you will copy the entire sheet.
- Go to Edit menu and select **Paste Special** and then **Paste Values Only**
- You are basically copying your entire worksheet over itself to get rid of formulas

c. Clean up Data

- You want to get rid of all the information that you don't need for creating your graphs/charts. In this case, you are going to want to get rid of everything but
 - The dates
 - The % hydration
 - Watering
- The easiest way to do this is to select the column or row heading and the entire column or row will "darken". Then I can just select "Delete" from the Edit drop down menu.
- Here is what my data sheet looks like at this point

A	B	C	D	E	F	G	H	I	J	K
	1/22/18	1/24	1/29/18	1/29	1/31	1/31	2/5	2/5	2/14	2/14
Accession	% hydration	% hydration	% hydration	Watered ?	% hydration	watered?	% hydration	Watered?	% hydration	Watered?
	100%	93%	76.92%	Watered	91.63%		69.68%		26.06%	
	100%	92%	70.89%	Watered	106.24%		103.76%		50.94%	
aha	100%	90%	71.23%	Watered	90.46%	yes	70.66%	watered	25.47%	yes
	100%	90%	65.84%	Watered	90.10%		67.48%		67.48%	
ink	100%	92%	70.86%	Watered	94.44%	yes	76.15%	yes	44.26%	yes
	100%	91%	68.65%	Watered	91.98%		72.49%		21.41%	
	100%	91%	73.56%	Watered	91.34%		75.58%		34.64%	
	100%	89%	72.85%	Watered	85.58%		63.70%		29.80%	

2. Calculating average and standard deviation

I wanted to calculate the average % hydration for each day that you weighed your practice plants. I also wanted to have a sense of the variation in weights which we'll measure by using the standard deviation

a. Insert Rows

You need to insert rows where you can place the formula for calculating the average and variation.

- Select a row and right-click it
- From the menu that appears, select **Insert row**
- Here's what my spreadsheet looked like at this point (notice that I went ahead and entered rows for calculating standard deviation and the number of days at the same time)

A	B	C	D	E	F	G
	1/22/18	1/24	1/29/18	1/29	1/31	1/31
average hydration						
standard deviation						
days since planting						
accession	% hydration	% hydration	% hydration	Watered ?	% hydration	watered?
	100%	93%	76.92%	Watered	91.63%	
	100%	92%	70.89%	Watered	106.24%	

b. Calculating Average and Standard Deviation

- click in the cell where you want the average to be placed and enter the following formula
- =average(

	A	B	C
1		1/22/18	1/24
2	average hydration	=average(B6:B31)	
3	standard deviation		
4	days since planting		
5	accession	% hydration	% hydration

- And then select the block of cells with the data that you want to average
- And then enter closed parenthesis
- =average(B6:B31)
- I then copy and paste that formula for all the other dates

	A	B	C
		100% x /18	1/24
average hydration		=average(B6:B31)	
standard deviation			
days since planting			
accession	% hydration	% hydration	% hydra
		100%	93%
		100%	92%
cha		100%	90%

- Notice there are problems for the “Watered” column. Don’t worry about that, we’ll fix it later

	A	B	C	D	E	F	G
		1/22/18	1/24	1/29/18	1/29	1/31	1/31
average hydration		100%	91%	72.48%	#DIV/0!	93.25%	#DIV/0!
standard deviation							

- Standard Deviation: use the same process, but use the following formula
 - =stdev(B6:31)
 - Of course your cell numbers will be different from mine.
- Calculating number of days between dates
 - The formula for calculating this is
 - =datedif(start date, end date, “units”)
 - For our first day, the start and end date were the same date and I wanted to calculate the difference in days, so used a “d” in quotes to indicate that.

A	B	C	
	1/22/18	1/24	
average hydration	100%	91%	
standard deviation	0	0.02047933042	0.0
days since planting	=datedif(B1,B1,"d")		
accession	% hydration	% hydration	% t
	100%	93%	
	100%	92%	

- To make it easy to copy this formula to other cells, we can make sure that Google knows we ALWAYS want the cell with 1/22/18 to be our first date. I do that by putting \$ symbols in front of the column and row designation (\$B\$1)
- Then I can copy and paste that formula into the row for “Days since planting”

ard tion	0	0.020479330
ing	=datedif(\$B\$1,B1,"d")	
ssion	% hydration	% hydration

- This is what my spreadsheet looks like so far

=datedif(\$B\$1,B1,"d")

A	B	C	D	E	F	G
	1/22/18	1/24	1/29/18	1/29	1/31	1/31
average hydration	100%	91%	72.48%	#DIV/0!	93.25%	#DIV/0!
standard deviation	0	0.02047933042	0.06073718476	#DIV/0!	0.05469615683	#DIV/0!
days since planting	0	2	7	7	9	9
accession	% hydration	% hydration	% hydration	Watered ?	% hydration	watered?
	100%	93%	76.92%	Watered	91.63%	

e. Watering

- Now I need to do something about my “Watering?” columns. I want to change the information so it isn’t words, but is numeric.
- To do that I replace every **yes with a 1** and every **no with a 0**
- I also want to create a row for that information.
- And I removed the weird ‘#DIV/0! Since that was an artifact of the watered data being in words
- Here’s a picture that shows me in the process of doing that with cells highlighted that I to show what I changed.

1		1/22/18	1/24	1/29/18	1/29	1/31	1/31	2/5	2/5	2/14	
2	average hydration	100%	91%	72.48%		93.25%		74.27%		29.03%	#D
3	standard deviation	0	0.02047933042	0.06073718476		0.05469615683		0.10981111		0.1993372906	#D
4	days since planting	0	2	7	7	9	9	14	14		
5	Watered				1		1				
6	accession	% hydration	% hydration	% hydration	Watered ?	% hydration	watered?	% hydration	Watered?	% hydration	Watered
7		100%	93%	76.92%	1	91.63%	1	69.68%	0	26.06%	
8		100%	92%	70.89%	1	106.24%	1	103.76%	0	50.94%	
9	sha	100%	90%	71.23%	1	90.46%	1	70.66%	watered	25.47%	yes
10		100%	90%	65.84%	1	90.10%	1	67.48%		67.48%	
11	unk	100%	92%	70.86%	1	94.44%	1	76.15%	yes	44.26%	yes
12		100%	91%	68.65%	Watered	91.98%	1	72.49%		21.41%	
13		100%	91%	73.56%	Watered	91.34%	1	75.58%		34.64%	
14		100%	89%	72.85%	Watered	85.58%	1	63.70%		29.80%	

f. Creating graph

a. Copying Data to new sheet

- The first thing that I like to do, is copy the rows with Average, Standard Deviation, Day Since Watering and Watered
- And paste them into a new worksheet, so it will be easy to see what I am doing.

- Remember to ‘Paste Special’ and select Paste Values so you don’t get a bunch of error messages because you lost the formula data.

	A	B	C	D	E	F
		1/22/18	1/24	1/29/18		
	average hydration	#DIV/0!	#DIV/0!	#DIV/0!		
	standard deviation	#DIV/0!	#DIV/0!	#DIV/0!		
	days since planting	0	2	7		
	Watered					

	A	B	C	D	E	F
1		43122	43124	43129	43129	43131
2	average hydratio	1	0.9126641362	0.7248127712		0.9325187561
3	standard deviatric	0	0.02047933042	0.06073718476		0.05469615683
4	days since planti	0	2	7	7	9
5	Watered				1	
6						
7						

- Notice my dates got messed up in the process. Simply select that row and then go to the
 - Format** menu and hover over ‘**Number**’ and then select ‘**Date**’
 - That will return that row to being in normal date format.
- b. Transposing the data
- In Google Sheets it will be easier to make our graph if the data is in columns rather than rows.
 - The first thing I did was rearrange my rows to put the ‘Days since planting’ as the first row.

	A	B	C	D	E
		1/22/2018	1/24/2018	1/29/2018	1/29/2018
	days since planti	0	2	7	7
	average hydratio	100.00%	91.27%	72.48%	
	standard deviatric	0	0.02047933042	0.06073718476	0.054
	Watered				1

- Then I selected all of the rows except the actual date row
- Ctrl + C** (windows) or **Command +C** (Mac) to copy all the rows and then

- Clicked in a cell below my rows and selected **Paste Special** > “**Paste Transposed**”
- Here is what it looked like.

days since planti	average hydratio	standard deviatric	Watered
0	100.00%	0	
2	91.27%	0.02047933042	
7	72.48%	0.06073718476	
7			1
9	93.25%	0.05469615683	
9			1
14	74.27%	0.10981111	
14			1
23	29.03%	0.1993372906	
23			1
25	57.29%	0.3984786422	
25			1
37	36341.11%	54.00540354	

- I then tidied up my data by removing the duplicate rows and putting a “1” where I had watered and a 0 where on the days there was no watering.

days since planti	average hydratio	standard deviatric	Watered
0	100.00%	0	
2	91.27%	0.02047933042	
7	72.48%	0.06073718476	1
9	93.25%	0.05469615683	0
14	74.27%	0.10981111	1
23	29.03%	0.1993372906	1
25	57.29%	0.3984786422	0

- I then selected my Standard Deviation and clicked % so it was in the correct units.

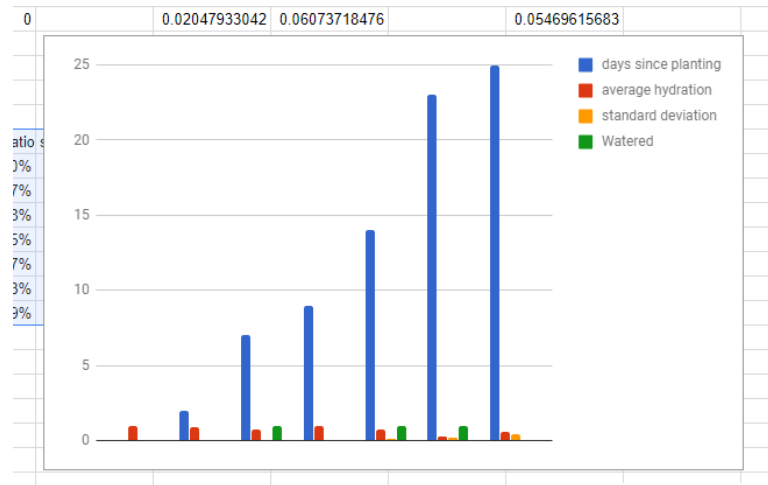
<div> <div> <div></div> <div></div> <div></div> </div> <div>100%</div> <div>\$ %</div> <div>.0</div> <div>.00</div> <div>123</div> <div>Arial</div> </div>				
.0204793304160897				
A	B	C	D	
average hydration	100.00%	91.27%	72.48%	
standard deviation	0	0.02047933042	0.06073718476	
watered				
days since planting	average hydration	standard deviation	Watered	
0	100.00%	0		
2	91.27%	0.02047933042		
7	72.48%	0.06073718476		1
9	93.25%	0.05469615683		0
14	74.27%	0.10981111		1
23	29.03%	0.1993372906		1
25	57.29%	0.3984786422		0

c. Making the graph

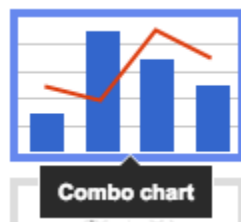
- Select the cells with Days since planting, hydration through watered, making sure to select the column headings as well

days since planting	average hydration	standard deviation	Watered
0	100.00%	0	
2	91.27%	2.05%	
7	72.48%	6.07%	1
9	93.25%	5.47%	0
14	74.27%	10.98%	1
23	29.03%	19.93%	1
25	57.29%	39.85%	0

- Then go to the drop down menu and select **Insert > Chart**
- And you will have a messy looking graph like this



- The Chart Editor should have opened up as well,
- Click on the changes marked with the highlighter and then on the drop down menu circled in red and select the **Combo Chart**



- Click the three dots next to Standard Deviation and select **remove**
- Click on **Customize** and then on **Series**
- Now you want to change the way the Average Hydration is graphed from columns to a line.
- You do that by selecting **Apply to>average hydration** and then under **Type> Line**

Chart editor

DATA

CUSTOMIZE

Chart type

Column chart

Stacking

None

Data range

A9:D16

X-AXIS

123 days since planting

SERIES

123 average hydration

123 standard deviation

123 Watered

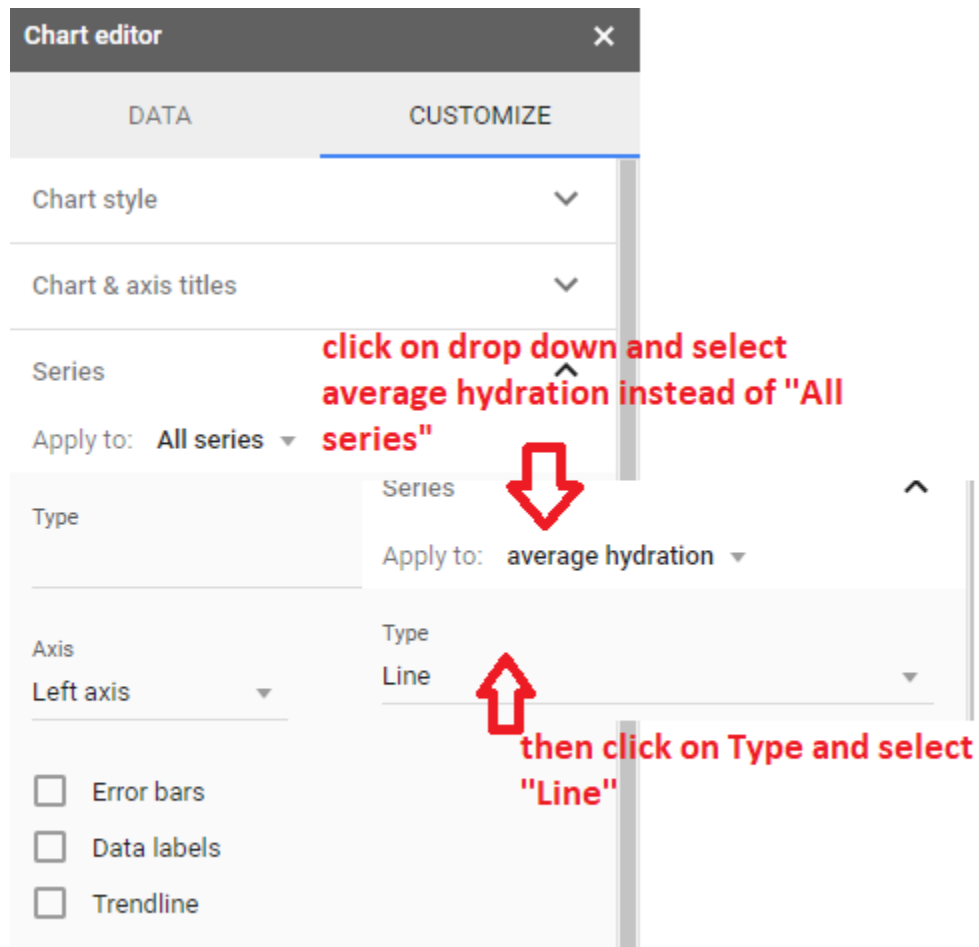
Add Series

Switch rows / columns

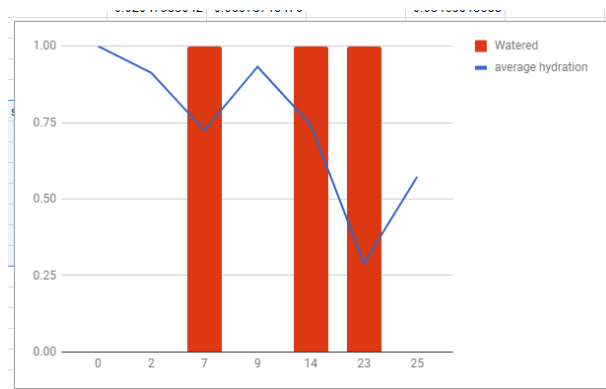
Use row 9 as headers

Use column A as labels

Aggregate column A

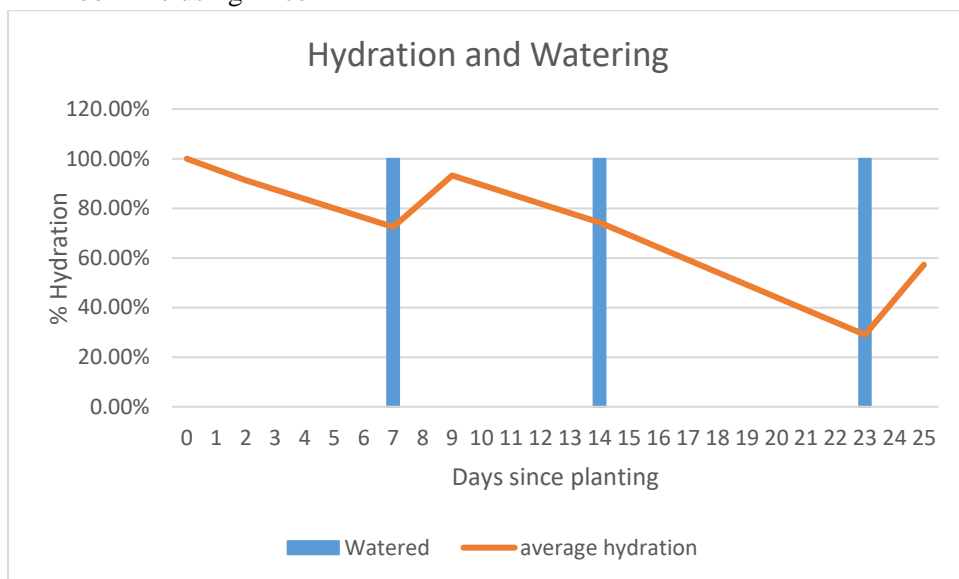


- Now switch Watered to a column. Here is what your graph should look like:
- You can then play around with it to make it look better.



6. Next steps:

- I would like this graph to have the correct scale for days since planting. I don't know how to do this in Google Sheets, so if one of you figures it out, let us know. Here is what that would look like using Excel



- One way to do this in Google Sheets would be to just add in rows for the missing dates. But surely there is a more elegant solution!
- Graphing variation.

We'd like to see how variable the hydration is between 6 packs in your projects. I'd like you each to play around with methods of graphing that. Here are some ideas/options

 - Graph each 6pack as its own line but keep them on the same graph
 - Graph error bars with standard deviation
 - Something else!
 - Play around with it.