

# Capstone Project

Francisco Velasquez | University of Florida



## Problem / Question

How different amount of water can affect the development of roots in *Sesamum indicum*?

## Abstract

- This study described sesame's rooting behavior and the relationship with water. The Experiment was divided in 4 blocks, each block had 2 plots for a total of 8 plots. Each plot has 8 tubes. Every block had one plot with full irrigation and one with half. The root systems were imaged *in Citra* with a rhizotron in 2019. Total root length and diameter were measured for each picture, roots were separated between alive and dead.

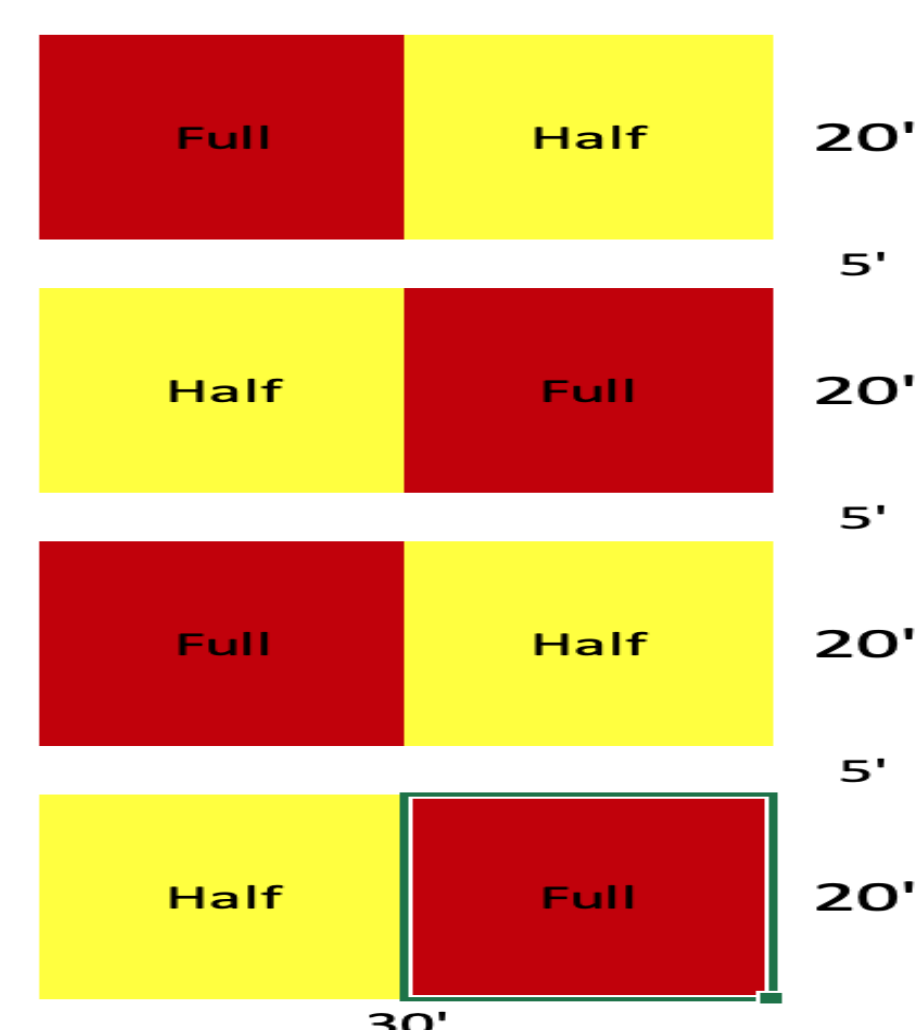
## Calculations for irrigation

CALCULATIONS ON 07/15/2019		Total water needed for full irrigation	
Actual flow rate of the system:		1071 gallons	full
Red:	245 g/h	535 gallons	half
Yellow:	242 g/h		
So, running time:		Red: 4.37 h	equals 4h22min
		Yellow: 2.21 h	equals 2h13min
1 in of water =	27154 gal/ac		
	25.40 L/m <sup>2</sup>		
	25.4 mm of water		
7/15/19	1st true irrigation	Water applied	Red 0.75 Yellow 0.36
7/22/19	Beginning irrigation	Red (full) 2093 Yellow(half) 768	Run time Red 5:45 Yellow 2:58
	End irrigation	Red 3014 Yellow 1267	
	Difference	Red 921 Yellow 499	equals 0.65 in equals 0.35 in
7/30/19	Beginning irrigation	Red 3014 Yellow 1267	Run time Red 5:45 Yellow 2:58
	End irrigation	Red 6372 Yellow 1754	
	Difference	Red 3358 Yellow 487	
8/7/19	No irrigation	Red 6372 Yellow 1754	3803
8/15/19	Beginning irrigation	Red 6372 Yellow 1754	
	End irrigation	Red 7321 Yellow 2240	
	Difference	Red 949 Yellow 486	
8/23/19	Beginning irrigation	Red 7321	

## Background

The root is a hard-to-reach part of the plant because it is underground. Roots have as one of their functions to support and anchor the soil, as well as the absorption of water and nutrient uptake. Given their hard to reach place, roots require special devices to study them. In this case, the Rhizotron was used. The rhizotron is a plant growth system that allows you to observe the development and architecture of the roots. The rhizotron consists of two glasses separated by a small distance, filled with a substrate in which a plant grows. It uses a camera to record the growth of the root. In addition, it allows to determine area, length and the number of Secondary Roots and/or Root Hairs Architecture. A tracing program was used to measure the roots and to determinate how many were alive or death.

Map of the irrigation system



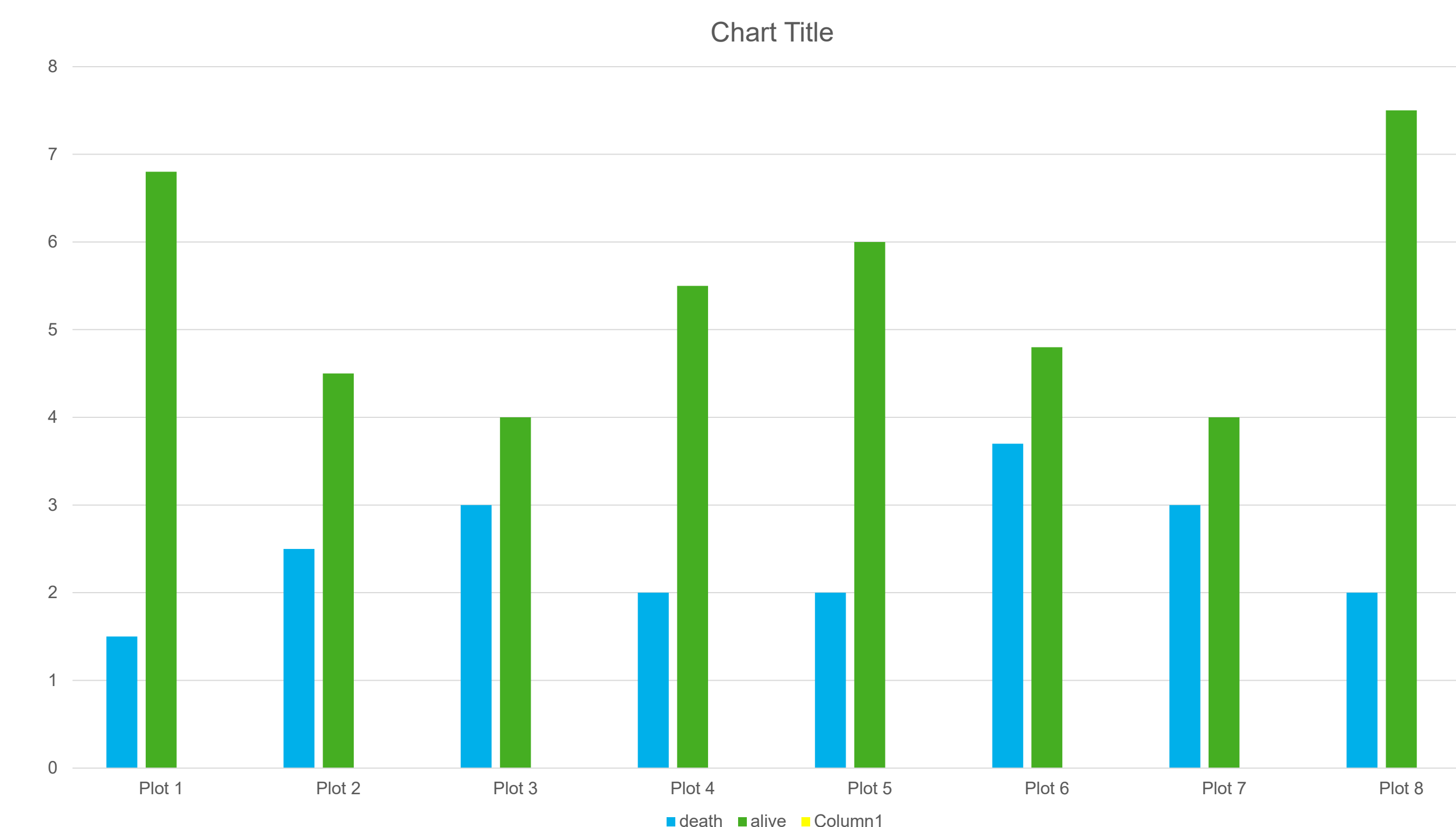
## Half irrigation



## Full irrigation



## Expected Results



- Light blue line: Death
- Green line Alive
- I expect to have more death roots in the plots that have less water, but I expected that the roots are going to be deeper than the roots with more water.
- I expect to have more alive roots in the plots with more water and I expect to have shallow roots.

## Conclusion

Although the research is not yet finished it shows that sesame plants tolerate drought. It can be observed that roots with limited irrigation have deeper roots, this phenomenon is because the plant is looking for water. These plants spend energy on creating deep root systems, the goal of this is to find water in the depth. The plants that had full irrigation had a small number of roots in deep places, but the roots survived longer. This is because the roots do not see the need to reach a great deepening because they have a reasonable amount of water to survive.

## References

- [https://www.researchgate.net/publication/339050928\\_Variability\\_of\\_root\\_traits\\_in\\_sesame\\_genotypes\\_under\\_different\\_irrigation\\_regimes](https://www.researchgate.net/publication/339050928_Variability_of_root_traits_in_sesame_genotypes_under_different_irrigation_regimes) (Links to an external site.)
- <https://nwdistrict.ifas.ufl.edu/phag/2016/01/08/ufifas-researchers-studying-corn-root-development-in-floridas-sandy-soils/> (Links to an external site.)
- [https://www-pub.iaea.org/MTCD/Publications/PDF/te\\_1493\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/te_1493_web.pdf) (Links to an external site.)
- [https://www.researchgate.net/publication/334684320\\_Root\\_life\\_history\\_of\\_non-dehiscent\\_sesame\\_Sesamum\\_indium\\_L\\_cultivars\\_and\\_the\\_relationship\\_with\\_canopy\\_development](https://www.researchgate.net/publication/334684320_Root_life_history_of_non-dehiscent_sesame_Sesamum_indium_L_cultivars_and_the_relationship_with_canopy_development) (Links to an external site.)
- <https://pubmed.ncbi.nlm.nih.gov/31321496/>

## Materials

Materials
Sesame plants
Shelters
Computer
Tracing Key
Treatments (water)
tubes
Rhizotron