

Project Sunflower: How climate, water and fertilizer affects sunflower growth in Western Australia

ABSTRACT

The problem we investigated was how climate, different amounts of water and fertilised soil affected sunflower growth in Western Australia. In order to test the effect of climate, we grew plants in Baldivis, Karratha and Jurien Bay (1600 km apart). We predicted that the tallest sunflowers would be the ones that were given fertiliser, more water and were situated in the warmest climate.

DATA COLLECTION

We decided to conduct this research ourselves by planting several sunflower seeds and monitoring their growth over a period of 10 weeks. We planted seeds in four groups of plant pots which were subject to the following variables:

- Fertilised (F) + 750 ml of water/ week
- Unfertilised (UF) + 750 ml of water/ week
- Fertilised (F) + 1000 ml of water/ week
- Unfertilised (UF) + 1000 ml of water/ week

There were a number of variables beyond our control which still affected sunflower growth, for instance:

- Unseasonal weather patterns
- Rainfall
- The type of soil found in each place
- Pests and diseases affecting our plants

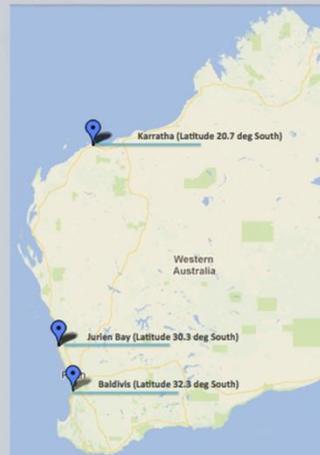
DATA ANALYSIS

Due to a lack of seed germination and early death of plants, data for Jurien Bay was only available for first two weeks. With 8 weeks of data missing, generating and projecting 80% of the data by extrapolation would not be appropriate for statistical analysis. Therefore, the data acquired from Jurien Bay had to be excluded from further analysis. Due to the shape of the inconsistent trends (see Fig 4.) it was deemed inappropriate to extrapolate Karratha data for weeks 9 and 10. As a result, we would have no confidence in the data if it was extrapolated to week 10. On the other hand, if there were just a few pieces of data missing in places, it would be fine to interpolate the data. No data could be collected for weeks 2 and 7 in Karratha due to absences. However, since data was recorded and thus available for weeks 1,3,6 and 8, the missing data was interpolated by averaging over the adjacent weeks' data.

DATA REPRESENTATION

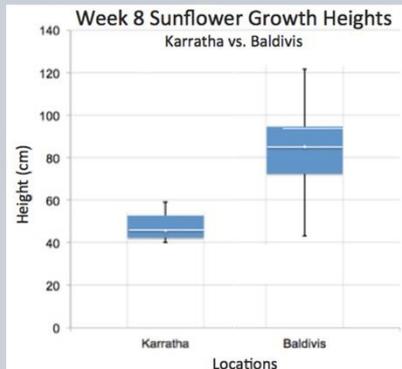
- Effect of latitude and climate (Fig 1, climate graph 1 & climate graph 2)

Fig. 1 Map of WA



For studying the effect of latitude and climate, the Box and Whisker plot was used to provide not only a good visualization of the overall effect of weather but also to show the differences in data spread and the effect of outliers. Furthermore, averaging all the sunflowers' heights excluded other variables like fertilizer and water, thus emphasizing the effect of climate only. As seen clearly from the plot, map and both climate graphs, the climate of Baldivis was more suitable for growth of sunflowers than Karratha. This leads to the observation that sunflowers may suffer from heat stress in places too close to the equator where there are high temperatures and more sunlight but less rainfall. In contrast, the climate in places farther from the equator with less sunlight, lower temperatures and more rainfall supported sunflower growth more at the end of a period of 8 weeks.

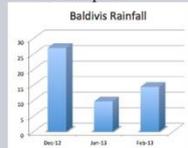
Fig. 2



Climate Graph 1

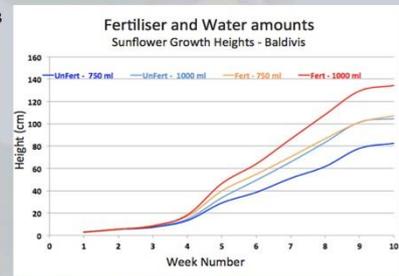


Climate Graph 2



- Effect of Fertilizer use and water amounts (Fig. 3)

Fig. 3



In order to assess the effect of fertiliser and water, Karratha's data was excluded (in addition to Jurien Bay) and only Baldivis data was used because it had more consistent data. Referring to (Fig. 3), it can be inferred that the fertilised plants with the most water grew to be the highest at 135cm. Looking at the light blue and yellow lines it shows that the unfertilised 1,000ml and the fertilised 750ml plants growth patterns were similar. This is because fertiliser compensates for the smaller amount of water that the plants were given and vice-versa. This growth chart (Fig. 3) supports exactly the expectation regarding the impact of fertiliser and water on growth with the fertilised and more water plants having the largest heights, the unfertilised and less water plants having the smallest heights and the overall consistency of the growth rates being maintained among each of the four categories.

- Comparison of sunflower growth in Karratha vs. Baldivis (Fig. 4).

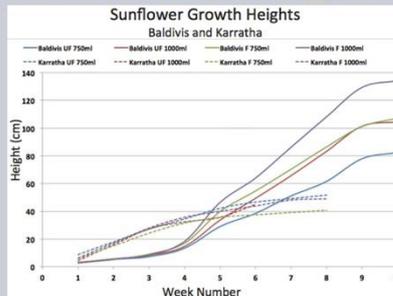


Fig. 4



A comparison graph showing all available data for Karratha and Baldivis as shown in (Fig. 4)

As seen from the following graph (Fig. 4), despite a great start to sunflower growth in the first few weeks in Karratha, due to prolonged heat, the sunflowers' growth was stunted and many died. This also seemed to mask the effect of water and fertilizers on growth.

CONCLUSION

Our original hypothesis was that the tallest sunflowers would be the ones that were given fertiliser & more water and were situated in a warmer climate. After data analysis, we found that our hypothesis was correct with as far as the effect of fertiliser and water are concerned, but our thoughts on the warmer climate were incorrect. The exposure to heat in Karratha actually hindered the plants' growth rates and killed many of them. The relatively cooler climate of Baldivis seemed best suited for consistent and high sunflower growth rate over long periods of time.