


Application of Gibberellin on Dwarf Mutant Millet Plants

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Introduction:

- Dwarf millet plants exhibit stunted growth
- Past studies identify 2 common reasons for their dwarfism:
- Either the plant is incapable of synthesising gibberellin (gibberellin deficient)
- Or it lacks the receptors that respond to gibberellin (gibberellin unresponsive) [1].
- Gibberellin is a plant hormone that stimulates plant growth
- Previous research shows that dwarf maize plants can exhibit normal growth when treated with a gibberellin solution [2].

Experimental Design:

Purpose: use the application of gibberellin to identify the cause of the dwarfism in two varieties of millet.

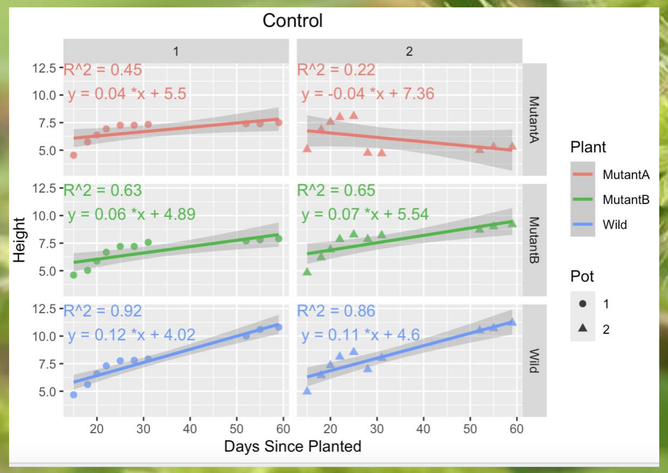
Research question: how do the two dwarf mutant genotypes respond to weekly and triweekly application of gibberellin?

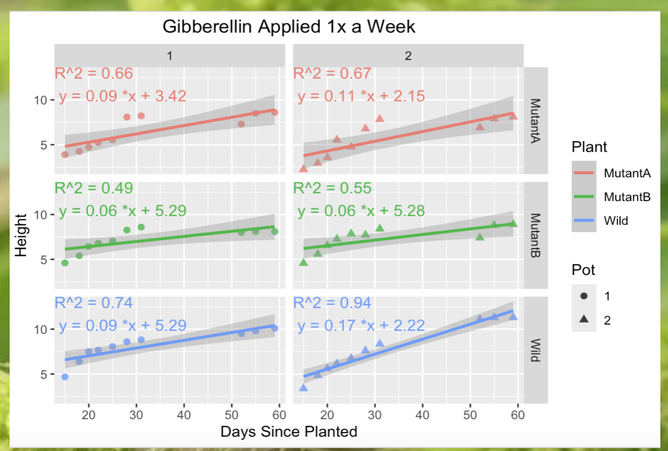
H_0: the dwarf plants will show no growth response to gibberellin.
H_1: the dwarf plants will exhibit normal growth if they have the gibberellin deficient genotype, and stunted growth if they have the gibberellin unresponsive genotype.
H_2: the gibberellin deficient genotypes will grow slightly taller than the control when gibberellin is applied weekly, and will grow significantly taller when gibberellin is applied tri-weekly.

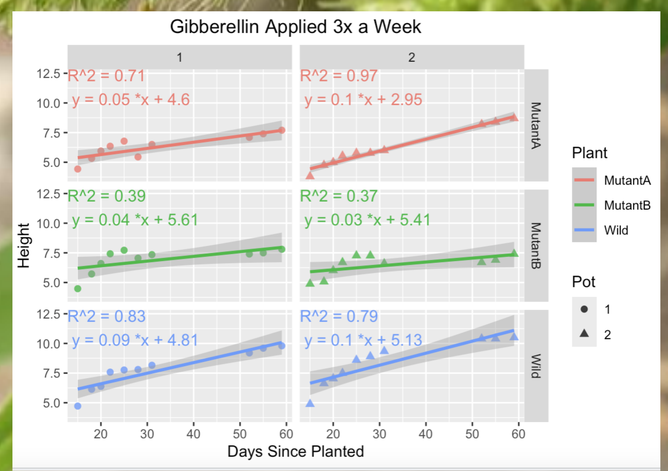
Materials & Method:

- 3 drops 1.44 x 10^{-3} M solution of aqueous gibberellic acid was applied to the soil using a pipette
- This solution was applied to wild type (non-mutants), mutant A and mutant B
- Gibberellin received either 3 x a week, 1 x a week, or not all

3 x a week mutant A	3 x week mutant A	3x a week mutant B	3 x a week mutant B	3 x a week wild type	3 x a week wild type
1 x a week mutant A	1 x a week mutant A	1 x a week mutant B	1 x a week mutant B	1 x a week wild type	1 x a week wild type
No gibberellin mutant A	No gibberellin mutant A	No gibberellin mutant B	No gibberellin mutant B	No gibberellin wild type	No gibberellin wild type







Results:

Understanding the Graphs:

- Each graph contains datapoints depicting the relationship between the average height of the seedlings in each pot and the days since it was planted.
- The line on each graph shows the linear trend of all collected datapoints to help identify how positive or negative a relationship is.
- Each graph has an R^2 value listed in the upper left corner which tells us how well the regression line fits the data points on the graph. The higher the R^2 value, the stronger the relationship between the two variables.

What the Graphs Tell Us:

- We expected a steeper gradient on the graphs of the mutant plants that were treated with gibberellin
- There is no significant difference, indicating the dwarf plants did not respond to the gibberellin
- Wild type (non-dwarf) plants grow faster than dwarf plants treated with Gibberellin
- The control mutant A pot exhibited a decrease in growth because some seedlings in that pot died

Conclusion:

Discussion:

- Both varieties of dwarf millet are probably gibberellin unresponsive
- Alternative hypothesis **H_1** is correct

Significance:

- It is important that the mechanisms behind the dwarf growth response of the two mutant millet varieties are identified as it affects agriculture
- Dwarfism can reduce crop yield [3]
- Therefore knowing which millet varieties respond positively to gibberellin and which do not will optimise crop performance and save farmers money and resources


References:

[1] Chen, JG., Zhou, X. & Zhang, YZ. (1998). Gibberellin-responding and non-responding dwarf mutants in foxtail millet. *Plant Growth Regulation, 26*, 19–24.
[2] Phinney, B. O. (1956). Growth response of single-gene dwarf mutants in maize to gibberellic acid. *Proceedings of the National Academy of Sciences*, *42*(4), 185-189.
[3] Rai, K. N., & Rao, A. S. (1991). Effect of d 2 dwarfing gene on grain yield and yield components in pearl millet near-isogenic lines. *Euphytica*, *52*, 25-31.