The Effects of Gibberellic Acid on Dwarf Plants

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Abstract

In this study, conducted by the students above, gibberellic acid was added to both dwarf and wild-type Seteria Viridis seedlings, and it started on February 13th and ended on March 29th (totaling 45 days). Applying gibberellic acid to the dwarf plants was testing to see if there was a direct effect on gibberellic acid to the heights (in cm) of the seedlings. The wild-type seeds were also tested in order to see if there is an effect of them also. Gibberellic acid was applied to a group of dwarf and wild-type seedling, there was an additional group of seedlings that were also just treated to normal conditions (simply just watering) as a control group.

Introduction

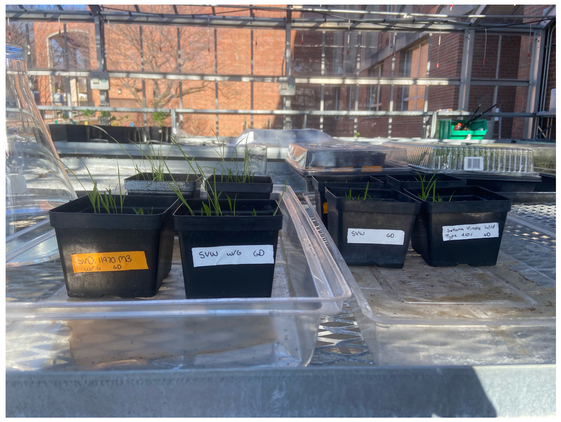
Gibberellic Acid (GA) also known as gibberellin is a naturally occurring growth hormone commonly found in plants. It was first discovered in Japan in the 1930s as a substance produced by a fungus that caused excessive growth in rice plants, leading to their tall, slender appearance (Gupta & S K Chakrabarty, 2013). Gibberellic Acid not only plays an important role in plant development and growth, but is also important for stem elongation, leaf expansion, seed germination and flowering. It is produced in young leaves, shoot tips, and roots, and is transported throughout the plant to promote growth in various tissues. GA also influences various physiological processes in plants, such as inducing flowering, breaking seed dormancy, and regulating fruit growth and development. In addition to its natural role in plants, gibberellic acid is also used in agriculture and horticulture to increase crop yields, promote fruit growth, and induce flowering.

Hypothesis

Certain mutants for Setaria Viridis seedlings are unable to process and take up gibberellic acid or have a gibberellin deficit and therefore, never reach the potential growth (normal growth).

Prediction

The dwarf plants of Setaria Viridis seeds were treated with gibberellic acid will show normal growth compared to the dwarf plants that are untreated. No effects will be seen for the wild-type and dwarf mutants that are only treated with water.



Materials and Methodology

The initial step of this study involves the preparation and administration of gibberellic acid to plant seeds of the species Seteria viridis, as a means of investigating the potential influence of gibberellic acid on plant growth. The gibberellic acid mixture used in this study consists of 5 scoops (scoop used inside gibberellic acid package) of 95% gibberellic acid and 50ml of water. The total number of seeds used for the experiment is 240. Gibberellic acid is only applied to 120 seeds (Seteria viridis dwarf 11970 M3 à 60 seeds and Seteria viridis à 60 seeds). The mixture of water and gibberellic acid is applied to the seeds with the help of a pipette. The seeds are placed on a paper towel. A total of 30 seeds are placed on each paper towel (4 paper towels in total). Dwarf mutants and the wildtype treated with gibberellic acid are isolated from the plant seeds only given water. The same procedure is being applied to the other 120 seeds, but only water is being given to the seeds instead of gibberellic acid. The seeds will be placed on the paper towels for 48 hours. After the 48 hours, the seeds will be planted in a small pot with soil. In total 8 pots à 30 seeds will be used. The four pots containing the dwarf mutants and the wildtype that are treated with gibberellic acid will be separated from the pots with the other seeds that only receive water. After planting the seeds, gibberellic acid, and water (200ml) will be applied to the dwarf mutants and the wildtype. The application of gibberellic acid and water takes place every other day. To apply the gibberellic acid, one pipette loading will be used. The application will be continued until the end of the experiment/study.

The present study investigates the growth characteristics of dwarf mutants in relation to their ability to process and uptake gibberellic acid. Specifically, we aim to determine whether the dwarf mutants exhibit a gibberellic acid deficiency or are unable to effectively process and absorb this hormone. To accomplish this, four separate pots containing both dwarf mutant and wildtype plants were used, all of which were only treated with water. Based on previous research, it is hypothesized that the dwarf mutant plants will exhibit a gibberellic acid deficiency, and consequently, their growth will be stunted. However, it is anticipated that after the application of gibberellic acid, the dwarf mutants will exhibit normal plant growth patterns, growing taller in a manner similar to wildtype plants. Thus, the growth of the dwarf mutants is thought to be dependent on the presence of gibberellic acid. To explore this hypothesis, the independent variable in this study is the different seeds (wildtype or dwarf mutant) and the application of gibberellic acid or just water. Meanwhile, the dependent variable is the growth and height of the plants, measured in centimeters. By systematically adding the amount of gibberellic acid administered and observing the resulting plant growth patterns, we aimed to gain insight into the mechanisms by which gibberellic acid affects plant growth, as well as the role of this hormone in the growth characteristics of dwarf mutant plants.

Results

Figure 1.

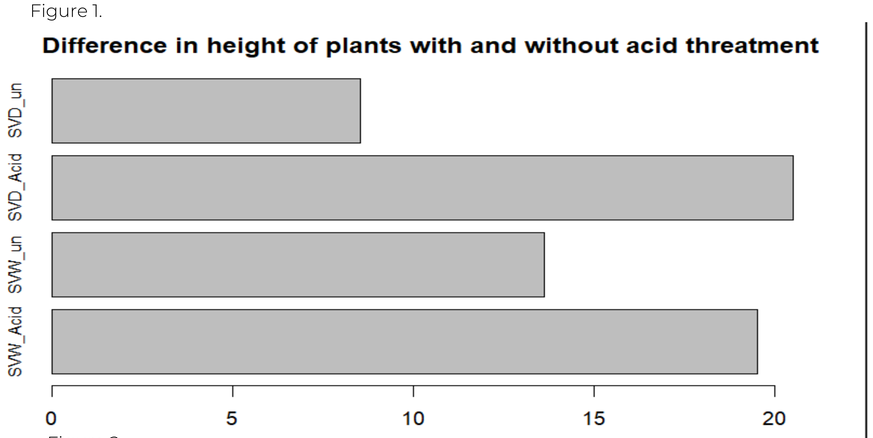


Figure 2.

SVW_Acid	SVD_Acid	SVW_un	SVD_un
Min. :10.00	Min. :13.00	Min. : 7.00	Min. : 4.000
1st Qu.:14.25	1st Qu.:17.00	1st Qu.:11.00	1st Qu.: 8.000
Median :17.00	Median :18.00	Median :14.00	Median : 9.000
Mean :19.52	Mean :20.41	Mean :13.18	Mean : 9.848
3rd Qu.:25.00	3rd Qu.:23.00	3rd Qu.:15.00	3rd Qu.:11.500
Max. :38.00	Max. :36.00	Max. :22.00	Max. :17.000
NA's :25	NA's :28	NA's :30	

Conclusion

In conclusion the results of the study support the hypothesis and predictions. The average heights of the Setaria Viridis treated seedlings greatly bypassed the average heights of the Setaria Viridis untreated seedlings. Proving that the dwarf seeds height is not due to an inability to uptake the gibberellic acid, rather it is due to an inability to produce the gibberellin. Plants that produce gibberellin, like the wild-type, also can have a positive effect from the addition of gibberellic acid, as the treated wild-type seeds proved by bypassing the average height of the untreated wild-type.

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