The effects of Gibberellic acid on plant growth in *Brassica rapa*:

Abstract:

Gibberellic acid is a crucial plant growth regulator since it is involved in the growth, development, and cell elongation activities of many plants. Plant growth depends on some external factors such as soil condition, sunlight, water, as well hormones. Studying the impact of various plant growth regulators that have a significant potential impact on plant growth, height, and amount of leaves is the primary goal of this paper. Gibberellic acid can be more beneficial to growth than simple watering. This research conducts experiments on plants using different concentrations of Gibberellic acid. The plants were treated with one drop of GA, two drops of GA, and with the conventional watering method. The growth in height of all three given treatments was recorded and ANOVA and Tukey HSD was used to generate a box plot for comparisons of significant data. It concluded GA treatment surely aids in plant growth if one drop of solutions is provided on daily basis, increasing the number of drops results in lesser growth than in ideal conditions.

Introduction:

It is a proven fact that plants are essential to life. The multicellular creatures known as plants convert light into chemical energy through a process known as photosynthesis. Plants provide a variety of resources for animals living on land, including organic food, oxygen, protection, and nutrient filtration. Gibberellin, a plant hormone, is being studied in this experiment. This hormone affects the plant in a variety of ways, including seed germination and elongation enzymes.

Brassica rapa is a relative of the mustard family and has been bred for rapid development. A hormone is a compound produced in one part of an organism and then translocated to other parts of the organism, which triggers responses in the target tissue (Hanley,2018). The function of the Gibberellins is the production of stem elongation. Gibberellins can stimulate the growth of leaves and stem; however, it has little impact on root growth. Gibberellins acid is a metabolic product of the fungus Gibberellins fujikuroi. The physical and cellular simplicity of the aleurone layer has caused it to be used extensively as a model system for the study of GA (Peng and Nicholas,2002). Under laboratory conditions, Brassica rapa plants should begin to bloom about 14 days after being planted, have a height of about 13 cm, and have an average life cycle of about 35 days. (Hanley,2018).

Gibberellins acid is rapidly biologically degraded in soil. Pea seedlings grow significantly longer stem internodes under comparable circumstances, but the size of the leaves is not significantly altered. (Brain, Elson 1954). The dry weight of seeds is increased, if shoots alone are considered the increase in dry weight is even greater; the dry weight of roots is decreased, though this does not occur if the gibberellic acid is applied to the shoots in lanolin paste.

(Radley,1954). The genes regulated by TERF-1 specifically under mannitol vs mannitol plus paclobutrazol (PAC, inhibitor of GA biosynthesis) (Wei,2022).

Gibberellins added in this experiment have a beneficial impact on the seed's growth. Both the plant’s height and the leaf size are larger and longer. This experiment helps to better understand how the gibberellic hormone affects plants and how they function, and it may be possible to create larger plants to benefit the environment using this knowledge. Brassicas rapa which grows quickly typically has a 35-day life cycle and a normal expected growth. In plant growth-promoting effects, the inoculation of Prussia sp.BSL-10 significantly increased the growth of draft mutant Waito-C and wild-type rice cultivars. Gibberellins can be used to promote the growth and yield of marginalized crops (Sajjad,2018).

In the experiment, I would expect the plant’s height to be longer day by day by adding drops of Gibberellins acids. The significance of this research will give a better understanding of the gibberellic hormone and its function in plants. This knowledge could lead to the synthesis of bigger and better plants for our environment.

Materials and Methods:

This experiment was conducted to find the effect of different plant hormones on their growth. Three different samples of normal-growth *Brassica rapa* seeds were utilized, and each was given one of three solutions (water, soil, seed, and Gibberellic acid) to determine the effect that each had. The water was used as a control group in this experiment. The dependent variable and independent variables were plant growth (Number of seeds, availability of water, and time) and types of hormones(amount of sunlight and soil temperature)respectively. Different quads were used consisting of four cells in which four seeds were placed along with the soil. Moisten the potting mix until it is slightly damp. Moreover, fertilizer pellets were added to each cell of the quads containing seeds. These quads were placed on top of a water mat leading down into a reservoir below and placed the entire setup under the growth lights. Next, the cells were watered and placed aside until the next week.

The water reservoir was checked three times during the week to ensure the proper water levels and to add water if needed. The constants in this experiment were the type of soil, the model organism, the amount of water, the location of the plants, and the constant lighting that the plants were receiving. After a week, the plants were thinned to only one per cell using forceps. The extra seedlings were placed in the same quad that did not germinate successfully. On the eighth day and every other following day, the plants were treated with a 5% solution. Plant height was then determined and according to treatment, one drop of water and Gibberellic acid was placed directly on the leaves. At the conclusion of the experiment, a box plot was created utilizing statistical programming to run an ANOVA and Tukey's HSD to scrutinize how different types of plant hormones affected the growth of the *Brassica rapa* plant and these statistical analyses were

done in the RStudio. F statistics value has distributed under the null hypothesis. The Degree of freedom is the number of independent pieces of information used. P the value is the number of null hypotheses defined under statistical data.

Results:

After completing the experiment and observing the growth of the plant plants for about two weeks, we found that the result supports the hypothesis that the hormone Gibberellins increased the growth rate. It has been supported by the Gibberellic acid, the rate of growth on normal plants. The graphs are displayed to display the rate of growth and determine which plants were influenced the most.

statistic value is F statistic value distributed under the null hypothesis. The degree of freedom can be the amount of information used. P value can be positive or negative, which is 0.7 the number that describes the null hypothesis under statistical data with the help of ANOVA. The value of standard deviation with 1 drop of GA and 2 drops of GA was 3.0 cm and 2.7 cm respectively.

The graph illustrates the growth rate for the six days the plants were observed, and the height was recorded in centimeters. On the final day of the week (Thursday) the plant with the gibberellins showed that they were the tallest. By recording each plant's height, we could determine when there was the most growth and by what plant type. The results show the normal plants with gibberellins were the ones that grew the most and grew the fastest. This supported the hypothesis that had been described and proven in many ways. This experiment continued to show the effect of plant hormones, gibberellins acid on the plant and their radical advancement height because of this hormone treatment to plant height as 29.33 and the same for the hormone treatment to the number of the leaf as 4.58.

Discussion :

Many interesting results were discovered during the study of the effects of Gibberellic Acid (GA) on Brassica rapa plants. The plants with one drop of GA grew the most, followed by two drops of GA, and finally by plants with only water. These findings support the hypothesis that plants exposed to gibberellic acid grew faster. We found that the result supports the alternate hypothesis that the hormone Gibberellins increased the growth rate.

These findings were anticipated because what is known about the hormone is that it promotes increased shoot length because of increased stem internode and leaf length (increased surface area of the shoots leads to increased uptake of nutrients). The total weight of treated peas and wheat increased; only if the shoots are considered, the dry weight increases even more; the dry weight of the roots decreases, though this does not occur if the gibberellic acid is applied to the shoots. Although treated plants have more soluble carbohydrates, this only accounts for a small portion of the increased carbon assimilation (Brain & Elson,1954).

It only takes a small amount of GA to influence the plant. One drop was the ideal concentration for maximum growth, while two drops may have been excessive. When the growth patterns of the drop and two drop plants were compared, there was a difference. It is critical to correctly elucidate the GA transport mechanism for plant species survival and crop production success (Gupta & Chakrabarty, 2013). Adding the proper amount of gibberellic acid to Brassica rapa plant will help the growth of the plant. By oxidatively destroying lipids, proteins, and nucleic acids, these highly reactive cytotoxic oxygen species have the potential to seriously impair

normal metabolism (Davish,1987). These findings support the theory that adding the appropriate amount of gibberellic acid to Brassica rapa rosette plants will aid in plant growth. The study of gibberellic acid on these plants is significant because it can lead to a better understanding of gibberellic synthesis in general, as well as hormones in general. The data was analyzed by a randomized design using ANOVA. If values were obtained at 0.05% of the level of significance. If gibberellic can effectively increase seed growth, we may be able to grow larger and better plants for our environment.

Acknowledgment:

I would like to express my gratitude to Dr. Erik Pilgrim for their guidance, academic encouragement, and friendly critique. Their attitude and care have helped me to complete this research paper on time and his advice and cooperation has helped me to access information from relevant university departments. I would also like to thank my lab mates who helped me with the experiments.

REFERENCES:

1. Brian, P.W., Elson, G.W., Hemming, H.G. and Radley, M. (1954), The plant-growth-promoting properties of gibberellic acid, a metabolic product of the fungus *gibberellic fujikuroi*. *Journal of Science of Food and Agriculture*., 5: 602-612.

2. Gupta, R. and Chakrabarty, S.K. (2013), Gibberellic acid in plant, *Plant Signaling & Behavior*, 8 (9): 1-5.

3. Hanley, C. (2018), *Concepts of Biology Laboratory II: Evolution and Ecology LAB MANUAL (10 edition)*, Mc Graw Hill.

4. Peng, J. and Harberd, N. P. (2002), The role of GA-mediated signaling in the control of seed germination, *Current Opinion in Plant Biology*, 5 (5): 376-381.

5. Tuna, A.L., Kaya, C., Dikilitas, M. and Higgs, D. (2008), The combined effects of gibberellic acid and salinity on some antioxidant enzyme activities, plant growth parameters and nutritional status in maize plants, *Environmental and Experimental Botany*, 62 (1): 1-9.