

Research Question: How does the phytohormone antagonist auxinole influence the growth and development of *Raphanus sativus*?

Abstract

It is hypothesized that the growth and development of radish plants, including the leaf and root systems, is dependent on the concentration of auxinole in the plant.

The design of this study involves the growth of radishes in a hydroponics growth system with various concentrations of auxinole being present in the water. The plants were then left to grow over a period of 21 days and, over those days, were observed and measured.

At the end of the experiment, the experimental and control groups were compared to determine the results. It was found that an increased concentration of auxinole in the growth media of plants resulted in smaller root length and bulb size, however had no impact on the leaf or stem size.

These findings may be used to possibly control the root systems of plants which are exposed to a concentration of auxinole, possibly in a commercial or scientific setting, without killing or influencing the leaf system of the plant.

Background

Auxin is a known phytohormone present in many species of plant.

This phytohormone signals for many factors in the growth and development of plants, including cell elongation, transcription, translation, and duplication. It was shown that the application of additional auxin to samples of carrots resulted in significantly improved growth parameters of the carrot, including increased number and area of xylem, increased plant and shoot length, increased number of petioles, and elongated cells.

Research has shown that Auxinole uses competitive inhibition to prevent the signaling of auxin within and between plant cells by using its molecular structure, which is like that of auxin, to prevent its binding to a receptor on the cell, the TIR1/AFB receptor. Auxin is responsible for the signaling of cell growth pertaining to the xylem, plant and shoot length, and length of cells within the plant, however it has not been seen what the effects on the growth of plants will be if auxinole is introduced into the environment.

Results

The results show that the growth and development of roots and bulbs of cherry belle radishes are dependent on the concentration of auxinole present in the growth media. It is also shown that the concentration of auxinole in the growth media has no significant effect on the growth and development of the leaves of cherry belle radishes.

Methodology

Prior to the experiment, 50 seeds were germinated until sprouts and roots were visible, allowing them to be easily planted into the hydroponics modules. During the duration of the germination, the hydroponics modules were assembled; 3D printing the tube collars, cutting and fitting the growth wicks into the urethane plugs, then setting them all into a 50ml conical tube.

The media in which the plants were to grow in was mixed during this prep phase, with different measurements depending on the experimental or control group. Liquid fertilizer was added to water, along with a varying amount of auxinole. One control group only had water as its media, with the goal to show the effect that the fertilizer had on the plants.

The plants, once germinated, were then planted in the hydroponics system, with 12 plants per experimental group, 8 plants for the control with fertilizer, and 4 plants for the water only control. These plants were then placed under an LED light and left to grow for 21 days, with more water and fertilizer being added to the tubes when it got low.

Once this period had ended, the plants were harvested and measured. To take results, I used a ruler and an electronic scale and recorded the results in a table.

Materials

Materials for this project include; for growing the radishes: 96 3D printed half 50ml tube collars, 48 50ml tubes, 48 19 x 25mm urethane foam plugs, Hydroponic Mat Material as water wick cut 5mm x 115mm, Hydroponic Fertilizer use 1uL for every 1mL of tap water, dose every 2 weeks, water, LED light with timer, 48 minimum cherry belle radish seeds, empty petri dish, parafilm, paper towels or another absorbent material, and auxinole. For measuring results, an electronic balance, ruler, scalpel or way to cut plants, and tweezers were used.



Figure 1: After harvesting, a control plant (left) compared to a high concentration plant (right). The roots and bulb is smaller in the high concentration plant than in the control plant.

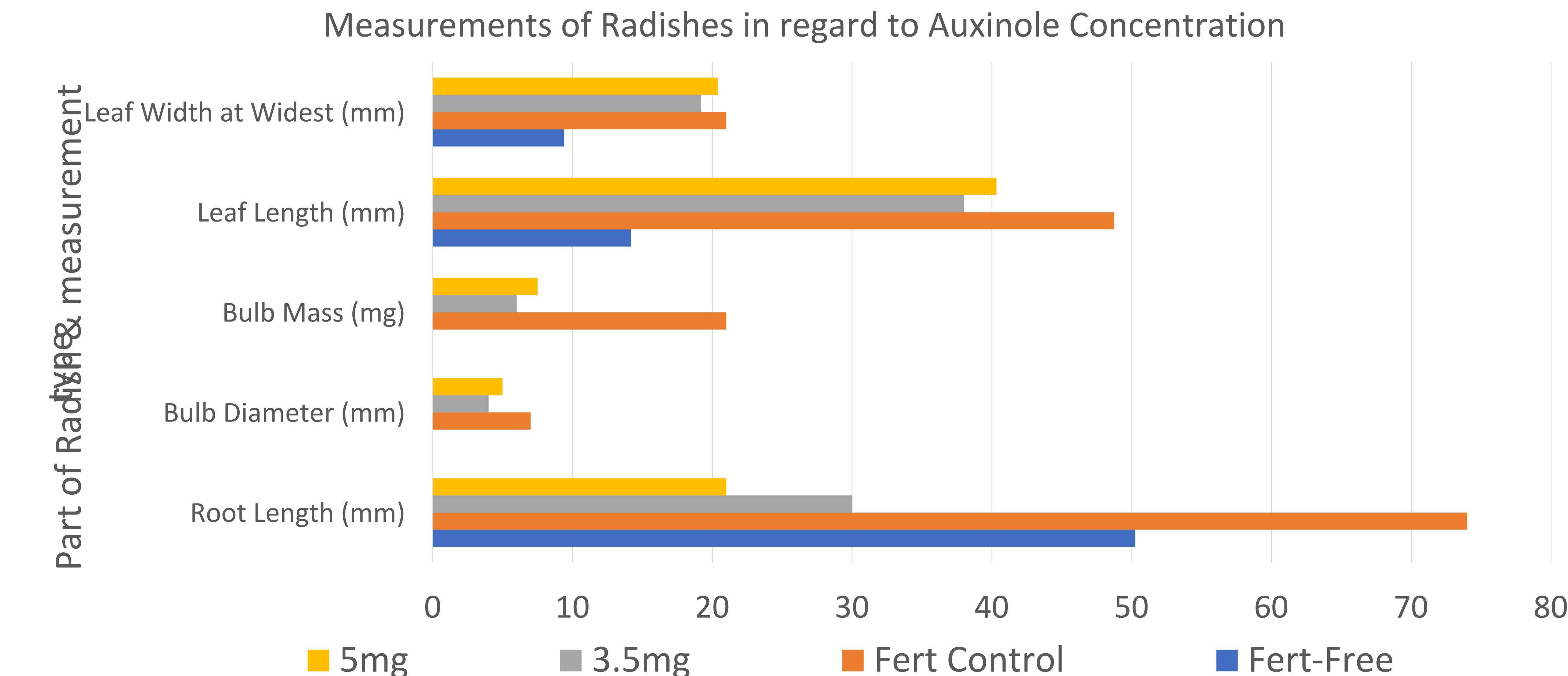


Figure 2: The experimental and control groups appr. 20 days into the growth period. Medium concentration top left, high bottom left, low top right, controls bottom right.



Figure 3: One module of the hydroponics growth system; a 50ml tube with a growth wick set into a urethane plug and a 3D printed collar.

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