The Response of Tomato (*Solanum lycopersicum* L.) Seedling to Foliar Application of Cultar (Paclobutrazol) Under Controlled Conditions

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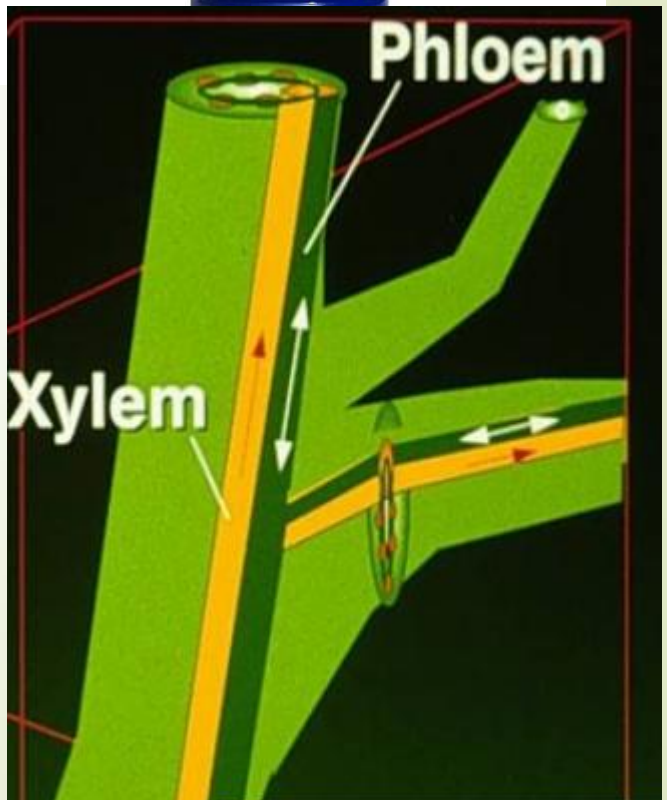
Introduction

- Tomato (***Solanum lycopersicum* L.**) belongs to the Solanaceae family,
- considered as one of the most widely grown vegetable in the world, with a very high daily consumption compared to other vegetables.
- Tomato has being also recognized as a rich source of vitamins and minerals; 100 gm fresh tomato contains 3.5 gm carbohydrate, 0.98 gm protein, 0.50 gm β-carotene, 0.35 mg iron and 10-100 mg ascorbic acid (Rashid, 1993).

- It is also among the most important vegetable crops grown in Palestine.
- With an estimated area cultivated with tomato of about 8918 dunums every year producing about 82,739 ton (MOA, 2017).

- Cultar (is a very potent plant growth regulator)
- use on a wide range of fruit and vegetable crops
- the active ingredient of ‘cultar’ is a broad spectrum xylem mobile plant growth regulator .
- The mode of action of paclobutrazol is the inhibition of gibberellic acid synthesis in plants.
- The inhibition of gibberellin production by paclobutrazol results in slow cell division and elongation without causing toxicity to cells
- Besides reducing gibberellins level, PBZ increases cytokinin contents, root activity and C: N ratio



- **Use the cultar (paclobutrazol) in fruit trees (Mango)for manipulate flowering**

- **The post- harvest application of a small amount of paclobutrazol to the soil significantly promotes flowering and fruiting .**

- • A significant increase in flowering leading to increased yield.
- • The early flowering considerably enhanced fruit maturity.
- • Treated trees flowered three to four weeks early, which reduced the time to fruit maturity by at least two weeks.
- • Visually, the fruit developed a better external colour.

Effect of cultar on vegetative growth

- Stem : inhibition of cell elongation , reduce length of internodes
- Leaves : reduce size and volume , increase chlorophyll production

Cultar is used on tomato plant especially in nurseries for some reason :

- To balance between vegetative and root growth
- When climatic conditions become unstable, especially high temperatures, the rate of vegetative growth becomes high
- And another reason for the owner of the nursery to delay the transplant for some reason

Objective

- **General objective:**
- Investigate the effects of Cultar (Paclobutrazol) plant growth regulator and optimizing the concentration application of vegetable seedlings.
- **Specific objective:**
- Find out the effect of paclobutrazol application on seedlings growth Performance and Leaf Greenness with different concentration
- Highlight the main parameters for identifying Paclobutrazol treated seedlings in commercial nurseries

Research question and identified problems.

- Depending on local nursery experience and observation :
- The current research is hypothesized that the application of culatr (**Paclobutrazol)** delays the growth of tomato seedling
- Therefor our project aimed to define the effect of cultar and its symptoms of appearance and identify a visual parameters to confirm the application of cultar on seedlings

Project Description and Methodology

- **Plant materials :**

48 seedlings (5-7day) old of tomato

- **Treatments :**

T1=200 µl/l
T2=150 µl/l
T3=100 µl/l
T4=control water

- Prepare 0.5 l of the spraying solution by adding half the assigned amount of the cultar in 500 ml tap water.
- Fully spray the seedling with the spray solution once at the beginning of the experiment

The experimental design

- The experimental design was a **complete randomized design(CRD)** with three replications for each treatment.
- Each replicate was consisted of 3 seedlings in one pot
- Mixed soil 50% and , 50% beatmoos

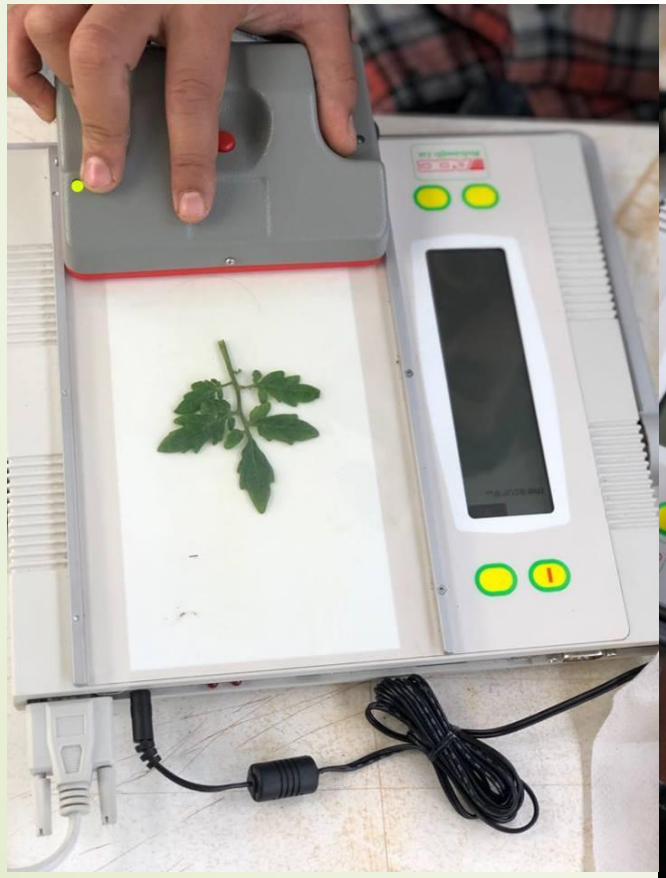
Parameters

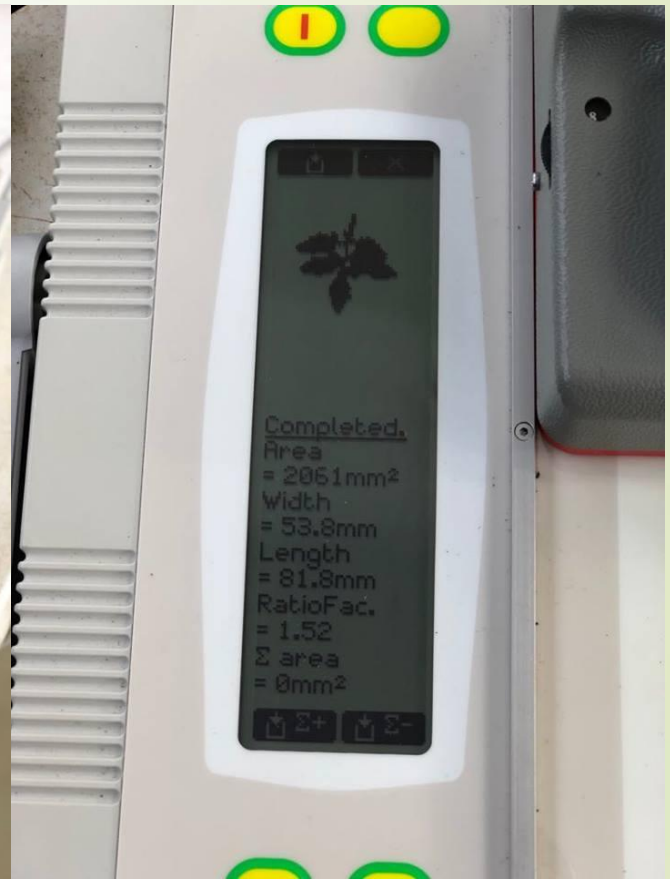
- The following parameters have been recorded after spraying with assigned concentration weekly :
- **Growth performance (Morphological Parameters)**
- **Plant height**
- The seedling height from the soil surface to the top of seedling (apical marstem) was measured for 3 seedlings per Rep.
  using a **measuring tape** and averaged to represent corresponding treatments.

- **Stem diameter**
- The seedling stem diameter near the soil surface (crown area) was measured for 3 seedlings using a **caliper**

- **Leaf colour**
- **The leaf color of three seedling was measured using the colorimeter at the end of experiment (5 weeks after transplanting)**
- The Hunter L (color lightness), a (position on the green-red axis) and b (position on the blue-yellow axis) values of leaf will be read using **Colorimeter CR-400**.

- **The leaf area**
- The seedling leaf area in (mm^2) will be measured with **Area Meter AM350** for 3 leaves at the end of experiment





- **Shoot and root fresh and dry weights**
- At the end of the experiments the Leaf and shoot fresh and dry weights (g) were determined.
- Dry weight was measured after drying for 24 h at 105 °C.
- **Leaf Greenness Parameters**
- Photosynthetic pigments chlorophyll was determined using chlorophyll meter (**SPAD- 502Plus**), which is presented by SPAD value.
- Average of 3 measurements from different spots of a single leave will be considered.

Results & Discussion

1. Plant height

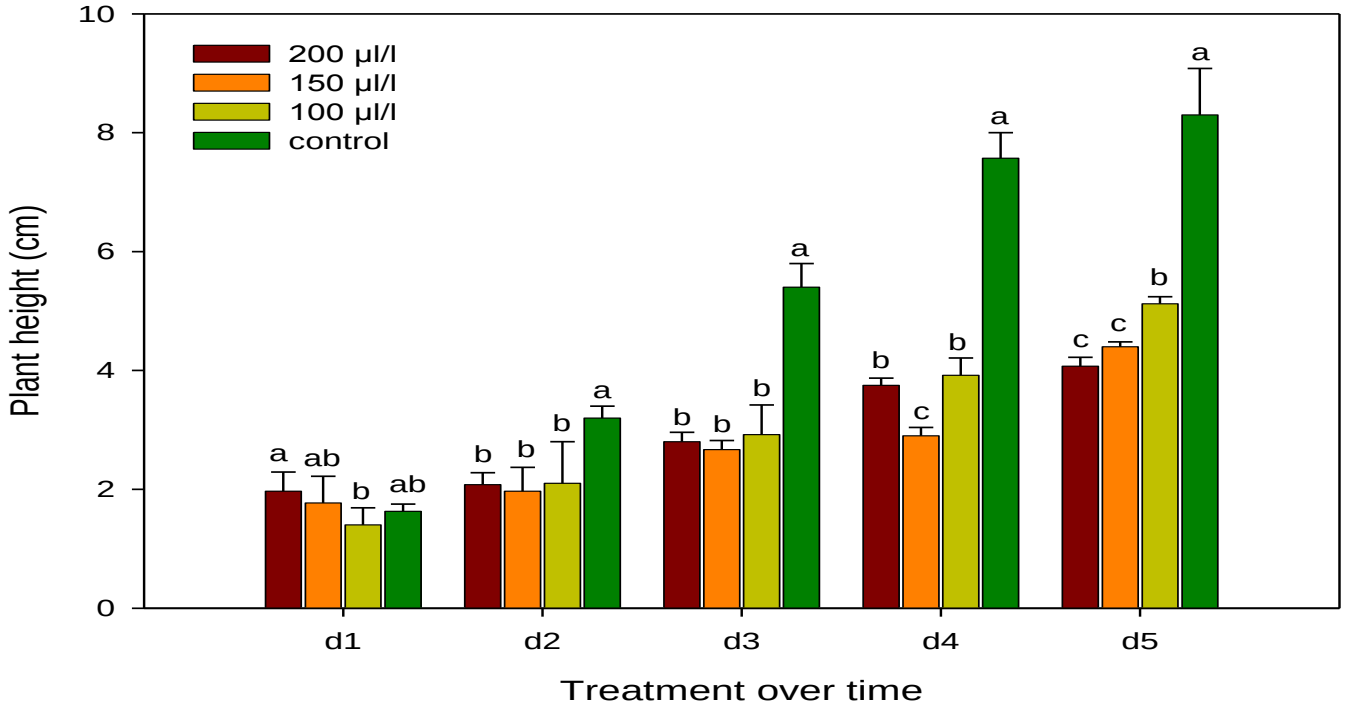
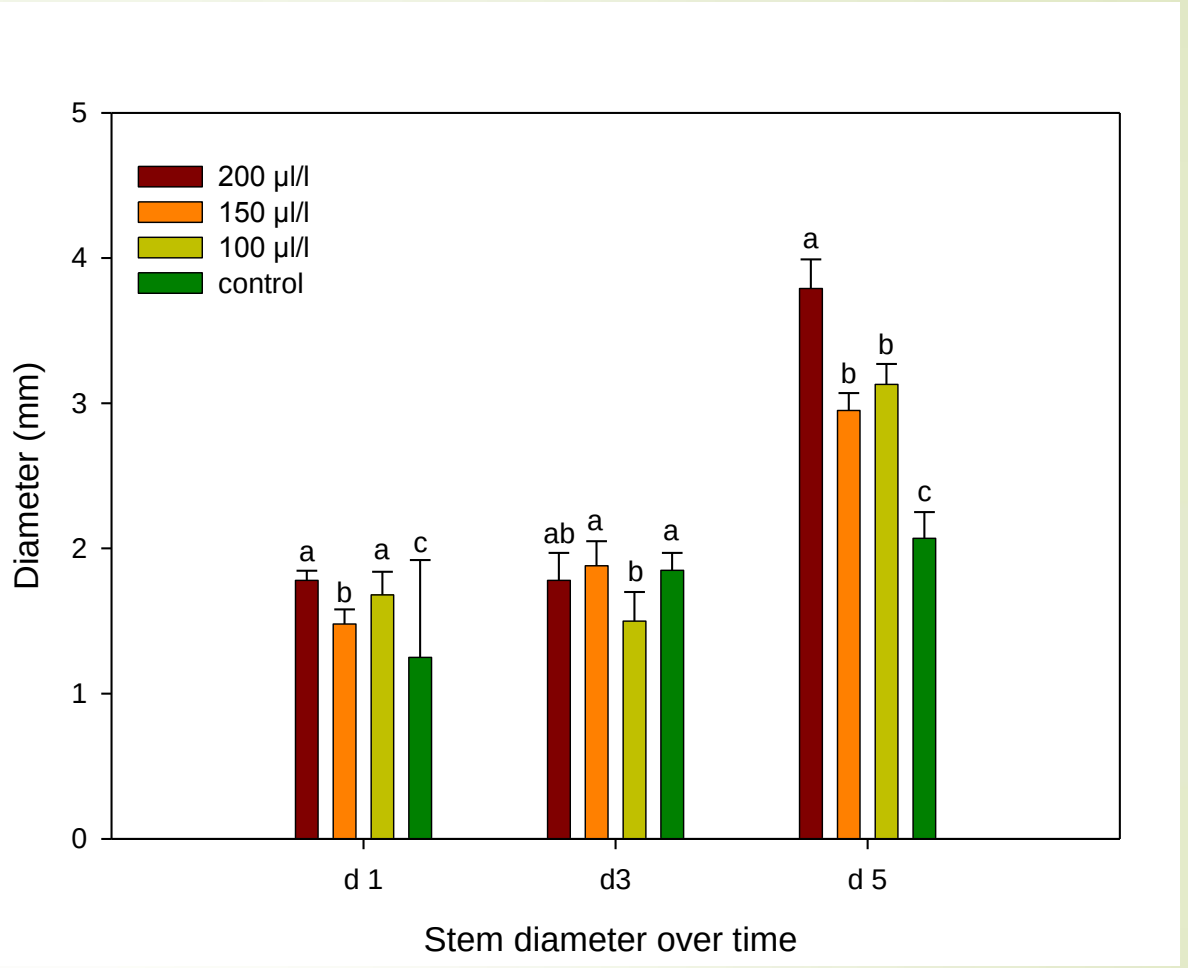


Fig 1. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings height

- The data were statistically analyzed using the analysis of variance and Duncan's multiple range test was used for the mean separation at 5% level of probability, using SAS software version 8.0

➢ **Cultar application was found to significantly reduce the plant height in treated seedlings compared to untreated seedlings (Fig 1).**

2. Stem Diameter



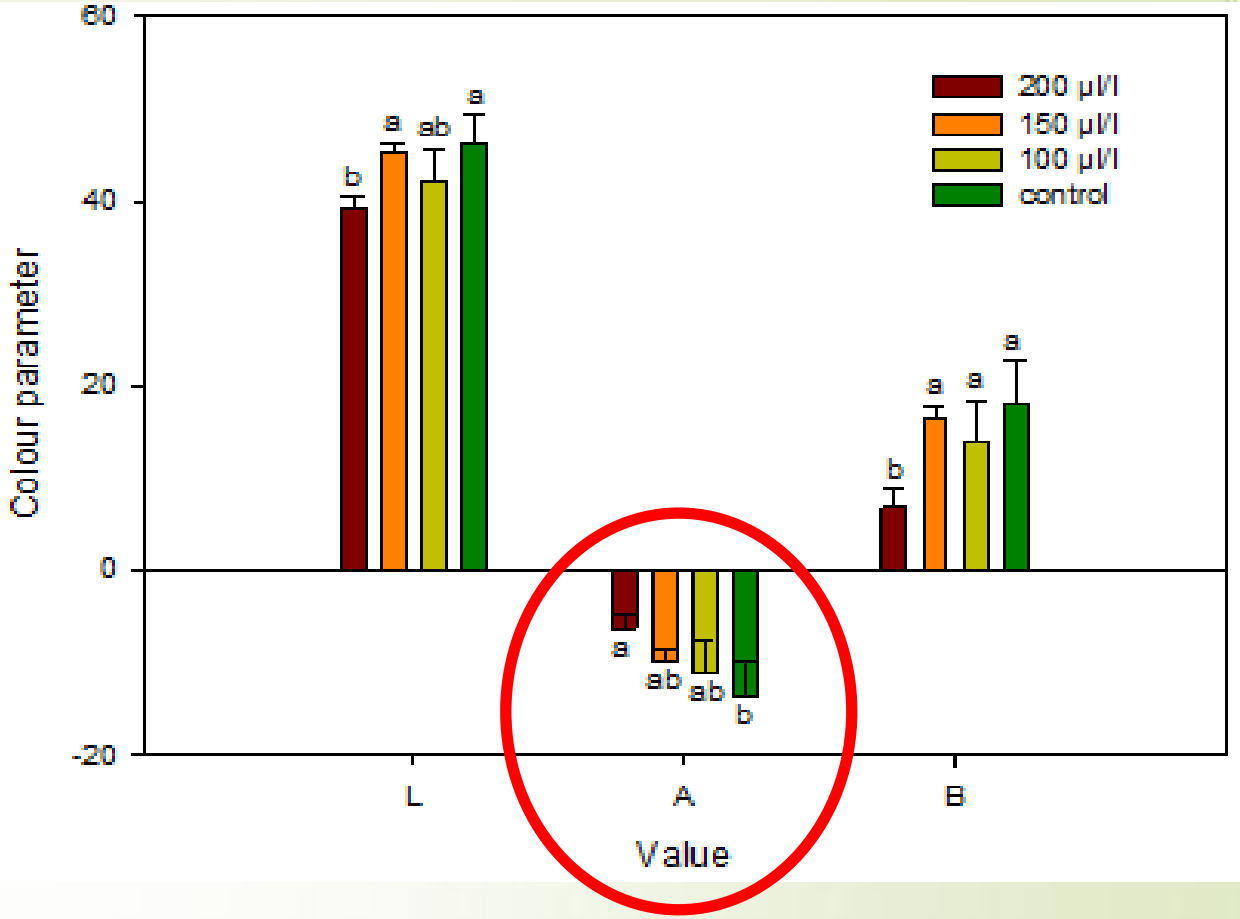
- Fig 2. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings diameter

➢ **In the 200 µl/l cultar treatment stem diameter, was significantly higher than non treated seedlings (Fig 2)**

3. Leaf Color

- Measuring color using Hunter L, a, b

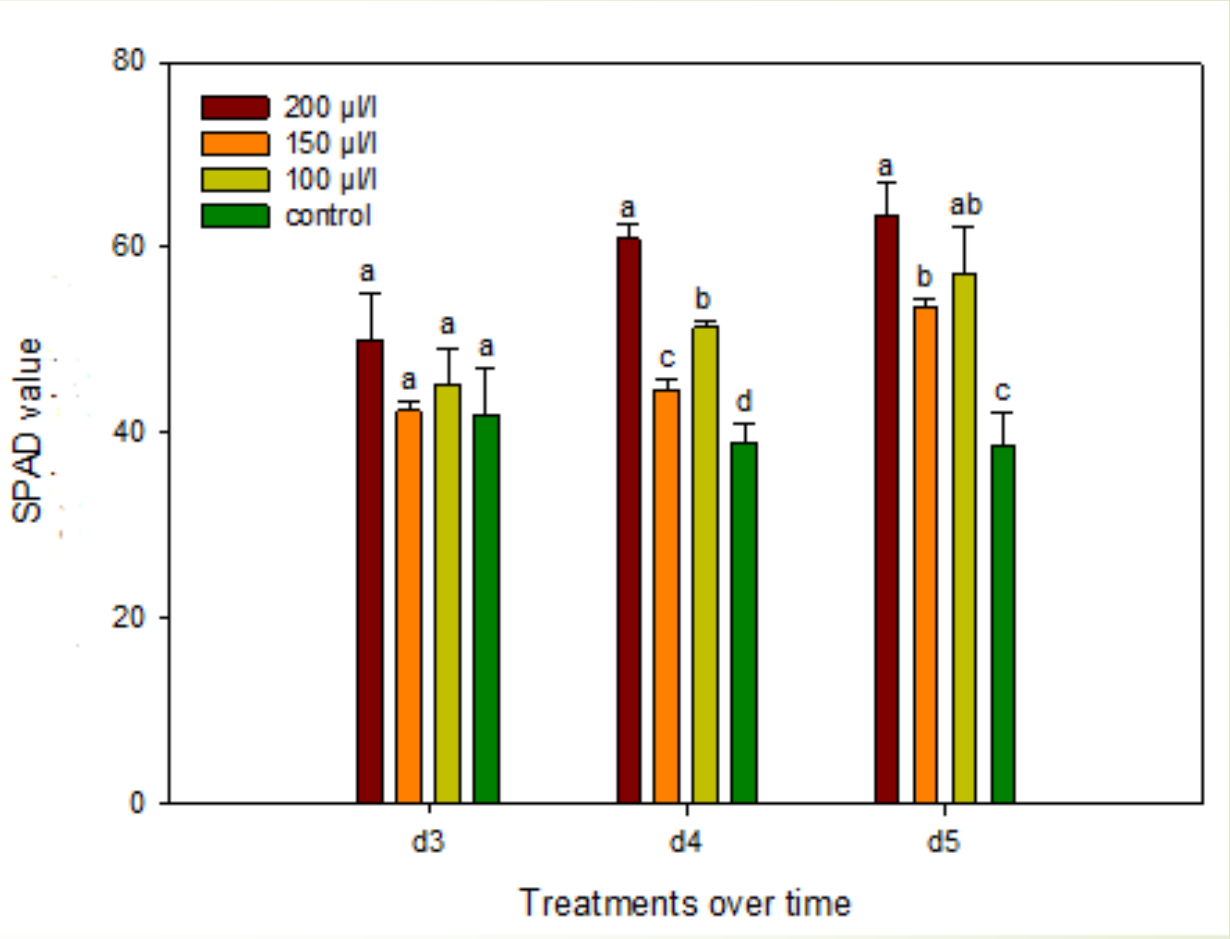
- Hunter L, a, b and CIE 1976 L*a*b* (CIELAB) are both color scales based on the Opponent-Color Theory.



- Fig 3. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings color
- This theory assumes that the receptors in the human eye perceive color as the following pairs of opposites.
- • L scale: Light vs. dark where a low number (0-50) indicates dark and
- a high number (51-100) indicates light.
- • a scale: Red vs. green where a positive number indicates red and a negative number indicates green.
- • b scale: Yellow vs. blue where a positive number indicates yellow and a negative number
- indicates blue.

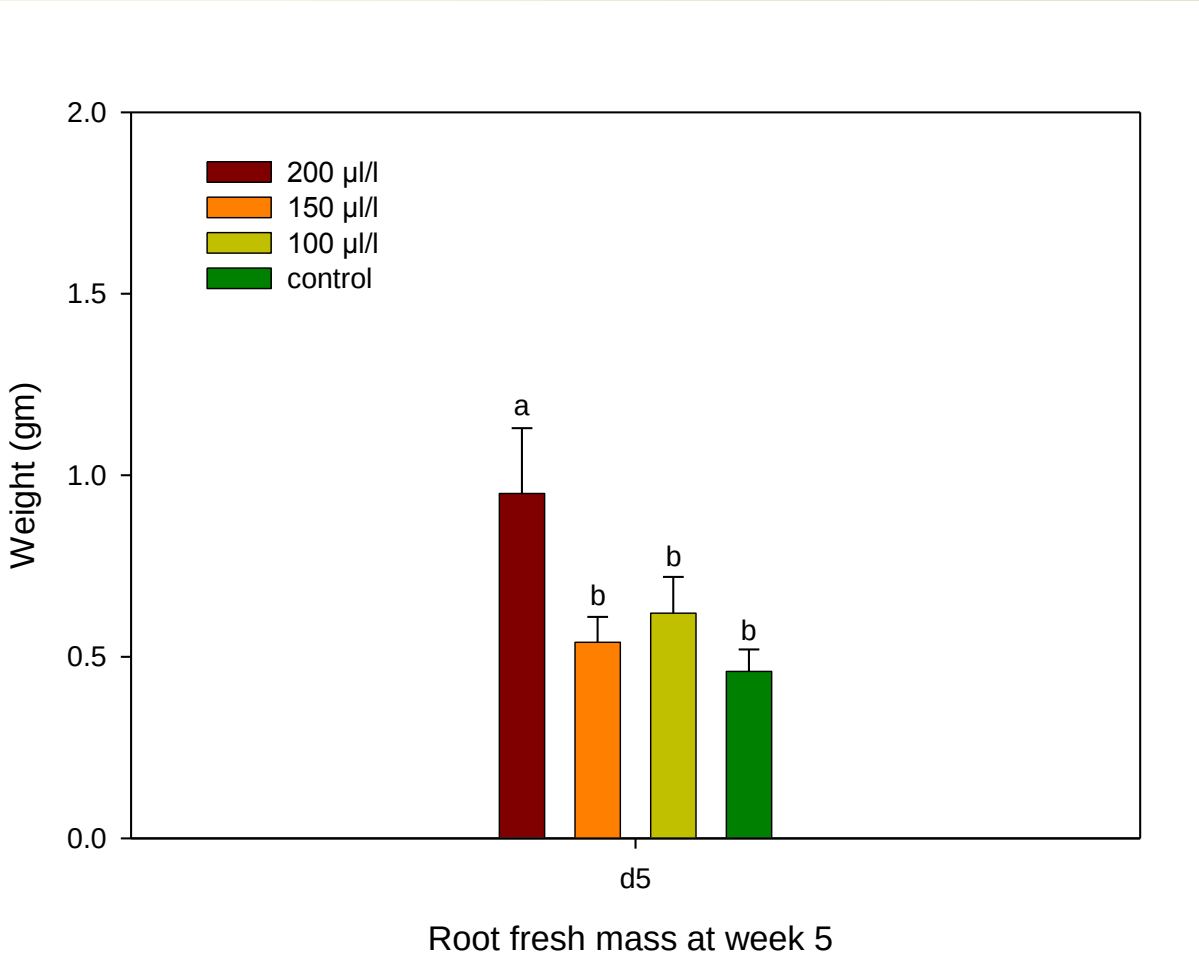
4.Relative Chlorophyll Content

- **The relative chlorophyll content was found to be significantly enhanced by 'cultar' application at later stages of seedlings growth (Fig 4).**



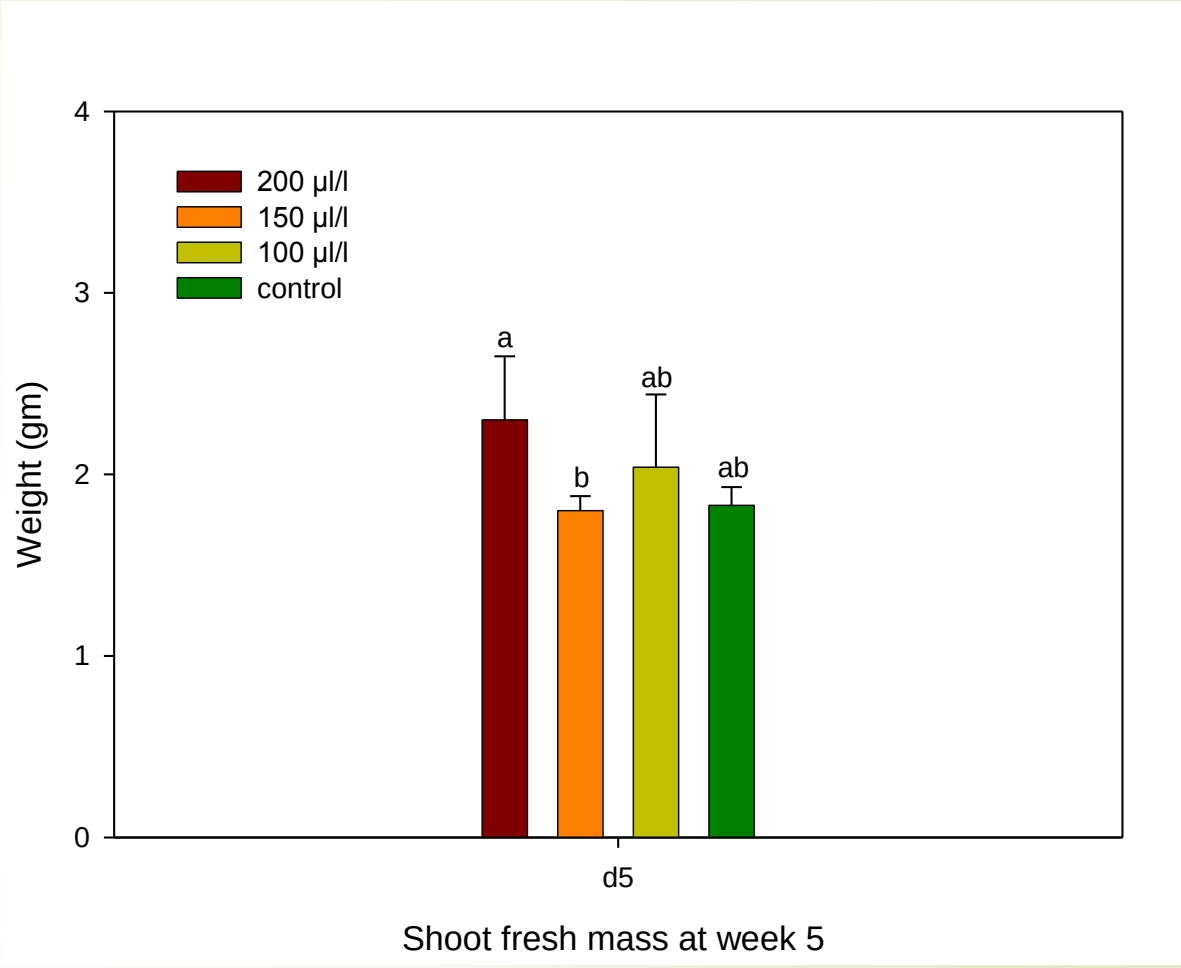
- Fig 4. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings chlorophyll content by using SPAD Meter

5. Root Fresh Mass



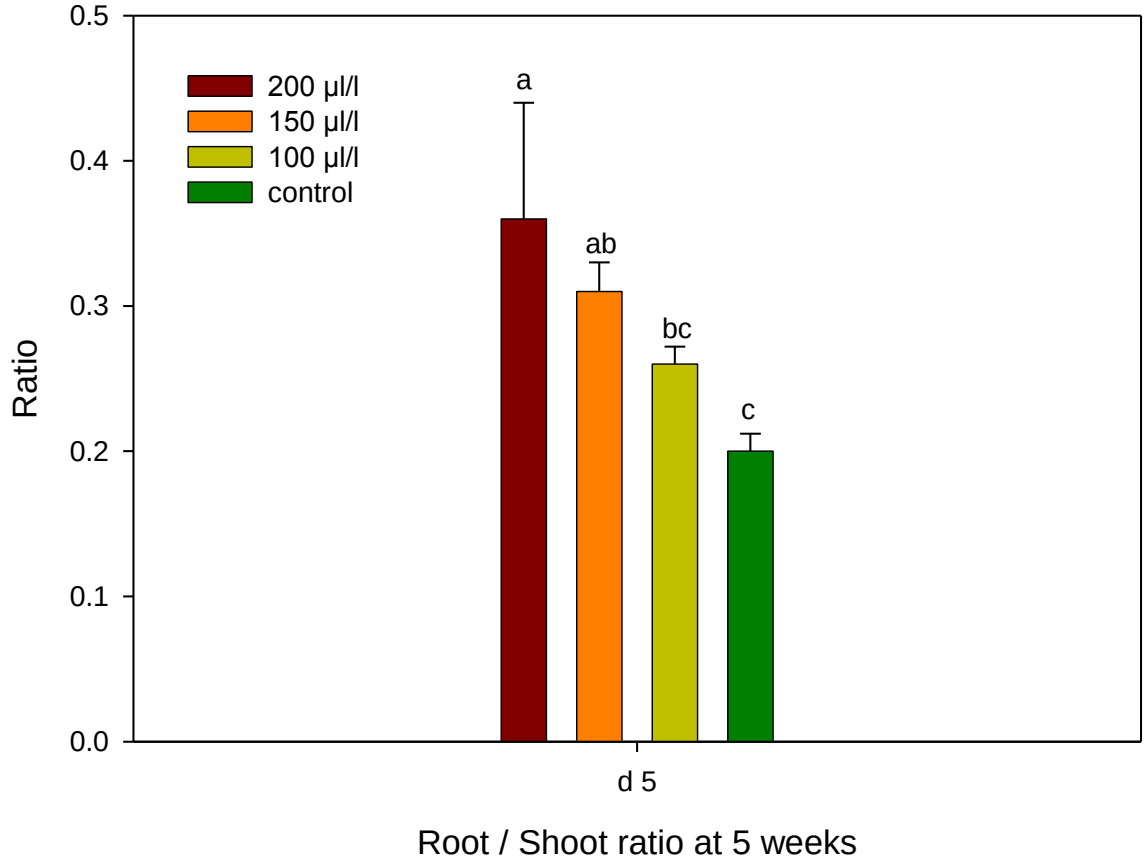
- Fig 5. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings Root fresh mass

6. Shoot Fresh Mass



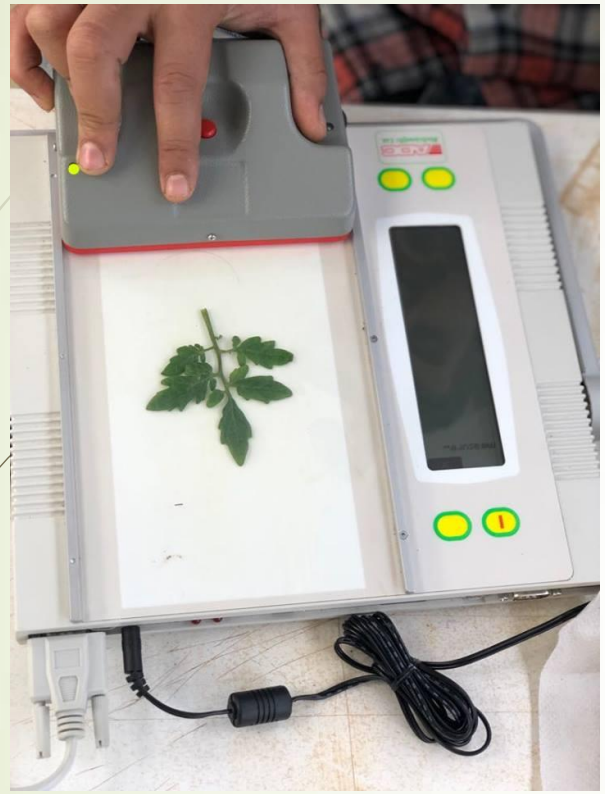
- Fig 6. the effects of different concentration of '**Cultar**' foliar application on tomato seedlings Shoot fresh mass

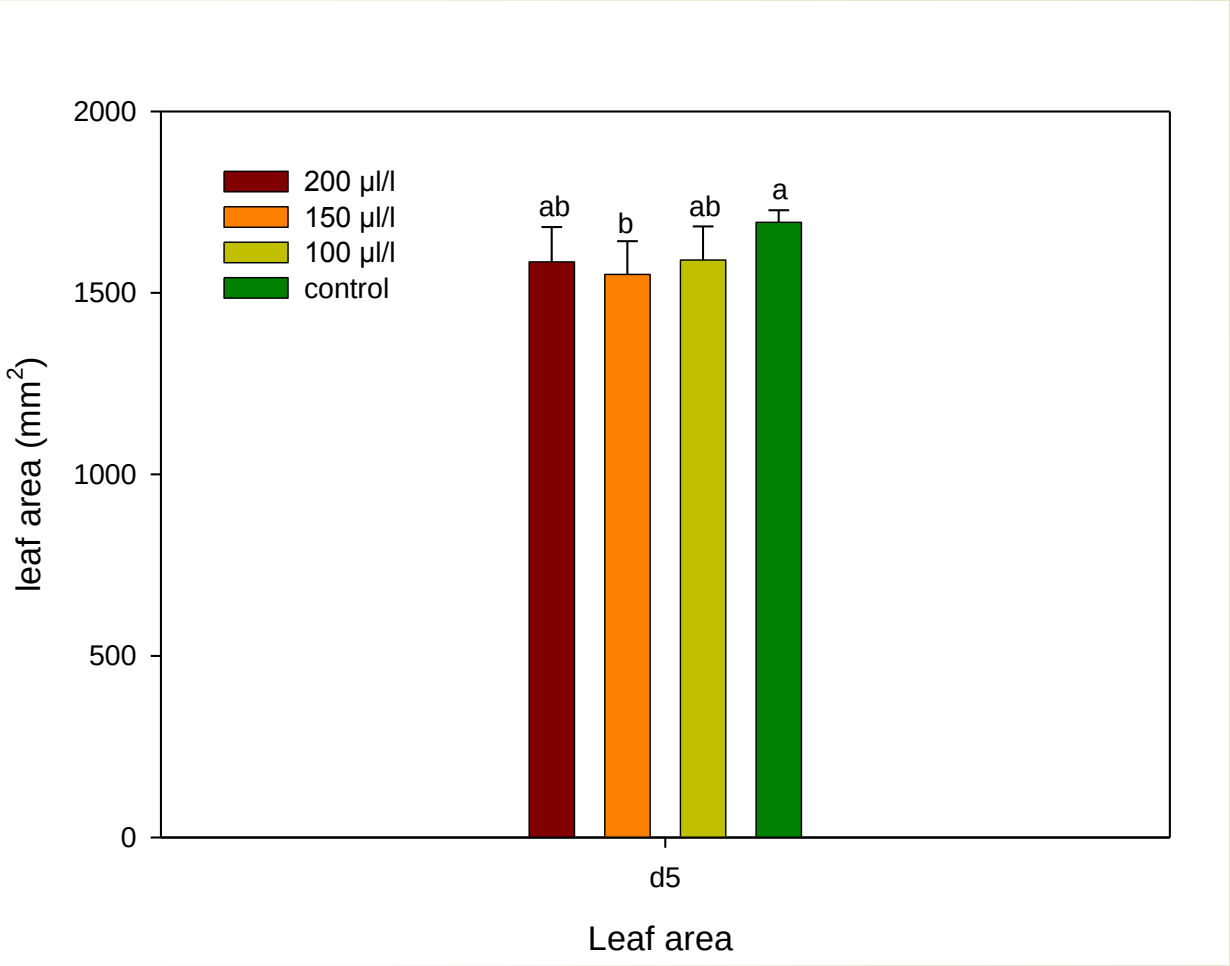
7. Root/Shoot Ratio



- Fig 7. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings Root/Shoot ratio mass

8. Leaf Area





- Fig 8. the effects of different concentration of **'Cultar'** foliar application on tomato seedlings Leaf area

Conclusions

- The paclobutrazol treated tomato seedlings were greener , more compact and have a better root system .
- Tomato seedlings treated with Cultar (Paclobutrazol) were superior in terms of increased photosynthetic characteristics when compared with untreated controls.
- The direct cause of the increase in leaf greenness and darkness of treated seedlings may be due to the increase in chlorophyll content

Recommendation

- Further work is recommended for :
- Investigate the impact of Cultar (Paclobutrazol) on tomato yield and production and fruit quality under greenhouse due to seedling treatments with cultar
- identify the time needed till the removal effect of Cultar (Paclobutrazol) on tomato seedlings in relation to growing season
- Investigate the impact of Cultar (Paclobutrazol) on tomato plants (indeterminate varieties) yield and fruit quality under greenhouse as an alternative method of plant trellising
- Investigate the impact of Cultar (Paclobutrazol) on controlling growth and influenced fruit characteristics of tomato

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