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# APPLICATION OF PACLOBUTRAZOL IN THE MANAGEMENT OF "SWEET GRAPE" TOMATOES IN A GREENHOUSE

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## ABSTRACT

The tomato plant has great economic importance, being a crop of high productivity and added value, despite its advantages, due to the high vegetative development and high susceptibility to pests and diseases, the crop has an intense need for cultural treatments. Among the management difficulties, the frequent need for sprouting, the large size of the plant and the high demand for pesticides stand out. The phytoregulator Paclobutrazol (PBZ) has an action in reducing vegetative development, resulting in a reduction in the need for cultural treatments, aiding management, and a lower demand for fungicides after tomato sprouting. In the present experiment, we sought to analyze the vegetative and reproductive characteristics of tomato plants under different doses of Paclobutrazole, in a protected environment, in the tomato system tutored in the Nova Alta Paulista region. The experimental design was completely randomized, with 5 treatments and 6 replications, totaling 30 plots with 5 plants/plots. The treatments were (in mg L-1 of active ingredient per seedling): 0; 37,5; 75; 112,5; 150 mg L-1. Paclobutrazol was sprayed 15 days after sowing. The use of PBZ proved to be effective to reduce the size of cultivars, not to reduce the length of lateral shoots, to advance and stagger the harvest and to maintain productivity.

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The use of phytoregulator was efficient to reduce the need for sprouting and pesticides, the best agronomic characteristics were observed at the dosage of 37.5 mg L-1.

**Keywords:** Solanum Lycopersicum. Phytoregulator. Lateral Sprouting. Size reduction. Production.

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## INTRODUCTION

The tomato plant (*Solanum lycopersicum* L.) has great economic relevance, being the second most important vegetable crop (DUSI, 1993), the crop also stands out for its high productivity and high added value, being an excellent cultivation option.

Despite its advantages, the crop proposes some cultivation challenges, According to Filgueira (2008) it is possibly the crop that most requires cultural treatments, most of the cultivars present "indeterminate" growth with a large number of lateral shoots, adjunct to the high susceptibility to pests and diseases, there are worrying factors, which denote attention. The use of hormone regulators, although little studied, can be an efficient strategy, helping management and increasing productivity.

The crop has high vegetative growth, reaching more than two meters (DAN, 2006), which makes harvesting, staking and spraying difficult. In crops that are at the end of the cycle, it may be necessary to use tools such as ladders to carry out crop treatments, reducing the efficiency of workers, consequently generating higher labor costs.

The lateral shoots of the plant develop next to each leaf, and their sprouting should be done when the branches reach 2 to 5 cm (TEIXEIRA, 2022), requiring constant shooting. In cultivation, the leaves located below the bunches already harvested are also removed.

Plant health and productivity are closely linked to the pruning and thinning processes, and require a large labor cost, in addition to generating physical damage to the cultivars caused by lesions that can be a gateway for fungi and bacteria (SANTIAGO, 2022).

After the pruning and thinning procedures, it is reasonable to spray with pesticides, such as cupric fungicides, to avoid the infection of diseases (ZAMBOLIM, 2000; COOXUPÉ, 2023), but this process generates additional costs, and it is desirable to reduce the need for cultural treatments. In this context, the plant growth regulator inhibits the biosynthesis of gibberellin, promoting the reduction of the vegetative growth of the plant (SELEGUINI, 2007) and consequent reduction of costs with cultural treatments.

In this context, the objective of this study was to evaluate the vegetative and productive characteristics of sweet tomatoes staked, under different doses of the phytoregulator Paclobutrazol (PBZ), in a greenhouse.

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## METHODOLOGY

### EXPERIMENTAL AREA

The experiment was installed and conducted in the plant science area of the University Center of Adamantina (FAI), in the region of Nova Alta Paulista, which is located at 430 m altitude, 21.6691681 south latitude (S) and 51.0743785 west longitude (W). The soil is classified as a dark red oxisol to moderate, medium texture. The climate of the region can be classified as Aw, being a tropical climate, with a dry season in winter, annual temperatures of approximately 24oC and average rainfall totals of 1,000 to 1,400 mm/year (CLIMATEMPO, 2024).

### EXPERIMENTAL DESIGN

The experimental design was completely randomized (DIC), with five treatments and six replications, totaling 30 plots with five plants each plot. The treatments were: T1 = 0; T2 = 37.5 mg $^{L-1}$; T3 = 75 mg $^{L-1}$; T4 = 112.5 mg $^{L-1}$; T5 = 150 mg $^{L-1}$ of active ingredient (a.i.) per seedling. The commercial product of the plant regulator was "Cultar 250 SC®" which has 25% of the active ingredient (Paclobutrazole), sprayed 15 days after planting (figure 1).

Figure 1. Plants after paclobutrazol spraying


Source: Authors.

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INSTALLATION AND CONDUCT OF THE EXPERIMENT

The present experiment was conducted in protected cultivation, with a sprinkler irrigation system, in the pre-planting of tomato plant, soil analysis was carried out, seeking to correct the acidity, exchangeable aluminum contents and nutritional values, after which the soil was prepared for implantation. The spacing adopted was 1.20 x 0.40 m with a population density of 20.8 thousand plants per $^{ha-1}$. The needs of crop treatments, use of pesticides and fertilizers were adjusted according to the needs of the crop. A sweet grape tomato, commercially known as Luan, was used.

EVALUATED CHARACTERISTICS

a) Average height (AM): based on the distance between the neck and the apical meristem of the plants, two evaluations were carried out regarding the average height of the plants, the first at 30 days after transplanting and the second at 60 days after transplanting (Figure 2);

Figure 2. Evaluation of mean height at 30 days.

Source: Authors.

b) Harvest period and distribution (PDC): based on the percentage of production of each harvest, the period and distribution of the harvest of each treatment were analyzed;

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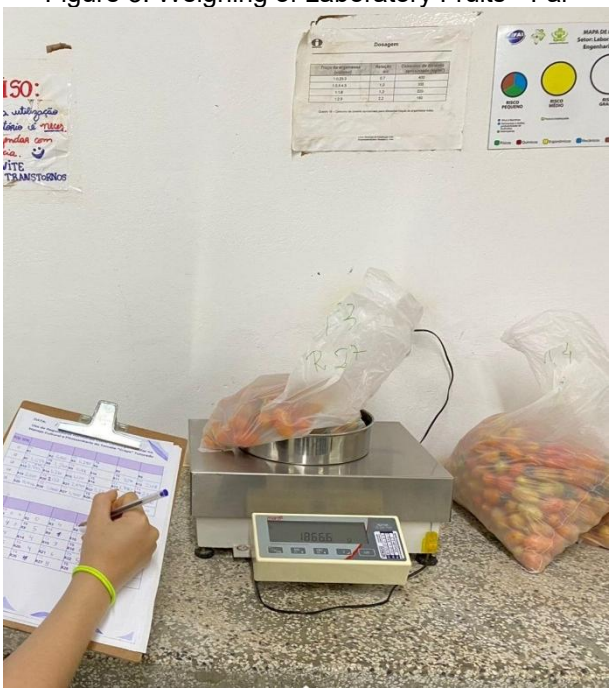
c) Length of lateral shoots (CBL): the rate of development of lateral shoots was observed. For this feat, the development of five shoots per plot in a period of 11 days was calculated;

d) Lateral shoot mass (MBL): weighing of lateral shoots. For this feat, the mass of lateral shoots per plot in the period of 11 days was considered;

e) Average productivity (MP): the productivity per plant was calculated, as a result of each treatment (Figure 3).

Figure 3. Weighing of Laboratory Fruits - Fai



Source: Authors.

The evaluations were carried out in the laboratories of the University Center of Adamantina (FAI), the environment counts all the materials that were used for the evaluations, such as: precision scale, tape measures and tools in general.

STATISTICAL ANALYSIS

The evaluated characteristics were submitted to analysis of variance by the F test, when their means were compared by Tukey's test at 5% probability (SISVAR, 2000).

## RESULTS

The present experiment showed a significant effect for the variables: mean height (MA); Lateral shoot length (CBL) and Average yield (PM), only the evaluation of lateral

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shoot mass (MBL) did not differ significantly. Analysis of variance (Table 1) and Tukey's test (Table 2).

Table 1. Analysis of variance as a result of the variables: Mean height (MA); Length of lateral shoots (CBL); Lateral shoot mass (MBL); Average productivity (PM)

| Analysis of variance | Anti-Mage 30d (cm) | Anti-Mage 60d (cm) | MBL (g) | CBL (cm) | PM (g) |
|---|---|---|---|---|---|
| GL Residue | 25 | 25 | 25 | 25 | 25 |
| F Treatment | 9.12** | 6.49** | 1,64 | 4.77** | 13,78** |
| Overall average | 24,66 | 92,34 | 85,62 | 69,13 | 2 215,03 |
| Standard deviation | 3,37 | 14,36 | 25,22 | 25,22 | 270,31 |
| DMS (5%) | 5,72 | 24,35 | 42,75 | 42,75 | 458,31 |
| CV (%) | 13,67 | 15,55 | 29,45 | 29,45 | 12,20 |

GL: degrees of freedom; DMS: minimum significant difference; CV: coefficient of variation
Significance level: ** 1%; * 5%.

Table 2. Tukey's test at 5% due to the variables: Mean height at 30 and 60 days (BF); lateral shoot length (CBL); lateral shoot mass (MBL) and average yield (PM) under different doses of paclobutrazole.

| PBZ doses* | Anti-Mage 30d (cm) | Anti-Mage 60d (cm) | MBL (g) | CBL (cm) | PM (g) |
|---|---|---|---|---|---|
| 0,0 | 30.60 to | 112.50 to | 87.00 to | 95.0 to | 2 566 A |
| 37,5 | 25.38 abs | 103.13 abs | 91.43 to | 88.0 to | 2 642 A |
| 75,0 | 24.63 bc | 87.05 bc | 92.52 to | 71.0 abs | 1,976 BC |
| 112,5 | 23.73 bc | 82.03 bc | 63.73 to | 54.7 ab | 2 230 abs |
| 150,0 | 18.97 c | 76.98 c | 83.40 to | 37.0 b | 1 660 c |

Means followed by equal letters do not differ from each other, at the level of 5% probability, by the Tukey test.
*mg $^{L-1}$(a.i).

The data show that the use of paclobutrazol reduced the average plant height (AM) at 30 and 60 days, favoring the management of sprouting, and at the dose of 37.5 the length of the lateral shoots (CBL) did not decrease, and the yield (PM) of the tomato did not differ from the control. This implies a reduction in time and savings in the application of pesticides and post-sprouting labor.

Figure 4 shows the distribution of yield per harvest at the different doses of the treatment and shows that the highest harvests were at C4 and C5. It is noted that in treatment 2 there was a gradual increase in the harvest, which favored the staggering of the harvest.

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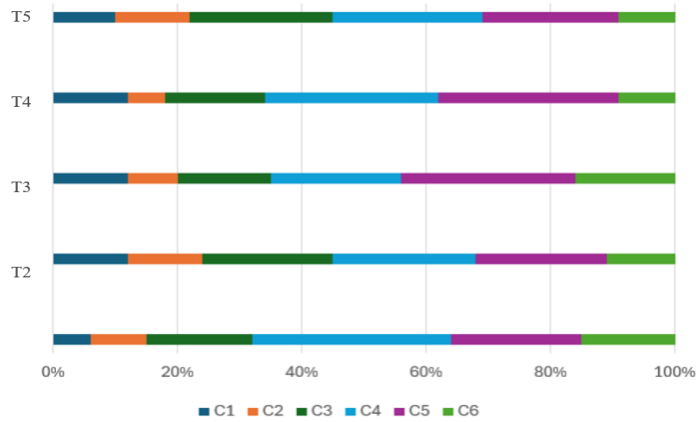
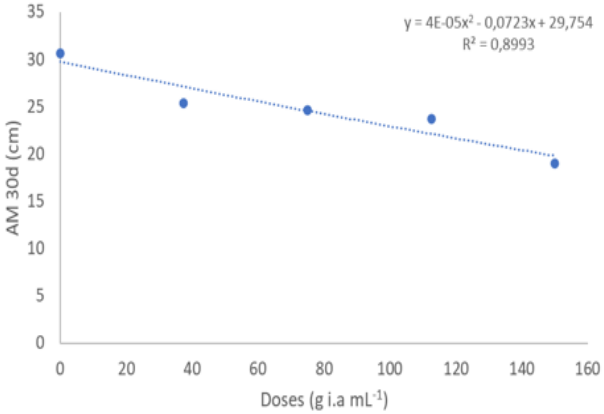
Figure 4. Distribution of tomato yield by the respective harvests (C1, C2, C3, C4, C5 and C6) in the treatments (T1, T2, T3, T4 and T5).




Source: Authors.

Regression analyses denote a reduction in the percentage of average plant height (AM) at 30 and 60 days (figures 5 and 6) with the increase in PBZ dose. Thus, the application of paclobutrazol favored sprouting management, saving time with labor and consequent reduction with post-sprouting phytosanitary treatment. From the dose of 37.5 mg $^{L-1}$ onwards, the length of the lateral shoots (CBL) was more accentuated (Figure 7), and perhaps, therefore, it did not change the productivity (PM) of the tomato in relation to the control (Figure 8).

Figure 5. Mean height percentage at 30 days.




Source: Authors themselves

Figure. 6 Percentage of mean height at 60 days.

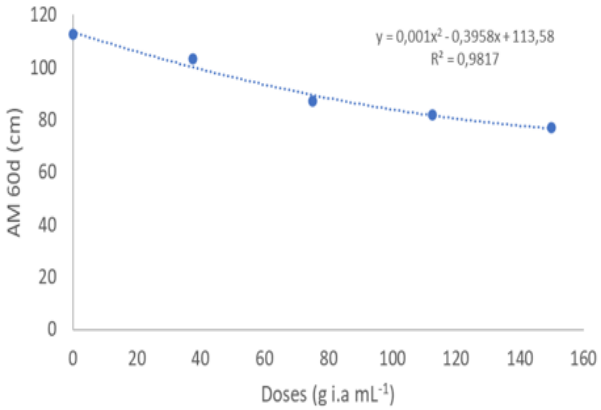



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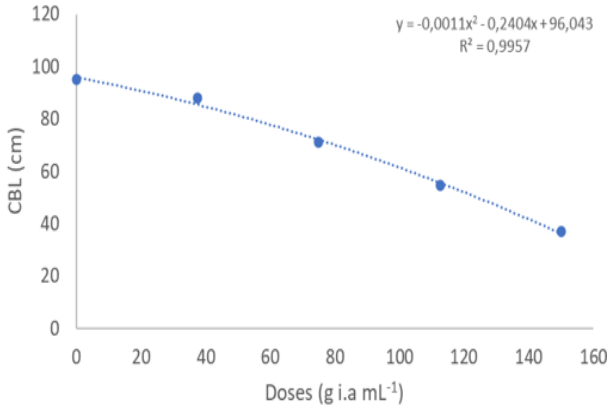
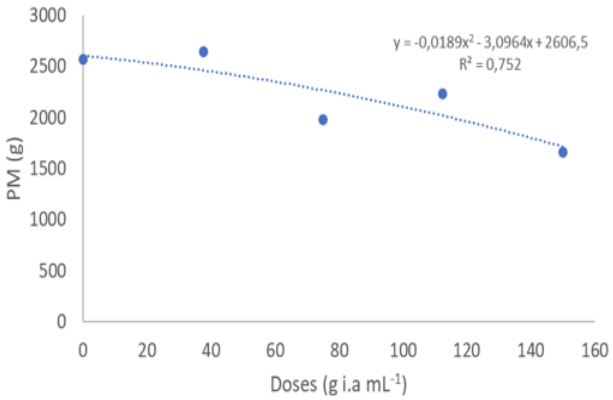
Figure 7. Percentage of the length of lateral shoots




Source: Authors themselves

Figure 8. Percentage of average productivity




Source: Authors themselves

## DISCUSSION

Paclobutrazol is a hormone regulator, being an antagonist to the synthesis of gibberellin phytohormones. Gibberellin, in turn, acts in the process of vegetative and reproductive development (TAIZ, 2013), reducing its biosynthesis and it is possible that the cultivars present desirable agronomic characteristics.

The use of the hormone regulator proved to be efficient in reducing the size of tomato plants, acting on the absolute growth rate and height of the plants (Figures 5 and 6). Which, in turn, can facilitate the sprouting, spraying and harvesting procedures, caused by the small size achieved by the cultivars. The result can be explained by the inhibition of the conversion of kaurene to kaurenoic acid, reducing the levels of gibberellic acid, consequently decreasing the rate of elongation and cell division (FLETCHER, 2000).

As observed in Taiz (2013), paclobutrazol is efficient in reducing the vegetative growth of plants, Seleguini (2007), verified a reduction in dry matter of the lateral shoots of the tomato plant, in the present experiment, a linear reduction in the length of the lateral shoots was observed, in the measurement carried out after sprouting (figure 7).

The PBZ promoted the advance and better distribution of the harvest (figure 4) at the dosage of 37.5 mg $^{L-1}$, the result can be explained by the inhibition of the phytohormone gibberellin, higher concentrations of the hormone favors the vegetative development of the plants (CARDOSO, 2007), so the inhibition can favor the reproductive development.

Experiments carried out by Bevora (2000) observed that PBZ spraying reduced yield by 9.6%, a result that differed from those observed by Souza (1999) and Seleguini (2007), who did not find changes in tomato yield with the spraying of the growth regulator. The present experiment showed a small non-significant increase in yield at the dosage of T2,

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37.5 mg $^{L-1}$, after which there was an increasing decline under tomato yield (table 2, figure 8).

## CONCLUSION

The use of paclobutrazol in sweet grape tomato cultivation reduced the percentage of average plant height (AM) at 30 and 60 days, the percentage of lateral shoot length (LBC), and the decrease in average yield with increasing doses. The growth regulator promoted the anticipation and staggering of the harvest and proved to be efficient in reducing the need for sprouting and consequent reduction in the use of pesticides after this operation. Further trials should be conducted to validate the data obtained.

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