

## effect of spraying with different concentrations of the growth regulator paclobutrazol on the yield characteristics of three varieties of oat crop *Avena sativa* L.

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### Abstract

The experiment was conducted at the Research Station of the College of Agriculture, University of Basrah, located north of Basrah city, during the winter season of 2022-2023, in a loamy soil. The study aimed to investigate the response of three varieties of oats (*Avena sativa* L.) to foliar spraying with different concentrations of the growth regulator paclobutrazol. The study included three oat varieties (Ganzania, Shafa, and Carloupp) under the influence of spraying three concentrations of paclobutrazol (25, 50, and 100 mg/L) and a control treatment. The interaction between the two factors was also studied. The spraying was carried out in two stages, the first at the beginning of branching, and the second after three weeks from the first spray. The experiment was arranged using a randomized complete block design (RCBD) with three replicates. The results showed the superiority of the paclobutrazol treatment (50 mg.l-1), which recorded the highest averages for most of the studied yield characteristics, as the lowest average number of panicles m-2 was recorded at 458.05 dalia - and the highest average number of grains per dalia was 55.45 grains g-1, and the highest average weight was recorded. 1000 grains amounted to 37.33 g, while the Ganzania variety was superior in terms of the number of days and the number of grains in of panicle and 1000 grains amounted to 458.05 and amounted to 55.45 grains in of panicle-1 and 34.93 g and its components, protein content in grains, and chlorophyll in leaves were studied. The results showed the superiority of the paclobutrazol treatment (50 mg/L), which recorded the highest means for most of the studied growth traits. It had the lowest average plant height, reaching 70.75 cm. It also recorded the highest average chlorophyll content, reaching 143.90 mg/100 g, and the highest average for the number of tillers, reaching 488.97 tillers/m<sup>2</sup>. Additionally, it recorded the highest average for stem diameter, reaching 4.49 mm.

**Key words :** Growth regulator , Paclobetrazole , Gibberellins , Auxines , Ethephon , Cytokinins.

### I. Materials and Methods

The oat crop (*Avena sativa* L.) is a member of the Poaceae family, commonly known as the grass family. It is a dual-purpose winter crop, serving as a source of both grains and fodder. The total cultivated area for oat crop reaches approximately 9.94 million hectares, with an annual production of around 24.95 million tons (1) Oats are distinguished for their high nutritional value, boasting a substantial content of vitamins and a significant proportion of dietary fiber. These attributes contribute to fat reduction within the body and regulate cholesterol and glucose levels. Moreover, oats contain unsaturated fats, proteins, and antioxidants (2)

**Plant growth regulators** are compounds produced naturally by plants or synthesized in laboratories. These regulators function at low concentrations to control various plant activities by altering hormonal activities (3) . Plant growth regulators are categorized into two groups: **growth promoters** such as gibberellins, cytokinins, and auxins, and the other group is **growth inhibitors** such as ethylene and abscisic acid. These compounds are naturally produced within plants and play a role in regulating growth, particularly



in the **apical meristem** region, which is responsible for the primary growth of the plant. This regulation occurs by inhibiting the growth of the growing tip (4)

Industrial growth inhibitors, known as Growth Retardants, include compounds such as cycocel, ethephon, paclobutrazol, and chlormequat. These manufactured substances exert effects opposite to natural gibberellins within the plant. Their function and purpose revolve around hindering gibberellin synthesis, thereby reducing its activity and decreasing the elongation of cells within the subapical meristem region. Consequently, this diminishes stem elongation. In recent times, there has been a global trend towards utilizing plant growth regulators in field crop production due to their significant role in enhancing crop growth, increasing yields, improving quality, and reducing lodging (5). This phenomenon has a substantial impact on both crop yield and its quality. Additionally, these regulators play a crucial role in delaying or accelerating germination, growth, flowering, maturation, and the ability of crops to withstand various environmental stressors

Paclobutrazol is a chemical growth regulator belonging to the triazole family. It possesses the ability to regulate plant growth. It is an extremely active synthetic chemical that affects nearly all plants, whether applied through spraying or soil immersion. Plant response to paclobutrazol, particularly when applied as a foliar spray or soil treatment, is more pronounced. One of the notable properties of paclobutrazol is its capacity to induce changes in crucial plant hormones, including gibberellins, abscisic acid, and cytokinins. By inhibiting gibberellin synthesis, paclobutrazol reduces its levels in the plant. Simultaneously, it enhances the production of cytokinins. This leads to a reduction in stem elongation, minimized lodging in plants, increased grain weight per ear, and improved grain quality through enhanced carbohydrate content, subsequently resulting in higher yields (6)

The experiment was conducted at the Agricultural Research Station of the College of Agriculture, University of Basrah, located in the northern center of Basrah Province. The study took place during the winter season of 2022-2023 in a clay-loam soil. The objective was to investigate the response of three varieties of *Avena sativa* L., namely 'Ginzania', 'Shifa', and 'carllup' (referred to as V1, V2, and V3 respectively), to different concentrations of the growth regulator paclobutrazol.

The experimental design consisted of comparing the mentioned oat varieties under the influence of three concentrations of paclobutrazol (0,25, 50, and 100 mg/L) as well as a control treatment (referred to as B1, B2, B3, and B4 respectively). Additionally, the interaction between the factors was studied. The application of paclobutrazol was carried out in two stages: the first at the onset of branching, and the second three weeks after the first application.

The experiment was arranged according to the randomized complete block design (R.C.B.D) with three replicates. Different treatments were randomly allocated within each block. The land was divided into plots, with each plot having an area of 6 m<sup>2</sup> (2x2 m). Planting was done in rows spaced 20 cm apart.

The sowing date was November 25, 2022. Measurements were taken on plant height, chlorophyll content in leaves, number of tillers, and stem diameter. Plant height was measured from the base to the tip, averaging ten randomly selected plants from the central rows. Ten leaves were collected randomly from each experimental unit for laboratory analysis of chlorophyll content. Tiller count was averaged from ten randomly selected plants from the central rows, while stem diameter was measured as an average of ten randomly selected plants from the experimental units.

## II. Results and Discussion:

1- number of panicles m-2,

Figure 1 indicates that there are significant differences between the varieties, as the Shifa variety excelled in the number of buds M-2, recording the highest average of 458.05 number of panicles m-2 while the Ganzania variety recorded the lowest average, amounting to 363.18 panicles m-2, and the reason may be due to the difference between the species in the composition of the fertile shores, and these results are consistent with the (7)

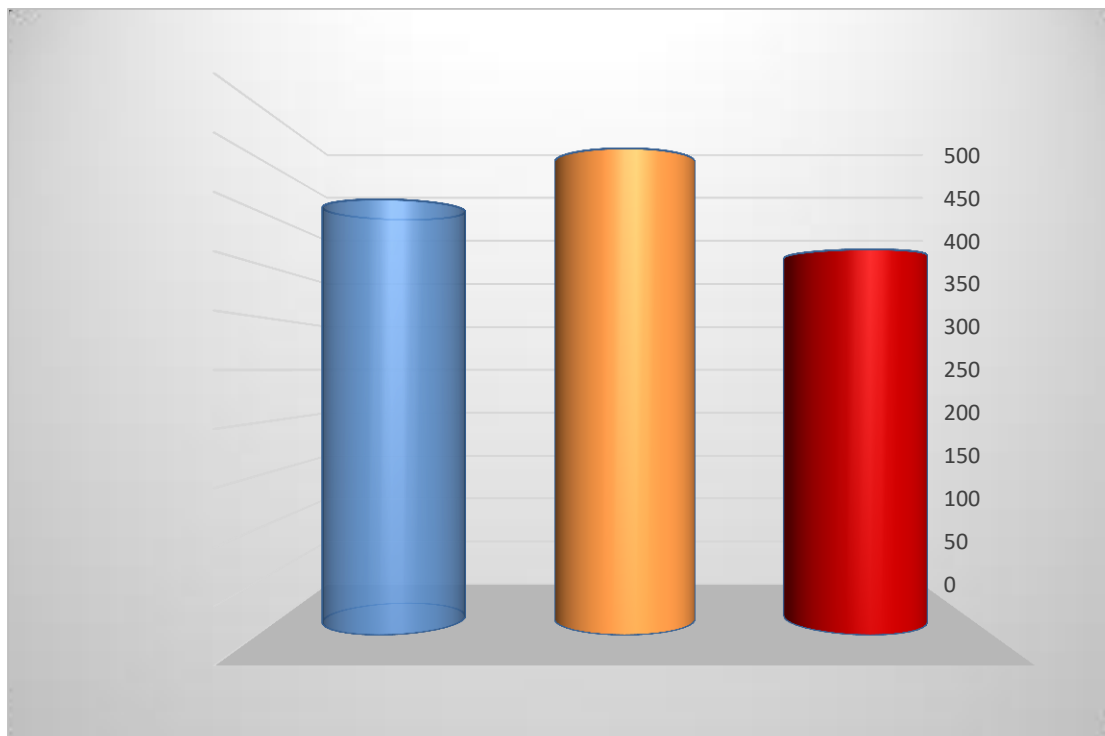


Figure (1) shows the effect of varieties on the number of panicles m-2,

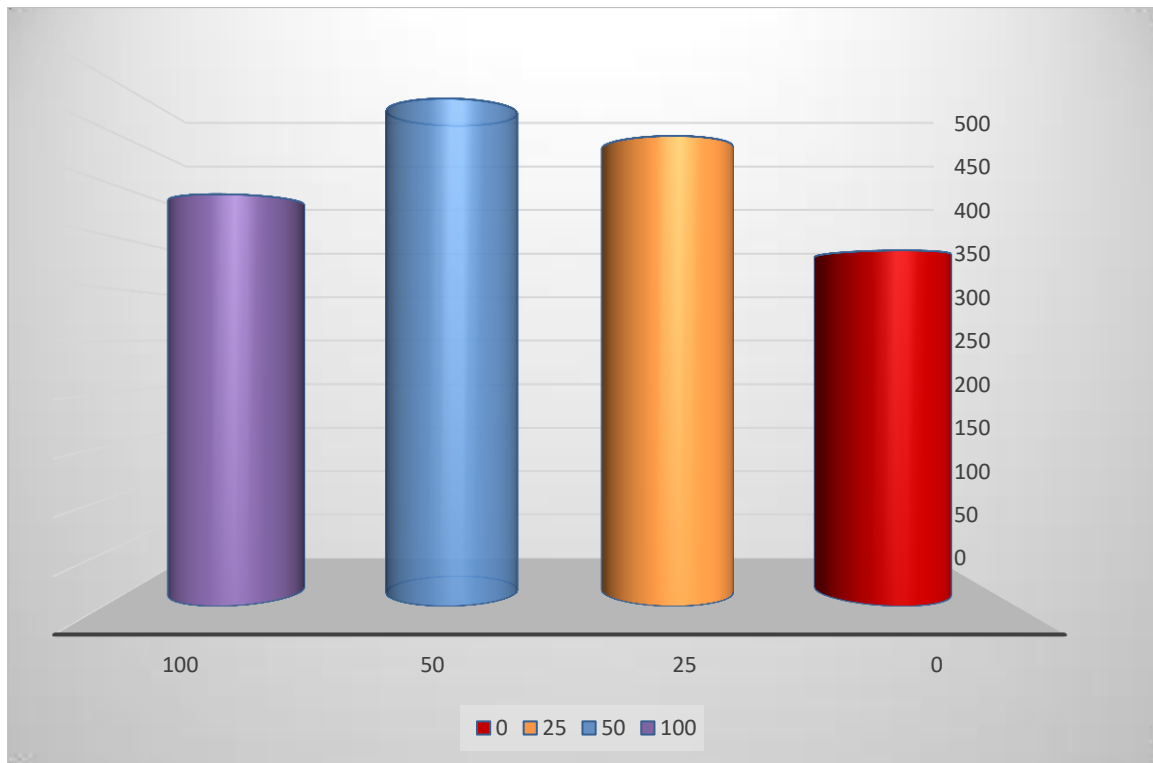


Figure (2) The effect of paclobutrazol on the number of Panicles m-2

Figure 3 shows the presence of significant differences in the interaction between the varieties and the concentrations of paclobutrazol, where the interaction between the variety gave the cure with the treatment concentration (50 mg.L-1) the highest average amounting to 511.96 number of panicles m-2, while the Ganzania variety with the comparison treatment recorded the lowest average of 292.83 number of panicles m-2, There was no significant difference with the interaction between the Carob variety and the comparison treatment, as the smallest significant difference was also recorded, amounting to 301.51(8).

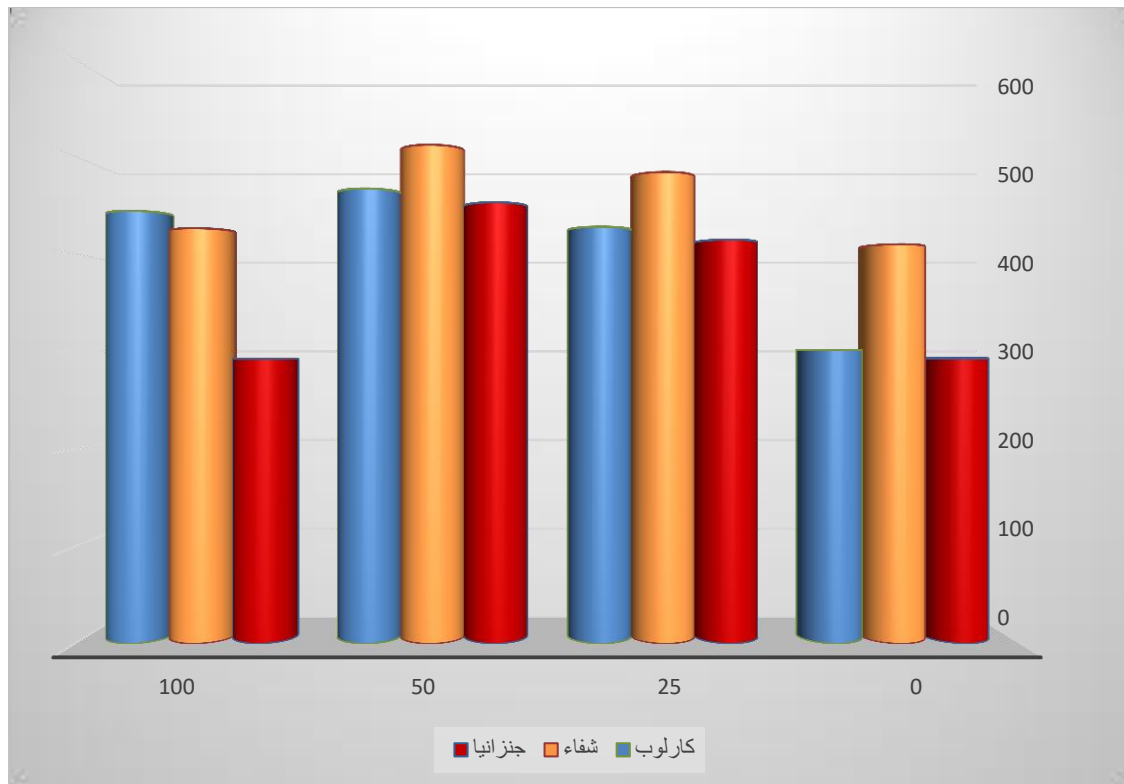


Figure (3) shows the effect of the interaction between paclobutrazol varieties on the number of panicles m<sup>-2</sup>,

#### 2-Number of grains panicle-1

Figure 4 shows that there is a difference between the varieties in the number of seeds in Dalia, where the variety Ganzaniya excelled and gave the highest average amounting to 55.45 of grains panicle-1, while the variety Shifa recorded the lowest average for the characteristic amounting to 42.51 of grains panicle-1. The reason for this may be the difference between the varieties in terms of Genetically, these results are consistent with (10),

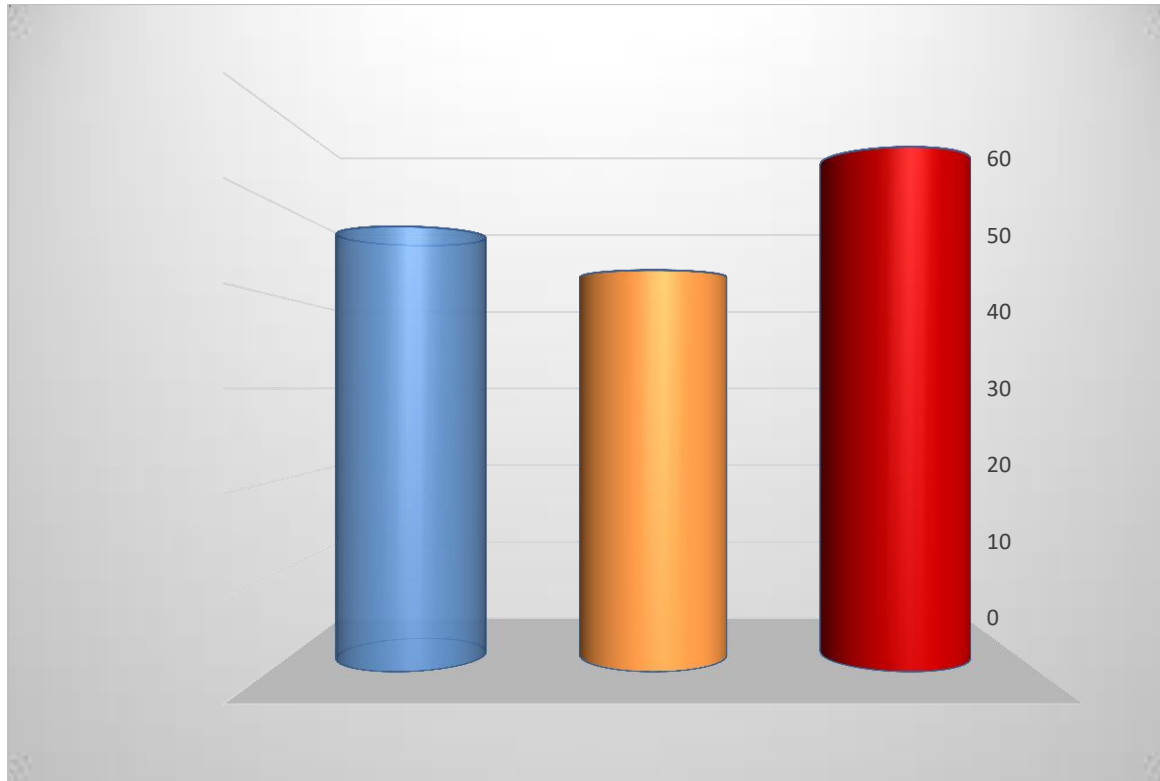


Figure (4) The effect of varieties on the number of of grains panicle-1

Figure 5 indicates that the concentration treatment (50 mg.L<sup>-1</sup>) was superior to the number of grains panicle-1 and recorded the highest average amounting to 58.94 of grains panicle-1 while the comparison treatment recorded the lowest average amounting to 38.25 of grains panicle-1. The reason may be due to the role of paclobutrazol. Increasing the number of days from 50% flowering to full maturity.(12)

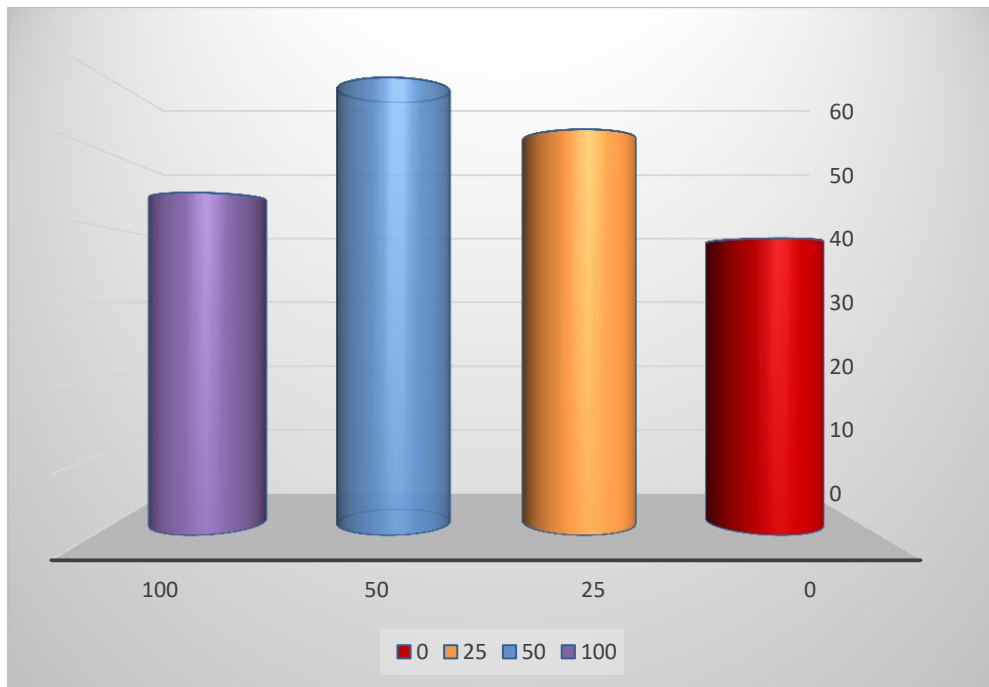


Figure (5) shows the effect of paclobutrazol on the number of grains panicle-1

Figure 6 shows that there are significant differences in the interaction between the varieties and the growth regulator paclobutrazol in terms of the number of seeds in the dahlia, where the combination between the variety Ganzania with (50 mg.L<sup>-1</sup>) was superior, as it recorded the highest number, amounting to 71.04 of grains panicle-1 when the combination between the Shifa variety recorded the lowest number of pills, amounting to 36.20 pills, of grains panicle-1

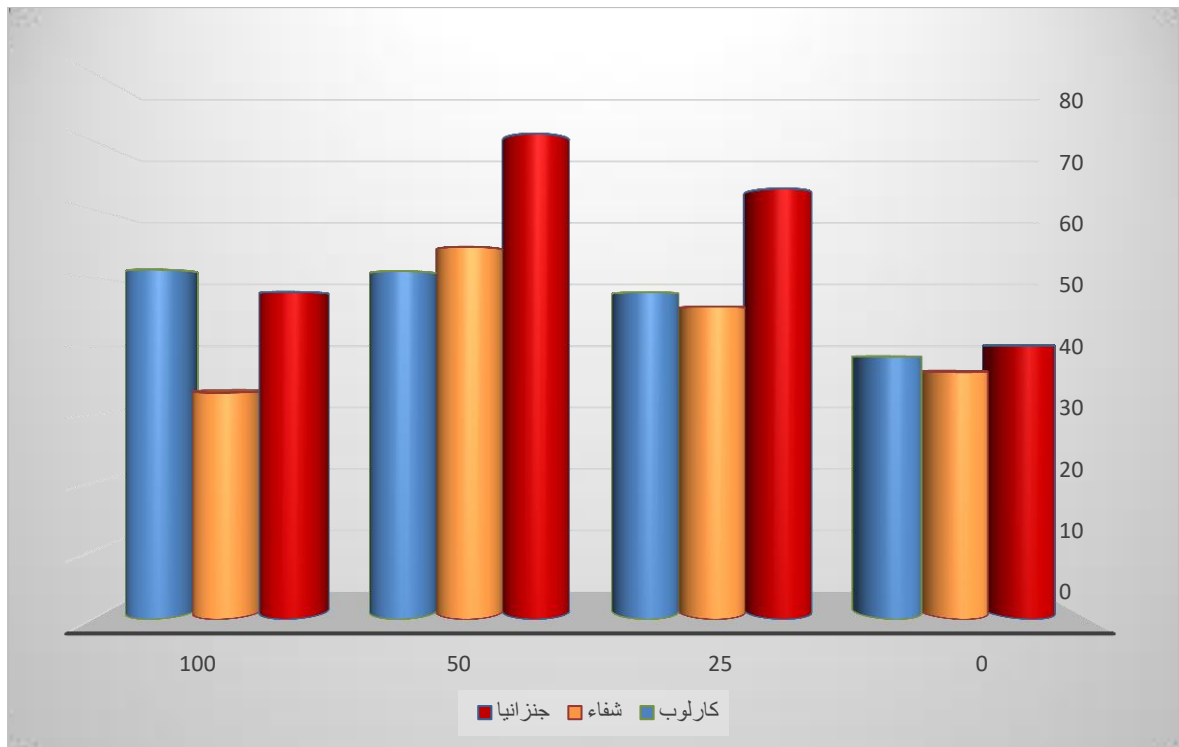


Figure (6) shows the effect of the interaction between varieties and paclobutrazol on the number of grains panicle-1

### 3- Weight of 1000 tablets (g)

Figure 7 indicates that there is a significant effect among the studied varieties regarding the weight of 1000 grains, as the Carlop variety excelled and recorded an average of 34.93 grams, while the Genzania variety recorded the lowest average for the trait, amounting to 25.09 grams. This discrepancy between the varieties may be attributed to the genetic differences between the varieties of The other category, and this is consistent with what the mechanism has reached (13.14).



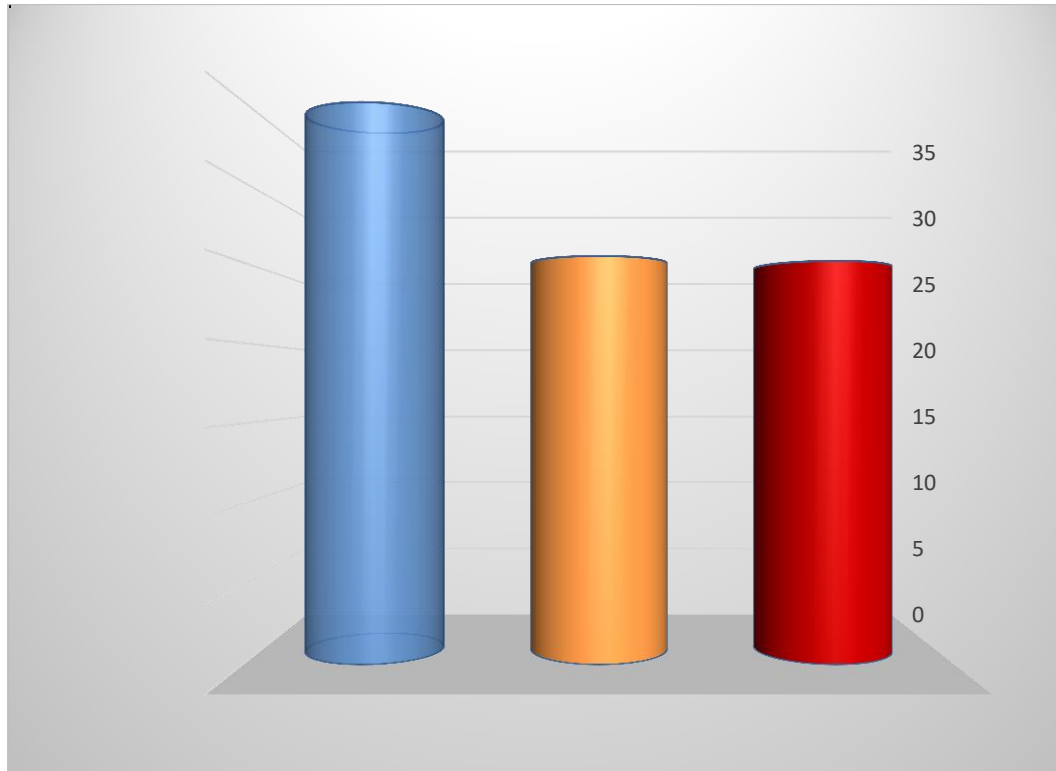


Figure (7) shows the effect of varieties on the weight of 1000 grains

Figure 8 shows the presence of significant differences between the concentration parameters in terms of the weight of 1000 grains, where the concentration was superior to (25 mg.L-1) and the highest average was recorded at 30.69 grams. There was no significant difference with the addition of (50 mg.L-1) as it recorded 29.56 grams. The reason for this can be attributed to the use of the regulator paclobutrazol, which activates oxidative enzymes in the leaves, which delays senescence and thus prolongs the period from 50% flowering to full maturity. This leads to the longest grain filling period, which is reflected in the increase in grain size and weight (Dewi et.at 2016). These results agreed with (Noorani et al. 2012).

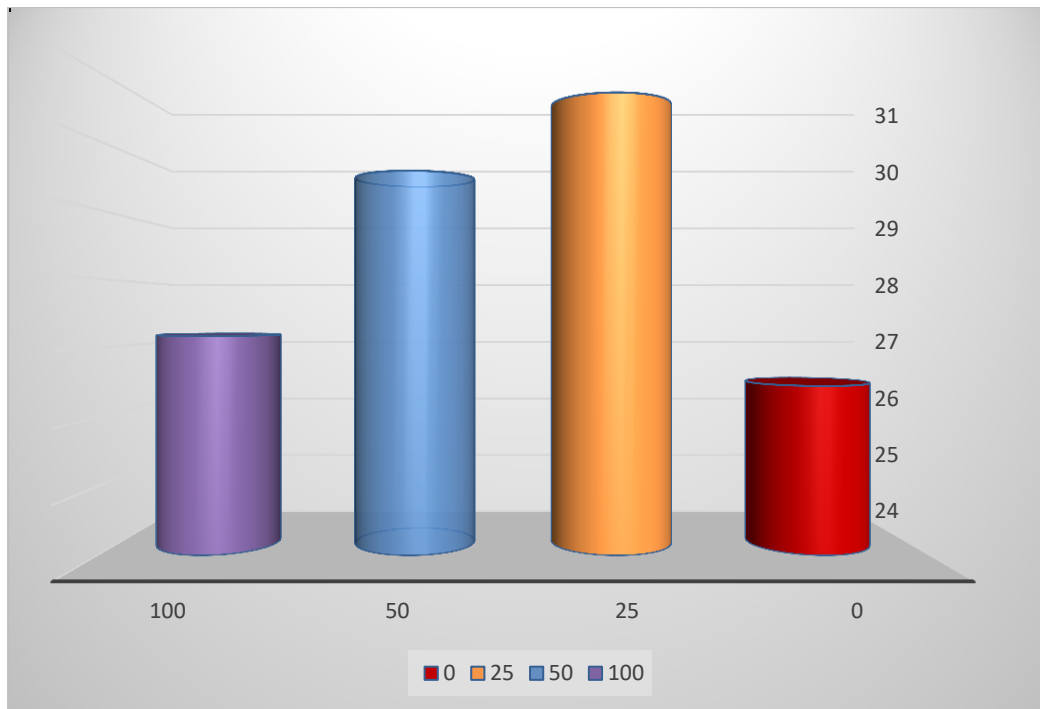
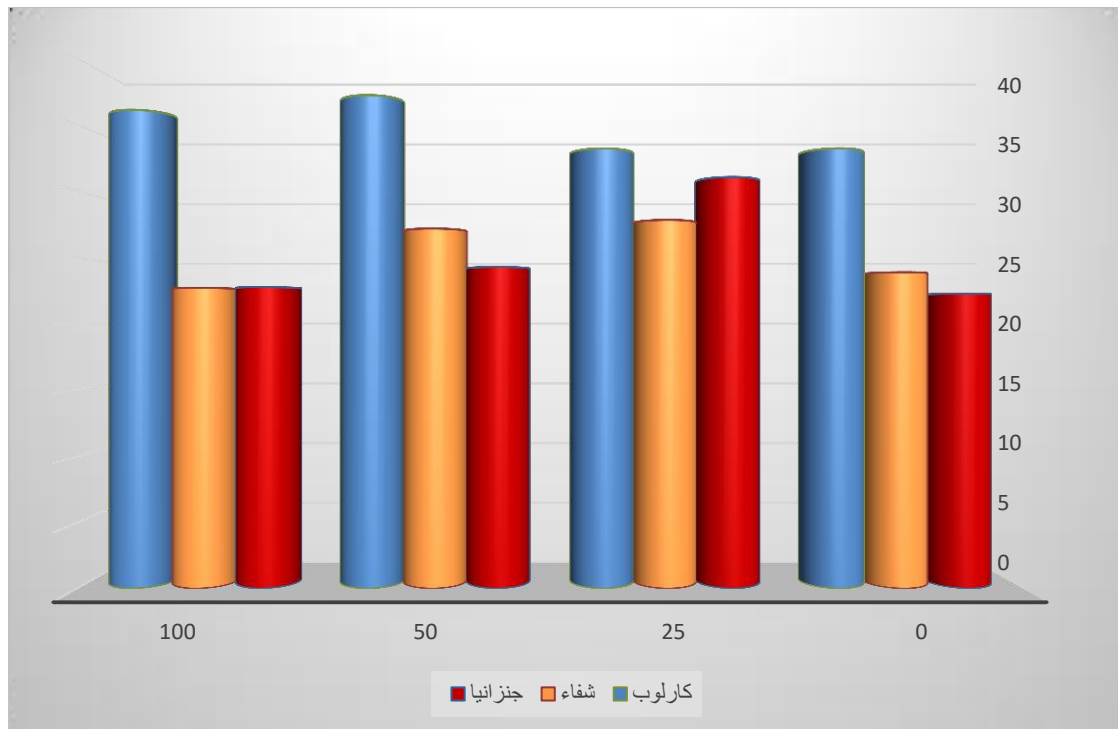


Figure (8) shows the effect of paclobutrazol on the weight of 1000 tablets

Figure 9 shows that there is a significant effect between the interaction of the varieties and the concentrations of paclobutrazol, where the interaction treatment between the variety Carlop and the treatment (50 mg.L-1) exceeded the highest average, recording 37.33 g, while the interaction between the variety Genzania and the comparison treatment recorded the lowest average, amounting to 22.27 g. It did not differ significantly with the interaction of the healing variety and the comparison treatment, as the smallest difference was also recorded, amounting to 23.88 grams(15).



Figur(9) shows the effect of the interaction between varieties and paclobutrazol on the weight of 1000 grains

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