Effect of gibberellin GA3, boron and zinc foliar application on the growth and production of *Hibiscus Sabdariffa* L.

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Abstract. This study was conducted in the fields of the center of planting and Development of the roselle in Al-Qadisiyah Governorate during the summer season 2015-2016 to study the effect of gibberellin acid (GA3), boron and zinc on the growth and production of roselle plant. GA3 applied as perlex tablets form (1g) at a concentration of 2 g.L-1. Zinc was applied in zinc sulphate form ZNSO4.7H2O at a concentration of 1 g. L-1(ZN 22.6%). Nutrients were applied at a 4-6 leaf growth Stage and applied once again after a month of the first application time. (RCBD) Randomize complete Block Design were used with three applies. Means were Compared according to the test of the least significant difference of LSD at (5%). The Results of the study showed a significant superiority of the treatment of the triangular overlap between the acid of gibberellin, Boron and Zinc in each of plant Height (146 cm), the number of branches (25 branches, plant-1), the number of Leaves (657 leaf) and the leaf area (3.7 m2). The total chlorophyll (Spad 45) and the Dry weight of the vegetative group (523.52g, plant-1), the number of walnuts (155.67 Walnut), the leaves of the dark leaves (44.17 g), and leaves thick (2.61 mm) The Comparison treatment resulted 123.23 cm height, 15.67 branches, 6.67 leaf, 2.06 m2, 38.8 Spad, 470.80 g, 127.47 nut, 2.147 mm and 827.2 kg, respectively.

Keywords: gibberellin, *Hibiscus Sabdariffa*, planting, Zinc, roselle

Introduction:
The *Hibiscus Subdariffal* plant is a medicinal plant, annual plant belonging to the Malvaceae family. Roselle plants have a strong branching branch (2.5 m) and are dependent on climatic conditions and species (Norman, 1992). (Al-Sarraf, 1991), its leaves are used as a source of the Hibiscin compound, which has the medical effect of treating high blood pressure (Ahmad, 1992). The plant entered Iraq before 70 years or more in Qadisiyah His seed was brought by a pilgrim from the Holy Land Conservative (Omran, 1988). In India, it is called Roselle, and in Iraq it is found in Turkey, Roselle, Jamaica and Iran. Sour tea (1991, Tarkahargi Faraji, 1999) is cultivated in tropical and subtropical regions of Africa, India, Malaysia, Indonesia, Australia (atall.Rab, ). That its seeds contain 17% oil, 6.2% protein and 15.2% gelatin used in the manufacture of foodstuffs such as juices, ice cream and jelly, which are characterized by viscosity. The seeds contain protein and fat (Hassanein et al., 2005). The leaves contain, which are used in the refreshing syrup (cough syrup) or red acid in the flower of the Roselle plant, are made of anthocyanin, one of the best colored pigments used in cosmetics (Marco et al., 2005). Roselle is one of the most important crops in the central provinces of the Middle East and North Africa. And the south has been spread in the rest of the provinces because it is a good income for farmers (cashier, 1991) and its production in Iraq is estimated at 800-1000 hectares and the
productivity varies depending on the climatic conditions and type of soil, benefiting from the leaves of the Seabates rich in vitamin A and vitamin C and phosphorus, iron and calcium Pigment anthocyanin and organic acids such as malic and citric and tartaric so taken advanta ge of it in the food and pharmaceutical industries, for coloring drugs and contain the active ingredient Hibicsine hydrochloride medical interest in lowering high blood pressure and strengthen the heart muscle and soothe the nerves and to treat atherosclerosis and facilitate digestion and reduce the process of blood viscosity (Degwy, 1996).

The plant has special properties for containing linoleic acid and preserving the cells from the crash. The dye is the main source of antioxidant capacity in the Roselle leaf extract (Tsai et al., 2002), which is derived from the fibers of the plant stems in the work of ropes (Babajide, 2005). For the importance of the plant in economic and medical terms and the lack of studies and research, many researchers have tried to study the possibility of increasing the harvest through the use of nutrients and organic growth organizations, so I used the research above the effect of Gabrlin As it stimulates cell division and increases the strength of Sink Strenght in the growth and location of modern walnut and its elongation through the use of materials manufactured in leaves (Bidwell, 1979) ; boron helps in the growth of metastatic tissue and the building of nucleic acids and the transfer of sugars in the manufacturing areas to the growth zones. The ceramic is important in activating the enzymatic reactions and regulating the amnottic voltage of the plant cells by raising the efficiency Plant in the absorption of potassium and in the composition of pectin and lacenin and there is 50% of the boron in the cell wall (Abu Dahi and Bots, 1988). Zinc is absorbed by the plant in the form of Z +2 . The plant needs a small amount of it (Mohamed, 1977) necessary for phosphorylation, glucose formation and help in the formation and deficiency of chlorophyll. The process of starch formation and pollen formation is necessary for the manufacture of amino acid Try tophan In the process of building IAA s and therefore has a role in elongation and plant growth (Yassin, 2001).

Materials and methods of work:

The field experiment was conducted in the summer season 2015 in cooperation with the development center of the Roselle in Qadisiyah Governorate in a mixed clay soil and the physiochemical and chemical properties established in Table (1) to determine the response of the capricorn plant to different levels of gibberellin, boron and zinc. R.C.B.D with four replicates, Samples of field soil were taken before planting for the purpose of studying their physical and chemical properties at a depth of 0-30 Cm. Table (1). The piece of land allocated to agriculture and its plow was prepared with a three-tailed plow. It was then divided into a distance of 0.75 m. The mower was divided into experimental units and each experimental unit was 4 m3 long. The seeds were irrigated prior to planting and seeds were planted on April 1, 2015, 3-5 seeds were planted in each of Joura and in the upper third of the meter, the distance between Joura and the other (0.5 m) and at a depth of 3-4 Cm. Crop processing operations were conducted as needed and all experimental units were identified as 200 kg urea, 160 kg superphosphate and 100 kg potassium-ha sulphate (Dujoi, 1996). And the irrigation method where the need for soil to water until the emergence of seedling without immersion water to the point of access to reach 4-6) (paper and then settle irrigation every 8-11 day), Messier 2018).

Table (1): Some physical and chemical properties of soil.

| Qualities | Sand % | Loam % | Clay % | Soils tissues | Ece | PH | No3 | P | K |
|-----------|--------|--------|--------|---------------|-----|----|-----|---|---|
| Amount    | 14.31  | 57.41  | 30.21  | Clay soil     | 3.5 | 3.5| 26.2| 12.5 | 5.4|

The research was carried out in the laboratories of graduate studies - Faculty of Agriculture - University of Qadisiyah and was the source of seeds from the Department of the development of the
Roselle cultivation in Diwaniyah and was the type used Sabdariffa spread farming in the province of Qadisiyah, which is the first in the cultivation of seventy years ago (Amran, 1988). Seedlings were sprayed when they reached the real leaf (5-7). The second spray was one month after the first spray. The solution of the sulfuric acid, boron and zinc was prepared in advance according to the concentrations mentioned below. The components of each single, bilateral and triangular treatment were dissolved and placed in a 5-liter dorsal spray and supplemented with normal water after adding liquid liquid and sprayed in the early morning until the full full wetness of the plant was achieved. The process of planting the plants was carried out after about one month of planting and leaving one strong plant in each of Joura. The manual harvesting process was carried out to remove the bush and grass as needed. The treatments used were as follows:

1. Control.
2. Acid Gibberellin (GA3) in the form of Perlex tablets (1 g of GA3) concentration of 200 mg/L.1.
3. Boron B in the form of boric acid $H_3B_3$ (17% of B) g/L.1.
4. Zinc Zn in the form of zinc sulphate $Z_4.7H_2O$ concentration 1 g/L.1 (22.6% Zn).
5. $G \_3 + B$
6. $G \_3 + Zn$
7. Zn + B
8. $G \ _3 + B + Zn$

The global experiment was carried out by using the design of the complete random segments of R.C.B.D with four replicates. The coefficients were randomized and the mean averages were measured with the least significant difference at a probability of 5% (Al Rawí, 1980).

The qualities studied in the research are as follows:

1. Plant height / cm.
The height of the main stem above the soil was measured to the developing top of the plant for ten plants from the average sediment and its mean.

2. Number of main branches. Plant $^{-1}$
The number of branches was calculated for the ten plants that were used to measure the average height and the number of branches per plant.

3. Number of leaves. Plant $^{-1}$
The number of leaves of the ten plants whose average size was measured and the number of leaves were calculated.

4. Leaf area. M $^2$. Plant $^{-1}$
The leaf area of five random plants and twenty leaves of one plant and from different parts of the plant were taken. The leaves were drawn on charts and then the full squares of the paper were used to calculate the area according to the following law:

$$\text{Leaf area cm}^2 = \left( \frac{N}{2} \right) \times \text{square space}$$

And then took the average (Fliha and Jamil, 1987)

To find the leaf area of the plant, the area of leaf was multiplied by the number of leaves (Alwan, 1986) and (Al-Saidi 2004).

5. Percentage of chlorophyll in leaves- SPAD
Chlorophyll was measured in leaves after the end of the second spray of plants. The mature and finely selected leaves were selected for five plants and 20 leaves per plant using the Chlorophyl Meter of Spade-502.

6. Dry weight of total vegetative. Plant $^{-1}$
Two plants were cut from the sediment to the experimental unit and from the vegetative contact point in the soil. The plants were cut and placed in perforated paper bags and stored in an electric oven at 60 °C of constant weight and using the sensitive balance.

7. Number of nuts. Plant⁻¹
The number of nuts was calculated in 10 random plants from the experimental unit per replicate, and then the number of nuts per plant was taken

8. Quotient of leaves g. Plant⁻¹
A total of 10 random plants were taken as in the seventh paragraph, and the seedling of the nut was dried and air-dried at room temperature. After weight stability, the weight of the leaves of each plant was found.

9. Thickness of the leaves (µm)
The thickness of the leaves was calculated from the plants where the vegetative measurements were made for each plant. Twelve nut using the bowl and then taking the average.

10. Total number of leaves – kg/Ha⁻¹
The walnuts were harvested from all the plants of the experimental units in the research separately. The leaves were then cut off and the air dried until the weight was stable. The total yield of each experimental unit was found on the basis of the area.

Results and Discussion: -

1. Plant height Cm⁻¹
The results of Table (2) showed a significant effect on the addition of mononucleic acid. (GA³) was superior to the comparison treatment. The performance was 138.13 cm, while the comparison treatment showed an increase of 123.23 cm. The results in Table (2) above indicate that the treatment of the binary elements has a significant effect on plant height. The treatment of B + GA³ was higher in this category and the plant height was 140.17 cm. This is due to the role of the boron element in the transfer of photosynthetic materials to areas of effective growth which help increase cell division and elongation and the role of Gabrelin in stimulating the division and elongation of cells and affect the distribution of hemicellulocyte loophyses of the walls of the cells and reduce their hardness, the aim of treating the medicinal plants Jabberlin is to increase the content of these plants of active substances and not the total vegetables J, the spraying of plants with Jabberlin, especially above containing the calcosides, led to an increase in the content of plants from the materials of the classics. Table (2) indicates the superiority of the results in the height of plants in the addition of three B + Z.

2. Number of branches. Cm⁻¹
Table 2 shows the significant effect of mono-zinc and Z on the comparison treatment of 17.33 and 20.67. Plant⁻¹. In contrast, 15.67 branches were given. Plant⁻¹. Table 2 indicates the superiority of the second addition of GA³ + B in the number of branches. The factors of the study and the overlap between them in this function exceeded the treatment of the comparison with the performance of 22 and 15.67 respectively. The bilateral treatment Zn + B also significantly exceeded the unilateral addition and comparative treatment. The highest number of branches was given in comparison to the comparison of the treatment and the addition of the monotonous factors (15.67, 17.33, 17.67 and 20.67) for the comparison treatment of GA³, B, Z respectively. Table 2 shows the moral superiority of the addition of GA³, B, Z. The overlap between the above transactions showed an increase in the number of branches by giving 25.1 branches. Plant⁻¹ that the cause of superiority is the role of the acid in the cell division of hyperplasia and increase the absorption of water and increase its volume and protein content.
B, which has an effect on vegetative growth, increases growth and cell division, and increases the growth hormone (Cytokinin), which stimulates the growth of lateral buds (El-Tantaw et al., 1993). Zinc acts as a cycle of biological processes within the plant, Enzymes such as Enolase enter the formation of the other number, such as glutamic acid, dehydrogenase, actic acid dehydrogenase (Al Sahaf, 1989), which is found in green plastids and acts as a buffer for the pH and works to rid the plant of toxic \( \text{Zn} \) and helps in the formation Chlorophyll.

3. Number of leaves

The results in Table (3) show that the spray treatment of \((\text{GA}_3)\) significantly exceeded the number of leaves on the comparison treatment and \(\text{Zn, B} \) treatment, giving a number of leaves of 640.33 sheets. While the number of leaves in the comparison treatment and \(\text{Zn, B} \) 600.67, 619.67 and 627.00 leaf. \(\text{Plant}^{-1}\) respectively. While the binary spraying coefficients did not differ between each other in the number of leaves. Table (3) shows that the equation \( G_3 + B + Z \) was significantly higher on all the transactions and the number of papers was 657.00. \(\text{Plant}^{-1}\)on the treatment of comparison and bilateral treatments, unilateralism, that the reason for the superiority of \((\text{GA}_3)\) because it caused the elongation of the leg and the height of the plant physiologically in the cell division and the extinction of living cells of the cells of the plant tissues internally, that the mother cell occurs in the division, \(\text{A} \) And boron has a role in the process of carbon construction and the organization of enzymes and cell division \(\text{Zn} \) where it is important in the process of phosphorylation and glucose formation and help in the formation of chlorophyll.

4. Leaf area \(m^2\). \(\text{Plant}^{-1}\)

The results of Table (2) show that the paper spray with the Gibberellin acid of the single treatment significantly exceeded the treatment of the comparison and the unilateral addition of elements \(\text{Zn, B} \), which gave 3.133 \(m^2\). \(\text{Plant}^{-1}\) compared to 2.067, 2.56, 2.633 \(m^2\). \(\text{Plant}^{-1}\), respectively. The reason for its superiority is due to the Gibberellin acid has the advantage of promoting vegetative growth and has an effect on the growth and division and elongation of cells and stimulate its expansion (Mohammed, 1988) and also due to the plasticity of the cells of modern growth, and this plasticity is important in the elongation and expansion of cells (Abdel Majid and others , 1991) Gibberellin significantly increases the build-up of DNA, RNA, and protein-building. Thus, the rate of cell wall construction increases (Hussein, 1985). The increase in leaf area of the plant is affected by the increase of Gibberellin due to cell division. At the level of spraying with two elements, the treatment \( G_3 + B \) significantly exceeded the comparison treatment and the two treatments \( G_3 + Z \) \((\text{Zn + B})\) where the performance was 3.300 \(m^2\). \(\text{Plant}^{-1}\) compared to 2.067, 3.200, 2.633 \(m^2\). \(\text{Plant}^{-1}\) and that the effect of boron in the leaf area is due to its importance in increasing the division of plant cells. Table (2) indicates the effect of paper spraying on three elements in the surface area of the leaf \(M^2\). \(\text{Plant}^{-1}\) to the affected effect \(G_{3} + Z \) \(+ B \) in the growth of the plant and the overlap of elements with each other and its concentration in the leaves and this leads to the improvement of plant growth in a balanced and this in turn reflected on the performance of the plant by giving the largest vegetable area of the plant, Where he gave \((3.700) \ m^2\). The \(\text{Plant}^{-1}\) was significantly superior to all the experimental units.

5. Percentage of chlorophyll in the leaves SPAD

The results of Table (2) show that the spraying of plants with nutrients \( G_{3}, B, Z \) alone exceeded the single treatment \((\text{Zn})\) in the chlorophyll percentage where the performance was 44.10 relative to the comparison treatment and \( G_{3} \)and B, which performed 30.80, 40.60 , 42.63, due to the fact that \(\text{Zn}\) plays an important role in many of the biological processes within the plant and acts as a buffer for pH and plant clearance of poisonous \( Z \) and in nitrogen transitions. At the level of spraying with two elements, treatment \((\text{Zn} + B)\) Comparative treatment and treatments \( B + G_{3} \) \(\text{GA}_3 \) + \(\text{Zn}\) and triple
interference treatment \(( G \_Zn + B )\) gave 48.57 relative to the treatment of Compared to 38.80 and 2.30 compared to 30.80, 42.13, 46.17, 45.00 respectively, the reason for the importance of plant zinc in the process of RNA synthesis is important in the process of protein synthesis and increases the composition of vitamin C and the complex vitamin B group (Abu Dahi and Al Yonsei, 1988).

6. Dry weight g.Plant

The averages shown in Table (2) indicate that the single treatment of \( G \_Zn \) is significant in the dry weight category. Plant on the treatment of the comparison and the treatments Zn, B, which in turn exceeded the treatment of the comparison also gave 507.23 g. Plant compared with 470.80, 485.27, 499.40 g.Plant, respectively, and at the level of bilateral spray treatment outperformed \( G \_Zn + B \) significantly on the two treatments \( Zn + G \_Zn \) and \( B + Zn \) gave 516.87 compared to 511.90, 503.97 respectively. The production of dry matter (part of the vegetative above the soil surface) the productivity of vegetation is associated with light resistance and net carbon representation appears from the table (2) that triangular interference of \( G \_Zn + B \) significantly higher than the rest of the treatments in dry weight g. Plant. The acid \( G \_Zn \) plays a major role in the vegetative growth, especially the leaf area \( m^2 \). Plant and the composition of plant branches and may be due to the effect of boron in this capacity to encourage the division of cells and stimulate the activity Some enzymes such as Catalase, Amylase, Peroxidas have an important effect in phylogenetic processes (Abu Dhahi and Al Yonsei, 1988). The Effect of binary and trilateral elements in the dry weight gain of the vegetative group can be attributed to the integration of these elements in their effect. They have a role in regulating the effectiveness of plant hormones controlling the growth and division of marshmallow cells and stimulating biological processes, which has a role on the leaf surface and the volume of nutrients needed to construct tissue The plant thus increased dry weight (Steer et al 1993).

7. Number of walnuts. Plant

Note from Table (3) that the superiority of the individual treatment of B significantly exceeded the treatment of comparison and treatment Zn and gave the number of nuts 14787 compared to 127.47 and 138.20 nut. Plant respectively. The treatment of B + Zn was significantly higher than the coefficients \( B + G \_Zn \) \( G \_Zn + Zn \). Is due to the role of boron in the growth of marastomycin tissue and the building of nucleic acids and the transfer of sugars from the places of composition to the areas of growth and storage, and contributes to the regulation of the ammuzic effort in raising the efficiency of the plant in the absorption of potassium (Maamouri, 1997) and has a role in the formation of pectin and lacanin, 50% of the boron is found in the cell wall (Abu Dhahi and Al Yonsei, 1988).

8. Total value of the leaves. g. Plant

The results of Table (3) showed that in the single addition, the Zn treatment was significantly higher than the comparison treatment, which gave 35.23 g. Plant and 29.50 g. Plant respectively, at the level of the binary spray treatments, the treatment of Zn + B was superior to 150.80 g. The plants were leaves on the two treatments \( G \_Zn + B \) and \( G \_Zn + Zn \), which performed 137.17, 137.97 g. Plant respectively. It is noted from Table (3) that the treatment with three elements \( G \_Zn + Zn + B \) gave the highest total value of the leaves and significantly exceeded all the transactions, giving a total of 44.17 g. Plants The improvement of plant growth and the increase of fruits of the fruit, which led to an increase in the number of nuts, and this reflected on the dry yield of the leaves of the glass, and the cause of their common effect due to the integration of elements among them in improving the growth of the plant and gave a greater number of nuts and thus increased the leaves of dry leaves of each plant.

9. The thickness of the leaves.
The results of Table (3) showed that the single spray treatment was significantly superior to the treatment of G and Zn and the comparison treatment in the thickness of the leaves, 2.807 mm while the thickness of the leaves of G and Zn , and the comparison treatment, 2.150, 2.740, 2.147 µm, respectively. The B+Zn spray treatment was superior to the rest of the treatments and the thickness of the leaves was 2.760 mm. At the level of elements of triangular transactions of G + B + Z the above treatment gave 2.610 µm. The reason for the lack of thickness of the leaves (g) when spraying with acid Gibberellin, where Gibberellin increases the abundance of vegetative growth and become walls of cells thin and as Gibberellin gives plant cells to plasticity, increasing the elasticity of cells and expand with the pressure of water condensation (Hussein, 1985) The Zn component is used to improve plant growth. It is one of the nutrients needed by plants in a small quantity and plays an important role in many of the plant's biological processes. It activates a number of enzymes and enters the formation of other enzymes such as Enolase, dehydrogenase, glutamic, actic acid dehydrogenase, and (Al Sahaf,1989) may be due to the influence of element B where it is present. The growth of the developing summit, the rapid growth of metastatic tissue, the increase in the length of the placenta and activation of the cellular membranes, which is necessary for the formation of the protein, has an effect on the biological hormonal processes such as IAA and production of growth organizations such as Gibberellin in seeds, which helps to germinate and contribute effectively to the transfer of food from sources to modern growth centers (Mingel and Kirkby 1982).

10. The total number of leaves. kg. ha⁻¹

The results of Table (3) indicate that there are no significant differences between the single spraying and the comparison treatments at the level of the binary spray treatments. The Zn + B spray treatment is significantly superior to the secondary spray treatments of B + G and G + Z . Plant⁻¹. Where it gave 1041.8 kg. ha⁻¹ and 959.5 and 959.3 kg.ha⁻¹ respectively. Within the triple spraying transactions G + Z + B triple treatment has excelled and showed overlap between the three elements gave the sum of the leaves of 1086.8 kg. ha⁻¹. This is due to the fact that each crop has genetic and environmental characteristics. The genetic factor is the efficiency of the species, the variety or one of the factors in the performance of the crop, in addition to the crop service operations, taking into consideration the environmental factors with the overlap between them, as well as the field characteristics of the species, For the plant on absorption and ionization, as increasing the total metabolic material manufactured in the plant leads to an increase quotient. (Hussein, 1985).

Table (2): Effect of spraying of Gibberellin, Boron and Zinc in plant height, number of branches, number of plant leaves, leaf area, % of chlorophyll and dry weight g. Plant⁻¹

| N  | Transactions | Plant height cm | Number of branches | Number of plants leaves | Leaf area m² | % Chlorophyll in pad leaves | The dry weight kg.Plant⁻¹ |
|----|--------------|-----------------|--------------------|------------------------|--------------|---------------------------|--------------------------|
| 1  | Const        | 123.23          | 15.67              | 600.67                 | 2.067        | 38.80                     | 470.80                   |
| 2  | G            | 138.13          | 17.33              | 640.33                 | 3.133        | 40.60                     | 507.23                   |
| 3  | B            | 130.30          | 17.67              | 619.67                 | 2.567        | 40.60                     | 485.27                   |
| 4  | Zn           | 135.23          | 20.67              | 627.00                 | 2.633        | 44.10                     | 499.40                   |
| 5  | B+G          | 140.23          | 20.67              | 640.67                 | 3.300        | 42.13                     | 516.87                   |
| 6  | B+Zn         | 140.17          | 19.67              | 642.67                 | 3.200        | 46.17                     | 511.90                   |
| 7  | G+B+Zn       | 135.50          | 22.67              | 639.67                 | 2.633        | 48.57                     | 503.97                   |
| 8  | B+G+B+Zn     | 146.00          | 25.00              | 657.00                 | 3.700        | 45.00                     | 523.83                   |
| 5% |              | 2.675           | 1.038              | 3.298                  | 0.3096       | 4.656                     | 0.968                    |

| N  | Transactions | Number of walnuts. Plant⁻¹ | The total value of leaves kg.Plant⁻¹ | Thickness of the leaves mL | Total number of leaves kg/ha⁻¹ |
|----|--------------|-----------------------------|------------------------------------|---------------------------|-----------------------------|
| 1  | Const        |                             |                                    |                           |                             |
| 2  | G            |                             |                                    |                           |                             |
| 3  | B            |                             |                                    |                           |                             |
| 4  | Zn           |                             |                                    |                           |                             |
| 5  | B+G          |                             |                                    |                           |                             |
| 6  | B+Zn         |                             |                                    |                           |                             |
| 7  | G+B+Zn       |                             |                                    |                           |                             |
| 8  | B+G+B+Zn     |                             |                                    |                           |                             |
| 5% |              |                             |                                    |                           |                             |
Table (3): Effect of the leaf feeding, Gibberellin, Boron and Zinc in the growth and weight of Roselle in the number of walnuts. Plant\(^{-1}\), total leaves. Plant\(^{-1}\) thickness of the leaves, the total value for the leaves kg.ha\(^{-1}\).

|   | Const  | AG\(_3\) | B   | Zn    | GA\(_3\)+B | GA\(_3\)+Zn | B+Zn   | GA\(_3\)+B+Zn | %5   |
|---|--------|----------|-----|-------|------------|------------|--------|----------------|------|
| 1 | 127.47 | 147.33   | 147.87 | 138.20 | 137.17     | 137.97     | 150.80 | 155.67         | 1.661 |
| 2 | 29.50  | 33.73    | 35.07 | 35.23 | 35.37      | 35.87      | 34.20  | 44.17          | 3.387 |
| 3 | 2.147  | 2.150    | 2.807 | 2.740 | 2.330      | 2.370      | 2.760  | 2.610          | 0.1596 |
| 4 | 857.2  | 837.5    | 951.0 | 958.3 | 959.5      | 959.3      | 1086.8 | 1086.8         | 3     |

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