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Effect of some plant extracts on the growth and product of tomato plants

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Abstract--The study was conducted in the winter season of 2022-2021 in the Department of biology, College of Education, University of Samarra, to evaluate the effectiveness of some plant extracts on the growth and productivity of tomato plants as well as to compare their use with chemical fertilizers, as well as to show the importance of reducing the use of chemical fertilizers in agriculture and the need to switch to clean agriculture to ensure of the quality of the product, the experiment was conducted in the greenhouse of the Department of biology. In this experiment tow extracts were used: Sesbania and Eruca sativa, and each of them had two concentrations (5,% 10%). The experiment was a global designed by design of randomized complete blocks (RCBD) with three replications with (4) pots for one experimental unit. The experiment contains (18) experimental units, which included (72) pots. After planting tomato seeds, the plants were sprayed with extracts, and some plants were treated with chemical fertilizers. The results were summarized as follows: Spraying with Sesbania extract caused significant positive differences in vegetative growth characteristics compared with plants that were not sprayed with it, where treatments (S1) achieved the highest rate of leaf numbers amounted to (380) and the highest rate of leaf area (4.424) cm² compared with treatment (E2) (sprayed with Eruca sativa extract). Concentration 2) It gave the lowest average number of leaves (96.5) and with (EO) (sprayed with water only), it gave the lowest average leaf area (2.132) cm². The interaction between extracts and chemical fertilizers had a significant effect on some vegetative characteristics such as stem height, where the treatments FS1) achieved the highest stem height of (41.75) cm, compared with those that were not used with them. Extracts or chemical fertilizers, such as the treatment (EO), which gave the lowest rate of stem height reached (30) cm. The results also showed the effect of Sesbania extract on the

production traits (yield), as it had a significant and clear effect on the characteristic of fruit diameter, weight and number. The treatments (S1) gave the highest average fruit diameter (10.75) cm, and the highest average fruit weight (95) g, and the highest Average number of fruits (8) fruits compared with (FE) treatments (which was sprayed with *Eruca sativa* extract and chemical fertilizers), which recorded the lowest rate of fruit diameter (2.75) cm, and the lowest rate of fruit weight (21.5), the (EO) treatment (sprayed with water only) recorded the lowest rate of the number of fruits (3) fruit only per plant, which was the lowest rate among all treatments.

Keyword--plant extracts, growth, product, tomato plants.

Introduction

Recently, industrial agricultural fertilizers (chemical fertilizers) have spread as an important step of modern agriculture in order to increase agricultural production and compensate for the lack of important nutrients in the soil in which agriculture has continued for many times and intensively throughout the year or even in several consecutive years. The excess or waste and the inaccurate use of these chemical fertilizers causes damage and results that are almost harmful to the plant and the soil itself and affect the biosphere and the environment, and this confirms the need for a balanced and rational use of these fertilizers to avoid these damages (1). Modern scientists have tended to use plant extracts as an alternative to chemicals, as these plant extracts have an important and effective role in feeding the plant and encouraging growth and flowering, because it contains many natural chemical compounds that do not harm the plant (2). Recently, in the biology, the scientists aims to reduce environmental pollution and the resulting damage as a result of the accumulation and decomposition of chemicals resulting from fertilizers and chemical growth enhancers, by using plant extracts as a substitute for these chemicals. Tomatoes (*Solanum Lycopersicum*) are considered one of the most important vegetables with great nutritional value because they contain minerals and carbohydrates. They are fleshy berries that vary in size and shape according to their many varieties. Using the plant extract as a substitute for these chemicals, so the aim of the study is to evaluate the effect of plant extracts on the growth and yield of tomato plants and compare it with chemical fertilizers.

Materials and Methods

The study location

A field experiment was conducted at the College of Education, University of Samarra, in a greenhouse, in order to study the effect of plant extracts (*Eruca sativa* extract and sisbania extract) on the development of tomato during the winter season on 111-2121.

Preparation of plant extracts

Leaves collecting stage

The leaves of *Sesbania* and *Eruca sativa* were collected, then cleaned, dried, after that grinded with the electric grinder, so they became powder of *Sesbania* and *Eruca sativa* leaves powder, then they were placed in nylon bags, then the name of each powder was written on the bag and preserved until use (4).

Preparation the aqueous extract

In the starting of the experimental parts (50 and 100) grams of *Eruca sativa* as well as *Sesbania* powder were weighed and was placed in a glass beaker and 1000 ml of sterile distilled water was added to it using an (Auto clave) device to obtain the different concentrations of each substance where the weight of 50 grams was added to it 1000 ml of water to obtain a concentration of 5% From *Eruca sativa* and with a weight of 100 grams of powder, 1000 ml of water was added to get a concentration of 10% and for both substances and each substance separately, and then the powder was left in the water for 24 hours so that the powder substance was completely dissolved in the water. Then the extracts were filtered by sterile gauze pieces and the filtrate was taken to separate in a centrifuge device for (15) minutes at a speed (3000 cycles per minute), then re-filtered by filter paper. Then the sediment was discarded and the filtrate was kept after placing each concentration in clean, sterile glass flasks, which are kept in the refrigerator until use (5).

Design of the experiment and the parameters used

After placing the soil, it was prepared in advance, sterilized, distributed in pots, and tomato seeds were planted with it, then the seedlings were fixed in the vegetable house, where the pots were distributed according to (RCBD). The experiment was carried out as a factorial experiment with two factors:

The first factor: spraying with plant extracts (*Eruca sativa* extract, *Sesbania* extract) with four different concentrations, two for each extract, as shown in the following table:

factor number	symbol	The details
T0	E0	only water
T1	E1	Spraying <i>Eruca sativa</i> extract first concentration 5%
T2	E2	Spraying <i>Eruca sativa</i> extract second concentration 10%
T3	S1	Spray with <i>Sesbania</i> extract first concentration 5%
T4	S2	Spray with <i>Sesbania</i> extract second concentration 10%
T5	E1S1	Spraying with a mixture of <i>Eruca sativa</i> and <i>Sesbania</i> extracts at a concentration of 5%

T6	E1S2	Spraying with Eruca sativa extract, first concentration, and sesban, second concentration
T7	E2S1	Spraying with Eruca sativa extract in its second concentration with Sisban in its first concentration
T8	E2S1	Spraying with Eruca sativa extract in its second concentration with Sesban second concentration

The second factor is triple chemical fertilizers

factor number	symbol	The details
T9	F	Treating plants with triple chemical fertilizers
T10	FE1	Spraying Eruca sativa extract, the first concentration, with the addition of fertilizers
T11	FE2	Spraying with Eruca sativa extract in its second concentration with the addition of fertilizers
T12	FS1	Spraying with sesban extract first concentration with the addition of fertilizers
T13	FS2	Spraying with sessipan extract in its second concentration with fertilizers
T14	FE1S1	Spraying with Eruca sativa and sesame extracts in their first concentration with the addition of fertilizers
T15	FE1S2	Spraying with Eruca sativa extract in its first concentration with sesban in its second concentration with the addition of fertilizers
T16	FE2S1	Spraying with Eruca sativa extract, the second concentration, with Sesban, the first concentration, with the addition of fertilizers
T17	FE2S2	Spraying with Eruca sativa extract, the second concentration, with sesban, the second concentration, with the addition of fertilizers

Spray Stage

After fixing the places of seedlings in the plant house and the pots were distributed randomly in their designated place, leaving a sufficient distance between all seedlings to prevent the arrival of the extract from one plant to another. (Eruca sativa and Sesbania by manual sprays with a capacity of (a quarter of a kilogram), the process of spraying was carried out on the vegetative

total of the plant (the stem and leaves) until complete wetness in the early morning usually to avoid high temperatures and by (9 sprays distributed every 20 days a spray (6) As for the treatments that were related to chemical fertilizers, it were given once every three weeks according to the recommendations of the Agricultural Office, as for the watering, it was manually watered with normal tap water and according to the age of the plant, where the seedlings were watered with water two to three times a week in the early stages of growth, then they need watering almost daily at the flowering and fruiting stages.

Attributes studied by experience

Characteristics of vegetative growth:

- plant height (cm)
- leaf area (cm²)
- The number of papers

Indicators of production

These readings were taken after obtaining the tomato fruits where they are calculated:

- Average fruit diameter (cm)
- average fruit weight (gm)
- The number of fruits per plant (the yield of the plant).

Statistical analysis

The results were statistically analyzed using the statistical program Minitab (Ver.17) according to the complete randomized design (RCBD) with the independent coefficients system. The arithmetic means of the coefficients were compared to determine the significant differences with Duncan's multinomial test with a probability level of 0.05 (7).

Results and Discussion

Effect of spraying with plant extracts and their interactions with chemical fertilizers on vegetative growth and production characteristics of tomato plants.

Characteristics of vegetative growth

Stem height

Figure (1-4) shows that when spraying plants with Sesbania extract with chemical fertilizers, it had a significant and noticeable effect on the rate of stem height since Treatment (FS1) gave the highest rate of stem height which it reached (41.75) cm, compared with the (EO) treatment which was not sprayed with any extract.

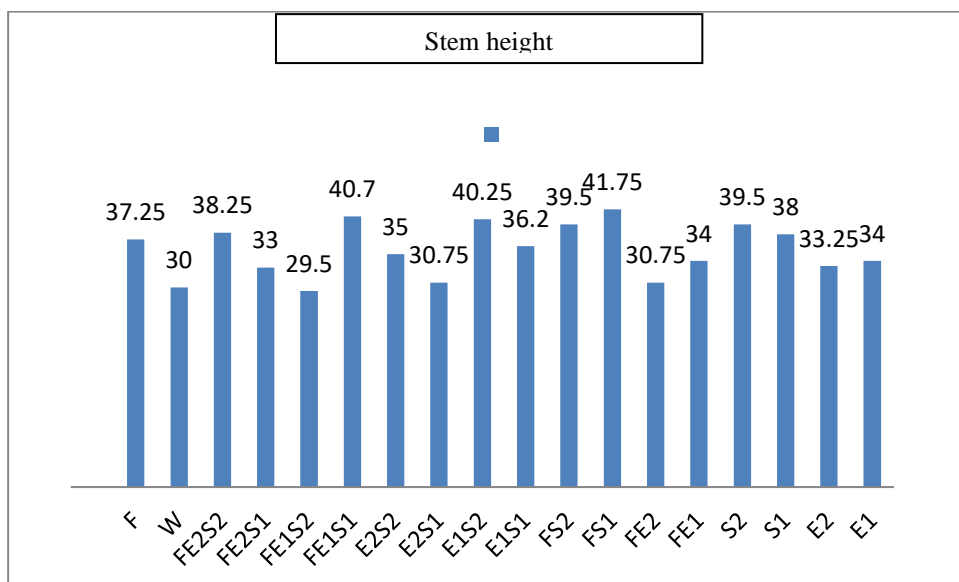


Figure 1-4. shows that Stem height

The average of leaves number

Figure (2-4) shows that spraying plants with Sesbania extract had a significant effect on the average number of plant leaves. Treatment (S1) recorded the highest average, reaching (382) compared with treatment (E2) (which sprayed with Eruca sativa extract), which gave the lowest rate of leaves number. (96.5).

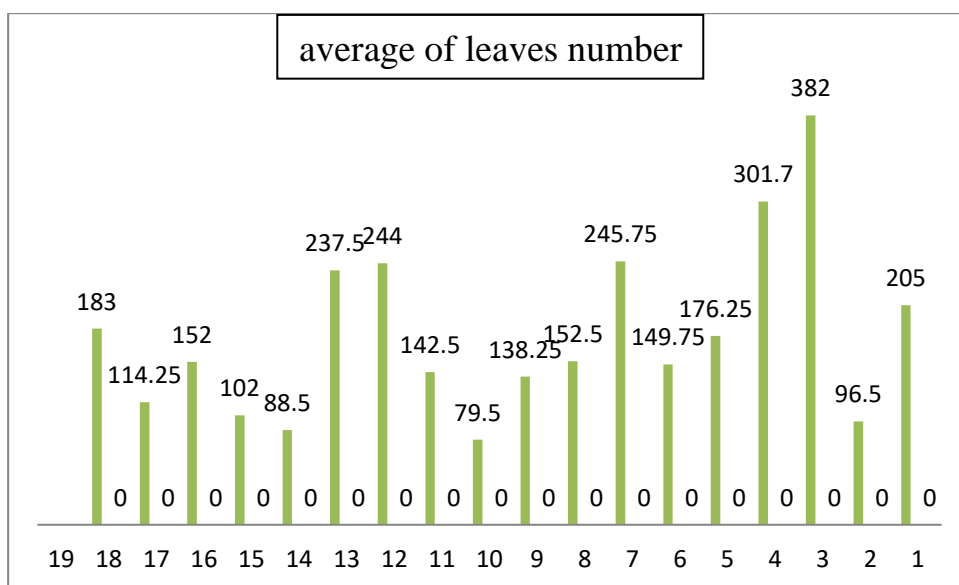


Figure 2-4. shows verage of leaves number

The area of the plant leaf

Figure 3-4 shows that spraying plants with Sesbania extract had a significant effect on leaf area characteristics, where the treatments (S1,S2) were characterized by giving the highest rate of leaf area amounted to (4.424) cm compared with the treatments (EO) which gave the lowest rate (2.132) cm. The reason for the increase in the vegetative growth characteristics of plants sprayed with Sesbania extract is that it contains many macro and micro nutrients that have an effective and important role in increasing the vital metabolic activities (8). The reason for this increase may be due to the increase in the number of leaves when sprayed with the extract, which in turn helps to increase the process of photosynthesis, which leads to the exploitation of the outputs of this process in the growth processes after cell division and thus increase the rest of the vegetative characteristics (9) and since the plant extracts have an effective role as the results showed an increase in vegetative growth, and this is consistent with what was stated by Al-Safi (2021) on the chrysanthemum plant, Whereas, spraying with Sesbania extract led to clear significant differences in the rate of vegetative and root growth, which in turn leads to an increase in the amount of water and nutrients absorbed from the soil and thus their transmission to the plant (10), and it agrees with Mahmoud (2021) on the spinach plant, and may be attributed to the reason for the increase in the characteristics of The vegetative growth to the optimal metabolism obtained by the plant that was sprayed with the extract, and this led to a balance between the macro and micro nutrients that the plant needs (12).

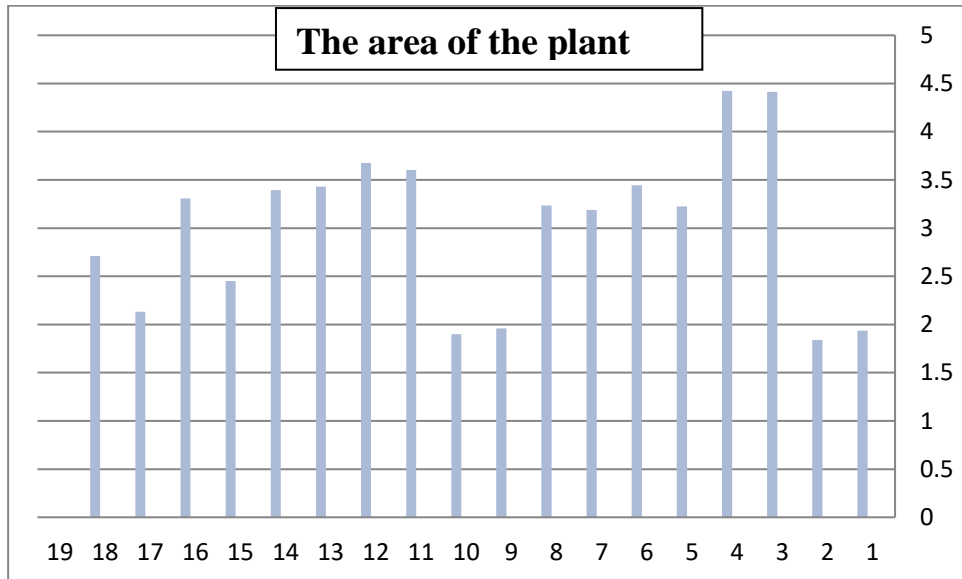


Figure 3-4. Shows the area of the plant

Effect of plant extracts and chemical fertilizers on production characteristics (yield)

The characteristic of the diameter of the fruit

Figure (4-4) shows that spraying the plant with Sesbania extract had a significant effect on the characteristics of fruits such as fruit diameter, where treatments (S1) were superior in that they gave the highest diameter of the fruit (10.75) cm, compared with treatment (FE1) (which sprayed Eruca sativa extract with fertilizers), which gave the lowest diameter (2.75 cm).

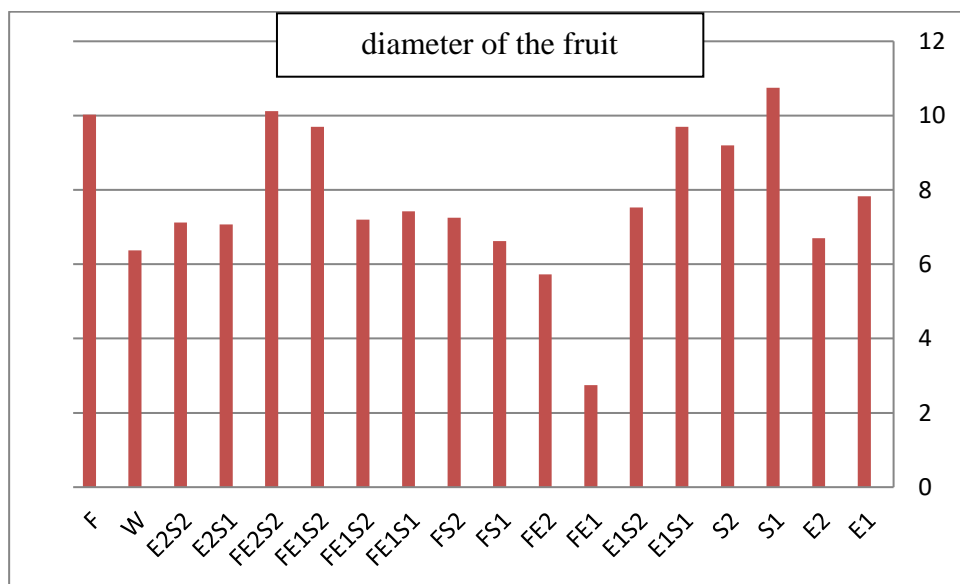


Figure 4-4. shows diameter of the fruit

Weight of the plant fruit

Figure (5-4) shows that when using plant extracts, it gave a positive increase, as treatments (S1) (which sprayed with Sesbania extract) gave the highest average fruit weight of 95 g, compared to treatments (FE2), which gave the lowest fruit weight rate. (21.5) g.

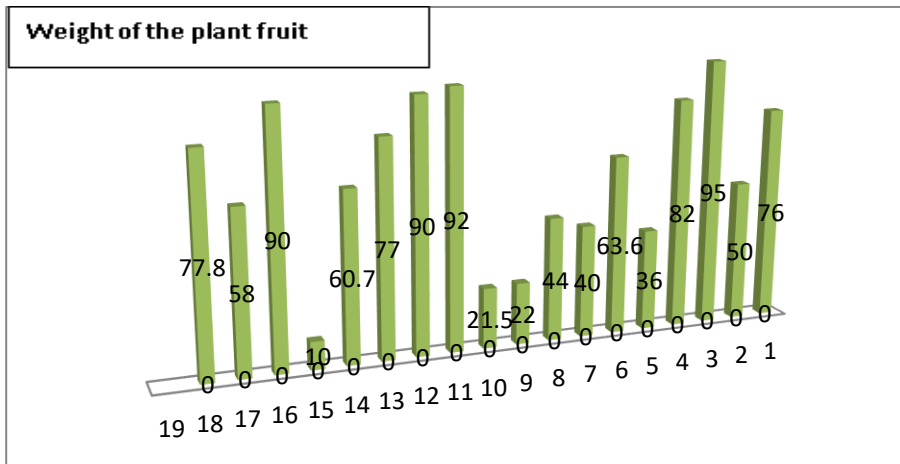


Figure 5-4. Shows weight of the plant fruit

Characteristic of the fruits number

Figure (6-4) shows that when spraying the plant with sesban extract, it gave a significant and clear increase in the number of fruits characteristic. The treatments (S2) gave the highest number of fruits (8 per plant compared to the treatments (EO) which gave the lowest rate of (3) fruits per plant Just. The reason for the change between plant extracts in the characteristics of vegetative growth, which was reflected on the production (the yield) and its components, may be due to the fact that these compounds were produced from plants belonging to multiple families and that they contain different chemical compounds and even secondary compounds that represent effective materials and according to their concentration used, they stimulate growth (13). The improvement of vegetative characteristics of plants and the characteristics of increased production came as a result of increased cell division and elongation (14). The superiority of the treatments of Sesbania with vegetative growth and production traits over the rest of the treatments is due to being a plant with a high content of nutrients such as (magnesium, potassium, phosphorous in addition to a large amount of calcium). It also contains minerals and vitamins, most importantly (vitamin A, C) in addition to To what it contains of proteins saturated with essential amino acids (15). Thus, it achieved positive results, and this is consistent with what was stated (16)and (17) on the pepper plant.

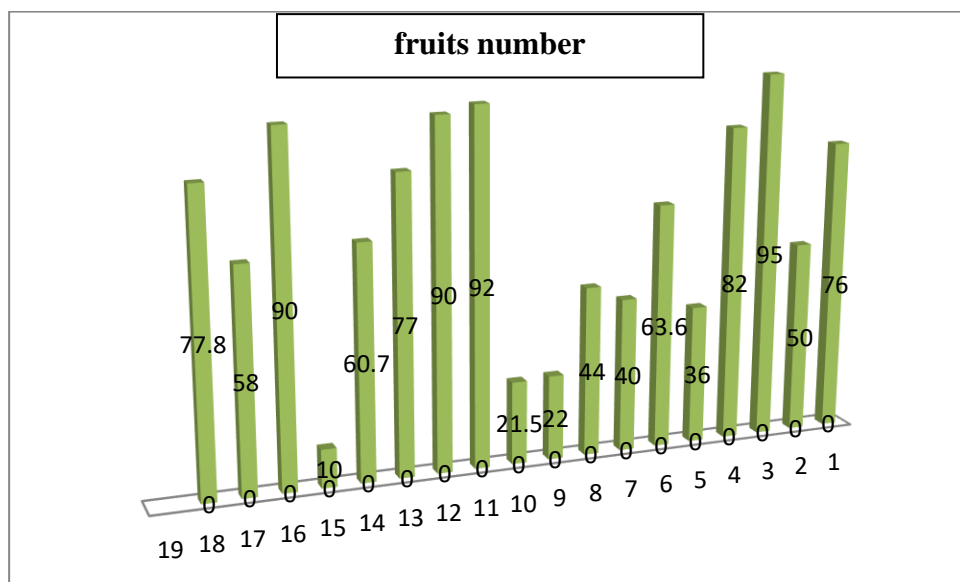


Figure 6-4. shows the fruits number

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