Effect of fertilizer type and spraying with growth regulator on growth and yield of squash in open cultivation

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Abstract:

Afield experiment carried out at the College of Agriculture / University of Diyala during the season 2021 according to Randomized Complete Block Design (RCBD) with three repeated, to study the effect of two factors. the first factors was to the soil fertilization by three types of the fertilizers, bird droppings and chemical Fertilizer 20-20-20 and Di Ammonium Phosphate . the second factor was spraying with growth regulator (Floratone), control treatment plants , Plants treated at a concentration of 0.6 $g.L^{-1}$ every 7 days every 14 days . The results showed the treatment of fertilizing with chemical fertilizer 20-20-20 was significantly superiority in the percentage of the flowering (66.96%) , fruits number (4.150 $fruits.plant^{-1}$) and early yield (662.6$g.plant^{-1}$) and a significantly superiority for untreated plants with Floratone (P_0) in the chlorophyll index (45.68).

Key word: squash, growth regulators, Yieidparameters.

Introduction

The squash plant (*Cucurbita pepo* L) is a member of the Cucurbitaceae family, which forms one of the main vegetable crops. It is locally called Mulla Ahmed squash and regionally, squash. It is a summer vegetable crop that is grown in spring and fall seasons in all regions of Iraq, as well as being cultivated in a protected facility. The importance of this crop is due to its uses and nutritional benefits, and its fruits are a rich source of nutrients (Encyclopaedia, 2018). Animal fertilizers are natural materials of biological origin that contain balanced concentrations of nutrients. The use of animal organic fertilizers is the best recycling process for materials that are subject. Most recent studies use organic fertilizers that are environmentally guarantee and not harmful to living organisms, as these materials are characterized by their ability to stimulate plant growth and increase production while maintaining safety and environmental health (Poras *et al*, 2011). The use of animal fertilizers as a partial or complete alternative to chemical fertilization has many beneficial effects such as improving nutrient absorption, increasing water holding capacity, reducing ammonia volatilization and improving soil biological system (Demir, 2019). The use of compound chemical fertilizer NPK is an important way to balance nutrients, improve the nutritional status of the plant, its development and increase production, and its use leads to an increase in production to about 50% (Ali and Mohamed, 2003). The process of nitrogen feeding regulates the action of plant hormones and increases the rate of meristematic cell division, and this positively affects the development of both the vegetative system and the root system (Hou *et al*, 2021 Phosphorus plays multiple and important roles for plants, which is essential to the plant process through the importance of phosphorus in the production of energy for the process, and its importance is one of the nutrients needed by plants in relatively large quantities (Tamimi and Razak,2016).This element has an important and influential role in the formation of nucleic acids, as well as ATP energy

compounds that have the capacity to supply the plant with the necessary energy, also to its role in entering into the installation of enzymatic accompaniments such as NAD , NADP Which has a role in adopting its activity many metabolic processes, and phosphorus plays an important role in cell division and thus contribute to the development of roots, which helps them spread and also contributes to the absorption of nutrients (Ali and Mohammed, 2003). Potassium is one of the major essential nutrients that plants need in large quantities. The distinguishing feature of potassium is that it is in the form of a free ion inside the plant and is included in the formation of any organic compound of the plant. However, its excess leads to the disruption of many functions in plants. Potassium comes in second place after Nitrogen is of importance to plant growth (Johnson *et al*, 2022). Plant growth regulators have an impact on vegetative growth as well as plant productivity and have various advantages such as consuming less time to treat the plant and are considered environmentally friendly, as it gives a rich yield of vitamins and minerals the use of growth regulators in vegetable production should be business-specific and toxicologically and ecologically safe (Swamy *et al*, 2021),and Auxien are important plant hormones, as they are associated with almost all stages of plant life and also play a vital role in establishing environmental conditions and thus improving growth (Mishra *et al*, 2022). Auxin is used commercially now to provide seedless fruits to the consumer when the seed begins to ripen after fertilization and the formation of the embryo. auxen is excreted from ovarian tissue, creating divisions and stretches in the cells surrounding the ovary, and forming the fruit tissues that surround the seed, so it is now agriculturally possible, after understanding how the fruit is formed by auxin, to produce fruits without the need for pollination and fertilization, by spraying flowers with auxin and in this way producing fruits without seeds without fertilization (Jing *et al*, 2022). Based on the foregoing, the study aimed to: Determine the appropriate ground fertilization for squash plants, as well as study the use of growth regulators manufactured for widespread use in the process of zucchini squash pollination and determine the most appropriate spraying time to improve plant productivity.

Materials and Methods

The field experiment was carried out during the agricultural season 2021-2022 in the open field of the Department of Horticulture and landscaping / College of Agriculture / University of Diyala in order to study the effect of the type of fertilizer added to the soil and artificial insemination on the growth and yield of squash in open cultivation. The research experiment was carried out using the Randomized Complete Block Design (RCBD) with three replications, the number of treatments was 9, and the number of experimental units was 27 experimental units the research experiment included two factors, the first: fertilizing the soil with three types of fertilizer (F): poultry waste (F1), Neutral chemical fertilizer 20-20-20 (F2) and DAP fertilizer (F3), while the second factor such as foliar spraying with Floratone (P) (Table 1): Without spraying (P0) and spraying with growth regulator at a concentration of 0.6 $g.l^{-1}$ every 7 days (P1) and spraying every 14 days (P2).

Table1. Components of the growth regulator Floratone used to improve fruit nodules percentage .

Concentration (W/W)	per 1kgComponents
1- Alpha naphthyl Acetic Acid	4.5 g
2- Alpha naphthyl Acetamide	12.5 g
3- Sticking and dispersing agents	35.0 g

Soil fertilization: The process of fertilizing the soil with chemical fertilizers was carried out according to the levels of the fertilizing factor F, and the fertilizers were added scattered on the cultivation terraces with an amount of 25 g. m^2 (250 $kg.ha^{-1}$) for each of the two types of chemical fertilizers and 3 volumetric liters of non-decomposed poultry fertilizer per m^2 and then stirred with the soil within a depth of 20 cm from the soil surface.

Irrigation: A drip irrigation system, GR type 16 mm, was installed with dots with planting distances of 40 cm within the line and with two irrigation lines for each sector (mastaba), the distance between the two planting lines is 50 cm.

Study Indications :
1- Evidence of chlorophyll in leaves (spad-502). 2- Leaf area of the plant (weighted method based on dry weight Samples of the outer leaves of five plants were taken randomly before the appearance of heads from each experimental unit and then weighed with an electronic balance and placed in an electric oven at a temperature of 70°C until the weight stabilized and the dry weight of the sample was measured and the percentage was calculated according to the following equation:

Percentage of dry matter (%)= (dry weight/wet weight)x 100 (Saloom, 1989) .

3- Percentage of the nodules.
4- The number of fruits .
5- Early yield (5 Harvestings). This characteristic was measured by calculating the cumulative yield from the beginning of the harvest until the end of the season, after which the product of each experimental unit was converted to (ton. ¯) according to the equation:

Total quotient (¯ ton) = (experimental unit quotient (ton .¯)/experimental unit area)* 10,000 (area per hectare). (Saloom, 1989)

Discussion and Results

The results of Table 2 show that there was no significant effect of the type of fertilizer used in soil fertilization (F) on the content of chlorophyll in the leaves of the plant, while we note the negative significant effect of the process of spraying with the industrial complex stimulator Floratone in this characteristic, as the highest value of chlorophyll content in the leaves was recorded when the plants were not sprayed (P0) reached 45.68 compared to the treatment of spraying with Floratone (P1) every seven days, which amounted to 42.25. The interaction between the fertilization and spraying agents with Floratone caused a significant difference in the chlorophyll content of leaves, as the highest value of 45.93 was observed when plants were not sprayed with poultry fertilizer (F1P0), while the lowest content was 41.32 recorded in plants fertilized with DAP fertilizer with plants sprayed every 7 days (F3P1).

It is noted from the results of Table 2 that there are no significant differences in the percentage of fruit nodules between soil fertilization treatments (F), but it was found that there was a clear significant superiority of the treatments of Floratone P1 and P2 pollinator in the percentage of fruit set compared to untreated plants, and the highest

percentage of it was recorded when spraying each 7 days (P1) followed without significant difference by spraying treatment every 14 days (P2) and they recorded 66.96% and 64.58% respectively, while the lowest fruit nodules percentage was for plants untreated with pollinator (P0), which amounted to 33.65%. The interaction between the type of added fertilizer and foliar spraying with Floratone pollinator produced the highest percentage of fruit set when fertilizing with neutral chemical fertilizer 20-20-20 with spraying with pollinator every 7 days (F2P1), which amounted to 70.68%, while the lowest percentage of fruit nodules was found in plants fertilized with (DAP) fertilizer with the plants left without spraying with the artificial inoculant (F3P0), which was 29.567%.

The results of Table 2 indicate that there was no effect of the type of fertilizer added to the soil (F) on the area one leaf of the plant, while spraying with nodules stimulator caused a significant effect when the highest area one leaf when not spraying with flower pollinator was 375.52 cm^2, compared to spraying treatment every 7 days (P1) Which gave its plants the least area one leaf 346.52 cm^2. It also showed that there was a significant effect of the interaction between the type of fertilizer and spraying with pollinator on the area one leaf of the plant, where the plants untreated with pollinator and fertilized with poultry fertilizer (F2P2) gave the largest area one leaf for the plant amounted to 416.90 cm^2, while the lowest area one leaf was when fertilizing with neutral fertilizer 20-20-20 And spraying with the pollinator every 7 days (F2P1), which amounted to 330 cm^2 .

The results of Table 2 showed that there was no significant effect of the type of fertilizer added to the soil (F) on the number of fruits of the plant, but it was found that there was a significant increase in the number of fruits harvested among plants treated with Floratone, and the highest number of fruits was recorded when spraying with the pollinator every 7 days (P1). 12.15 fruits.$plant^{-1}$, followed by the treatment of spraying plants with pollinator every 14 days (P2), which gave 11.89 fruits.$plant^{-1}$, while the least number of fruits was found in untreated plants, which amounted to 8,23 fruits.$plant^{-1}$. The interaction between the factors of ground fertilization and spraying with pollinator (FP) had a significant effect on the number of fruits of the plant, as the largest number of fruits was harvested for plants fertilized with chemical fertilizer neutral 20-20-20 and treated with artificial inoculant Floratone (F2P1), which amounted to 12,60 fruits.plant-1, while less The number of fruits found in each of the plants fertilized with poultry fertilizer and DAP fertilizer that were not treated with Floratone (F1P0 and F3P0) pollinator, as it reached 8,20 fruits. $Plant^{-1}$.

The results of Table 2 showed that the neutral fertilizer gave the highest early yield of 662.6 g.$plant^{-1}$, compared to the treatment of fertilizing with poultry fertilizer, which produced the lowest yield of 598.6 g.$plant^{-1}$. Spraying with Floratone produced a significant and clear effect on the early plant yield when the highest yield was recorded when spraying with the pollinator every 7 days (P1), which reached 838.7 g.$plant^{-1}$ with a significant difference from the lowest yield recorded for plants untreated with the inoculum (P0), which yielded 253.0 g.$plant^{-1}$. The interaction of the two experimental factors produced a significant effect when it recorded the highest yield of 880.4 g. $plant^{-1}$ when fertilizing with the equivalent compound fertilizer 20-20-20 and spraying the plants with flower pollinator every 7 days (F2P1), while the lowest yield was for the treatment of fertilizing with poultry fertilizer without spraying with Floratone (F1P0), which produced an early yield of 235.8 g.$plant^{-1}$..

Table2. Effect of fertilizer type and Floratone nodule stimulator on growth and yield indicators of squash.

treatments	Chlorophyll index (Spad-502)	one Leaf area $cm^2.plant-1$	Flower nodules %	Number of fruits $fruit.plant^{-1}$	early yield $g.plant^{-1}$
F1	45.15	349.28	55.214	9.24	598.58
F2	44.92	382.41	54.94	9.39	662.58
F3	45.00	359.58	55.03	9.30	635.67
LSD	2.71	49.65	4.88	0.75	53.56
P0	44.68	375.52	33.65	8.23	253.08
P1	45.25	346.52	66.96	12.15	837.83
P2	45.14	369.23	64.57	11.89	805.92
LSD	2.71	49.65	4.88	0.75	53.56
F1P0	44.92	356.62	36.07	8.20	235.75
F1P1	46.07	351.21	64.21	12.30	786.00
F1P2	44.45	340.01	65.35	11.85	774.00
F2P0	44.72	400.28	35.30	8.90	280.00
F2P1	45.37	330.06	70.68	12.60	880.50
F2P2	44.67	416.90	58.84	11.70	827.25
F3P0	44.40	369.66	29.57	8.20	243.50
F3P1	44.32	358.29	65.98	12.45	847.00
F3P2	46.30	350.79	69.53	11.85	816.50
LSD	4.70	85.99	8.45	1.29	92.77

Discuss the results:

The results showed that there were no significant differences for the type of fertilizer used in soil fertilization as an independent effect on growth and vegetative indicators the reason for this may be due to the quantities used in fertilizing, which provided close growth requirements among them, especially since it contains the necessary nutrients that the plant needs in order to continue in growth and development, as it is effective in biological processes and is involved in many important compounds that contribute to the metabolic processes of plants (Kazim and Al-Mamouri, 2017).

It also showed that there is a clear significant superiority of the treatments that were not spraying with the growth regulator Floratone in the content of chlorophyll, the

number of leaves and the leaf area (Table 1) causes an increase in the rates of flowering and an increase in the yield that competes with the vegetative system in the processed nutrients, in addition to that these compounds increase the levels of auxin in the plant and encourage plants to enter the age of old, and this was confirmed by previous studies that the increase in the construction of auxin stimulates the production of ethylene through the conversion of methionine to ethylene in vegetative tissue, which is considered an aging hormone, causes deterioration of vegetative characteristics (Girek *et al*, 2013). It is noticed from the overlapping effect of the same tables that the plants fertilized with neutral fertilizer are better in vegetative characteristics compared to other fertilizers and this may be due to the role of potassium as an enzymatic companion for many vital reactions in the plant and the regulation of the water content of plant cells (Abu Dahi and Al-Younes, 1988) and thus the plant became more resistant for chemical stresses caused by spraying with a growth regulator.

The results of the tables showed that treatment with the growth regulator Floratone containing auxin-building compounds as an independent effect, regardless of the spraying durations (P1) and (P2), increased the percentage of nodules and plant yield compared to the untreated plants (P0), and thus the high concentration of auxin could stimulate an increase in flowers feminine and thus increase plant yield (Girek *et al*, 2013), and these results are consistent with what was reached (Mancini *et al*, 2007).

The results showed that the interaction of the experimental factors showed that there was a significant superiority in the characteristics of the percentage of flower nodules, the number of fruits and the early yield of the plant when fertilizing with neutral chemical fertilizer and spraying with Floratone to each of the role of the regulator in improving the nodules, in addition to that the balance of macronutrients (NPK) is important in the continuous growth of the plant, especially in the stage of vegetative growth, flowers and nodules, with equal absorption rates and balanced growth (Al-Shahat, 2007) and the integrated fertilizer contains elements that enter as an enzyme catalyst, such as potassium, as well as phosphorous that enters the composition of enzymatic compounds such as NAD, NADP, which have a role in adopting its activity in many of the vital processes of the plant (Ali and Muhammad, 2003) and that potassium has an important effect on the growth and yield of the plant, as it contributes to regulating the water balance inside the plant, increasing photosynthesis, transferring sugars inside the plant and activating the work of enzymes, as it was found that potassium affects more than 91 enzymes (Rawat *et al*, 2022).

Conclusions :

1- vegetative characteristics of the plant were negatively affected as a result of treating the plant with Floratone regulator compared to the untreated plants, which were significantly superior in most of them (Table 1, 2, 3, and 4), while the dry weight of the roots was the rank superiority for the share of DAP fertilizer.

2- In the conditions of spraying with knot catalyst, the superiority in the yield characteristics in favor of fertilizing with neutral chemical fertilizer was 20-20-20 compared to DAP fertilizer and poultry fertilizer.

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