# Effect of planting date and spraying with Nutrients containing amino acids on the growth parameters of dry onion and its seed production

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## Abstract

The field experiment was conducted during the season 2021-2022 at the research station of the Department of Horticulture and Landscape Engineering / University of Diyala in order to study the effect of planting date and spraying with nutrients containing amino acids on the growth and production of dry onions and the production of its seeds .The study included two factors, the first planting date: 1/12, 21/12, 7/1 and 1/2, and the second factor was spraying with nutrients containing amino acids( without spraying, spraying with Tecamin Max, spraying with Ascophila, and spraying with Amino Quelant-K). The experiment included sixteen treatments with three replicates, so the total experimental units became forty-eight experimental units. The split plot design (R.C.B.D) was used, and the results were analyzed statistically using the SAS statistical program, and the results were compared using Duncan's multinomial test at the probability level of 0.05. The results showed that the plants planted in the first date (1/12) excelled in the vegetative growth traits represented by the diameter of the bulb neck (31.39 mm) and the leaf area (38.51 dm2), compared to the date 1/2, which amounted to 18.40 mm and 18.02 $dm^2$, respectively .The same treatment also excelled in the chemical traits of the leaves, represented by the percentage of nitrogen (2.46%), the percentage of phosphorus (0.30%), and the percentage of potassium (3.39%), compared to the date 1/2, which amounted to 1.62%, 0.19%, and 1.98%, respectively. The same treatment also excelled in the characteristics of the seed yield represented by the weight of 1000 seeds (3.80 g) compared to the date 1/2, which amounted to 2.75 g. As for spraying with amino nutrients, the results showed that there was a significantly excelled when spraying with the amino nutrient Tecamin Max in the vegetative growth traits represented by the diameter of the onion neck (29.04 mm) and the leaf area (36.77 dm2).Compared to the control treatments, which amounted to 21.40 mm and 22.74 dm2, respectively, and also excelled in the chemical traits in the leaves represented by the percentage of nitrogen (2.71%) and the percentage of phosphorus (0.30%) compared to the control treatment, which decreased to 1.33% and 0.19%, respectively. Whereas, the amino nutrient Amino Quelant-K excelled in the percentage of potassium per ounce (3.38%), compared to 1.62%, compared to 1.62%. Also, the amino nutrient Tecamin Max was significantly excelled in the traits of seed yield represented by the weight of 1000 seeds (3.67 g) compared to 2.90 g.The effect of the interaction between planting date 1/12 and the amino nutrient Tecamin Max on vegetative growth traits .As the interaction gave a significant increase in the diameter of the onion neck (36.42 mm) and the leaf area (47.38 dm2) compared to date 1/2 with the control treatment, which amounted to 17.10 mm and 15.15 dm2, respectively, as well as the effect of the same interaction on the chemical traits of the leaves, as the interaction gave an increase Significant in the proportion of nitrogen (3.37%) and phosphorus (0.36%).Compared to the 1/2 date with the control treatment, which amounted to 1.27% and 0.17%, respectively, while the interaction between the 1/12 sowing date with the amino nutrient Amino Quelant-K was excelled in the percentage of potassium per ounce (3.69%) compared to the 1/2 date with control treatment, which amounted to 1.54%, The planting date 1/12 and the amino nutrient Tecamin Max were excelled in the seed yield represented by the weight of 1000 seeds amounting to (4.33 g) compared to the date 1/2 with the control treatment, which amounted to 2.50 g.

## Introduction

Onion , whose scientific name *Alliumm cepa* L, is a herbaceous plant belonging to the Amaryllidaceae family, which is classified as monocotyledonous plants and is of the genus Allium, where it includes more than 500 species, the most famous of which are onions and garlic (1),Believed to have originated in Afghanistan, Iran, and the USSR, onions are now produced in more than 175 countries (2).The latest statistics of the Central Agency of the Ministry of Planning in Iraq for the year 2021 indicated that the area cultivated in onions amounted to 35,716 dunums, with a production of 74,177 tons, and an average productivity of 2,076 tons / dunum (3) It is known that onions are rich in antioxidant compounds and that its consumption contributes to the prevention of some diseases related to oxidative stress, and many epidemiological studies have confirmed that regular onion consumption reduces the incidence of various forms of cancer in addition to cardiovascular and neurological diseases (4, 5). Foliar spraying with amino acids are considered one of the methods of great importance in modern agriculture, which could become one of the basic directions in scientific research and its theoretical and applied purposes alike, as it leads to improving the quality of crops and increasing their productivity.It is also one of the main cellular components of the plant, as it works to regulate the number of branches in the plant that participate in the metabolic pathways. It also works to improve the components of the crop, improve its quality, and increase the proportion of protein (6),Where it was found (7) that the use of amino acids sprayed on onion plants at a concentration of 2 ml L-1 led to a significant increase in the traits of onion neck diameter and leaf area, It was also found (8) when using amino acids at a concentration of 1.5 liter feddan-1 spray on the onion plant, which led to a significantly excelled in the proportion of nitrogen, phosphorus and potassium. Al-Abdali (9) indicated that cultivation on the 30th of November gave the best results for the yield of onion seeds.Based on the above, this experiment aimed to study the effect of planting date and spraying with nutrients containing amino acids on the growth and production of dry onions and the production of its seeds.

## Materials and Methods

A field experiment was conducted during the season 2021-2022 at the research station of the Department of Horticulture and Landscape Engineering - College of Agriculture - University of Diyala, Where the field designated for agriculture was prepared, starting from removing the bushes, plowing , smoothing, leveling, and dividing them into longitudinal flats. The experiment included 9 plot, each one 75 cm wide and 1.5 meters long, and every three plot represent one replicates. The distance between one table and another is 50 cm .Each replicates included 16 experimental units, each with an area of 3.375 $m^2$ .Two terrace were used for the purpose of taking measurements of vegetative growth and yield traits, and one terrace was to extract measurements of seeds and the distance between one plant and another 12 cm alternately.

### study factors

**The experiment included a study of two factors:**

First: Planting dates, which include four dates

1-The first date was cultivated on 1/12/2021

2-The second date was cultivated on 21/12/2021

3-The third date was cultivated on 7/1/2021

4-The fourth date was cultivated on 1/2/2021

Second: spraying with some nutrients containing amino acids, including

1-spraying(control)

2-Spraying with Tecamin Max

3-Spraying with Ascophiloa

4- Spraying with Amino Quelant – K

Amino acids were sprayed in five time, the first spray after 45 days from the date of cultivation for each appointment, and between spraying and the next three weeks, and following table 1 shows the names of the nutrients and the components of each nutrient.

**Table 1. Components of nutrients containing Nutrient composition**

| Amino Quelant - K | Ascophila | Tecamin Max |
|---|---|---|
| 1- Free amino acids 5%<br>1% organic nitrogen<br>Water soluble potassium (K2O) 25% | 1- Seaweed extract 20%<br>2- Free amino acids 5%<br>3- Nitrogen 5%<br>4- Magnesium 8.2%<br>5- Iron 3% | 1- Total amino acids 14.4%<br>2- Free amino acids 12%<br>3- Nitrogen 3.5%<br>4- Organic matter 20%<br>5- C/N 2.5 |
| Usage rate 300-400ml/ 100 liters of water | It is used as a spray on the leaves at a rate<br>Add 250g/200 liters of water<br>As recommended by the manufacturer | It can be added to water Irrigation at the rate of adding 200 ml /<br>100 liters of water |

The Randomized Complete Block Design (RCBD) and split plot design were used.

planting dates were randomly distributed in the main plots, and spraying treatments with some nutrients containing amino acids in the subplots were also distributed randomly .The experiment included four treatments for planting dates and four treatments for amino acids, meaning that each strip contains 16 experimental units, thus the number of experimental units is 48 units .The study indicators included the diameter of the neck of the bulb, the leaf area, the percentage of nitrogen, phosphorus and potassium, and the weight of 1000 seeds. Where the nitrogen element was estimated by the process of evaporation and distillation by the Kjeldahl-Micro apparatus. As for the element phosphorous, it was estimated by spectrophotometer at a wavelength of 882 nm, while potassium was estimated by flamephotometer.

**Results and discussion**

**Onion neck diameter (mm)**

The results presented in Table 2 indicate that there are significant differences between the planting dates, where the plants cultivated in 1/12 excelled by giving them the highest diameter of the bulb neck amounting to 31.39 mm, followed by plants planted in 21/12 with 29.81 mm, while the last date was recorded as low. The minimum neck of the onion diameter was18.40 mm.The results also indicated that there was a significant effect between the spraying treatments with amino nutrients in the trait of the onion neck diameter, where the amino nutrient Tecamin Max excelled by giving the largest onion neck diameter of 29.04 mm. While the treatment without spraying recorded the least diameter of the neck of the bulb amounted to 21.40 mm. The interaction between planting dates and spraying with amino nutrients had a significant effect on the traits of onion neck diameter. The interaction treatment for the planting date 1/12 and 21/12 with spraying with the amino nutrient Tecamin Max excelled with the highest diameter of the bulb neck reaching 36.42 mm and 34.96 mm respectively, while the fourth date with the unsprayed treatment showed the lowest diameter of 17.10 mm.

**Table 2. The effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on the diameter of the bulb neck (mm).**

| Planting date average | Nutrients containing amino acids | | | | Planting date |
|---|---|---|---|---|---|
| | Amino Quelant-K | Ascophila | Tecamin Max | control | |
| 31.39 A | 31.24 bc | 33.39 ab | 36.42 a | 24.53 d | 12/1 |
| 29.81 A | 29.42 c | 31.32 bc | 34.96 a | 23.57 de | 12/21 |
| 22.49 B | 21.67 defg | 22.62 def | 25.25 d | 20.43 efgh | 1/7 |
| 18.40 C | 18.20 gh | 18.80 gh | 19.53 fgh | 17.10 h | 2/1 |
| | 25.13 B | 26.53 B | 29.04 A | 21.40 C | Nutrient averages |

*** Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.**

## Leaf area ($dm^2$)

The results in Table 3 indicated that there were significant differences between the planting dates, where the plants planted in 1/12 excelled by obtaining the highest average leaf area of 38.51 $dm^2$. Followed by plants cultivated on 12/21, which amounted to 35.43 $dm^2$, compared to plants grown on the 1/2 date, whose value decreased to 18.02 $dm^2$.The results in the same table also indicate that there are significant differences when spraying the Amino acids nutrients, where the plants sprayed with the amino nutrient Tecamin Max recorded the highest rate of leaf area amounted to 36.77 dm2, compared to the control treatment, whose value decreased to 22.74 $dm^2$.Also, the interaction had a significant effect between planting dates and amino nutrients.Where the plants that were planted on 1/12 and sprayed with the amino nutrient Tecamin Max excelled from the rest of the treatments and gave the highest leaf area of 47.38 $dm^2$. In comparison with the planting date 1/2 and the plants that were not sprayed, the value of which decreased to 15.15 $dm^2$.

**Table 3. The effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on leaf area ($dm^2$)**

| Planting date average | Nutrients containing amino acids | | | | Planting date |
|---|---|---|---|---|---|
| | Amino Quelant-K | Ascophila | Tecamin Max | control | |
| 38.51 A | 37.14 de | 40.95 bc | 47.38 a | 28.57 g | 12/1 |
| 35.43 B | 34.80 e | 39.05 cd | 42.59 b | 25.28 h | 12/21 |
| 29.84 C | 29.94 fg | 31.57 f | 35.87 e | 21.99 i | 1/7 |
| 18.02 D | 17.18 jk | 18.50 j | 21.26 i | 15.15 k | 2/1 |
| | 29.76 C | 32.51 B | 36.77 A | 22.74 D | Nutrient averages |

* Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.

**The percentage of nitrogen in the leaves (%)**

Table 4 shows that there are significant differences for the planting dates in the percentage of nitrogen in the leaves. The planting date was 1/12 significantly higher and gave 2.46%.This is followed by the date of 12/21, which reached 2.36%, followed by the date of 1/7, which amounted to 2.07%, compared to the date of 2/1, which gave the lowest average of 1.62%.The same table also shows that there are significant differences when spraying nutrients containing amino acids. The amino nutrient Tecamin max gave the highest percentage of nitrogen in the leaves, amounting to 2.71%. It was followed by Ascophila, which reached 2.26%, followed by Amino Quelant-K, which reached 2.19%, while the control treatment gave the lowest percentage of nitrogen, amounting to 1.33%. The interaction between planting dates and spraying with amino nutrients had a significant effect on the percentage of nitrogen in the leaves.The interaction between the planting date 1/12 and the amino nutrient Tecamin max gave the highest percentage of nitrogen in the leaves, amounting to 3.37%, compared to the fourth planting date, with treatment without spraying with the amino nutrients, which gave the lowest percentage of 1.27%.

**Table 4. The effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on the percentage of nitrogen in the leaves (%).**

| **Planting date average** | **Nutrients containing amino acids** | | | | **Planting date** |
|---|---|---|---|---|---|
| | **Amino Quelant-K** | **Ascophila** | **Tecamin Max** | control | |
| **2.46 A** | **2.53 c** | **2.56 c** | **3.37 a** | **1.38 h** | **12/1** |
| **2.36 B** | **2.41 cd** | **2.51 c** | **3.16 b** | **1.35 h** | **12/21** |
| **2.07 C** | **2.21 e** | **2.31 c** | **2.43 cd** | **1.32 h** | **1/7** |
| **1.62 D** | **1.63 g** | **1.68 g** | **1.89 f** | **1.27 h** | **½** |
| | **2.19 B** | **2.26 B** | **2.71 A** | **1.33 C** | **Nutrient averages** |

*** Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.**

**The percentage of phosphorus in the leaves (%)**

The results Table 5 show that there is a significant difference between the planting dates. The planting date 12/1 excelled and gave a significant increase in the percentage of phosphorus in the leaves, amounting to 0.30%, followed by the date 12/21, without a significant difference of 0.29%, while the last date gave the lowest percentage of phosphorous, amounting to 0.19. %.Also, the results in the table showed that spraying with amino nutrients was significant in the percentage of phosphorus in the leaves, as the amino nutrient was superior to Tecamin Max and gave the highest percentage of phosphorus, reaching 0.30%, followed by Ascophila, which reached 0.28%, followed by Amino Quelant-K, which reached 0.26%, while the treatment without spraying gave the lowest. A rate of 0.19%.Also, the interactions between planting dates and spraying with amino nutrients had a significant effect on the percentage of phosphorus in the leaves. The treatment of the planting date 1/12 and the date 21/12 and spraying with Tecamin max acid significantly excelled and the rest of the treatments and gave 0.36 and 0.35%, respectively. Compared to the planting date 1/2 with treatment without spraying with amino nutrients, which gave the lowest percentage of which amounted to 0.17%.

**Table 5. Effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on the percentage of phosphorus in the leaves (%)**

| Planting date average | Nutrients containing amino acids | | | | Planting date |
|---|---|---|---|---|---|
| | Amino Quelant-K | Ascophila | Tecamin Max | control | |
| 0.30 A | 0.32 b | 0.32 b | 0.36 a | 0.21 f | 12/1 |
| 0.29 A | 0.30 bc | 0.31 b | 0.35 a | 0.21 f | 12/21 |
| 0.25 B | 0.26 e | 0.28 ed | 0.29 cd | 0.19 fg | 1/7 |
| 0.19 C | 0.18 gh | 0.20 fg | 0.21 f | 0.17 h | 2/1 |
| | 0.26 C | 0.28 B | 0.30 A | 0.19 D | Nutrient averages |

*** Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.**

**Percentage of potassium in the leaves (%)**

The results Table 6 indicate that there is a significant difference between the planting dates, where the planting date 1/12 excelled and gave the highest percentage of potassium in the leaves, reaching 3.39%.It was followed by the planting date of 12/21, which reached 3.15%, followed by the planting date of 1/7, which gave 2.57%, while the fourth date was lower and gave the lowest rate of 1.98%. The results also showed in the same table that there is a significant difference in the percentage of potassium in the leaves when using amino nutrients.The amino nutrient Amino Quelant-K was significantly superior and gave the highest percentage of potassium in the leaves, reaching 3.38%, followed by Tecamin Max, which reached 3.22%. It was followed by Ascophila, which reached 2.87% compared to the control treatment, which gave the lowest rate of 1.62%. The results also indicated in the table that there is a significant effect of the interaction between planting dates and amino nutrients. The interaction between the planting date 1/12 and the amino nutrient Amino Quelant-K gave the highest percentage of potassium in the leaves, reaching 4.13%. While the percentage of potassium decreased at the time of planting 1/2 with treatment without spraying with amino nutrients, which amounted to 1.54%.

**Table 6. The effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on the percentage of potassium in the leaves (%)**

| Planting date average | Nutrients containing amino acids | | | | Planting date |
|---|---|---|---|---|---|
| | Amino Quelant-K | Ascophila | Tecamin Max | control | |
| 3.39 A | 4.13 a | 3.79 c | 3.69 abc | 1.68 h | 12/1 |
| 3.15 B | 4.06 ab | 3.01 d | 3.88 bc | 1.66 h | 12/21 |
| 2.57 C | 3.01 d | 2.77 e | 2.90 de | 1.63 h | 1/7 |
| 1.98 D | 2.32 f | 1.93 g | 2.15 f | 1.54 h | 2/1 |
| | 3.38 A | 2.87 C | 3.22 D | 1.62 D | Nutrient averages |

*** Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.**

**Weight of 1000 seeds (g)**

The results presented Table 7 show that there were significant differences for the planting dates in the weight of 1000 seeds, as the plants cultivated in 1/12 excelled by giving them the highest seed weight of 3.80 g. Then it was followed by the date 21/12, which reached 5.57 g, followed by the date 7/1, which reached 3.03 g, while the last date gave the lowest seed weight, amounting to 2.75 g. Also, the results in the same table indicate that there are significant differences when spraying with date plants decreased with the treatment without spraying and gave the lowest weight of 2.50 g. amino nutrients. Tecamin Max was significantly excelled on spraying with the amino nutrient and gave the highest seed weight of 3.57 g, while the untreated plants gave the lowest seed weight of 2.90 g. As the table shows, there is a significant effect of the interaction between planting dates and spraying with amino nutrients. The plants sown on 1/12 with spraying with the nutrient Tecamin Max were significantly excelled and gave the highest seed weight amounting to 4.22 g, while the last

**Table 7. The effect of planting dates and spraying with nutrients containing amino acids and the interaction between them on the weight of 1000 seeds (g).**

| Planting date average | Nutrients containing amino acids | | | | Planting date |
|---|---|---|---|---|---|
| | Amino Quelant-K | Ascophila | Tecamin Max | control | |
| **3.80 A** | **3.81 c** | **4.03 b** | **4.22 a** | **3.14 e** | **12/1** |
| **3.57 B** | **3.49 d** | **3.72 c** | **4.04 b** | **3.03 ef** | **12/21** |
| **3.04 C** | **3.03 ef** | **3.07 e** | **3.13 e** | **2.94 fg** | **1/7** |
| **2.75 D** | **2.79 h** | **2.83 gh** | **2.89 gh** | **2.50 i** | **2/1** |
| | **3.28 C** | **3.41 B** | **3.57 A** | **2.90 D** | **Nutrient averages** |

*** Values that share the same letters are not significantly different from each other according to Duncan's multiple range test at the probability level of 0.05.**

It is clear from the results presented in Tables 2 and 3 that there are significant differences when planting in 1/12 in the traits of vegetative growth (onion neck diameter, leaf area),The reason may be due to the increase in the diameter of the neck of the onion on the first date (1/12) as a result of the increase in chlorophyll, which was positively reflected in the increase in the diameter of the neck of the onion.The reason for the increase in the leaf area of the plants in the first date (1/12) and its decrease in the late planting date may be due to the long period of plant growth, the hours of lighting that the plant needs, and the appropriate temperatures, which gives more opportunity for the leaf to grow and expand its area (11, 12). Perhaps the reason for the excelled of the first date plants in Tables 4, 5 and 6 (nitrogen, phosphorus and potassium) is due to the relatively long growth period (compared to the fourth date).As it provided the plant with a greater opportunity to absorb nitrogen, phosphorus and potassium and increase its percentage in plant leaves (13),The reason for the excelled of the first date plants in Table 7 (weight of 1000 seeds) may be due to the appropriate environmental conditions of temperature, relative humidity, light and sunshine that are suitable for increasing the rate of photosynthesis and the increase in the

production of nutritional compounds, which is reflected in the increase in growth and the production of inflorescences from the seeds, and the accumulation of nutrients in the seeds, which leads to an increase in production (14), and this is supported by an increase in vegetative growth indicators, which reflects positively on the plant's production of seeds and thus an increase in its weight. Tables 2 and 3 also showed that spraying with the amino nutrient Tecamin Max gave a significant excelled in vegetative growth traits (onion neck diameter and leaf area).The reason for this may be due to the fact that it contains 18 types of amino acids, in addition to the free amino acids (Table 1), which are considered a necessary source in building enzymes and proteins and provide the energy needed to metabolize nitrogen and improve plant growth (15) as well as regulate the metabolic processes that encourage growth processes. By providing them with proteins and vitamins necessary for plant growth (16 and 17),and thus improving the vegetative growth traits represented by the diameter of the neck of the bulb and the leaf area, as tables 4, 5 and 6 showed that there were significant differences when spraying the amino nutrients, where the amino nutrient Tecamin Max was significantly excelled in the percentage of nitrogen and phosphorus, while the amino nutrient Amino Quelant-K was excelled in the proportion of potassium.The reason for the excelled of the amino nutrient Tecamin Max in the ratio of nitrogen and phosphorus may be due to the fact that it consists of many amino acids (Table 1) that work to increase the vegetative growth of the plant in addition to that increasing the leafy area had a great impact on the proportion of these elements in the plant and by increasing the leaf area the process of photosynthesis increased and thus It activates all vital processes and thus increases its accumulation in the leaves, which leads to an increase in the absorption of these elements. The reason for the increase may be attributed to the essential role of amino acids in building enzymes for the photosynthesis process, in addition to their role in supplying the plant with the nitrogen element that participates in building vitamins, proteins and other compounds (18). The reason for the excelled of the amino nutrient Amino Quelant-K in the percentage of potassium in the leaves may be attributed to its containment of this element, which led to its accumulation (Table 1), as Table 7 showed the excelled of the amino nutrient Tecamin Max in the weight of 1000 seeds, The reason may be due to the role of amino acids in the accumulation and production of nutrients in seeds such as carbohydrates, vegetable oils and proteins, in addition to their role in transporting nutrients from leaves to storage parts (seeds) due to the role of amino acids in the production of cytokinins that act as a downstream of nutrients ( 19).

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