European Journal of Agricultural and Rural Education (EJARE)
Available Online at: https://www.scholarzest.com
Vol. 5 No. 07 July 2024
ISSN: 2660-5643

EFFECT OF ADDING PROLINE ON NITROGEN AVAILABILITY OF GROWING LEGUMINOUS CROPS UNDER DATE PALM *PHOENIX DACTYLIFERA* L.

[1]Taghreed M. K. AlFarjawi.
[1]Data Palm Research Center, University of Basrah, Iraq
[2]Fatimah A. Jamel
[2]Department of Field Crops, College of Agriculture, University of Basrah, Iraq
Fatima.chamel@uobasrah.edu.iq

Article history:

Received: 7th May 2024
Accepted: 4th June 2024

Abstract:

The study was conducted in a farmer's orchard in the Al-Yuba/Al-Jazeera area in the north of Basrah Governorate during the 2022-2023 agricultural season. To determine the effect of proline acid and its role in reducing the negative effect of sodium chloride on the vegetative stage of alfalfa plant and its impact on the readiness of nitrogen when growing alfalfa around palm trees, using Four treatments (0, alfalfa, p1, p2). where 12 date palm trees, Al-Sayer variety, were selected as homogeneous as possible in terms of vegetative growth, height, size, and age. The results of the study showed the significant effect of the study treatments on most of studied traits of Al Sayer fruits. As the P2 treatment excelled in the weight of the fruit and seed as well as in the length, diameter, and size of the seed, as the following averages were recorded as 6.950 g, 6.233 g, 3.627 cm, 1.653 cm, and 5. 260 cm3, respectively. The P2 treatment also excelled in maturity percentage, shoot weight, and total yield, reaching 68.330%, 6.810 kg, and 40.847 kg, respectively. Adding proline to alfalfa crop around palm trees at a concentration of 30 ppm played a major role in increasing the yield.

Keywords: Date Palm; Al-Sayer class; Alfalfa; Proline; yield.

INTRODUCTION

Date palm. dactylifera L. Phoenix is of great economic importance in the world, because this blessed tree offers fruits rich in nutrients and high economic value, which contributes significantly to national income (Ibrahim 2008). Iraq is considered one of the most important date-producing countries in the world (Hassan 2005), but its productivity is suffering from a decline due to the neglect of palm orchards and the lack of fertilization programs, which are among the main factors in the success of palm cultivation. Studies have proven the importance of adding fertilizers to palm trees to provide them with the necessary nutrients. The most important of these elements are nitrogen, phosphorus, and potassium, which are among the main nutrients for date palms. These elements are usually obtained through fertilizers (Shahraki al et, 2012). The technology of biological fixation of atmospheric nitrogen, which is carried out by leguminous crops such as jelly beans, chickpeas, chickpeas, and other leguminous crops. Is of great importance, as these crops are characterized by their symbiotic nature with root nodule bacteria, as they provide a cheap food source for plants as an alternative to mineral fertilizers and contribute to reducing pollution. Soil and water. The lack of knowledge among farmers about the side effects of using mineral fertilizers, in addition to the high cost of fertilizers, constitutes a major challenge. Legume crops play an important role in overcoming these challenges, as they encourage protein synthesis as a result of their high protein content, provide nitrogen for subsequent crops in the same soil, and improve soil properties (Mahmoud et al., 2010; Lateifa 2012; Bandana and Peter, 2014).

Agricultural lands suffer from many challenges, the most important of which are water shortages and salinity. Salinity is one of the main factors that negatively affect the growth of plants, as it reduces their absorption of water and essential nutrients while causing the accumulation of toxic ions such as sodium and chloride in their cells (Mu'nis, 2005). This problem has greatly worsened with the increase in agricultural area and population growth. Which makes managing water resources efficiently necessary to achieve optimal exploitation of them (Yassin, 1992). Many environmental factors also affect the determination of productivity, starting from seeds and plant growth, up to the various stages of growth, due to the accumulation of dissolved salts in the soil to a degree exceeding their natural levels.

Legume plants, such as alfalfa plants, are crops of great economic importance, but their cultivation faces difficulties in saline soil. Studies indicate that the number of root nodules in legume plants decreases significantly in saline soil, despite the presence of root nodule bacteria (rhizobia) on the roots (Al-Sabah et al., 2017).

Proline is a non-essential amino acid that plays an important role in plant resistance to environmental stresses, including salinity. Therefore, scientific research is directed towards finding a solution to mitigate the negative effects of salt stress conditions by spraying good amounts of proline acid. As it works to control the osmotic pressure of plant tissue cells and has an important role in the plant's resistance to salt stress, as it is considered a storehouse of carbon and nitrogen necessary for plant growth under stress conditions. Therefore, this study aims to know the effect of proline acid and its role in reducing the negative effect of sodium chloride on the vegetative stage of alfalfa plant and the effect of this on the readiness of nitrogen when planting alfalfa around the palm, and to know the effect of this on the natural yield characteristics of the palm.

MATERIALS AND METHODS

The study was conducted in a farmer's orchard in the Shatt al-Arab District in the Yuba region, north of Basrah Governorate, during the 2022-2023 season, where 12 date palm trees, the Al-Sayer variety, were selected as homogeneous as possible in terms of vegetative growth, height, size, and age. The palm trees were approximately 12 years old. The soil was prepared. Around the palm trees by plowing to a depth of 5 cm, then basins were made around the selected palm trees with a diameter of 2 m, and service work was carried out for the palm trees planted at a distance of (5 x 5) m, and the transactions were carried out as follows:

1. Planting alfalfa plants around the palm tree in a circle with a diameter of 2 m.
2. P1 = Treating alfalfa plant grown around the palm tree with proline at a concentration of 20ppm.
3. P2 = Treating alfalfa plant grown around the palm tree with proline at a concentration of 30 ppm.
4. The comparison treatment was left without cultivation and without spraying with proline.

Preparation of proline acid concentrations. First, the base solution Stok is prepared from proline acid by weighing 1 g of it and dissolving it in 1000 ml of distilled water to obtain a base solution with a concentration of 1000 parts per million (mg. L-1), after which the required concentrations are prepared (20, 30). mg liter-1) according to the dilution law, in addition to the control treatment, which is zero mg liter-1. These concentrations were prepared shortly before the spraying process. alfalfa spraying was carried out 30 days after planting under the palm trees.

The number of stems was determined in all treatments, leaving six stems per palm tree. Each treatment included three replicates, and each palm tree was considered one replicate (experimental unit). Thus, the total number of palm trees for the experiment was 12 palm trees with the comparison treatment. The following characteristics were evaluated:

1- Fruit weight, fleshy layer and seed

A comparative study was conducted on the characteristics of Rutab fruits by analyzing ten fruits that were taken randomly from each replicate and for each treatment. The weight of each fruit was measured using a sensitive balance, then the seeds were removed from each fruit and their weight was measured separately, and then the average weight of the fruit and kernel was calculated for each treatment. . The weight of the fruit flesh was also extracted by subtracting the weight of the seed from the total weight of the fruit. Ten fruits in the wet stage were taken randomly from each replicate and for each treatment, and their weight was recorded using a sensitive balance. Then the seeds were removed from the fruits and their weight was recorded, and then the average weight of the fruit and kernel for each treatment (seed) was calculated.

2- length, diameter and size of the fruit

In the rutab stage, the length and size of the fruits were measured for ten fruits from each replicate in each treatment and for all treatments, using the Vernier electronic caliper in units (cm). Then the length and diameter of the fruit were extracted by dividing the sum by the number of fruits. As for the size of the fruit, it was done using a graduated cylinder. Capacity 500 ml. A known volume of water was placed in the graduated cylinder, and the 20 fruits were placed. The size of the fruits was measured by finding the difference between the water level in the two cases, then extracting the average volume of one fruit, cm3, by dividing the size difference by the number of fruits.

3- Maturity rate

The percentage of fruit maturity after entering the rutab stage was calculated by taking five fruit buds for each replicate, and the percentage of maturity was calculated as in the equation: -

% of maturity = Number of ripe fruits (rutab)/Total number of fruits *100

4- Grain weight and total yield per offshoot

Data on the total yield of each tree was collected, ensuring that each tree's yield was accurately weighed using a field scale that measured in kilograms. The number of shoots in that tree, resulting in the individual shoot weight for each tree, divided the total yield of each tree. The shoot weights for all trees within each treatment were summed, and then this sum was divided by the number of trees in the treatment, resulting in an average weight of the price for every transaction.

Statistical analysis

The experiment was designed using a randomized complete block design (R.C.B.D). Complete Block Design Randomized As a simple experiment with four treatments and three replications for each treatment, the number of experimental units was 12 trees, divided into three sectors. Each sector contains four trees, the treatments were randomly distributed over them, and the experimental unit represented one palm tree. The results were analyzed

using analysis of variance and the differences between Averages using the least significant difference (L.S.D.) (least significant difference) and at a probability level of 0.05, based on (Al-Rawi and Khalaf Allah, 1980).

RESULTS AND DISCUSSION

1- Weight of fruit (g)

The results in Table (1) showed the significant effect of all treatments on the average fruit weight in the rutab stage, as alfalfa treatment recorded the highest average fruit weight of 7.043 g, which did not differ significantly from the P2 treatment, which gave an average of 6.950 g. As for the lowest average fruit weight, it was recorded by the comparison treatment amounted to 5.247 g, which differed significantly from the rest of the other treatments. The reason for the increase may be attributed to the role ofalfalfa in fixing high amounts of nitrogen and because nitrogen has an important role in building proteins and nucleic acids in fruits and increasing the activity of the photosynthesis process and the formation of carbohydrates and its role in the activity of Protein, enzymes, and chlorophyll, which leads to an increase in the weight of the fruit (Taiz and Zeiger, 2002). In addition to the positive role of proline acid in regulating osmotic potential and water potential, which increases the cell's ability to withdraw water from the growth medium, thus increasing plant growth and the process of photosynthesis. Proline is a source Nitrogen, which helps build protein and thus provides the plant with energy, which leads to an increase in fruit weight (Al-Hammoudi, 2009).

2- Seed weight (g).

From Table (1) there are no significant differences in all coefficients for this trait.

3- Weight of fleshy layer (g).

Table (1) shows the significant effect on the average fleshy layer weight as a result of adding proline and planting leguminous plants around palm trees. Treatment P2 recorded a significant superiority compared to the comparison treatment in fleshy layer weight, amounting to 6.233 g, and did not differ significantly from the other treatments - Jet and P1, which recorded weights of 6.133 and 6.027. g respectively, while the comparison treatment recorded the lowest weight of 4.370 g.

Cultivation of legumes and the addition of proline may have a primary role in increasing mineral elements, especially nitrogen and carbon storage, which are necessary for plant growth under conditions of salt stress. Also, many studies have shown that the concentration of nitrogen in leaves (wickers) has a positive effect on increasing meat weight, and these results are consistent with what was found (Jassim and Al-Arab, 2016).

Table (1) Effect of alfalfa plant cultivation and treatment with proline on the weight of the fruit, seed, and fleshy part of date palm fruits at the rutab stage.

Treatments	Fruit weight (g)	Seed weight (g)	Fleshy layer weight (g)
Control	5.247	0.853	4.370
Alfalfa	7.043	0.870	6.133
P1	6.493	0.877	6.027
P2	6.950	0.870	6.233
L.S.D 0.05	0.2589	N.S	0.2253

4- Length, diameter and size of fruit (cm).

The results in Table (2) indicated the significant effect on the characteristics of length, diameter, and size of the fruit resulting from adding treatments and planting legumes around palm trees. In the character of length, all treatments recorded a significant superiority compared to the comparison treatment, as treatment P2 gave the highest average of 3.627 cm. As for the lowest length of the fruit, it was recorded by treatment comparison treatment reached 2.917 cm. As for the diameter of the fruit, it was a significant increase for all the treatments studied compared to the comparison treatment. Treatment P2 recorded the highest value for the average diameter of the fruit, reaching 1.653 cm, while the lowest diameter was in the comparison treatment, reaching 1.257 cm, Table (2).

As for the average size of the fruit, and from the results shown in Table (2), the effect was significant for all the treatments studied compared to the comparison treatment, as the P2 treatment recorded the highest average size of the fruit, which did not differ from alfalfa treatment, as they recorded 5.260 and 5.247 cm3, respectively, as for the lowest average size. The fruit, when treated as a comparison, amounted to 5.213 cm3. The reason for this is attributed to the role of nitrogen fixed by cultivated leguminous plants, in addition to the mineral elements present in the soil, the essential role in the process of photosynthesis, the construction and accumulation of carbohydrates and proteins, and increasing the efficiency of the process of photosynthesis and physiological processes, in addition to the role of proline in stabilizing proteins and molecular structures, in addition to being resistant to stress. Accompanying local growth during the growth period, and these results are consistent with (Saqr, 2010) and (Shaima and Jahbdeh, 2019).

Table (2) effect of alfalfa plant cultivation and treatment with proline on the length, diameter, and fruit size of date palms in the rutab stage.

5-

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit size (cm3)
Control	2.917	1.257	5.213
Alfalfa	3.552	1.587	5.247
P1	3.523	1.587	5.213
P2	3.627	1.653	5.260
L.S.D 0.05	0.03176	0.02997	0.02922

Maturity rate %

It is clear from the results of Table (3) that there is a significant increase in the maturity rate due to the cultivation of alfalfa around palm trees and the addition of proline, as the P2 treatment, outperformed the rest of the treatments, recording the highest average of 68.330%, while the lowest average was 44.057% in the comparison treatment. The reason may be due to the abundance of elements. Minerals, especially nitrogen resulting from stabilizing the root nodules, which has a role in compensating for the deficiency occurring in these elements as a result of the setting and growth of fruits. These results are consistent with (Al-Duri and Al-Rawi, 2000) and through treatment with proline acid, its effectiveness was different in counteracting the effect of salinity with the changes and additions studied (Jassim and Al-Arab, 2016).

6- Offshoot Weight (kg)

The results shown in Table (3) indicated the significant superiority in the average offshoot weight of treatment P2, which recorded the largest stem weight of 6.810 kg, and that it did not differ significantly with alfalfa treatment, which recorded weight of 6.600 kg, while the comparison treatment recorded the lowest average offshoot weight of 5.313 kg. The reason for this is attributed to the role of proline added at different levels to alfalfa, which encourages and stimulates the growth and increase of palm productivity, in addition to the role of the nitrogen fixed by alfalfa, which leads to the formation of proteins and amino acids that have the main function in the processes of photosynthesis and thus increase the metabolic products, and this affects the weight of the fruits (El -Taib et al. 2021).

7- Total yield (kg)

Among the results shown in Table (3) is that the total yield characteristic of the palm tree behaved similarly to the characteristic of offshoot weight, as the average total yield of the tree increased. The moral superiority of the treatments was observed, as the P2 treatment recorded the highest average amounting to 80.847 kg, and the lowest value recorded by the comparison treatment amounted to 31.843 kg and was superior. Treatments due to the cultivation of leguminous plants, especially alfalfa, which has the role of preparing the soil with elements, especially nitrogen, as it is one of the components of proteins, enzymes and photosynthesis, which causes an increase in the average weight of the fruit and reduces the fall of the fruit and thus leads to an increase in yield. These results are consistent with (Havlin et al. 1999).

Table (3) Effect of alfalfa plant cultivation and treatment with proline on the productive traits of date palms in the rutab stage.

Treatments	Maturity rate %	offshoot weight (kg)	Total yield (kg)
Control	44.057	5.313	31.843
Alfalfa	64.317	6.600	39.713
P1	52.603	6.317	36.313
P2	68.330	6.810	40.847
L.S.D 0.05	0.1606	0.03034	0.03508

REFERENCES

1. Al-Douri, A.; and Adel A. (2000). Fruit Production - Dar Al-Kutub Printing and Publishing Press - University of Mosul - Iraq: 532 pages
2. Al-Hamoudi, M. A. Athbi .(2000). Response of four varieties of wheat (Triticum aestivum L.) to added concentrations of proline under different levels of water stress. Master's thesis, College of Education for Pure Sciences, University of Karbala.
3. Al-Rawi, K. M.; and Khalafallah, A. M. (1980). Design and analysis of agricultural experiments. Dar Al-Kutub Foundation for Printing and Publishing, University of Mosul, Iraq.
4. Al-Sabah, R. (2017). The effect of salinity on the formation of root nodules and their functions in legume plants. Journal of Agricultural Microbiology, 39(2): 233-242.
5. Bandana Biswas and Peter M. Gresshoff (2014). The Role of Symbiotic Nitrogen Fixation in Sustainable Production of Biofuels. Int. J. Mol. Sci. 15: 7380-7397
    a. Date fertilization using statistic quality control case study: date
6. El- Taib, A.B.A.; M.A. Bakheit ; A. Awadalla and A.S. Abd El- Galil (2021). Impact of Proline Foliar Spray on Yield and its Components of Some Soybean Genotypes under Newly Reclaimed Soils. Assiut J. Agric. Sci., 52 (5) 2021

(64-75) Greenhouses. Journal of Agricultural Sciences, 36(3), 577-588. groves of Sistan and Baluchistan province, Iran International Journal

7. Havlin ,J. L.; Beaton, J. D. ; Tisdal, S. L. and Nelson, W. L. (1999) .Soil fertility and fertilizers: an Introduction - to Nutrient management, 6th edition, New Jersey, United States of America. Distribution of nutrients in barley and Corn (*Zeamays* L.) . Agron. J. 62: 46 – 48.
8. Ibrahim, A. B. O. (2008). The date palm is the tree of life. The Arab Center for Studies of Dry Zones and Dry Lands "ACSAD" (390) pages.
9. Jassim, A. M.; and Imad H. A. S. A. (2016). The effect of adding NPK complex fertilizer and planting leguminous plants on some physical and productive characteristics of date palm fruits (dactylifera Phoenix L. Al-Sayer cultivar). Dhi Qar University Journal of Agricultural Research, Volume 5 (1) of 2016.
10. Lateifa S. Assefat, (2012). Biofertilizer and Its Role in Reducing Water Pollution Problems with Chemical Fertilizers. Libyan Agriculture Research Center Journal International 3(S2), 1457-1466
11. Mahmoud, Y. A.; Ahmed H. L.; Saad O. F. (2212) The reality of the use of fertilizers by orchard farmers in the Tarmiyah district in Baghdad and the degree of their knowledge of its dangers. Al-Anbar Journal of Agricultural Sciences, Volume: 8, Issue 4.
12. Munis, A. H. (2005). The effect of salinity on the growth of some winter vegetable plants under conditions of Agriculture: Research and Review. vol.6:
13. Saqr, M. T. (2012). Plant Physiology, First Edition - Mansoura University - Arab Republic of Egypt.
14. Shahraki,J; Ali,S .S. AND Esmail, G. (2012) Economical management of Date fertilization using statistic quality control case study: date groves of Sistan and Baluchistan province, iran International Journal of Agriculture: Research and Review. vol.6:
15. Sherwana, S. S. J. (2019). The effect of proline acid and its role in reducing the negative effect of sodium chloride on the vegetative stage of wheat plants. Master Thesis. College of Natural and Life Sciences. Constantine University 01.
16. Taiz, L.; and Zeiger, E. (2002). Plant Physiology. 3rd edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts.
17. Yassin, Bassam Taha (1992). The science of water stress in plants. Dar Al-Kutub for Printing and Publishing, University of Mosul - Iraq