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Response of Malabar neem trees (*Melia dubi*a Cav.) to the amount of fertilizer added and the method of application

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ABSTRACT

This experiment on Malabar neem trees (*Melia dubia Cav.*) aimed to know the extent to which some vegetative growth traits of these trees are affected by the amount of NPK fertilizer added and the method of addition. The experiment was designed according to a two-factor randomized complete block design (RCBD), the first factor: adding balanced NPK fertilizer (20, 20, 20) at three levels (60, 120, 180) g.plant^{-1} and the second: number of NPK fertilizer batches (6, 12, 24) batches.plant^{-1}. The data were analyses by use SAS program the difference between various treatments means are tested with Duncan Multiple range test at the 5% probability level. The results showed that the plants treated with a concentration of 180 g. plant^{-1} were significantly superior in all studied traits (number of branches, number of leaves, stem diameter, stem height, branch diameter and branch length) compared to the same studied traits with the lowest concentration of 60 g. plant^{-1}. As for the factor of the number of NPK batches, the fertilizer batch 6 batches. 4 weeks^{-1} was superior to the batches 12 and 24 respectively in the traits of number of branches, number of leaves, stem diameter and main stem height. The study concluded that the amount of fertilizer 180 g. plant^{-1} had a positive effect in improving the studied vegetative growth traits. but for the batches number factor, there was no noticeable effect appear on the trees size at the end of the experiment period due to the small amount of fertilizer used.

مدى استجابة أشجار نيم المالابار (*Melia dubia* Cav.) لكمية السماد المضاف وطريقة الإضافة

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الخلاصة :
هدفت هذه التجربة على أشجار نيم مالابار(*Melia dubia* Cav.) لمعرفة مدى تأثر بعض صفات النمو الخضري لتلك الأشجار بكمية سماد NPK المضافة وطريقة الإضافة، وصممت التجربة وفق تصميم القطاعات العشوائية الكاملة (RCBD) ثنائية العوامل ،العامل الأول : إضافة سماد NPK المتوازن (20،20،20) بثلاث مستويات (180،120،60)غم.نبات$^{-1}$ والثاني: عدد دفعات سماد NPK (24،12،6) دفعة.نبات$^{-1}$. وتم تحليل البيانات باستخدام برنامج SAS وتم اختبار الفرق بين متوسطات المعاملات المختلفة باستخدام اختبار دنكان متعدد الحدود عند مستوى احتمال 5% . أظهرت النتائج الى أن النباتات المعاملة بتركيز 180 غم.نبات$^{-1}$ تفوقت معنويا في جميع الصفات المدروسة (عدد الأفرع وعدد الأوراق وقطر الساق وإرتفاع الساق وقطر الأفرع وطول الأفرع) مقارنة بنفس الصفات المدروسة مع أقل تركيز 60غم.نبات$^{-1}$ أما عامل عدد دفعات NPK تفوقت الدفعة السمادية 6 دفعة. 4أسابيع$^{-1}$ على الدفعتين 12 و 24 على التوالي في صفات عدد الأفرع و عدد الأوراق و قطر الساق و ارتفاع الساق الرئيس . وخلصت الدراسة أن لكمية السماد 180 غم.نبات$^{-1}$ أثر إيجابي في تحسين صفات النمو الخضري المدروسة ، اما عامل عدد الدفعات فلم يظهر ذلك التأثير الملحوظ في حجم الأشجار في نهاية فترة التجربة بسبب قلة كمية السماد المستخدم .

الكلمات المفتاحية : نيم المالابار ، كمية السماد ، عدد الدفعات .

INTRODUCTION

Melia dubia Cav. is one of the huge trees of the tropical and subtropical regions. It is one of industrial woody trees and belongs to the family Meliaceae. It is primarily cultivated on a large scale for its industrial and medicinal importance. India is the original home for this tree, Southeast Asia, and Australia . It is a deciduous to semi-evergreen tree ,the leaves fall during the months, September and January, and new leaves appear in February and March with flowers, the tree's branches are widely spread with bright leaves. As for the flower, it is an axial pink cluster 12-20 cm long. it is small, greenish-white, and appear in clusters with the new leaves growth. The fruit is oval or elliptical with longitudinal pulp protrusions. It ripens in the winter and turns yellow. It contains 3-4 seeds and have attractive smell (Goswami *et al*., 2020).

The tree is characterized by a spreading crown and a cylindrical stem 9 m high, straight and smooth, with dark brown, fibrous bark that peels off in long, rectangular slices, the tree height reaches 30 m, and it is fast growing, as its general growth rate ranges from 20-25 cm per year when managed well and from 6- 8 cm per year in case of unmanaged farms (Chauhan and Thakur, 2020). The tree grows at an altitude of 1500-1800 m and prefers sandy alluvial soils, while the growth stops in shallow, gravel soils. It requires a pH of 5.5-7 for the soil and an annual temperature rate 23-43 °C, the tree is demanding of sunlight and grows well at an annual rainfall rate of 750 - 1500 mm and a relative humidity of 50-90% and is characterized by its ability to adapt to different agricultural climatic conditions (Goswami *et al*., 2020).

This tree has spread rapidly in Indian subcontinent in the past decades and has become one of the most important trees for farmers in many states of India due to its rapid growth nature, as it forms pulp wood after 3-4 years, plywood and veneer can be obtained after 6-8 years, it can be used as an alternative source of raw materials used in paper manufacture and pulp. However, if the tree is left to grow until 10-12 years old, wood of high economic value can be obtained, which is characterized by its ductility. which involved in many light wood industries, such as light furniture manufacture, matches, and musical instruments (Chauhan and Thakur, 2020). For its environmental importance, it helps prevent temperature rise and reduce the emission of gases into the atmosphere, and because trees are distinguished by their ability to adapt with different agricultural climatic conditions, it absorb the maximum amount of carbon dioxide and thus may contribute to reducing the phenomenon of global warming. *Melia dubia* Cav. trees also have many medicinal properties, as the plant extract is generally used as an effective anti-cancer, and the leaf and fruit extract is used as antioxidant and to inhibit of some insects growth which is harmful to plants. The fruit extract is also used as an effective anti-diabetic, while the essential oil of the leaves is used as anti-fungal for many bacteria and fungi. Sources indicate that many compounds found in different parts of the plant can be used as effective biocides against the larvae of some insects (Goswami *et al*., 2020). Due to the importance of nitrogen, phosphorus and potassium in plant growth and increasing the size of trees, NPK compound fertilizer has been adopted in fertilization processes because it is known to be quickly absorbed by the plant and improves the efficiency of absorbing positive ions such as calcium and magnesium and has a high degree of purity as it is free of chlorine and sodium and is also characterized by the possibility of storing it for a long period compared to single fertilizers (Bakht, 2020). Nitrogen is known to combine with carbon formed in plants to produce many organic compounds, including proteins, amino acids, lipids, vitamins, and others (Awad, 1987) . It is also essential in the green pigment (chlorophyll), which is important in the process of photosynthesis. It also enters into the composition of plant hormones (Havlin et al. 2005). Phosphorus is considered the second most important major element in plants due to its physiological importance in the formation of nucleic acids (DNA) and (RNA). Therefore, it is one of the basic components of the genetic material of the cell. It also participates in the process of respiration, photosynthesis, and energy transfer ATP (Barad *et al*., 2010).

Potassium participates in rapid cell division and stimulates the activity of various enzyme systems. Increasing its concentration leads to an increase in the diameter of the stems because it acts as a catalyst for iron absorption (Ayemi *et al*., 2017). Potassium plays an important role in regulating the process of opening and closing the stomata and thus regulates the absorption of carbon dioxide necessary for the process of photosynthesis (Abu Dahi and Al-Younes, 1988). Finally, Importance of research is to know the effect of adding the fertilizer requirement at once, or dividing this batch and adding the same quantity, but in the form of multiple batches and at different intervals. The aim of the study is to determine how affected the vegetative growth of these trees by NPK fertilizer quantity added and the number of its batches on some characteristics of vegetative growth.

MATERIALS AND METHODS

The study was conducted at the sand dune stabilization station in Baiji district of Salah al-Din Governorate, which is about 220 km north of Baghdad, for the period from 1/3/2022 to 15/11/2022 on Malabar neem trees(*Melia dubia* Cav.) to determine the effect on vegetative growth of these trees by quantities of NPK fertilizer the additive (the first factor) and the number of batches (the second factor) through its effect on vegetative traits.

Study factors and studied characteristics:

The experiment was designed with two factors and three replications.

(1) The first factor: the amount of NPK fertilizer added, which is at three levels (60, 120, 180) grams.

(2) The second factor: the number of fertilizer batches, which is also at three levels, as shown below:

1) One batch every four weeks (the quantity is divided into 6 batches).

2) A batch every two weeks (the quantity is divided into 12 batches).

3) One batch every week (the quantity is divided into 24 batches).

Thus, we have 3X3X3 = 27 experimental units. At the end of the experiment, the following vegetative traits were measured:

1. Branches Number: branches number was calculated for each experimental unit, then the data was recorded and statistically analyzed.

2. Leaves Number: leaf number was calculated for each experimental unit, then the data was recorded and statistically analyzed.

3. Main stem diameter: The stem diameter was measured at a height of 15 cm from the soil surface for each experimental unit using a vernier foot, then the data was recorded and analyzed statistically.

4. Stem height: Stem height was measured using a tape measure from the soil surface level to the end of main branch growing tip. Then the data was recorded and analyzed statistically.

5. Branch length: The length of each branch in each plant was measured using a measuring tape, the measurements were recorded, and then the data was analyzed statistically.

6. Branch diameter: The diameter of each plant branch was measured using a vernier foot, the measurements were recorded, and then the data was analyzed statistically.

Site selection

A site free of windbreaks was chosen to determine the species response in the study to desert environmental conditions.

Planting dimensions, cultivation method, and irrigation system

The holes were made with dimensions of (50x50x50) cm2, and an amount of mixed soil was placed at the bottom of each hole. The planting dimensions were (2x2) m2. Then one seedling was placed in each hole and buried with mixed soil. Then the soil was compacted well around each tree, noting that all the trees were the same age. As for the irrigation system, the drip irrigation method was used with (9) drip pipe lines according to experiment design.

Irrigation

The seedlings were irrigated every three days for the months of April, May, June, and October. As for the months of July, August, and September, the trees were irrigated every two days.

Fertilizer type, quantity, and batches number

The compound fertilizer NPK (Sangral) neutral (20,20,20) was used in powder form the amount of fertilizer representing the first factor was distributed in three levels (60, 120, 180) grams on each replicate of the experiment. The three batches representing the second factor were divided into (6 batches/month, 12 batches/two weeks, 24 batches/week) also for each replicate and (1) kg of humic acid was added at planting for each experiment with irrigation water.

Agricultural service operations

Tree service operations, including irrigation, weeding, and control, continued throughout the study period, with frequent maintenance of drip irrigation pipes, especially maintenance of water flow points at each tree (nozzles) to prevent them from blocking.

Statistical analysis

This experiment was performed by use randomized complete block design (RCBD), the data were analyses by use SAS program the difference between various treatments means are tested with Duncan Multiple range test at the 5% probability level (Al-Rawi and Khalafallah 1980**)**.

RESULTS AND DISCUSSION

Table (1) indicates that there are significant differences in the amount of fertilizer effect added on branches number, as the highest number of tree branches with the amount of fertilizer 180 gm.plant-1 reached 10,278 branches.plant-1. While the lowest branches number was with fertilizer amount 60 gm. Plant-1, where branches number reached 5,481 branches. Plant-1. The reason may be due to the increase in the products of the photosynthesis process as a result of

doubling the percentage of nutrients that led to stimulating growth and encouraging and increasing branches number on the plant. This is consistent with what (Al-Assadi, 2016) reported in his study on the response of olive seedlings to foliar spraying with the mineral fertilizer NPK, and it also agrees with the results of (Qasim and Hammo 2024) in his study on Influence of Shading, GA3 and NPK fertilizer on the growth and development of Myrtle *Myrtus communis* plants .

As for the batches number effect, the plant number branches was highest with 6 fertilizer batches, reaching 8,611 branches. Plant-1, while the lowest branches number with 24 fertilizer batches amounted to 5,556 branches. Plant-1 The reason is the decrease in the fertilizer amount added with the increase in fertilizer batches number, or perhaps the reason is the role of major elements of added fertilizer, especially the elements phosphorus and potassium, as phosphorus contributes Mainly in energy production and gives the plant the strength to grow, increase branches number, and strengthen the root system (Al-Sahhaf, 1989), Potassium also contributes to plant cell division and encourages the growth of meristematic tissues and the carbohydrates formation in the leaves. after it move to the growth and storage areas of the plant, enzymes and hormones are activated that stimulate the plant to form new growth and form new branches (Al-Nuaimi, 1999).

As for the interaction between the factors of fertilizer quantity and number of batches, Table (1) indicates that the plants treated with 180 g. plant-1 and a number of batches of 6 batches. 4 weeks-1 gave the best result for the number of branches, which amounted to 12,722 branches. plant-1 compared to the lowest value of 3,889 branches. plant-1 at (60 g. plant-1 and 24 batches). Perhaps the reason is that despite the increase in the number of batches, a period of one week may not be sufficient to observe the positive effect of the amount of added fertilizer.

Table (1) The effect of NPK fertilizer quantity (g) and batches number on branches number of *Melia dubia* Cav. trees (branches.plant^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	5.444 bc	7.222 bc	3.889 c	5.481 b
120 g (A2)	7.766 bc	3.889 c	5.444 bc	5.667 b
180 g (A3)	12.722 a	10.667 b	7.445 bc	10.278 a
Batches number effect (B)	8.611 a	7.259 ab	5.556 b	

Different letters within column indicating of significant differences (p<0.05)

Table (2) indicates that there are significant differences in the effect of fertilizer quantity on leaves number, as the highest leaves number with the amount of fertilizer was 180 gm.plant-1, reaching 205.22 leaves.plant-1, while the lowest leaves number with the amount of fertilizer was 60. gm.plant-1, where leaves number reached 74.56 leaves.plant^{-1}. These results agreed with

what (Houri, 2022) reached in his study on the response of local orange seedlings to compound fertilizer and spraying with a mixture of amino acids, and they differed with what (Bakht, 2020) reached in His study on Saraca acacia trees to demonstrate the effect of NPK fertilizer on the vegetative growth of those trees.

As for the effect of batches number, the highest leaves number was with 6 fertilizer batches, reaching 158.67 leaves plant^{-1}, while the lowest leaves number was with 24 fertilizer batches, amounting to 95.78 leaves plant^{-1}. this is due to the decrease in fertilizer amount added with the increase in batches number. Fertilization and the plant's benefit from the number of that batch and its distribution throughout the month compared to the number of other batches this significant difference may also be due to of the added elements role in encouraging the vital activities of the plant, especially nitrogen, which represents the basic element of protein and is involved in enzymes synthesis, some growth regulators, and chlorophyll, and in increasing the processes of photosynthesis and its carbohydrate products, which contribute effectively to increasing vegetative growth and leaf formation (Al-Sahhaf , 1989).

As for the interaction between the two factors of fertilizer quantity and number of batches, the data in Table (2) indicate that the plants treated with 180 g. plant^{-1} and a number of batches of 6 batches 4 weeks^{-1} gave the best result for the number of leaves, which amounted to 247.33 leaves. plant^{-1} compared to the lowest value of 61.22 leaves. plant^{-1} at (120 g. plant^{-1} and 24 batches).

Table (2) The effect of NPK fertilizer quantity (g) and batches number on leaves number of *Melia dubia* Cav. Trees (leaves.plant^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	85.11dc	77.11dc	61.44 d	74.56 b
120 g (A2)	143.65 bc	62.11d	61.22 d	88.96 b
180 g (A3)	247.33 a	203.67 ab	164.67 b	205.22 a
Batches number effect (B)	158.67 a	114.30 b	95.78 b	74.56 b

Different letters within column indicating of significant differences (p<0.05)

It is noted from Table (3) that adding NPK fertilizer at 180 g. tree^{-1} led to a significant increase in stem diameter compared to the amount of fertilizer 120 and 60 g. plant^{-1}, respectively, as the highest diameter reached 3.9722 cm when the amount of fertilizer was 180 g. plant^{-1}. The minimum diameter is 1.7314 cm when the amount of fertilizer is 120 g. plant^{-1}, this result is consistent with (Al-Imam, 2021) in his study on the effect of levels of the chemical fertilizer NPK on the growth and production of seedlings grafted on almonds. It is also consistent with what was reported by Majeed and Joudy (2016) in their study on one of the peach varieties to determine the extent of the increase in branch length and stem diameter result of adding 50 g N.

tree^{-1}. As for batches number effect, Table (3) indicates that the highest diameter of the stems was in 6 batches/4 weeks, amounting to 2.8333 cm, while the smallest diameter was in 24 batches/week, amounting to 2.2777 cm. Perhaps the reason for the moral superiority in batch 6 batches/4 weeks is due to Nitrogen role in builds cytokinins that increase the activity of lateral meristematic cell division, increasing plant growth, including stem diameter (Tawajen, 1987). The interaction between the factors of fertilizer quantity and number of batches indicated that the plants treated with 180 g. plant^{-1} and 6 batches 4 weeks^{-1} gave the highest value of the main stem diameter of 4.4723 cm compared to the lowest value of 1.6667 cm at (120 g. plant^{-1} and 12 batches).

Table (3) The effect of NPK fertilizer quantity (g) and batches number on stem diameter of *Melia dubia* Cav. Trees (leaves.plant^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	2.2777 c	2.2777 c	1.7777 c	2.1110 b
120 g (A2)	1.7500 c	1.6667 c	1.7777 c	1.7314 b
180 g (A3)	4.4723 a	4.1667 a	3.2777 b	3.9722 a
Batches number effect (B)	2.8333 a	2.7037 ab	2.2777 b	

Different letters within column indicating of significant differences (p<0.05)

It is also noted from Table (4) that the level of fertilization with NPK at 180 g. plant^{-1} led to a significant increase in the height of the main stem compared to the fertilizer quantity 60 and 120 g. plant^{-1}, respectively, as the highest height reached 250.00 cm.plant^{-1} at the amount of Fertilizer 180 gm.plant^{-1}, while the minimum height is 26.169 cm.plant^{-1} when the amount of fertilizer is 120 g. plant^{-1} this result is consistent with what was reached by (Bakht, 2020) in his study on NPK fertilizer effect on some vegetative growth characteristics of the Ashoka plant, and differs with what was reached by (Al-Karam 2021) in his study on the effect of nano- and non-nano-NPK fertilizer on pear seedlings growth. good fertilization and increasing leaves number (Table 2) have the main role in increasing main stem height as a result of increasing the products of the photosynthesis process, which increased the hormone gibberellin, which is responsible for internodes length in the plant, which reflected positively on increasing vegetative growth and increasing main stem height. As for batches number effect, it appears from Table (4) that the highest height of the stems was 217.59 cm.plant-1 in 6 batches/4 weeks, while the lowest diameter was in 24 batches/week and amounted to 173.70 cm.plant^{-1}. This result agreed with what was found (Boateng, 2015) in his study to demonstrate the effect of rates and time of application of NPK fertilizer on *Manihot esculenta* Crantz cassava trees. The interaction between the fertilizer quantity and number of batches in Table (4) indicated that the plants treated with 180 g. plant^{-1} and 6 batches 4 weeks^{-1} gave the best result for plant height, which amounted to

266.67 cm. plant^{-1}, compared to the lowest value of 147.78 leaves. plant^{-1} at (60 g. plant^{-1} and 24 batches).

Table (4) The effect of NPK fertilizer quantity (g) and batches number on stem height of *Melia dubia* Cav. Trees (cm. plant^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	182.22 bcd	178.33 bcd	147.78 d	169.44 b
120 g (A2)	203.89 bc	148.33 d	155.56 cd	169.26 b
180 g (A3)	266.67 a	265.56a	217.78 ab	250.00a
Batches number effect (B)	217.59 a	197.41 ab	173.70 b	

Different letters within column indicating of significant differences (p<0.05)

Table (5) indicates that there are significant differences in the effect of fertilizer amount added on the branches diameter, as the highest diameter of tree branches with fertilizer amount 180 gm.plant^{-1} reached 1.53144 cm.plant^{-1}, while the lowest branches diameter with fertilizer amount was 60 gm. Plant^{-1} reached 0.74833 cm. Section^{-1}. This result is consistent with the findings of (Al-Douri and Al-Araji, 2009) In their study to demonstrate the effect of two leve.ls of nitrogen on some vegetative traits of two peaches varieties, including branches diameter. As for batches number effect, it is noted from Table (5) that the highest branches diameter was at 24 batches/week, amounting to 2.94078 cm. Branch^{-1}, while the lowest diameter was at 12 batches/2 weeks, amounting to 1.00756 cm. Branch^{-1}. Perhaps the reason for this is Increasing the production of inhibitors at the expense of stimulants that prevent the action of auxins, which are responsible for cell elongation and thus the cells tend to grow tangentially and increase the branches diameter as a result of alternating fertilizer payments and increasing their number over a limited period. While the interaction between the fertilizer quantity and number of batches in Table (5) indicated that the plants treated with 180 g. plant^{-1} and a number of batches of 24 batches. week^{-1} gave the best result for the diameter of the plant branches, which amounted to 1.7223 cm. branch^{-1} compared to the lowest value of 0.7113 cm. branch^{-1} at (60 g. plant^{-1} and 12 batches).

Table (5) The effect of NPK fertilizer quantity (g) and batches number on branch diameter of *Melia dubia* Cav. Trees (cm. Branch^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	0.8113 c	0.7113 c	1.7223 c	0.74833 b
120 g (A2)	0.9777 bc	0.7557C	0.7667 c	0.83333 b
180 g (A3)	1.7053 a	1.5557 a	1.3333 ab	1.53144 a
Batches number effect (B)	1.16478 a	1.00756 ab	2.94078 b	

Different letters within column indicating of significant differences (p<0.05)

Table (6) indicates that the level of NPK fertilization at 180 g. plant^{-1} led to a significant increase in branches length compared to the amount of fertilizer 60 and 120 g. plant^{-1}, respectively, as the highest length of branches reached 110.111 cm.plant^{-1} at the amount of fertilizer 180 g. plant^{-1}. The minimum branches length is 72.037 cm. branch^{-1} when the amount of fertilizer is 120 g. plant^{-1} , the reason for the increase in branches length may be due to the role of added nutrients in increasing vegetative growth, especially nitrogen, which stimulates the plant to produce auxins that encourage cell elongation and thus increase branches length. These results are consistent with the findings of (AL-katelh, 2021) in his study on NPK fertilizers, Brassinolide effect in some vegetative growth traits the results for date palm trees of the Khastawi variety growing in gypsum soil are also consistent with what (Al-Karam, 2021) reached in his study of NPK fertilizer effect on pear seedlings growth. As for batches number effect, it is noted from Table (6) that the highest length of the plant branches was at 12 batches/2 weeks, amounting to 96.296 cm. Branch-1, while the lowest length of the plant branches was at 24 batches/week, amounting to 77.593 cm branch^{-1}. This may be due to a reason The non-significant increase in branch lengths is due to an increase in branches number per plant (Table 1) and competition between them for their elongation and growth requirements (Al-Imam, 2021). While the interaction between the factors of fertilizer quantity and number of batches in Table (6) indicated that the plants treated with 180 g. plant^{-1} and 12 batches 2 batches 1 week^{-1} gave the best result in branch length, which amounted to 120.00 cm. branch^{-1}, compared to the lowest value of 62.78 cm. branch^{-1} at (120 g. plant^{-1} and 24 batches).

Table (6) The effect of NPK fertilizer quantity (g) and batches number on branch length of *Melia dubia* Cav. Trees (cm. Branch^{-1})

Fertilizer quantity (A)	Batches number (B)			Effect of fertilizer quantity (A)
	In 6 Batches Batch\4week B1	In 12 batches Batch\2week B2	In 24 batches Batch\week B3	
60 g (A1)	77.22 bc	0.7113 c	1.7223 c	0.74833 b
120 g (A2)	76.67 bc	0.7557C	0.7667 c	0.83333 b
180 g (A3)	115.33 a	1.5557 a	1.3333 ab	1.53144 a
Batches number effect (B)	89.741 a	1.00756 ab	2.94078 b	

Different letters within column indicating of significant differences (p<0.05)

CONCLUSIONS

We conclude from the study that using balanced NPK fertilizer in powder form can increase the vegetative growth of trees, as the results of the study indicated noticeable increases in the number of branches, number of leaves, diameter and height of the main stem, and diameter and length of branches for the study plants using the fertilizer quantity of 180 g/tree compared to other fertilizer quantities of 60 and 120 g/tree. As for the factor of the number of batches, the method of addition did not have an effect on the vegetative growth characteristics of the studied plants.

CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

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