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EFFECT OF CULTURES, BUDDING DATES, KINETIN AND THEIR INTERACTIONS ON BUDDING PERCENTAGE AND SOME VEGETATIVE GROWTH CHARACTERISTICS OF PISTACHIO TRANSPLANTS (*PISTACIA VERA* L.)

NAWZAD JAMEEL IBRAHIM
M.Sc., Directorate of Horticulture, College of Agricultural Sciences and Engineering, University of Duhok, Ministry of Agriculture and Irrigation, Kurdistan Region-Iraq. Email: Nawzad_NB@yahoo.com

AZAD AHMED MAYI
Professor, Department of Horticulture., College of Agricultural Sciences and Engineering, University of Duhok, Kurdistan Region-Iraq. Email: azad.mayi@uod.ac

Abstract

The main objectives of the production of pistachio (Pistacia vera L.) transplants from a certified cultivar are to preserve the genetic characteristics of the plant species and to produce healthy, strong transplants with excellent genetic characteristics that are suitable for the environment and can withstand difficult climatic conditions in the appropriate places for them to be planted. Hence, the current study was carried out to produce P. vera transplants from a certified cultivar during the early stages of the nursery. The study was conducted during the growing season of 2021 in Bani village, Duhok city, in the Kurdistan Region of Iraq. The aim of this study was to investigate the effects of three pistachio cultivars (Abas-Ali, Kale-gnocchi, and Siirt), find out the best dates of budding among the three dates (med-June, 14 August, and med-September), and determine the best concentrations of Kinetin among the three cultivars (0, 5, and 10 mg/L) and their interactions. The T-budding methods were used on one-year-old transplants. The results show that the Siirt cultivar recorded the highest budding success percentage. At the same time, the Abas-Ali cultivar dominated the section height and length of lateral branches. Furthermore, the first budding date (med-June) recorded the maximum values of budding success percentage, section height, scion diameter, number of lateral branches, and length of lateral branches. On the other hand, the third concentration (10 mg/L) of Kinetin showed the highest values of budding success percentage, section height, and the number of lateral branches. However, the most effective interactions were cultivar Siirt, the first budding date, and concentration (10 mg/L) of Kinetin, which increased budding percentage and section diameter

Keywords: *Pistachio, Cultivars, Budding Date, Kinetin, T- budding*

INTRODUCTION

Pistachio (*Pistacia vera* L.) is a dioecious hard-shelled fruit species in the Anacardiaceae family (Karcı *et al.,* 2022). their cultivation is rapidly growing due to government support, the availability of adapted environmental conditions, suitable soil, and economic importance. Consequently, farmers are favoring it more. So, in recent years, their farming has expanded in the Kurdistan region. However, cultivating them nowadays poses a number of challenges for the majority of farmers. Some of these challenges are obtaining a transplant from a certified cultivar, delays in the bearing nut, alternate bearings, and pollination. Farmers may find it challenging to achieve their ideal atmosphere because ignorance wastes their time, effort, and income.

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Pistachios are a common nut crop grown in semi-arid regions of the Middle East, the Mediterranean area, and the United States. Pistachio trees require special climatic conditions, which include cold winters and mild summers. So, there is a limited area of land worldwide that may be used for the cultivation of pistachio nuts. The average winter temperature in the pistachio-growing regions is between 7.0 and 7.4°C, according to (Ayfer 1990), and the average chilling requirements of this species are between 800 and 1000 hours. In addition, the average summer temperature in the pistachio-growing regions should be above (30°C) for 98 to 110 days.

The propagation of pistachio is the most difficult of all nut trees (Izzet *et al.,* 2017). In comparison, rooting pistachio cuttings is quite difficult. Since traditional propagation of pistachios is costly and time-consuming, either the right clones are budded onto heterozygous rootstocks or seeds are directly planted. It is common to see a male and female scion bud on one rootstock since pistachios are dioecious. Incompatibility between rootstock and scion often requires inte-grafing (Onay, 2000). Since they are difficult to propagate and their cultivation capacity is limited. So, this study focused on vegetative propagation by budding, which is more predictable and effective than other methods (Kumar, 2011). Budding percentages have been increased by using T-budding techniques, which are mostly recommended for use in nurseries. This experiment aimed to increase the budding percentage of pistachio by combining the effects of three cultivars, three budding dates, and three concentrations of Kinetin. Previous research has shown an increased budding percentage in various horticulture crops; for example, (Ozkan *et al., 2001*) found that walnut varieties with Bilecik had the highest budding percentage. (Ak *et al.,* 2013), also found that the Siirt cultivar had the highest budding percentage. However, the budding date may have an effect on the budding percentage in pistachio due to the incompatibility of rootstock and scion. In pistachio, budding in June was reported to be the most successful (Arpaci *et al.,* 1998), but September is a better month for budding than August (Ak *et al.,* 2013). Recently, horticulturists have used plant growth regulators for both conventional and micropropagation. Auxins and cytokines have an influence on cell expansion and are responsible for callus formation. This has an effect on budding injury healing, union formation, and overcoming budding incompatibility between the rootstock and section. Kinetin is a highly effective synthetic cytokinin that has been soaked in a Kinetin solution prior to budding. (Fakhraddin 2004) recommended using Kinetin (10 mg/l) to increase the success percentage of pistachio budding. The objective of this study was to produce transplants from the certified cultivar of P. vera L. in nursery black bags. Therefore, the effect of three cultivars of pistachio was studied in order to achieve these goals. Also, to find the most suitable date for budding, and determine the optimal concentration of Kinetin for a successful budding union.

MATERIALS AND METHODS

The study was conducted during the growing season of 2021 in Bani village, located in Dohuk City, Kurdistan Region of Iraq. The fresh Scions (Buds) were taken from healthy and mature trees from three different pistachio cultivars (Abas-Ali, Kale-gnocchi, Siirt) and performed the budding process on three budding dates (mid-June, mid-August, and

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mid-September) after removing the bud from the bud stick and putting it in the Kinetin solution at three concentrations (0, 5, and 10 mg/L) for about 5 seconds, then they are budded at the middle stem by T-budding was utilized on one-year-old transplant. After budding, cut off the apical and all branches, leaving only one branch that contains (4 to 5) leaves. To guarantee the success of the budding process, the joint zone between the scion and stock was tightly bound. Service operations were required for the transplants until the study's end. The experiment comprised 27 treatments, with each treatment selecting 10 transplants with three replications. The experiment was conducted in factorial mode (RCBD). The differences between various treatment means were tested with Duncan's multiple range test at a 5% level.

The following parameters were recorded in August 2022:

1. budding success
2. section height
3. scion diameter
4. number of lateral branches per transplant
5. length of lateral branches
6. and length per internode.

RESULTS

1- *Budding success percentage (%)*

According to Table 1, the budding percentage for cultivar Siirt was significantly different from that for other cultivars. The highest budding percentage was observed on the first date at 56.4%, while the lowest was observed on the second date. The highest budding percentage was observed with a concentration of 10 mg/L of Kinetin. The interaction between cultivar Siirt and the first budding date was the most effective treatment compared to other treatments. Additionally, there was a better response to the interaction between the cultivar Siirt and the third concentration (10 mg/L) of Kinetin. The highest significant value was observed with the interaction between the first budding date and the third concentration (10 mg/L) of Kinetin, which was 62.2%. Furthermore, Table 1 displays the triple interaction between cultivar Siirt, the first budding date, and the third concentration (10 mg/L) of Kinetin, which provided the highest value of 73.3%.

2- *Section height (cm)*

Table 2 demonstrates that the cultivars Abas-Ali and Siirt are significantly taller than the others. The budding dates (med-June and med-August) were significantly longer than the other dates registered (32.4 cm and 30.9 cm, respectively). The data obtained from the concentration (10 mg/L) of Kinetin showed a significant increase; in addition, the interaction between cultivar Abas-Ali and the first budding date resulted in the greatest improvement in section height (35.1 cm). Furthermore, the interaction of the cultivars

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Siirt and Abas-Ali with the third concentration (10 mg/L) of Kinetin produced the most effective results. Also, the interaction between the first budding date and the third concentration (10 mg/L) of Kinetin had the highest significant section height (39.3 cm). In the same table, the interaction between the cultivar Kale-gnocchi, the budding date, and the third concentration (10 mg/L) of Kinetin provided the highest value (41.1 cm) compared to other treatments.

Table 1: Effect of cultivars, budding dates, Kinetin and their interactions on budding (%)

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	5	10		
Abas-Ali,	med-June	56.7 a-f	56.7 a-f	60.0 a-d	57.8 ab	51.9 b
	med-Aug	40.0 ef	50.0 b-f	53.3 a-f	47.8 b-e	
	med-Sept.	46.7 c-f	50.0 b-f	53.3 a-f	50.0 b-e	
Kale-gnocchi	med-June	38.3 ef	42.7 d-f	53.3 a-f	44.8 c-e	43.1 c
	med-Aug	36.7 f	40.0 ef	43.3 d-f	40.0 e	
	med-Sept.	40.0 ef	40.0 ef	53.3 a-f	44.4 ed	
Siirt	med-June	56.7 a-e	70.0 ab	73.3 a	66.7 a	59.1 a
	med-Aug	53.3 a-f	46.7 c-f	63.3 a-d	54.4 b-d	
	med-Sept.	60.0 a-e	43.3 d-f	65.0 a-c	56.1 a-c	
Kinetin (mg/L).		47.6 b	48.8 b	57.6 a	Date of Budding	
Cultivar *Kinetin	Abas-Ali,	47.8 bc	52.2 b	55.6 b	med-June	56.4 a
	Kale- gnocchi	38.3 d	40.9 cd	50.0 bc		
	Siirt	56.7 b	53.3 b	67.2 a	med-Aug	47.4 b
Budding Date*Kinetin	med-June	50.6 b-d	56.4 a-c	62.2 a		
	med-Aug	43.3 d	45.6 cd	53.3 a-d	med-Sept	50.2 b
	med-Sept.	48.9 b-d	44.4 d	57.2 ab		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another.

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Table 2: Effects of cultivars, budding dates, Kinetin, and their interactions on section height (cm)

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	5	10		
Abas-Ali,	med-June	32.5 a-f	35.0 a-e	37.7 a-d	35.1 a	32.0 a
	med-Aug	25.7 b-g	30.0 a-f	38.3 a-c	31.3 ab	
	med-Sept.	24.0 d-g	29.0 a-f	36.0 a-e	29.7 ab	
Kale-gnocchi	med-June	24.5 c-g	29.0 a-f	41.0 a	31.5 ab	27.0 b
	med-Aug	23.7 e-g	24.3 d-g	34.3 a-e	27.4 a bc	
	med-Sept.	13.3 g	26.0 b-g	27.0 b-f	22.1 c	
Siirt	med-June	23.3 e-g	29.0 a-f	39.3 ab	30.6 ab	31.4 a
	med-Aug	33.0 a-f	35.0 a-e	34.0 a-f	34.0 ab	
	med-Sept.	20.3 fg	34.0 a-f	34.3 a-e	29.6 ab	
Kinetin (mg/ L).		24.5 c	30.1 b	35.8 a	Date of Budding	
Cultivar *Kinetin	Abas-Ali,	27.4 b-d	31.3 a-c	37.3 a	med-June	32.4 a
	Kale-gnocchi	20.5 d	26.4 cd	34.1 ab		
	Siirt	25.6 cd	32.7 a-c	35.9 a	med-Aug	30.9 a
Budding Date*Kinetin	med-June	26.8 c	31.0 bc	39.3 a		
	med-Aug	27.4 c	29.8 bc	35.6 ab	med-Sept.	27.1 b
	med-Sept.	19.2 d	29.7 bc	32.4 a-c		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another

***3- Scion diameter (mm)**:* Table 3 shows no significant differences in section diameter between cultivars. On the other hand, the data obtained from budding dates revealed that the first budding date was significantly superior. On the other hand, Kinetin treatment has no significant effect on section diameter. Similar tables show that the interaction between the cultivar and budding date had no significant effect on interaction treatments. The interaction between the cultivar Kale-gnocchi and the third concentration (10 mg/L) of Kinetin produced the highest results (16.8 mm). This demonstrates that the interaction between the budding date and Kinetin does not affect section diameters. The triple interaction of the Siirt cultivar, the first budding date, and the third concentration (10 mg/L) of Kinetin provided the highest diameter value (18.2 mm).

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Table 3: Effects of cultivars, budding dates, Kinetin, and their interactions on section diameter (mm)

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	med-June	14.0 ab	14.5 ab	14.9 ab	14.5 a	13.7 a
	med-Aug	11.7 b	12.6 ab	13.5 ab	12.6 a	
	med-Sept.	13.8 ab	14.1 ab	14.3 ab	14.0 a	
Kale-gnocchi	med-June	14.2 ab	15.0 ab	15.2 ab	14.8 a	15 a
	med-Aug	15.8 ab	15.2 ab	17.5 ab	16.2 a	
	med-Sept.	12.3 ab	12.3 ab	17.8 ab	14.1 a	
Siirt	med-June	13.8 ab	15.9 ab	18.2 a	16.0 a	14.5 a
	med-Aug	14.0 ab	15.0 ab	15.1 ab	14.7 a	
	med-Sept.	12.4 ab	13.4 ab	13.2 ab	13.0 a	
Kinetin (mg/L).		13.5 a	14.2 a	15.5 a	Date of Budding	
Cultivar *Kinetin	Abas-Ali,	13.1 b	13.7 ab	14.2 ab	med-June	15.1 a
	Kale-gnocchi	14.1 ab	14.2 ab	16.8 a		
	Siirt	13.4 b	14.8 ab	15.5 ab	med-Aug	14.5 ab
Budding Date*Kinetin	med-June	14.0 a	15.2 a	16.1 a		
	med-Aug	13.8 a	14.3 a	15.4 a	med-Sept.	13.7 b
	med-Sept.	12.8 a	13.3 a	15.1 a		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another.

4- The number of lateral branches per transplant: Table 4 shows that the number of branches per transplant by cultivar variant is not significantly different between cultivars. However, the first budding date resulted in a significantly higher number of branches per transplant. In addition, Kinetin (10 mg/L) was the superior treatment, scoring 10.4 compared to other treatments. Regarding the interaction between the cultivar Abas-Ali and the budding date, it was the most effective treatment in comparison to other treatments. The interaction of cultivar Abas-Ali with (5 mg/L) of Kinetin showed the highest significant differences compared to other treatments. Furthermore, the interaction between the first budding date and the second concentration (5 mg/L) of Kinetin produced the most effective treatment (11.9). The same table presents the interaction between cultivar Abas-Ali, the first budding date, the second concentration of Kinetin (5 mg/L), the most effective treatment, and all other treatments.

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Table 4: Effect of cultivars, budding dates, kinetoplasts, and their interactions on the number of lateral branches per transplant

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	med-June	10.7 b	15.3 a	11.3 ab	12.4 a	10.5 a
	med-Aug	7.3 b	10.0 b	10.3 b	9.2 b	
	med-Sept.	8.7 b	9.8 b	11.0 ab	9.8 ab	
Kale-gnocchi	med-June	10.3 ab	10.7 ab	11.0 ab	10.7 ab	9.4 a
	med-Aug	8.3 b	8.4 b	10.3 b	9.0 b	
	med-Sept.	8.0 b	8.7 b	9.0 b	8.6 b	
Siirt	med-June	9.3 b	9.7 b	10.7 ab	9.9 ab	9.6 a
	med-Aug	9.3 b	10.3 b	11.0 ab	10.2 ab	
	med-Sept.	8.3 b	9.0 b	8.7 b	8.7 b	
Kinetin (mg/L).		8.9 b	10.2 ab	10.4 a	Date of Budding	
Cultivar *Kinetin	Abas-Ali,	8.9 b	11.7 a	10.9 ab	med-June	11.0 a
	Kale-gnocchi	8.9 b	9.3 ab	10.1 ab		
	Siirt	9.0 b	9.7 ab	10.1 ab	med-Aug	9.5 b
Budding Date*Kinetin	med-June	10.1 ab	11.9 a	11.0 ab		
	med-Aug	8.3 b	9.6 ab	10.6 ab	med-Sept.	9.0 b
	med-Sept.	8.3 b	9.2 ab	9.6 ab		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another.

5- Length of lateral branches (cm): Table 5 shows that the Abas-Ali cultivar was significantly effective in lateral branch length and was registered (6.7 cm). The budding date on the first budding date also had a significant impact. However, there are no significant differences in Kinetin concentrations in lateral branch length. Also, the interaction between the cultivar Abas-Ali and the first and second budding dates was the most effective treatment compared with other treatments. However, the results of the interaction between the cultivar Abas-Ali and the third concentration (10 mg/L) of Kinetin showed a better result (7.2 cm). But, the interaction between budding dates and Kinetin did not significantly affect the lateral branch lengths per transplant. According to a similar table, the interaction effect of the cultivar Abas-Ali, the second budding date, and the third concentration (Kinetin 10 mg/L) produced the highest result, which was 7.85 cm.

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Table 5: Effect of cultivars, budding dates, Kinetin and their interactions on the length of lateral branches (cm)

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	med-June	7.10 a-c	7.37 a-c	7.62 ab	7.4 a	6.7 a
	med-Aug	5.50 a-d	7.50 ab	7.85 a	7.0 a	
	med-Sept.	5.87 a-d	5.33 a-d	6.27 a-d	5.8 a-c	
Kale-gnocchi	med-June	6.12 a-d	5.67 a-d	5.70 a-d	5.8 a-c	5.1 b
	med-Aug	5.00 a-d	5.17 a-d	5.13 a-d	5.1 bc	
	med-Sept.	4.07 de	4.27cd	4.73 a-d	4.4 c	
Siirt	med-June	4.17 cd	4.40 cd	4.67 a-d	4.4 c	5.2 b
	med-Aug	4.63 b-d	5.33 a-d	5.03 a-d	5.0 bc	
	med-Sept.	5.63 a-d	6.07 a-d	6.53 a-d	6.1 ab	
Kinetin (mg/L).		5.3 a	5.7 a	5.9 a	Date of Budding	
Cultivar *Kinetin	Abas-Ali,	6.2 a-c	6.7 ab	7.2 a	med-June	5.9 a
	Kale-gnocchi	5.1 c	5.0 c	5.2 bc		
	Siirt	4.8 c	5.3 bc	5.4 bc	med-Aug	5.7 b
Budding Date*Kinetin	med-June	5.8 a	5.8 a	6.0 a		
	med-Aug	5.0 a	6.0 a	6.0 a	med-Sept.	5.4 b
	med-Sept.	5.2 a	5.2 a	5.8 a		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another.

6- Length per internode (cm): The data in Table 6 show that the cultivar, budding date, and Kinetin had no significant effect on the length per internode. But the interaction between the cultivar Kale-gnocchi and the first budding date provided the highest value (4.47 cm) compared to other treatments. However, there were no significant differences in the interaction between cultivars and Kinetin. Also, the interaction between budding dates and Kinetin did not significantly affect the lengths per internode for each transplant. In the triple interaction of the cultivar Kale-gnocchi, the first budding date and the second and third concentrations (5 and 10 mg/L) of Kinetin obtained (4.67 and 4.63 cm) were compared to all other treatments.

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Table 6: Effect of cultivars, budding dates, Kinetin and their interactions on length per internode (cm)

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	5	10		
Abas-Ali,	med-June	3.37 ab	3.52 ab	3.62 ab	3.50 ab	3.35 a
	med-Aug	2.50 ab	3.83 ab	3.79 ab	3.37 ab	
	med-Sept.	2.60 ab	3.27 ab	3.63 ab	3.17 b	
Kale-gnocchi	med-June	4.00 ab	4.67 a	4.73 a	4.47 a	3.71 a
	med-Aug	3.37 ab	4.13 ab	3.80 ab	3.77 ab	
	med-Sept.	3.20 ab	2.13 b ab	3.33 ab	2.89 b	
Siirt	med-June	3.17 ab	2.47 ab	2.87 ab	2.83 b	3.39 a
	med-Aug	3.73 ab	4.00 ab	3.33 ab	3.69 ab	
	med-Sept.	3.53 ab	3.37 ab	4.00 ab	3.72 ab	
Kinetin (mg/L).		3.27 a	3.49 a	3.68 a	Budding Date	
Cultivar *Kinetin	Abas-Ali,	2.82 a	3.54 a	3.68 a	med-June	3.60 a
	Kale-gnocchi	3.52 a	3.64 a	3.96 a		
	Siirt	3.48 a	3.28 a	3.49 a	med-Aug	3.61 a
Budding Date*Kinetin	med-June	3.51 a	3.55 a	3.74 a		
	med-Aug	3.20 a	3.99 a	3.64 a	med-Sept.	3.23 a
	med-Sept.	3.11 a	2.92 a	3.74 a		

Duncan's multiple range test at the 5% level shows the means of each factor and the interactions between them. These means are all preceded by the same letter and are not statistically different from one another.

DISCUSSION

Based on the results which appear clearly in table (1), the outstanding budding success (%) in cultivar Siirt may be attributed to the differences in the budding responses of cultivars, with some performing better than others and the taken scions for the budding process were more mature than other dates. These findings are consistent with (Ak *et al*. 2013), and (Kako *et. al.,* 2015). This may be due to cultivar-specific genes, environmental conditions, nutrient status, and hormone content in both sections and rootstock that influence budding success and the habit of vegetative growth to release buds. These factors are adequate for callus formation, cell differentiation, and scion elongation in budded scions (Hartmann, 2002).

The results which appear in Tables (2 and 5) show that the Abas- Ali cultivar significantly dominated the other cultivars on some vegetative growth characteristics such as (section height and lateral branch length). These results agree with (Kako *et al.,* 2012); (Al-Kayssi 2011); and (Jody *et al.,* 2012). Who found that vegetative growth characteristics varied with cultivar. The reasons behind that might be due to differences among cultivars in their budding response. In addition, it might also be related to genetic trait variation among cultivars and their responses to environmental conditions (Teng *et*

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al., 2002) while the rest of the vegetative growth characteristics from (3, 4 and 6) such as scion diameter, and a number of lateral branches and length per internode were not influenced by variation of cultivars.

The findings revealed in table (1) relate to the superior percentage of budding success on med-June, these results may be due to environmental and climatic conditions (Kaplan *et al.,* 2012), especially temperature during this date is favorable for budding, whereas the temperature on med-August was high, which caused gumming exudate resin to form and prevent calluses from initiating and inhibiting budding unions (Noori, 2019) there was a low success rate. Due to physiological differences between scions and rootstocks, the bark was easy to separate, possibly due to the juvenility and maturity of scions. These physiological variations may also impact variations in the amount of nutrition in tissues, growth regulator and inhibitor content, and climatic elements such as temperature and humidity that influence wound healing.

It is clear from the table (2, 3, 4, and 5) that the first budding date (med-June) significantly caused an increase in the most vegetative growth characteristics (section height, scion diameter, number of lateral branches, and length of lateral branches). These results confirm the results drawn by (Al-Mamoury 2012); (Hadi *et al.,* 2013), (Ahmad *et al.,* 2012), and (Aram, 2022). There are many reasons behind the obtained results. This might be due to the favorable environmental conditions during the budding date that would be a reason causing to build a strong union area between the scion and rootstock. This will allow for the movement of water and nutrient materials rapidly. This will increase cell division, enlargement, and hence callus formation. In addition, it will help to increase photosynthesis which will increase the synthesis of nutrient materials that help improve transplant growth. Furthermore, table (6) shows that budding dates did not affect internode length.

The data from Figure (1) clearly shows that the (10 mg/L) concentration of Kinetin significantly increased the budding success percentage compared with the other two concentrations first treatment (control) and the second concentration (5 mg/L) of Kinetin. This result agrees with (Peng *et al.,* 2006), (Fadhil *et al.,* 2011), and (Kako *et al.,* 2015). The response may be attributed to Kinetin's role in encouraging cell division, cell enlargement, and elongation, which leads to the initiation and proliferation of calluses. Calluses are necessary for uniting scions to rootstocks or for wound healing. However, callus formation may occur more quickly if bud scions are soaked in a Kinetin solution.

The influence of Kinetin appears as follows: Tables (2 and 4) confirm the third concentration (10 mg/l) of Kinetin, which significantly influenced only some vegetative characteristics (section height, and the number of lateral branches). These results are in agreement with those published by (Oliveira and Ramadas 1995) cytokines have great roles in inducing cells enlargement and elongation and producing callus, which is considered the first and most important step for union area between the scion and stock for injury healing, which leads to increase vegetative characteristics.

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The interaction effect from Table (1) shows that the interaction between the siirt cultivar and the third concentration (10 mg/l) of Kinetin, significantly affects budding percentage and section height in the table (2).these significant effects from the interaction between cultivars and Kinetin return to the reasons that each cultivar has its genetic habit to improve quality of vegetative growth characteristics combined with the effect of Kinetin to increase the quality of these vegetative growth characteristics. Whereas the interaction between budding dates and Kinetin, the interaction between 1st date (med-June) and the third concentration (10 mg/l) of Kinetin significantly affected budding percentage and section height. These improvements in vegetative growth characteristics, which was the longest date to improve these studied vegetative characteristics and the effect of growth regulators, help to enhance these vegetative characteristics. There was a significant interaction among cultivars, budding dates, and Kinetin; but the most effective triple interaction was between a siirt cultivar plus a first budding date with a third concentration (10 mg/l) of Kinetin, which increased budding percentage and section height. These significant values obtained from triple interaction were affected by each of the treatments studied alone.

CONCLUSION

Our findings show that the Siirt cultivar had a higher budding success rate (percentage) compared to the other cultivars. However, in terms of vegetative growth characteristics, the Abas-Ali cultivar outperformed the others. Additionally, the first budding date was found to be the most efficient date for a one-year transplant based on the percentage of budding success and vegetative characteristics. Furthermore, the third concentration of Kinetin (10 mg/L) significantly affected the percentage of budding success and almost all vegetative characteristics. Finally, the combination of the Siirt cultivar, the first budding date (med-June), and the third Kinetin concentration (10 mg/L) had the greatest effect on all parameters.

RECOMMENDATIONS

The advice to our farmers the budding percentage differs from cultivar to cultivar and from region to region; therefore, there are several options for the budding date in June. However, if buds do not sprout in August and September, re-budding is an option, but the chance of success decreases if it is done later. The most appropriate date for budding is when the cambial growth of the rootstocks is active and sap flows are moving actively, which allows the cambium to divide and the bark to easily separate from the wood. Also, budding can be performed when the rootstock reaches its optimum diameter.

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