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EFFECT OF CULTIVARIS, BUDDING DATES, KINETIN, AND THEIR INTERACTION ON THE BUDDING AND VEGETATIVE GROWTH CHARACTERISTICS OF PISTACHIO TRANSPLANTS "*Pistacia vera* L."

NAWZAD JEMIL IBRAHIM and AZAD AHMED MAYI
Directorate of Horticulture, Ministry of Agriculture and Irrigation, Kurdistan Region–Iraq
Dept. of Horticulture., College of Agricultural Sciences and Engineering, University of Duhok, Kurdistan Region-Iraq

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ABSTRACT

The experiment was conducted during the growing season (2021) at a private orchard in Bani village, Dohuk City, Kurdistan Region-Iraq. The research aimed to produce transplants of pistachio with certified cultivars for commercial marketing purposes, using the T-budding method on one-year-old seedling pistachio rootstocks. The study investigated the effect of three cultivars (Abas-Ali, Kale-gnocchi, and Siirt), three budding dates (mid-June, mid-August, and mid-September), three Kinetin concentrations (0, 5, and 10 mg/L) and their interaction. The finding results indicated that the Siirt cultivar had the highest budding success percentage (59.1%) and total chlorophyll content (54.2 SPAD) compared to the other cultivars. However, the mid-June budding date showed the highest success percentage of budding (56.4%) and leaf number per transplant (39) compared to the other budding dates. Additionally, the third concentration of Kinetin (10 mg/L) significantly increased the budding percentage (57.6%), leaf area (21.9 cm²), and total chlorophyll (55.6 SPAD). And, the interaction between the Siirt cultivar, the mid-June date, and the third concentration of Kinetin resulted in the highest budding success percentage (73.3%). These findings suggest that the selection of appropriate cultivars, budding dates, and appropriate concentration of Kinetin can significantly impact the success percentage and quality of pistachio transplant production in the nursery for commercial marketing purposes.

K YWORDS: Pistachio, Cultivars, Budding Date, Kinetin, Budding percentage

1- INTRODUCTION

Pistachio (*Pistacia vera* L.) is a deciduous and dioecious tree species belonging to the Anacardiaceae family Torun *et al.,* (2021). It is native to the arid areas of old Mesopotamia, which currently includes Syria, Iraq, and some parts of Turkey and Iran Nezami *et al.,* (2023). Pistachio trees require warm, dry summers and relatively cold winters, and they are highly resistant to drought conditions Kaska, (2002). Due to the suitable environmental conditions and economic importance, pistachio cultivation is rapidly expanding in Kurdistan. The demand for pistachio nuts has increased, and more pistachio trees need to be planted. However, obtaining a certified cultivar is challenging.

Pistachio cultivation has faced several challenges, and its growth has not been as rapid as other fruits Ghasemnezhad *et al.,* (2021). One of the most critical issues is the difficulty of obtaining high-quality budding transplants from nurseries due to slow growth and low budding success rates Izzet *et al.,* (2017). Pistacia transplants need to be budded at an early stage of growth on a particular cultivar's scion. Due to its long vegetative growth stage, it takes more time for the plant to produce fruit. Furthermore, the gender of the tree that grows from seed cannot be predicted. Pistachio nuts are commonly propagated by budding or grafting on rootstocks or seedlings since they do not reproduce the true type when propagated by seed Ahmet, (2005)

The success of budding in Pistachio trees can be influenced by various factors, among which is the cultivar of the scion. Research studies conducted by Younis *et al.,* (2019), Kako *et al.,* (2012), Kandemir *et al.,* (2013), Niveyro *et al.,* (2012), Yazdani *et al.,* (2015), and Goulas *et al.,* (2013) have all shown that different cultivars have different success rates in budding, which can be attributed to their genetic characteristics. These genetic characteristics can be influenced by environmental conditions and climatic changes, affecting hormone content and compatibility between scions and rootstocks, as well as callus formation, cell differentiation, and elongation during the growth of budded scions Hartmann *et* *al.,* (2015). Therefore, the current experiment aimed to produce transplants of different cultivars with higher budding success percentages.

The budding date is an important factor that affects the success of budding and growth of pistachio transplants. The date of budding can impact the survival and growth of the bud, as well as the subsequent growth of the transplanted tree Sajedi *et al.,* (2012). Several studies have investigated the effects of budding dates on the success of budding and growth of pistachio transplants, including those by Moosavi *et al.*, (2015) and Sajedi *et al.,* (2012). Budding dates refer to the period during which budding takes place on transplant. The timing of budding is critical for the success of the budding process, which affects the propagated plant's subsequent growth and development. In general, budding is performed during the growing season when the plants are actively growing, and the cambium layer (the tissue responsible for growth and development) is active Sajedi *et al.,* (2012). The exact date of budding can vary depending on the plant species and local environmental conditions. However, it is typically influenced by factors such as temperature, humidity, and daylight hours Hartmann *et al.*, (2011). Previous studies have used different criteria to determine the optimal budding date for Pistachio transplants, including Saleh, (2004), Kandemir *et al.*, (2013), Aram, (2022), Ghasemnezhad *et al.*, (2021), and Sorkheh *et al.,* (2015). Therefore, identifying the most suitable date is crucial in maximizing the success rate of Pistachio propagation through budding. This experiment aims to determine the ideal date for budding Pistachio transplants, taking into account various factors that can affect the process, such as environmental conditions, genetic characteristics, and hormonal treatments.

Kinetin is a cytokinin that has been reported to improve plant growth and development by promoting cell division, differentiation, and expansion. Moreover, it has been suggested that kinetin can enhance the success rate of grafting and budding in various crops, including, grapevine, apple, citrus pistachio, persimmon, and peach. Previous studies have reported positive effects of kinetin on the success rate of grafting and budding in different crops. For instance, kinetin application was found to increase the percentage of successful buds in grapevine Liu *et al.,* (2016), improve the growth and development of grafted apple trees Liu *et al.*, (2019), enhance the success rate of budding, and improve the growth and yield of citrus (Citrus sinensis Osbeck) Wang *et al.*, (2018), improving the budding percentage in pistachio Saleh, (2004), whoever increasing budding rate in persimmon Fadhil *et al.,* (2011), and enhancing the budding peach Kako *et al.,* (2015) can accelerate budding union formation. Thus, determining the ideal concentration of kinetin was one of the most important findings of these studies. This experiment investigates the impact of kinetin on pistachio transplant success rate, focusing on bud percentage. Further research is needed to determine optimal concentration and application for different species and growing conditions. Plant growth regulators should be used cautiously and with professional guidance to avoid negative effects.

The objectives of this study were threefold: (1) to evaluate the effect of the cultivar (2) to investigate the effect of different budding dates, and (3) to determine the ideal concentration of kinetin as well as their interactions on budding percentage and some vegetative growth characteristics of pistachio transplants, The aim of investigating these factors was to optimize the rapid union between the scion and rootstock and to provide sufficient quantities of nursery transplants for establishing new pistachio plantations.

2- MATERIALS AND METHOD

This investigation was conducted during the growing season (2021) in the privet orchard located in Bani Village, Dohuk City, Kurdistan Region, Iraq, at a latitude of 36° 92' 18" N, a longitude of 43° 22' 29" E, and an altitude of 937 m above sea level. The study included three factors: three pistachio cultivars (Abas-Ali, Kale-gnocchi, and Siirt), three budding dates (mid-June, August, and mid-September), and three concentrations of kinetin (0, 5, and 10 mg/L), and their interactions. The seeds were soaked in water for 24 hours to ensure uniform germination and regular growth. The seeds were sown in plastic bags with a depth of 60 cm, a width of 15 cm, and a seed depth of 3 cm, with a distance of 15 cm between each seed, after the stratification process, the sowing began on 1st March 2020, when the seedling diameter reached the optimal thickness of about 7 to 8 mm, and budding was initiated. Fresh scion buds were taken from healthy, mature trees aged between 6 to 8 years of the three pistachio cultivars and were budded on the three budding dates using T-budding on one-year-old transplants. Before budding, the scion buds were soaked in kinetin solution at three concentrations (0, 5, and 10 mg/L) for 5 seconds. After budding, the scion and stock were tightly bound together to ensure proper union, and all branches were removed except for one branch with 4-5 leaves. The experiment consisted of 27 treatments with three replicates and 10 transplants per replicate, resulting in a total of 810 transplants. The experimental design was a factorial randomized complete block design (RCBD), and the means were compared using Duncan's multiple range test ($P < 0.05$) with a computerized SAS program (SAS, 2001). Daily harvesting of bud sticks was essential.

The following parameters were recorded in August 2022, such as

1- Budding success (**%**).
2- Number of leaves per transplant.
3- Single Leaf area **(cm^2)**.
4- Total chlorophyll **(SPAD Unit)**.
5- leaves dry weight **(g)**.

3- RESULTS

3.1 Budding success (%) :

The percentage of successful budding (%), as presented in Table 1, showed that cultivar Siirt had significant differences in budding (59.1%) when compared to cultivar Abas-Ali and Kale-gnocchi. Also, the results indicated that budding during the first date (mid-June) had the highest success rate (56.4%), while the lowest success rate was observed during the second date (mid-August). However, when treated with (10 mg/L) of Kinetin, the highest success percentage was observed (57.6%), while the control treatment had the lowest success rate. Furthermore, the interaction between cultivar Siirt and the first budding date (mid-June) was found to be the most effective treatment compared to other treatments. Furthermore, there was a better response to the interaction between cultivar Siirt and the third concentration of Kinetin (10 mg/L). The highest significant value was observed in the interaction between the first budding date (mid-June) and the third concentration of Kinetin (10 mg/L) (62.2%). However, the lowest budding success percentage was observed on the second date with the control of Kinetin. Table 1 also displays the effect of triple interaction between cultivar Siirt, the first budding date (mid-June), and the third Kinetin treatment (10 mg/L), which provided the best success rate (73.3%).

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	**Budding Date**	
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.

3.2 Number of leaves per transplant:

The number of leaves per transplant, as shown in Table 2, indicates that Abas-Ali had a significantly higher number of leaves per transplant than other cultivars. Moreover, the first budding date (mid-June) resulted in a significantly higher number of leaves compared to the other dates. Also, the concentrations of kinetin (5 and 10 mg/L) showed a significant increase in the number of leaves per transplant, with the highest value obtained from the treatment with 10 mg/L of kinetin.

Furthermore, the interaction between cultivar Abas-Ali and the first budding date (mid-June) produced the highest number of leaves compared to other treatments. Furthermore, the interaction between Abas-Ali and the third concentration of kinetin (10 mg/L) produced the most effective results. Following, the interaction between the first budding date and the third concentration (10 mg/L) of kinetin resulted in the highest number of leaves. And the triple interaction between cultivar Abas-Ali, the first budding date (mid-June), and the third concentration (10 mg/L) of kinetin produced the highest significant number of leaves.

Table (2):- Effect of Cultivars, Budding Dates, Kinetin, and their interactions on the number of leaves pretransplant of Pistachio (leaf. transplant^{-1})

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	**Med-June**	43.3 ab	48.3 ab	56.3 a	49.3 a	38.8 a
	Med-Aug.	34.3 bc	37.0 bc	40.3 a-c	37.2 b	
	Med-Sept.	29.7 c	34.3 bc	25.6 bc	29.9 b	
Kale-gnocchi	**Med-June**	27.3 bc	40.3 a-c	43.3 a-c	37.0 b	34.9 ab
	Med-Aug.	29.7 c	31.3 bc	32.2 bc	31.1 b	
	Med-Sept.	36.7 bc	36.5 bc	36.3 bc	36.5 b	
Siirt	**Med-June**	27.0 c	34.3 bc	30.3 bc	30.6 b	31.0 b
	Med-Aug.	25.3 c	34.7 bc	41.0 a-c	33.7 b	
	Med-Sept.	24.3 c	29.3 bc	32.3 bc	28.7 b	
Kinetin (mg/L).		30.9 b	36.2 a	37.5 a	**Budding Date**	
Cultivar *Kinetin	**Abas-Ali,**	35.8 a	39.9 a	40.8 a	**Med-June**	39.0 a
	Kale- gnocchi	31.2 ab	36.1 a	37.3 a		
	Siirt	25.6 b	32.8 ab	34.6 ab	**Med-Aug.**	34.0 ab
Budding Date*Kinetin	**Med-June**	32.6 bc	41.0 ab	43.3 a		
	Med-Aug.	29.8 c	34.3 a-c	37.8 a-c	**Med-Sept.**	31.7 b
	Med-Sept.	30.2 c	33.4 a-c	31.4 bc		

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.

3.3 Single Leaf Area (cm^2):

Table 3 shows that the single-leaf area wasn't significantly affected by the cultivar variant. Similarly, the budding date did not have a significant effect on the single-leaf area. However, the third concentration of kinetin had a significant effect on the single-leaf area. However, the interaction between the cultivar and budding date in other treatments showed significant values, but the most effective treatment was the interaction between cultivar Kale-gnocchi and the first budding date (mid-June) with a single leaf area of 22.5 cm^2. Furthermore, the interaction between the cultivar Kale-gnocchi and the third concentration (10 mg/L) of kinetin resulted in the highest value of 23.9 cm^2. In contrast, the interaction between the budding date and kinetin did not produce any significant differences in single-leaf areas. The triple interaction of the Kale-gnocchi cultivar, the second budding date (mid-August), and the third concentration (10 mg/L) of kinetin produced the highest value of 25.4 cm^2.

Table (3):- Effect of Cultivars, Budding Dates, Kinetin and their interactions on single leaf area (cm^2).

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	**Med-June**	16.4 ab	17.3 ab	17.2 ab	17.0 bc	19.8 a
	Med-Aug.	18.2 ab	23.1 ab	24.5 ab	21.9 ab	
	Med-Sept.	18.9 ab	21.3 ab	21.2 ab	20.5 a-c	
Kale- gnocchi	**Med-June**	20.7 ab	22.5 ab	24.2 ab	22.5 a	22.2 a
	Med-Aug.	20.2 ab	21.8 ab	25.4 a	22.4 a	
	Med-Sept.	21.7 ab	21.2 ab	22.1 ab	21.7 ab	
Siirt	**Med-June**	22.5 ab	23.4 ab	24.7 ab	23.5 a	19.5 a
	Med-Aug.	15.0 b	15.2 b	18.8 ab	16.4 c	

	Med-Sept.	18.4 ab	18.4 ab	19.3 ab	18.7 a-c	
Kinetin (mg/L).		19.1 b	20.5 ab	21.9 a	**Budding Date**	
Cultivar *Kinetin	**Abas-Ali,**	17.8 b	20.6 ab	21.0 ab	**Med-June**	21.0 a
	Kale- gnocchi	20.9 ab	21.8 ab	23.9 a		
	Siirt	18.6 ab	19.0 ab	20.9 ab	**Med-Aug.**	20.2 a
Budding Date*Kinetin	**Med-June**	19.8 a	21.1 a	22.1 a		
	Med-Aug.	17.8 a	20.0 a	22.9 a	**Med-Sept.**	20.3 a
	Med-Sept.	19.7 a	20.3 a	20.9 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.

3.4 Total chlorophyll (SPAD Unit):

Table 4 indicates that the total chlorophyll percentage in the leaves of cultivar Siirt was significantly higher than in other cultivars. Moreover, the results demonstrate that the third budding date (mid-September) resulted in higher leaf chlorophyll content. Additionally, the concentration of 10 mg/L of kinetin resulted in a chlorophyll level of 55.6 SPAD, which was higher than other treatments.

The most effective treatment was found based on the interaction between cultivar Siirt and the third budding date (mid-September). However cultivar Siirt with the third concentration of kinetin (10 mg/L) showed the highest significant differences compared to other treatments. Furthermore, the interaction between the third budding date (mid-September) and the third concentration (10 mg/L) of kinetin produced the most effective treatment with a chlorophyll content of 58.6 SPAD units. And, significant interaction was found between cultivar Siirt, the third budding date (mid-September), and the third concentration (10 mg/L) of kinetin.

Table (4) :-Effect of Cultivars, Budding Dates, Kinetin and their interactions on total chlorophyll SPAD.

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	5	10		
Abas-Ali,	**Med-June**	48.20 c	48.53 c	50.77 bc	49.2 b	49.9 b
	Med-Aug.	49.44 c	53.60 a-c	53.93 a-c	52.3 b	
	Med-Sept.	46.13 c	48.13 c	50.00 bc	48.1 b	
Kale- gnocchi	**Med-June**	48.83 c	49.27 c	55.07 a-c	51.1 b	53.6 ab
	Med-Aug.	53.3 a-c	54.37 a-c	56.70 a-c	54.8 ab	
	Med-Sept.	49.54 c	56.47 a-c	58.80 a-c	54.9 ab	
Siirt	**Med-June**	49.60 c	49.60 c	50.70 bc	50.0 b	54.2 a
	Med-Aug.	46.57 c	50.73 bc	57.47 a-c	51.6 b	
	Med-Sept.	52.00 bc	64.60 ab	66.93 a	61.2 a	
Kinetin (mg/L).		49.3 b	52.8 ab	55.6 a	**Budding Date**	
Cultivar *Kinetin	**Abas-Ali,**	47.9 c	50.1 bc	51.6 0 a-c	**Med-June**	50.1 b
	Kale- gnocchi	50.6 a-c	53.4 a-c	56.9 ab		
	Siirt	49.4 bc	55.0 a-c	58.4 a	**Med-Aug.**	52.9 ab
Budding Date*Kinetin	**Med-June**	48.9 b	49.1 b	52.2 b		
	Med-Aug.	49.8 b	52.9 ab	56.0 ab	**Med-Sept.**	54.7 a
	Med-Sept.	49.2 b	56.4 ab	58.6 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.

3.5 leaves Dry Weight (g):

A review of Table 5 indicates that the cultivar did not significantly influence the leaves' dry weight. Also, the budding date did not significantly affect the leaves dry weight. However, the leaves dry weight was adversely affected by kinetin at the second concentration (5 mg/L) and the third concentration (10 mg/L).

Additionally, the interaction between cultivar Abas-Ali and the third budding date (mid-September) provided the maximum value of 3.5 g compared to other treatments. However, in the interaction between cultivars and kinetin, there were no significant differences among the treatments. Moreover, the interaction between the third budding date (mid-September) and the second concentration (5 mg/L) of kinetin significantly affected the dry weight of the leaves.

In the study, the triple interaction between cultivar Abas-Ali, the third budding date (mid-September), and the third concentration (10 mg/L) of kinetin resulted in the highest dry weight of 4.9 g compared to all other treatments.

Table (5):- Effect of Cultivars, Budding Dates, Kinetin and their interactions on leaves dry weight (g):

Cultivar	Budding Date	Kinetin (mg/L).			Cultivar * budding Date	Cultivar
		0	**5**	**10**		
Abas-Ali,	**Med-June**	2.7 cd	3.0 b-d	3.1 b-d	2.9 ab	3.1 a
	Med-Aug.	1.9 d	2.7 cd	3.2 a-d	2.6 b	
	Med-Sept.	1.9 d	4.7 ab	4.9 a	3.8 a	
Kale- gnocchi	**Med-June**	2.6 cd	3.6 a-d	3.7 a-d	3.3 ab	3.2 a
	Med-Aug.	3.2 a-d	3.6 a-d	3.4 a-d	3.4 ab	
	Med-Sept.	2.8 cd	3.0 b-d	3.0 b-d	2.9 ab	
Siirt	**Med-June**	3.0 b-d	3.5 a-d	3.9 a-c	3.5 ab	3.1 a
	Med-Aug.	2.3 cd	2.4 cd	3.3 a-d	2.7 b	
	Med-Sept.	3.3 a-d	3.5 a-d	3.0 b-d	3.2 ab	
Kinetin (mg/L).		2.6 b	3.3 a	3.5 a	**Budding Date**	
Cultivar *Kinetin	**Abas-Ali,**	2.1 b	3.5 a	3.7 a	**Med-June**	3.2 a
	Kale- gnocchi	2.9 a	3.4 a	3.4 a		
	Siirt	2.9 a	3.1 a	3.4 a	**Med-Aug.**	2.9 a
Budding Date*Kinetin	**Med-June**	2.8 ab	3.4 a-c	3.5 ab		
	Med-Aug.	2.5 bc	2.9 ab	3.3 ab	**Med-Sept.**	3.3 a
	Med-Sept.	2.7 ab	3.7 a	3.6 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.

4- DISCUSSION

The Siirt cultivar showed a more significant budding percentage and total chlorophyll than other cultivars, while the Abas Ali cultivar was significant in the number of leaves per transplant. This result is consistent with studies conducted by Younis et al. (2019), Kako et al. (2012), Kandemir et al. (2013), Niveyro et al. (2012), Yazdani et al. (2015), and Goulas et al. (2013) Yildirim and Ercisli (2015), which have reported similar results. These differences in performance may be attributed to the cultivars' genetic characteristics between the cultivars, which can be influenced by environmental conditions and climatic changes. Moreover, these factors can affect hormone content, compatibility between scions and rootstocks, callus formation, cell differentiation, and elongation during the growth of budded scions Hartmann *et al.,* (2015) Niveyro *et al.,* (2012). However, the cultivars did not significantly affect the single leaf area and leaf dry weight.

The first budding date (mid-June) showed a more significant budding percentage and number of leaves per transplant than other dates, while the third budding date was significant in the total chlorophyll. This result is consistent with the findings of Sajedi *et al.,* (2012), M. Mohebodini and M. Mahmoudi (2010), However, it disagrees with the results of Ghasemnezhad *et al.,* (2021), Sorkheh *et al.,* (2015), Kafkas and Perl-Treves (2009), and Mahdavi *et al.,* (2018). These differences may be due to the physiological condition of both scions and rootstocks at that date, the hormone levels inside tissues at the budding date, rootstock diameters Hartmann *et al.,* (2015), and the maturity of taken scions from branches at that date. In addition, Environmental conditions can significantly affect the date and success of budding. For instance, temperature and moisture levels can influence the growth and maturation of the scion and rootstock, affecting the timing of budding Hartmann *et al.,* (2015). In some cases, high temperatures and low humidity levels may accelerate the maturation of the plants, leading to an earlier budding date. On the other hand, low temperatures and high humidity levels may delay the maturation of the plants, leading to a later budding date Choudhary *et al.,* (2021). Moreover, the maturity of the shoots in the spring (end of May to June) may determine the start date of June budding. As water flows to the plants in the spring, cambium activity begins in the plants to be budded and the plant's bark. Plants that have started to easily split bark can be used for budding İzzet, (2022). Furthermore, the amount of plant growth regulator inside scions' tissues varies according to the taken dates Choudhary *et al.*, (2021).

The third concentration of Kinetin (10 mg/l) showed a more significant budding percentage and all vegetative parameters. This result is consistent with the findings of Saleh (2004), Bhat *et al.* (2017), Kako *et al.*, (2015), and Tahmasebi-Sarvestani *et al.*, (2017), This may be due to the ability of kinetin to stimulate cell division and promote the formation of callus tissue, which is essential for successful budding Jaskani *et al.*, (2016). Moreover, kinetin has been shown to improve the success rate of budding in some fruit trees, but the optimal concentration and timing of application may vary depending on the species and environmental conditions Tworkoski, (2016).

5- CONCLUSION

In conclusion, The Siirt cultivar was found to be the most effective for budding percentage and total chlorophyll, while the Abas Ali cultivar was significant in the number of leaves per transplant. The first budding date (mid-June) was the most appropriate, showing better results in budding percentage and the number of leaves per transplant, followed by the third budding date (mid-September), which was significant in terms of total chlorophyll. However, the optimal budding date may vary based on environmental factors such as temperature, moisture levels, and shoot maturity during the spring. Additionally, a concentration of 10 mg/L of kinetin was identified as the ideal concentration for enhancing the success rate of budding. The highest positive interaction was observed between the Siirt cultivar, the first budding date (mid-June), and the third concentration (10 mg/L) of kinetin for a successful budding union of each cultivar. Overall, understanding the genetic characteristics of different cultivars, environmental factors, and the appropriate use of plant growth regulators such as kinetin can help improve the success rate of budding in (*Pistachio vera* L).

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