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RESEARCH ARTICLE **(Open Access)**

Budding of Walnut (*Juglans regiaL.*)

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Abstract

The walnut is classified as a strategic species for human nutrition and is included in the FAO's list of priority plants. Walnut, (*Juglans regia* L.) propagation is more difficult, compared to most fruit species. Due to walnut heterozygosity, propagation by seeds does not lead to inheritance of all the characteristics of certain varieties. That is the reason why propagation technologies are being improved worldwide. The purpose of this experiment was to increase the success of inoculation of the walnut budding var. Franquete. Methods such as the patch budding and chip budding have been employed during the experiment. To establish the most appropriate season of inoculation, June budding on 28 June (with buds taken in the current season), autumn budding on 28 August (with buds taken in the current season) and spring budding on 28 May (with buds collected from the winter dormant period), were tested. As rootstocks for the June and August budding, the seedlings of *Juglans regia* L. of the current year's growth have been employed. For the spring inoculation the one year old scions have been used. Patch budding resulted the most successful method for walnuts. However, the success of the method of patch budding depends on the season of inoculation. An 80 % of successful inoculation was achieved by June budding (on 28 June). Furthermore, cutting off the leaf 20 days before the buds being taken for budding, led to even higher results reaching 87% of successful inoculation. According to the results of the present study, the June budding of the patch method seems to be the best solution for the production of grafted young walnut trees.

Key words: walnut, budding, rootstock, inoculation

1. Introduction

Walnut is one of the main nut crops in Albania. The population of *Juglans regia* in Albania is currently estimated around 144000 plants [7] and, according to a government's programme, three million walnut trees should be planted in Albania during the years 2012-2017 [7]. Most of the existing trees are seedlings and notably variable in production and nut quality. Due to walnut heterozygosity, propagation by seeds does not lead to inheritance of all characteristics of a certain variety [1]. In the last years, the market demand for planting of the best walnut cultivars has increased, resulting in a bigger interest in the vegetative propagation of this species. Walnut trees are more difficult to graft than most fruit trees [5]. This is due to the presence of high concentration of phenolic compounds in its tissues and their oxidation by wounding, [1]. The walnut nursery industry uses many different types of propagation to create finished propagated trees for orchard planting, including sexual propagation (rootstocks only), micro-propagation, cuttings, budding, and grafting [9].In Albania, walnut propagation is achieved by using seeds coming from valuable varieties. This type of propagation produces a large number of plants with various characteristics into the walnut orchards [7]. Other countries have developed other, apparently more successful methods. In Bulgaria the main method used for propagation of walnut is the patch budding, where the grafted plants have grown in the nursery [1]. In Romania utilizing the whip and tongue grafting followed by callusing at the grafting point, the rate of success is more than 80% (2). The results of other research suggest also that patch budding produces better callusing, scion growth and bud-take compared to chip budding [3]. Patch budding is the most common budding method used for walnuts, but to ensure the best buds, the budwood should be prepared by removing the leaves while still on the tree a few weeks before use [9]. Different types of grafting have different optimum timing and the success of the method of patch budding seems to depend on the season of inoculation [1]. June budding creates a tree in only one year. Rootstocks to be used in June budding are grown in very fertile conditions and typically reach budding size by June, coinciding with the time in which current season scion buds develop to a condition suitable for use as budwood (walnut propagation). Also genotype has highly significant effects on grafting success [6]. The present research focused on two types of budding (patch and chip) and paid special consideration to the time of budding. The positive effects of cutting off the leaf, several days before the buds were taken for budding, have been proved by the budding success.

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2. Materials and methods

The present study was conducted in a private nursery located in the Peze, a village in the district of Tirana. The rootstocks were *Juglans regia* seedlings, which had been direct sown on January (20-25 January)**.** For the June and August budding, the seedlings of the current year's growth have been employed. While for the spring budding (May budding) one-year old seedlings have been used**.** Two weeks before budding, the stocks were selected based on uniformity of girth (approximately 10 mm diameter.) Scionwoods of *Juglans regia* var.'Franquette were obtained from a 7-years-old orchard block on the day of budding. Patch budding and Chip budding were employed.

Three budding times were selected at one month interval, as follow:

1. Spring budding on 28 May (with buds, collected from the winter dormant period)
2. June budding on, 28 June (with buds, taken from the current season) and;
3. Autumn budding on, 28 August (with buds, taken from the current season).

To study the effect of cutting off the leaves before the buds were taken for budding two kinds of scionwoods had been used:

- Scionwoods with the leaves.
- Scionwoods without leaves (The leaves were cut off three weeks before the buds were taken for budding)

The influence of BAP (Benzyl Amino Purine) on budding success has been proved by spraying of the inoculations, before tying, with 500 ppm BAP.

Experimental design was a randomised complete block with three replicates of each treatment. Each replicate contained 20 stocks

3. Results and discussion

According to the results, summarized in Tables 2 and 4, the patch budding method, performed during the growth season, has a higher percentage of success compared with chip budding. The higher percentage of patch budding has been reported by other authors [3]. The date of vaccination had a highly significant effect on budding success. Table 1, 2 and 4 show that the patch budding, performed on 28 June, gave the highest success rate. The success rate in June was 86 % while in August, it resulted only 29 %. The results reported in this paper are supported also by other researches [4]. Most probably June budding success is due to the equality between roots' pressure and the suction power of the leaves. This balance between these two pressures avoid that scions be damaged from excessive liquids coming from the root.

Patch and chip budding, performed on 28 May had the lowest success, about 6%.

Cutting off the leaf, 20 days before the buds were taken for budding, gave higher results, about 87 per cent of success (Table 2). The best result has been achieved when the remaining leaf stalks shrivel and fall away.

The lowest success of budding, on 28 May (Table1), may be due to low activity of the cambium of the scion, necessary to enhance the formation of callus of the wounded tissues [8]. As can be seen in Table 2 and 3, the result of cutting off the leaves before inoculation was significant to the success of patch budding. The percentages of budding success using scions without leaves were significantly higher (87%) compared with those made with leaves (50%) This can happen for the following reasons:

a. Removal of the leaves can reduce the presence of the high concentration of phenolic compounds in its tissues and their oxidation by wounding.
b. The bark on the current year's wood is exceedingly tender, and the outer layers are very apt to be rubbed off in handling, while the leaf removal does the bark of the buds more hard
c. Removal of the leaves avoids distortions of the bark around the bud, prepared for budding. This helps to better contact of the bud with the rootstock

Table 1 Results of different budding performed on 28 May

	Patch budding		*Chip budding*	
	Budded stocks	Budded success	Budded stocks	Budded success
With BAP	45	2	45	4
Without BAP	45	3	45	3

Table 2 Results of different budding performed on 28 July

	Patch budding				*Chip budding*			
	Without leaves		With leaves		Without leaves		With leaves	
With BAP	Budded stocks	Budded success	Budded stocks	Budded success	Budded stocks	Budded success	Budded stocks	Budded success
	45	39	45	22	45	13	45	3
Without BAP	45	37	45	19	45	15	45	5

Table 3 Effect of removing of the leaves on patch budding success

Replicates / *Treatments*	R_1	R_2	R_3	S	M
Without leaves (-BAP)	12	15	12	39	13 A
Without leaves (+BAP)	13	10	14	37	12,33A
With leaves (-BAP)	9	6	7	22	7,33B
With leaves (+ BAP)	4	8	7	19	6,33B
S	38	39	40	117	

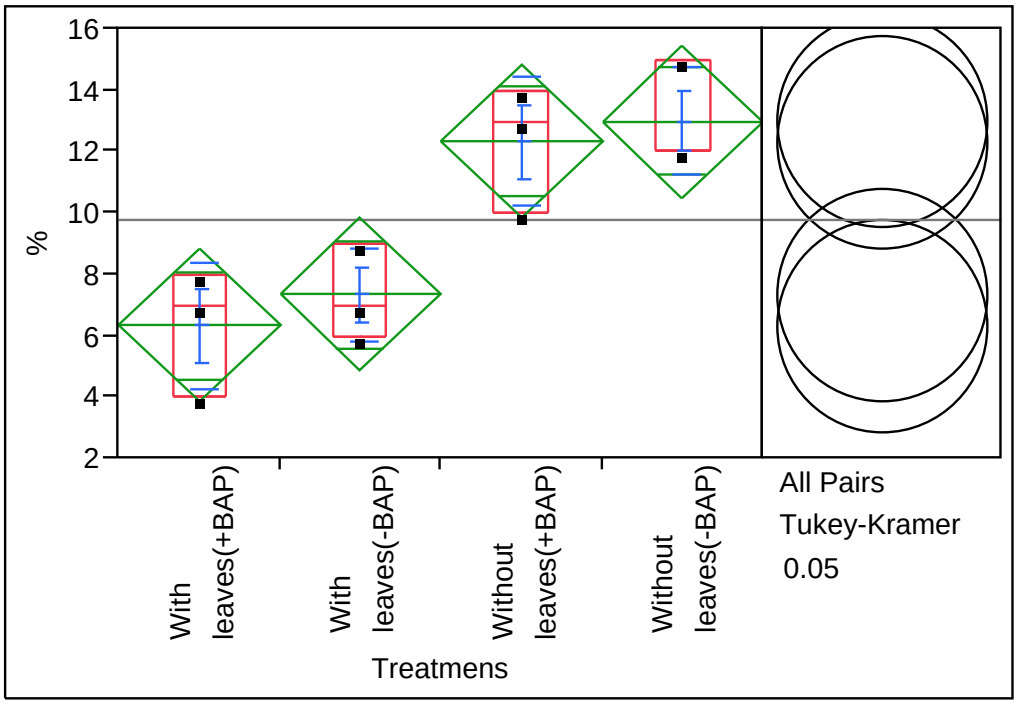

Figure 1: Cluster of Anova Analysis of Variance, LSD = 2.30600, Alpha = 0.05

Table 4 Results of different budding performed on 28 August

	Patch budding				*Chip budding*			
	Without leaves		With leaves		Without leaves		With leaves	
With BAP	Budded stocks	Budded success	Budded stocks	Budded success	Budded stocks	Budded success	Budded stocks	Budded success
	45	12	45	4	45	1	45	2
Without BAP	45	13	45	6	45	3	45	-

Figure 2: New plant (budding method)

Figure 3: New budding plants

4. Conclusion

-The June budding of the patch method can be implemented in the production of grafted young walnut trees.

-Cutting off the leaf, 20 days before the buds were taken for budding, gave highest results

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