



Short Communication

Rooting hardwood cuttings of plum (*Prunus domestica* L.) according to taking time of the cuttings

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Abstract

Effect of different taking times of cuttings on rooting of hardwood cuttings of plum (*Prunus domestica* L.) cv. Greengage were assessed at the College of Agricultural Engineering Sciences, University of Sulaimani Kurdistan Region-Iraq. The taking times of the cuttings started from December 9, 2019 to February 18, 2020 with fortnight intervals, included (9th December, 24th December, 7th January, 21st January, 4th February and 18th February). The cuttings dipped in 3000ppm IBA for 10 seconds and were planted in 3:1 sterilized sand: peat, and the experiment laid out in Randomized Complete Block Design (RCBD). The results indicated that the highest (40%) rooting was detected in cuttings were taken on 9th December and to a lesser extent (26.67%) in those taken on 24th December. Also, the cuttings from 9th December gave the best (6.66) root number, the longest root (21.71cm), the longest shoot (8.66cm) and the maximum shoot diameter (1.78mm). In contrast, the cuttings were taken on 7th January, 4th and 18th February showed the inferior results. Generally, depending on the results of this experiment, early December is the best time to take hardwood cuttings of plum (*Prunus domestica* L.) to obtain the best rooting rate and other shoot and root traits. While the cuttings prepared in winter gave the lowest results.

Keywords: Hardwood cuttings; IBA; plum; taking time.

Introduction

Propagation of plums is performed in most cases through budding or grafting onto appropriate rootstocks of peach, apricot or plum. Despite, these two methods are costlier, more laborious and time consuming^{1,2}.

Alternatively, cutting propagation has been studied by researchers as a convenient method for plum propagation, however many limitations such as seasonal change may restrict rooting capacity of the cuttings^{3,4}.

In this regard, Sándor et al.⁵ referred that potential of hardwood cuttings of plum rootstocks to produce root is varied seasonally during dormant season. Changing rooting capacity of cuttings according to season or time of taking cuttings may relate to the phenological stage, change in metabolism, physiological characteristics and nutrient reserves such as carbohydrate in the cutting tissues^{6,7}.

Also, time of taking cuttings affects the ratio of hormonal contents of cuttings that correlate with rooting ability of cuttings. Besides, responses of the cuttings to exogenous auxins used as rooting promoters are different according to the season in which cuttings are taken^{8,9}. In the light of the vital role of taking time of cuttings in production of roots in cuttings, this

experiment was carried out to determine the best time to take hardwood cuttings of plum (*Prunus domestica* L.).

Materials and methods

This experiment was conducted in the College of Agricultural Engineering Sciences, University of Sulaimani, Kurdistan Region-Iraq to investigate rooting capacity of hardwood cuttings of plum (*Prunus domestica* L.) cv. Greengage according to time of taking the cuttings during the dormant season. The hardwood cuttings were taken from one-year-old shoots of Greengage plum cultivar with about fortnight intervals from December 9, 2019 to February 18, 2020, included (9th December, 24th December, 7th January, 21st January, 4th February and 18th February). All the cuttings were collected from a single 8-year-old plum tree.

The cuttings were prepared with 20cm length and 1-0.6mm diameter. They were soaked in 1g/L tops in 70% fungicide for 5 minutes, and after surface dry, they dipped in 3000ppm IBA for 10 seconds. After that, they were planted in 3:1 sterilized sand: peat media in plastic bags with a size of 35-15cm which were placed in a plastic high tunnel, and in each plastic bag five cuttings were planted. The average maximum and minimum temperature inside the plastic high tunnel during the experiment was between 12.5-28.3°C. The experiment was laid out in a

Randomized Complete Block Design (RCBD) with three replications.

After 5 months and 15 days the cuttings were uprooted to measure rooting percentage, number of the main roots, the longest root, the longest shoot and shoot diameter. The data were analyzed using XLSTAT software version 2019.2.2, one-way ANOVA-RCBD and Duncan's multiple-range at 5% for comparison of means.

Results and discussion

Hardwood cuttings of Greengage plum cultivar were assessed to determine rooting percentage (Figure-1). The results indicated that rooting percentage was significantly affected by the time of taking cuttings. The highest (40%) rooting was detected in cuttings were taken on 9th December and to a lesser extent (26.67%) in those taken on 24th December. Rooting sharply reduced to the lowest rate (6.67%) in cuttings taken on 7th January, while the cuttings taken on 21st January gave (13.33%) rooting but not to a significant extent. Rooting percentage once again was dropped to (6.67%) in the cuttings taken on 4th and 18th February. Many researchers reported that collection time of cuttings strongly linked with rooting capacity of the cuttings even in easy-to-root species. For instance, Marianna plum rootstock is a very easy-to-root species but Szećskó et al.¹⁰ found that the best time to take Marianna cuttings was from October to December. Others referred that rooting of cuttings is evidently variable depending on the physiological state of the stock plant, such as the ratio of endogenous rooting promotor per rooting inhibitor substances and the level of reserved food which are directly affected by season^{11,12}. The rooting result of the present study exhibited that rooting percentage was the best when the cuttings were taken in December, but the worst when they were taken in February. Similar results were found in the cuttings of Cadaman stone fruit rootstock in which the highest rooting was given by the cuttings collected in December from basal part of the shoots, while no root was observed in cuttings collected in February¹³. Moreover, Erez and Yablowitz¹⁴ found December to be the best time to take cuttings of 'Earligrande' peach and late January was the worst. They attributed these results to breaking dormancy earlier in the buds of the cuttings taken in late January in advance to establishment of a good root system, thus more water transpired finally desiccation occurred. Hambrick et al.¹⁵ reported that rooting of hardwood cuttings of *Rosa multiflora* showed maximum rooting as taken from 15 November to 15 December. They stated that this result may be due to high carbohydrates at this time (15 November to 15 December) which is important for rooting in cuttings, and low N which negatively influences root formation in cuttings. Also, Eliwa et al.¹⁶ determined the 1st December as the best time to take cuttings of some peach rootstocks because of that the cuttings in this time had superior values of total indoles, total phenols and total carbohydrates and the lowest value of total nitrogen. On the other hand, the rooting result of the present experiment may connect to the degradation of absorbed IBA in the cuttings which taken at different times. Sándor et al.⁵

concluded that concentration of absorbed IBA in plum cuttings was variable according to the time of taking cuttings. They found the highest degradation of IBA portion in the cuttings taken in the late winter, January and February, but IBA degradation was less in those taken at the end of autumn.

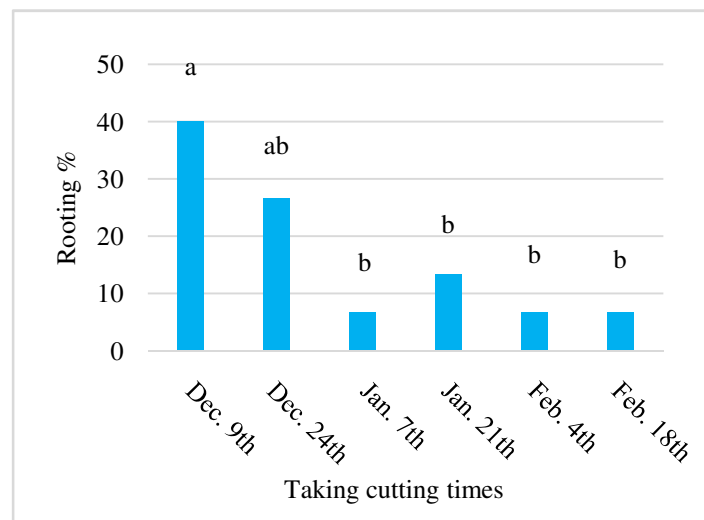


Figure-1: Rooting percentage of plum hardwood cuttings in different taking times of the cuttings. Means sharing the same letter are not significantly different according to Multiple Duncan Test at ($p \leq 0.05$).

The data in Figure-2 depicted that root number and root length were greatly influenced by the time of taking the cuttings. The cuttings taken on 9th December gave the highest (6.66) root number and the longest root (21.71cm), in opposite root number and root length reduced to the lowest levels (0.67 and 2.99cm, respectively) onto the cuttings taken on 7th January. Improving root quality in cuttings taken on 9th December might belong to that, these cuttings were first taken and planted, hence had more time to produce more roots and elongate them. Hartmann et al.¹¹ referred that when hardwood cuttings of deciduous species are collected and planted in fall in which the buds are in a dormant state the best root may form and well established in spring by the time of opening the buds. However, these results also might relate to the ratio of chemical and cold unit accumulations in the stock plant from which the cuttings were taken along different taking times. Szećskó et al.¹⁰ concluded that phenols, peroxidase enzyme activity, polyphenol oxidase activity, the daily mean temperature and Cold Units acquired by the stock plant have an effect on almost all examined parameters in hardwood cuttings of different plum rootstocks when they were collected in at different times.

The results of comparison of means (Duncan Test at $p \leq 0.05$) for shoot length and shoot diameter shown in Figure-3 revealed that taking times of the hardwood cuttings of Greengage plum cultivar significantly resulted in different shoot lengths and diameters. The longest 8.66cm shoot and the maximum shoot diameter 1.78mm were found in the cuttings taken on 9th

December. In contrast, shoot length and shoot diameter dropped to 0.28cm and 0.36 mm, respectively in the cuttings taken on 7th January, and statistically the similar results were achieved in the cuttings taken on both 4th and 18th February like 7th January. These might be because of the cuttings of December produced the best quality of roots and might absorb more water and nutrients, but the cuttings of January and February gave poor root quality (Figure-2). Bredmose et al.¹⁷ stated that better root formation and growth give rise to better shoot growth. Besides, it is possible that the cuttings from different taking times responded variably toward the applied IBA to obtain the best studied characters via hydrolysis and mobilization of reserves. de Andrés et al.⁸ mentioned variable receptivity of tissues of the cuttings to IBA when collected in various times as a factor to obtain different results.

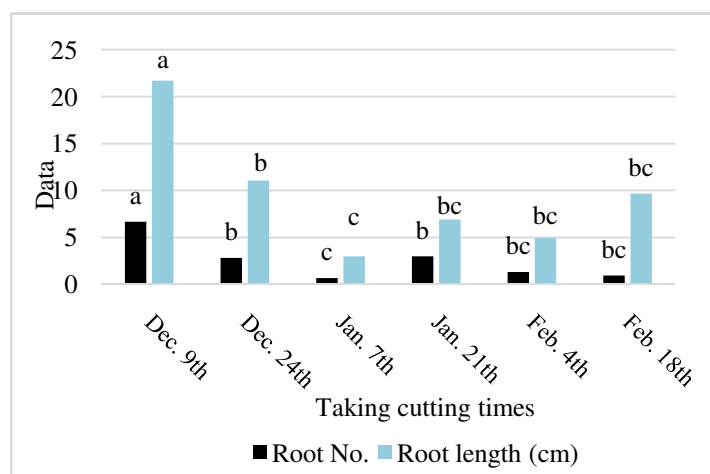


Figure-2: Root number and root length onto hardwood cuttings of plum in different taking times of the cuttings. Means sharing the same letter are not significantly different according to Multiple Duncan Test at ($p \leq 0.05$).

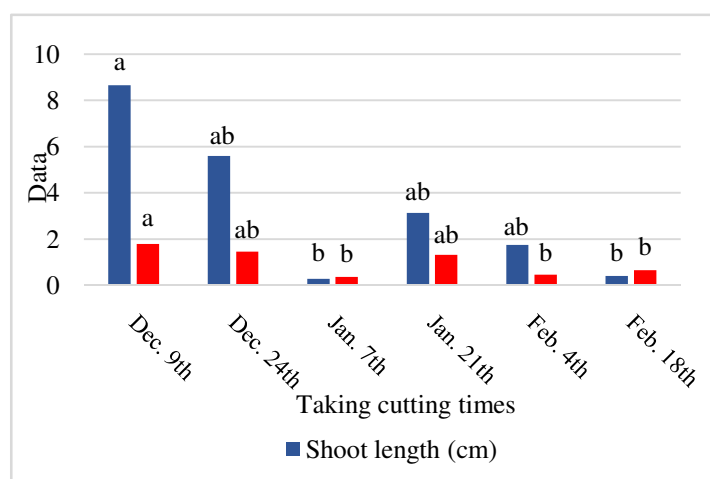


Figure-3: Shoot length and shoot diameter onto hardwood cuttings of plum in different times of taking the cuttings. Means sharing the same letter are not significantly different according to Multiple Duncan Test at ($p \leq 0.05$).

Conclusion

From the outcomes were obtained in this experiment, it can be concluded that late fall time which manifested on 9th December was outstanding for taking hardwood cuttings of plum (*Prunus domestica* L.), in order to achieve the best rooting rate and other characters of root and shoot. While, the cuttings of winter didn't sufficiently give the examined results.

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