Production of Fig (*Ficus carica* L.) Nursery Plants by Stem Layering Method

Oguz DOLGUN [1(✉)]
Faik Ekmel TEKINTAS [2]

Summary

This research was carried out in Turkey in 2006. The aim of the present research is to study the possibility of fig nursery plant production with stool bed layering method. Fig cultivar Sarilop was used as a material. It is the best fig cultivar for drying and it can also be consumed fresh. The mother plants were planted horizontally with distance of 70 x 60 cm in November after the fall of the leaves. In February, all the buds on the ground side of plants were blunted and plants were fixed parallel (layered) to the ground surface with prongs made of a thick galvanized wire in the shape of U. Bottom parts of the new shoots which developed from the mother plants and reached 20 cm were covered by 10 cm of soil. Bottom parts of the newly formed shoots were continuously covered with the soil taken from between the rows appropriately to the development of the shoots during vegetation period. At the end of the vegetation period, eighty nursery plants of different sizes were obtained from twenty mother plants. Most of the nursery plants (77.5 %) had sufficient qualitative and quantitative features for sale. The small sized plants, which may not be sold, can be used as nursery plant or mother plant (stock) after one year of care period. It was determined in this research that it was possible to propagate nursery plant by stem layering. The production of fig nursery plants by stem layering with low production costs is suggested to as an alternative method for the production of fig nursery plants.

Key words

fig, propagation, layering, nursery plant, "Sarılop"

[1] Adnan Menderes University, Sultanhisar Vocational College, Sultanhisar, Aydin, Turkey
✉ e-mail: odolgun@adu.edu.tr
[2] Adnan Menderes University, Faculty of Agriculture, Department of Horticulture, Kocarli, Aydin,Turkey

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Introduction

Fig is a subtropical fruit that belongs to the *Ficus* genus of the *Moraceae* family. It is grown in some parts of the world such as Mediterranean region, South West Asia, South America, South Africa, Caucasia and in a lesser extent in Australia. Fig fruits, having quite large nutritional values, are consumed fresh or dried and it is accepted as a blessed fruit in celestial religions. Due to these specifications, it has been cultivated and consumed since ancient times (Kabasakal, 1990; Aksoy and Can, 1993; Botti et al., 1997; Pareira and Nachtigol, 1997; Yildiz,1999).

Fig nursery plants can be produced with different production methods such as layering, bottom shoots and tip cuttings (Aksoy, 1990). With production of classical layering and bottom shoots methods, small amount of nursery plants are produced because of the limited shoots. For this reason, these methods are not prefered in commercial nursery plant production. Therefore, in commercial nursery plant production figs are propagated by tip cuttings in field or misted rooting units (Dolgun et al., 2003; Kabasakal, 1990).

In field production, ecological conditions such as sudden changes of temperature and low moisture adversely affect rooting and growing of cuttings. It is important to prepare the soil and seize a suitable climate conditions in order to use this method for production. Even the slightest stress conditions, faced during production can adversely affect production costs and quantity.

Fig cuttings can easily be rooted bottom heated and fogged rooting units. They show a high rate of rooting in bottom heated and misted rooting units but these roots are rather brittle. While transferring into the ground or a tube, these fragile roots are damaged and the plants which have such roots wilt and die in a short time. Although it is supposed that it is easy to produce fig nursery plants by cuttings, since they have a high rooting ability, the desired level of success and continuity can not be achieved because of these problems. The aim of the present research is to solve problems faced in the production of fig nursery plants and to study the possibility of fig nursery plant production with stool bed layering method. Recently, stool bed layering method was intensively used during propagation of many different fruit crops including some dwarf apples, from which cuttings can hardly be rooted. (Boutherin and Brong, 1989; Sadhu, 1989; Hartmann et al., 1990; Kembelo, 1992; Seferoglu et al., 1994; Nicholas, 1998; Shaltout et al., 1998; Dolgun et al., 2003; Cobanoglu et al., 2004).

Materials and methods

In this research, nursery plants of fig cultivar Sarilop for drying were used as a plant material. “Sarilop” is the best fig cultivar for drying in the world. It has big and light yellow coloured fruits with a high level of sugar. The fruits can also be consumed fresh, and they are exported to other countries of the world both dried and fresh. The trees are 7-8 m in height and have a wide and shallow form. Fig can be cultivated in different soil and drought conditions. It has got a dioic flower structure. (Eroğlu,1976; Anonymous, 2001; Aksoy, 1993). In this research one-year old tube mother plants with average height of 60 cm and trunk diameter 1.7 cm measured at a distance of 5 cm from the soil surface were used. The bottom and middle parts of the mother plants were well lignified. The tip parts were semi-lignified. On average, each plant had 18 buds.

The place for nursery is ploughed deeply and 1 m^3 of eliminated manure were added to every 10 m^2 plot and mixed in depth of 30-40 cm of the soil. After that, soil surface was hoed and raked. The mother plants were planted horizontally with distance of 70 x 60 cm in November after the fall of the leaves. In February, all buds on the ground side of the plants were blunted with a sharp knife and then the mother plants were fixed parallel (layered) to the ground surface with prongs made of a thick galvanized wire in the shape of U. Nursery was designed as a randomized split plots with four replicates, and five plants were used for each replicate.

The first covering with the soil was carried out when the new shoots which developed from the layered (mother) plants reached 20 cm. Bottom 10 cm of shoots were covered with soil and were continuously covered with the soil taken between the rows appropriately to the development of the shoots. Plants were watered by sprinkles in order to keep the soil moisture. Special attention was paid at keeping the soil moisture so that the parts remaining in the soil root efficiently. No chemicals were used in this research.

At the end of the vegetation period, the soil put on the bottom parts of the new plants formed from shoots was carefully taken away and rooted plants, which developed during the vegetation period, were cut off from mother plants. Total number of plants was counted and the number of plants which developed from the buds of the bottom, middle and tip buds was determined separately. The number of roots more than 2 mm thickness, the height, stem diameter, fresh and dry weight of the plants were determined. Buds and roots of each plants were counted manually. Band measuring device was used for the height measurements of each nursery plant. Stem diameter was measured with electronic caliper. Stem fresh and dry weights were determined with the scales with sensitivity of 0.01 g (Scaltec Instruments, Heilingenstad, Germany).

Results and discussion

At the end of the research, 80 plants of different size were obtained from 20 mother plants. An average of four

Table 1. Quantities of obtained plants of different sizes

	Plant Length (cm)							
	10-20	21-30	31-40	41-50	51-60	61-70	71-80	81and up
Number	5	9	4	8	7	7	2	38

Table 2. Average of examined characteristics

	Plant Length	Stem Diameter	Bud Number	Root Number	Stem Dry Weight	Stem Fresh Weight
Lowest Buds	102.10a	22.21a	23.95a	11.08a	85.18a	196.85a
Middle Buds	54.45b	14.72b	13.95b	8.20b	26.60b	55.45b
Tip Buds	26.85c	11.52c	9.92c	6.68c	14.50b	35.17b
LSD 0.05	7.301	2.552	2.915	1.175	17.472	35.527

nursery plants obtained from each mother plants which have an average of nine buds after blunting. The numbers of the plants grouped with sizes of 10 cm increment were shown in the Table 1.

A total of 62 plants higher than 40 cm, which can be used for establishing of orchards, were accepted as nursery plants for sale (77.5 %).

The findings were evaluated statistically using SAS (1996). Plant length, stem diameter, bud number, root number, stem dry and fresh weight of the nursery plants were found to be significantly different.

Statistic values concerning the nursery plants formed from the bottom, middle and tip buds are given in Table 2.

Nursery plants which formed from the bottom buds had the highest value for plant length (102.10*a*). Bottom bud plants have a significant superiority to middle (54.45*b*) and tip (26.85*c*) bud plants for plant length. Bud number is significantly higher in bottom bud plants (23.95*a*). Middle (13.95*b*) and tip (9.92*c*) bud plants have lower values for bud number. For stem diameters, bottom bud plants have high value (22.21*a*). Middle (14.72*b*) and tip (11.52*c*) bud plants have low statistical values for stem diameters. Bottom bud plants have significantly highest statistical value (85.18*a*) for stem dry weights. Middle (26.60*b*) and tip (14.50*b*) buds have lower values. For stem fresh weights, bottom bud plants have highest statistical value (196.85*a*). Bottom bud plants have a superiority to middle (55.45*b*) and tip (35.17*b*) bud plants for stem fresh weights.

The literature on propagation of figs by layering method is very limited. There is some literature on propagation of figs by cuttings. Yildiz (1999) studied different propagation methods by cuttings for increase production of nursery plants of "Bursa Siyahı" fig cultivar and obtained nursery plants which had an average stem height of 15.06 cm. They also determined that stem fresh and dry weights were 22.06 g. and 9.88 g. respectively.

By cutting of "Sarılop" and "Bursa Siyahı" fig cultivars and using chemicals Dolgun et al. (2003) obtained nursery plants with average height of 108 cm, average stem diameter of 1.91 cm, average fresh weight of 251.51 g and average dry weight of 138.58 g.

It is not possible to compare these two studies that were carried out on rooting of the cuttings with the results of the this research.

It is well known that fig is a plant with a single branching out (monopodial) and it has a strong apical dominancy. It forms strong shoots from apical (tip) buds. But in this research, it was observed that plants from the tip buds of the mother plants showed very slow development and formed small size plants.

On the other hand, the buds placed in the middle and bottom parts of mother plant formed stronger and higher plants than the ones formed from the buds in the tip parts. It is supposed that as the result because of the mother plants being laid down apical dominancy disappears. Plants which formed bottom buds were close to the root system of mother plant and they took more water and nutrients from the ground through the root system of the mother plant and their own roots.

Root number was high in bottom bud plants (11.08*a*). Middle (8.20*b*) and tip (6.68*c*) bud plants showed low values for root numbers. Shoots formed less roots than it was expected. It was observed that the stems of the mother plants, remaining in the ground, formed a great number of strong roots in all parts, which thickened and took a form of the main root. It was assumed that this fact was the reason for new plants not having many roots.

According to previous studies, it is difficult to find a branch long enough for layering use and to layer it into the soil by the classical method of layering close to the soil surface. With classic layering method, it is possible to produce limited number of nursery plants mostly in old gardens with old trees. Therefore, by using this method, the com-

mercial production is not possible. As for the production of fig nursery plants by the method with cuttings, one can get only one nursery plant from a 25 cm long cutting with 4-5 buds. These cuttings are planted with 20 x 50 cm distance and about a 1 m long place is needed for four or five cuttings. As for the method used in this research, 70 cm long place was used for a plant with about nine buds.

In field production with cuttings, the weather conditions can have negative effect on rooting. In case of sudden rise in temperature, the buds on the cuttings open immediately but rooting does not occur yet, or just starts and the cuttings do not get enough water, which causes wilting and/or the death of the cuttings. Therefore big losses can occur in production. Irrigation is very important for the rooting and blooming period. Even if there is enough water in the soil, high temperatures in the afternoon especially in hot areas can be a reason of fast wilting of cuttings with immature root system. Another problem faced in the production with cuttings is the need for upright and straight developed shoots. But there is not enough number of cuttings with such characteristics. In the units with bottom heating, fig cuttings are rooted very easily but these roots are quite fragile and sensitive. These roots can easily be broken when placed into sacks or into the ground or they wilt during transportation. As the result, in spite of large number of rooted cuttings, after the transfer small number nursery plants were obtained by this method (Eroglu, 1976; Kabasakal, 1990; Aksoy,1990; Dolgun and et al., 2003).

No chemicals were used for the growth of the plants in this research but most of the nursery plants obtained were more than 80 cm in height and the ones that were smaller could be used in the orchards. Therefore, it could be said that the results were successful in the aspect of the number of usable nursery plants.

Conclusions

In the present research it was determined that it was possible to produce nursery plants by the stem layering method. In comparison with classical methods of layering or propagation with cuttings, the hand labor and care took less time and expenses. Most of the nursery plants (77.5 %) obtained in this research had qualitative and quantitative features for sale. The small size plants, which may not be sold can be used as nursery plant or mother plant (stock) after one year of care period. These positive sides of this method give superiority to the method of propagation with cuttings. Therefore, with the stem layering method, the production of fig nursery plants becomes easy and cheaper. It is supposed to be a positive contribution as an alternative method in the production of fig nursery plants.

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