International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 873-876

Received: 24-03-2019
Accepted: 28-04-2019

**Usha Mehra**
Department of Fruit Science, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal Uttarakhand, India

**Manuj Awasthi**
Department of Fruit Science, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal Uttarakhand, India

**Correspondence**
**Usha Mehra**
Department of Fruit Science, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal Uttarakhand, India

# Studies on rooting of hardwood stem cuttings using rooting media on Japanese persimmon (*Diospyros kaki* L.) Cv. Fuyu, treated with different concentration of indol-3-butyric acid

**Usha Mehra and Manuj Awasthi**

**Abstract**
The present propagation study has been attempted to enumerate the rooting response of Hardwood stem cuttings of Persimmon (*Diospyros kaki* L.) cv. Fuyu. The different concentrations of IBA as, 1500 ppm, 3000 ppm, 4500 ppm and 6000 ppm respectively along with control by soaking method for 10 seconds. Later the cuttings were placed in rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1, 1:2 and 2:1 with filled in polythene bags. The maximum rooted cutting (64.40%) were recorded on 1:2 soil and FYM + 6000 ppm IBA treatment. The length of longest root obtained maximum in the same treatment *i.e*. 1:2 soil and FYM + 6000 ppm IBA, reached up to 8.00 cm. Significantly maximum number of primary roots per cutting (8.17) was found in cuttings planted in 3000 ppm IBA + 1:2 soil. Significantly maximum number of secondary roots per cutting (18.80) was found in the cuttings planted in 6000 ppm + 1:2 soil and FYM. Significant effect on length of shoot of rooted cutting, the maximum length of shoot (11.27 cm) was recorded in treatment (1:2 soil and FYM + 6000ppm IBA). Maximum fresh weight of roots per plant (1.36 g) and maximum dry weight of roots per plant (0.16 g) was found in the cuttings planted in 1:2 soil and FYM + 6000 ppm IBA. As conclusion is observed that the persimmon Interaction of IBA treatments and rooting media were also found significant for many of the parameters. The treatment combination (1:2 soil and FYM + 6000ppm IBA) was found to be significantly superior for many of the root parameters.

**Keywords:** persimmon, *Diospyrus kaki*, soil, FYM, survival cutting

## Introduction
Persimmon belongs to the genus *Diospyros* in the Ebenaceae family and are fairly common trees in the warmer regions of the world, particularly in Asia and North America. The genus contains almost 190 species, of which three are used in commercial fruit growing: *D. kaki* (oriental or Japanese persimmon), *D. lotus* (Date plum) and *D. virginiana* (American persimmon). The most important of these is *D. kaki*. The persimmon tree can be either a multi-trunk or single-stemmed deciduous tree that can grow to 6 meters at maturity. The branches are brittle and easily damaged by wind. The leaves are large and turn a dark glossy green as they age. Under mild autumn conditions the leaves often turn an attractive yellow, orange and red colour making them valuable as an ornamental tree.

The production of persimmon has recently increased worldwide, and now Azerbaijan, Brazil, Israel, Italy, and Uzbekistan each produce more than 30000 t (Food and Agriculture Organization of the United Nations, 2017). In the semi-arid climate of eastern Afghanistan, persimmon production has also increased, where there are about 100 ha of orchards growing astringent persimmon cultivars (Samadi *et. al.,* 2009). At the same time, natural wild populations of *D. lotus* can be found in the mountainous area of this region, and *D. lotus,* seedlings are mainly used as rootstock for *D. kaki* cultivars. Recently, seedlings of *D. kaki,* have shown potential as rootstocks for persimmon cultivars, and some non-astringent cultivars have been introduced to this region. However, graft incompatibility can occur between *D. lotus*, rootstocks and some non-astringent cultivars such as 'Fuyu' (Tanaka, 1930). The persimmon is considered to be difficult to propagate using cuttings (Tao and Sugiura, 1992) and commercial cultivars have usually been propagated by grafting or budding onto seedlings of *D. kaki*, *D. lotus*, *D. virginiana*, or other species.

The propagation techniques for persimmon do not greatly vary from other fruit trees and are reproduced from seeds, propagation by cutting budding, grafting, etc. The early history of asexual propagation was essentially the history of grafting. It was not until the 17th century that detailed information on the propagation of plants by means of layers and cuttings was available. Probably no other single for regeneration, will develop into a complete plant. Propagation of Japanese persimmon cultivars by cuttings has so far proved to be very difficult (Kitagawa *et al.*, 1984) [4] and few scientists tried it and succeeded in softwood cutting propagation (Machida and Fuji, 1969) [5]. In all cases, etiolation of stock plants and blanching of cutting bases were necessary to obtain good rooting. These operations requires a lot of time. These propagation methods have never been used commercially, and there has been no report of field performance of the own-rooted trees are propagated by cutting, although there are many advantages in hardwood cuttings propagation. They are more difficult to root than softwood cuttings (Gemma *et al.*, 1983) [3]. Operation in asexual propagation is more important than cutting because the average nurseryman depends very largely upon this type of propagation. Cutting may be described as a method of propagating plants by the use of detached vegetative plant parts which, when placed under conditions favorable.

The application of root promoting growth regulatory substances, especially auxins is the most common treatment to enhance rooting in stem cuttings. Before the auxins many chemicals were tried with limited success. The discovery that auxins such as Indole-3-butyric acid (IBA), Indole-3-acetic acid (IAA) and Naphthalene acetic acid (NAA) stimulated the production of adventitious roots in cuttings. Typically, cuttings treated with auxins root more rapidly and produce more roots with a higher percentage of rooted cuttings. Indole-3-butyric acid (IBA) is the best auxin for general use because it is nontoxic to plants over a wide concentration range and is effective in root promotion of a large number of plant species. It is relatively a stable compound. It is also probably the single most effective treatment to achieve successful propagation.

With the view of above facts the present study entitled "Studies on Rooting of Hardwood Stem Cuttings using Rooting Media on Japanese persimmon (*Diospyros kaki* L.) cv. Fuyu, Treated with Different Concentration of Indol-3-Butyric Acid'' will be carried out with the following objectives:

- To study the effect of different rooting media and Indole-3–Butyric Acid on survivability of cutting.
- To study the effect of different rooting media and IBA on rooting.

## Materials and Methods

The study was conducted under the polyhouse condition at Fruit nursery of Department of Fruit Science, College of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand. The site is located at an altitude of 1900 meters above mean sea level at a Longitude of 78.99 ºE and 30.056 ºN (IMD, 2016). The climate of Bharsar is mild summer, higher precipitation and colder or severe cold prolonged winter. The South-east monsoon commences towards the end of June while the North-east monsoon causes occasional winter showers during November- February. During winter, snow fall is common in this region, during summer months, the valley has hot climate prevailing for few hours in a day, the maximum temperature during May-June was recorded between 18.98 °C-22, 23 °C, however nights are cool. Last week of January to first week of February are the coldest days, the minimum temperature reaches to 2.62 °C to 5.73 °C. Relative humidity is normally highest during rainy season (June- July), often recorded near to saturation point (92-97%). In the polyhouse condition, 27±4 °C temperatures and 80-90 per cent humidity was maintained.

### Experimental details

The details of the experiment conducted in 2018 are as under-Planting will be done in Factorial Completely Randomized Design with three replications Fruit nursery, Department of Fruit Science. To carry out investigation on "Studies on Rooting of Hardwood Stem Cuttings using Rooting Media on Japanese Persimmon (*Diospyros kaki* L.) cv. Fuyu, Treated with Different Concentration of Indol-3-Butyric Acid" the planting of cuttings was done in polybags on January, 2018.

### Materials used

The study was conducted with hardwood cuttings of persimmon cv. Fuyu under polyhouse conditions. Root promoting chemical IBA at four different concentration of 1500, 3000, 4500 and 6000ppm was used independently.

### Sources of cuttings and their preparation

Cuttings of persimmon cultivar, Fuyu were procured from field. In this study, mature persimmon tree were used as a cutting sources. Trees were subjected to routine management operations in previous year. Hardwood cuttings were prepared from one-year old wood about 0.80 cm to 1.20 cm in diameter and 15.00 to 20.00 cm in length with 5-8 nodes each. The basal end of the cuttings was given a slant cut to expose maximum absorbing surface for maximum rooting.

### Preparation of potting mixture

Good quality of soil was used along with the farm yard manure in the ratio of 1:1, 1:2 and 2:1. Potting mixture was filled into 20 x 10 cm sized perforated polythene bag of 200 gauge thickness.

### Preparation of growth regulator formulations

The required concentrations of growth regulators IBA (1500, 3000, 4500 and 6000 ppm) were prepared by weighing 1.50 g, 3.0 g, 4.50 g and 6.0 g respectively and dissolve it in a small amount of alcohol and then the solutions were made up of to a volume of 1000 ml each by using distilled water.

### Treatment of cuttings and planting

The basal 5.00 cm portion of the cutting was dipped in growth regulator formulation for 10 seconds and were allowed to dry for 15 minutes under shade and planted in polythene bags containing rooting media. Cuttings should be planted in inclined position at an angle to the horizontal to avoid water drops enter through cut surface and to a depth of 1-2 nodes below the soil.

### Observation recorded

Five plants were selected randomly and tagged in each treatment of all three replications for the purpose of recording observations on various parameters of shoots and roots. Percent of rooted cutting, length of longest root (cm), number of primary and secondary root, length of shoot of rooted cutting (cm), fresh and dry weight of root (g /plant), recorded 90 days after cuttings were planted. The data recorded were

subjected to statistical analysis for least significance difference factorial randomized block design (FRBD) as described by (Cochran and Cox, 1992).

## Results and Discussion

The rooting response of Persimmon (*Diospyros kaki* L.) cv. 'Fuyu' cuttings treated with various concentrations of IBA and different rooting media ratio in showed (Table 1).

### Rooted cuttings (%)

The data showed significant interaction existed between rooting media and IBA for per cent rooted cuttings of persimmon cv. Fuyu, at 90 days after planting. Significantly maximum per cent rooted cutting with the maximum per cent of (64.40 %) was observed in 1:2 Soil and FYM + 6000 ppm IBA ($M_2I_5$). The superiority of soil + FYM (1:1) rooting medium might due to its unique ability to enhance rooting and root development as compared to other rooting media. FYM plays vital role in maintenance of physical and biological condition of soil and supplies nutrients to crop beside maintenance of humic substances in soil.

### Length of the longest root (cm)

The data recorded for the effect of rooting media and IBA on the length of longest root per cutting. It is evident from the Table. 1, that the length of the longest root varied significant under different concentrations of IBA concentration and rooting media. Among the interactions, the treatment combination $M_1I_3$ (1:1 soil and FYM + 3000ppm IBA) was recorded to give the maximum length of the root (8.00 cm). These media might be attributed to their better physical, chemical and biological properties, which in turn supported better root growth and hence, increased its root length. The increase in length of the roots is might be due to the amount of food reserves in cuttings. Similar findings have been previously reported by Ozenc (2007) [6] in kiwifruit.

**Table 1:** Effect of different concentration of IBA and rooting media on various characters.

| Treatment combinations | Rooted cutting (%) | Length of longest root(cm) | Number of primary roots | Number of secondary roots | Shoot length of rooted cutting(cm) | Fresh weight of roots (g) | Dry weight of roots (g) |
|---|---|---|---|---|---|---|---|
| $M_1I_1$ | 22.21 | 2.93 | 3.93 | 9.40 | 7.76 | 0.11 | 0.02 |
| $M_2I_1$ | 28.89 | 3.18 | 4.27 | 10.13 | 8.98 | 0.12 | 0.02 |
| $M_3I_1$ | 25.51 | 3.07 | 3.80 | 6.87 | 4.79 | 0.12 | 0.05 |
| $M_1I_2$ | 33.30 | 3.76 | 4.33 | 11.80 | 10.19 | 0.23 | 0.03 |
| $M_2I_2$ | 32.19 | 4.98 | 5.33 | 9.47 | 9.32 | 0.25 | 0.04 |
| $M_3I_2$ | 32.20 | 4.69 | 4.73 | 10.93 | 9.02 | 0.43 | 0.04 |
| $M_1I_3$ | 44.43 | 8.00 | 5.27 | 14.73 | 8.86 | 0.71 | 0.15 |
| $M_2I_3$ | 42.19 | 7.78 | 8.17 | 13.27 | 9.89 | 0.65 | 0.14 |
| $M_3I_3$ | 48.89 | 7.57 | 7.07 | 11.80 | 10.41 | 0.61 | 0.14 |
| $M_1I_4$ | 44.40 | 6.22 | 4.87 | 14.87 | 10.57 | 0.42 | 0.12 |
| $M_2I_4$ | 55.51 | 6.52 | 5.00 | 15.33 | 10.12 | 0.41 | 0.12 |
| $M_3I_4$ | 56.63 | 6.20 | 5.20 | 13.53 | 10.07 | 0.43 | 0.12 |
| $M_1I_5$ | 61.10 | 6.46 | 5.07 | 18.07 | 9.97 | 1.30 | 0.15 |
| $M_2I_5$ | 44.40 | 7.24 | 4.70 | 18.80 | 11.27 | 1.36 | 0.16 |
| $M_3I_5$ | 61.10 | 6.19 | 4.93 | 16.60 | 9.56 | 1.36 | 0.15 |
| C.D $_{0.05}$ | 5.04 | 0.53 | 1.0 | 1.68 | 1.70 | 0.11 | 0.01 |

$M_1$=SOIL+FYM (1:1), $M_2$=SOIL+FYM (1:2), $M_3$=SOIL+FYM (2:1), $I_1$= Control (Untreated IBA), $I_2$=1500 PPM (IBA), $I_3$=3000PPM (IBA), $I_4$=4500PPM (IBA), $I_5$=6000PPM (IBA).

### Number of primary roots per cutting

Significantly maximum number of primary roots per cutting (8.17) was found in cuttings planted in $M_2I_3$ (3000 ppm IBA + 1:2 soil and FYM) treatment. The more number of roots were due to the more nutrients, optimum heat, good porosity, aeration and high water holding capacity of the medium containing soil + FYM. The results are matching with the observation of Baghel and Saraswat (1989) [1] in pomegranate, Sharma (1993) [8] in mulberry cuttings.

### Number of secondary roots per cutting

There existed a significant interaction between rooting media and IBA treatments for number of secondary roots per cutting. Significantly maximum number of secondary roots per cutting (18.80) was found in the cuttings planted in $M_2I_5$ (6000 ppm + 1:2 soil and FYM) treatment. This might be due to may be attributed to more nutrient, optimum heat, porosity, proper aeration and high water holding capacity. This result is in close conformity with the work reported by Baiyeri, (2003) [2] in cashew.

### Length of shoot of rooted cutting (cm)

Significant interaction existed between rooting media and IBA for length of longest shoot per cutting. Significantly longest shoot per cutting with the maximum length of 11.27 cm was observed in 1:2 Soil and FYM + 6000ppm IBA ($M_2I_5$). This may be attributed to nutritionally better mixture, high water and nutrient holding capacity, good drainage and high porosity of the media combination, which helped in the development of excellent root system, which in turn supported better shoot system. In addition, such media enhanced apical meristematic activity and also triggered cambial division. Similar findings have been reported by Sharma (1993) [8] in mulberry, Singh *et al*. (2003) [9].

### Fresh and dry weight of root (g / plant)

The interaction between rooting media and IBA treatments for fresh and dry weight of roots was tested significant Maximum fresh weight of roots (1.36 g) and maximum dry weight of roots (0.16 g) was found in the cuttings planted in 1:2 soil and FYM + 6000 ppm IBA ($M_2I_5$). This might be due to addition of FYM to soil directly added organic carbon and helped to stimulate the growth activity of micro-organisms and ultimately increased the available nutrient status of plant, thus this combination performed fairly well, Jat, *et al.* Similar results were also observed by Wahab *et al*. (2001) [11] in guava and Riaz, *et al*. (2007) [7] in kiwi fruit.

## Conclusions

**Conclusions based on experimental results are as;**

- Among the rooting media the cuttings planted in 1:2 soil and FYM was found better than other media used.
- In the present study cuttings planted under 6000ppm IBA were found the best for many of the root and shoot parameters.
- Interaction of IBA treatments and rooting media, were also found significant for many of the parameters. The treatment combination $M_2I_5$ (1:2 soil and FYM + 6000 ppm IBA) was found to be significantly superior for many of the root and shoot parameters.

## References


1. Baghel BS, Saraswat BK. Effect of different rooting media on rooting and growth of hardwood and semi-hardwood cuttings of pomegranate (*Punica granatum* L.). Indian Journal of Horticulture. 1989; 46:458-462.
2. Baiyeri KP. Evaluation of nursery media for seedling emergence and early seedling growth of two tropical tree species. Moor Journal of Agriculture Resource. 2003; 4(1):60-65.
3. Gemma H, Ishida M, Sobajima Y. Anatomical studies on initiation and development of roots in wild peach stem cuttings. Journal of Japanese Society of Horticulture Science. 1983; 52:256-265.
4. Kitagawa H, Shikhani E, Anma L. Proliferation of Japanese persimmon rootstock by shoot tip culture. Agriculture Horticulturae. 1984; 26:7-16
5. Machida H, Fujii T. Studies on the promotion of the rooting in cuttings and the formation of adventitious roots. Agriculture Horticulturae. 1969; 15:48-92.
6. Ozenc DB, Ozenc N. The effect of hazelnut husk compost and some organic and inorganic media on root growth of kiwifruit (*Actinidia deliciosa* L.). International Journal of Agronomy. 2007; 6(1):113-118.
7. Riaz A, Khalil UR, Muhammad I, Muhammad AR. Effect of indole butyric acid concentrations on the rooting of kiwi cuttings. Sarhad Journal of Agriculture. 2007; 23:293-95.
8. Sharma KK, Jawanda JS, Gill SS. Propagation of guava by mound layering. Punjab Horticultural Journal. 1993; 18:65-67.
9. Singh AK, Rajesh S, Mittal AK, Singh YP, Shiva J. Effect of plant growth regulators on survival rooting and growth characters in long pepper (*Piper longum* L.). Progressive Horticulture. 2003; 35:208-11.
10. Tao R, Tetsumura T, Suguira A. Factors Affecting Rooting of Softwood Cuttings of Japanese Persimmon. Engei Gakkai Zasshi. 2001; 70(3):275-280.
11. Wahab F, Nabi G, Ali N, Shah M. Rooting response of semi hard wood cuttings of guava (*Psidium guajava* L.) to various concentrations of different auxins. Online Journal of Biological Sciences. 2001; 1(4):184-87.