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Effect of pre-conditioning treatments, IBA and collection time on the rooting of semi- hardwood cuttings of kiwifruit, *Actinidia deliciosa* Chev

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ABSTRACT

A study was conducted to elucidate the effect of pre-conditioning treatments, IBA and collection time on the rooting of semi-hardwood cuttings of kiwifruit under intermittent misting at Dr YS Parmar university of Horticulture and Forestry, Solan, HP during the year 2008-09. The experiment comprised of eight treatments viz blanching, girdling, IBA @ 5000 ppm, blanching + girdling, blanching + IBA @ 5000 ppm, girdling + IBA @ 5000 ppm and blanching + girdling + IBA @ 5000 ppm. The cuttings under control treatment were untreated. These treatments were given in three months viz mid of May, June and July. The experiment was laid out in Randomized Block Design with three replications per treatment. The results obtained from investigations revealed that the treatment of blanching by covering with black adhesive tape just above a node in second week of June followed by girdling with the thin metallic wire just below a node in first week of July and IBA @ 5000 ppm application done at the time of planting of semi-hardwood cuttings collected in mid July improved various root and shoot characteristics viz fresh and dry weight of roots, shoot length, shoot diameter fresh and dry weight of shoots.

Keywords: Kiwifruit, Chinese gooseberry, semi-hardwood cuttings, mist propagation

INTRODUCTION

The Chinese gooseberry or kiwifruit (*Actinidia deliciosa* Chev) is a deciduous, dioecious fruiting vine native to south and central part of China. The full economic potential of this fruit was exploited in New Zealand. It was popularized as kiwifruit only after 1960s owing to its resemblance to the bird 'Kiwi' which is the national bird of New Zealand. Now its commercial cultivation has been extended to several other countries namely USA, Italy, Japan, France, Germany and Australia. About, 0.7 million tonnes of kiwifruit enters the world trade every year, which is dominated by Italy (35%), New Zealand (32%) and Chile (15%) (Anon 2005). In India, kiwifruit has also shown potential for cultivation in mid-hills of Himachal Pradesh,

Uttarakhand, Jammu and Kashmir and north eastern states.

For commercialization of kiwifruit in India, there is increasing demand for planting material which has necessitated the need for development of an easier, quicker and economic method of propagation. Raising of kiwifruit plants by cuttings is quick, less expensive and requires less space and skill. In general, semi-hardwood cuttings of kiwifruit are known to give higher rooting success than the hardwood cuttings.

The higher rooting potential of semi-hardwood cuttings has been attributed to the endogenous auxin in tender vegetative growth of semi-hardwood cuttings (Hartmann and Kester 1983). Hardwood cuttings on the other hand induce excessive callus development and poor rooting (Sale 1983). The physiological status of the plant exerts a strong influence on the root initiation. The involvement of metabolites and rooting promoters and inhibitors has been reported to play a significant role. A number of exogenous compounds have been applied to the cuttings to encourage rooting and the most widely applied is IBA (Indole 3-butyric acid). Furthermore, pre-conditioning treatments such as blanching and girdling have also been reported to improve rooting capacity of the cuttings (Hartmann et al 2002). Keeping in view the above factors into consideration, the present investigations were carried out to study the effect of pre-conditioning treatments and IBA and also to study the effect of collection time in combination with pre-conditioning treatments and IBA on the rooting of semi-hardwood cuttings of kiwifruit.

MATERIAL AND METHODS

The investigations were carried out in the mist chamber and field of the Department of Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during the year 2008-2009. The experiment was conducted on the uniform, healthy and disease-free 24 years old own rooted bearing vines of kiwifruit cv Allison which were selected for collecting semi-hard wood cuttings. All the selected vines were given uniform cultural practices to maintain them in active state of vegetative growth during the course of these investigations. Eight treatments were given to semi-hardwood cuttings viz blanching, girdling, IBA @ 5000 ppm, blanching + girdling, blanching + IBA @ 5000 ppm, girdling + IBA @ 5000 ppm and blanching + girdling + IBA @ 5000 ppm. The cuttings were collected three times viz in mid June, mid July and mid August from actively growing shoots having well developed axillary buds without lateral branches. Blanching was done four weeks before taking the cuttings.

Blanching was done by covering with 2 cm black adhesive tape just above a node. Girdling was done one week before

taking the cuttings with the thin metallic wire just below a node. The 10 cm long cuttings were taken from the selected plants. The sharp and slanting cut was given just above the uppermost node of cutting and a clean round cut was given at the base of cutting. The leaves of the basal portion were removed while the topmost leaf was retained without injuring the adjoining axillary buds. The IBA application was given at the time of planting of cuttings. IBA application was done with quick dip method (5 seconds). The experiment was laid out in a Randomized Block Design (RBD).

The rooting medium in the mist chamber was taken as sand as it is porous in nature and thus facilitates drainage of excess water at the time of intermittent misting for a prolonged period. The rooting medium was sterilized with formalin solution and water in the ratio of 1.5:10 (v/v) 20 days before planting.

The cuttings were planted in late evening hours in the straight rows with a distance of 10 cm within row and 10 cm between rows. The propagation beds were partially shaded with the green colour nylon net and misting intervals were adjusted in accordance with the prevailing temperature and humidity conditions so as to maintain the air temperature between 20-25^{o}C and the relative humidity of the mist chamber between 80-90 per cent.

The observations were made after 120 days of planting of cuttings on different root characteristics of semi-hardwood cuttings. The data on field survival of the rooted cuttings were recorded 60 days after transferring of the rooted cuttings from mist chamber to the open field condition and expressed in percentage. The data under each experiment were analyzed by applying RBD. The data on percentage were statistically analyzed after arc sin transformation, whereas, the data on other root and shoot parameters were analyzed after square root (x + 0.5) transformation as suggested by Gomez and Gomez (1984). Correlation coefficient (r- values) between different root characters and survival percentage was calculated as per the method suggested by Panse and Sukhatme (1961).

RESULTS AND DISCUSSION

The collection time of the semi-hard wood cuttings exerted a significant influence on the different root and shoot characteristics. The results showed the root characteristics viz fresh weight and dry weight were also influenced by different pre-conditioning treatments and IBA treatment.

The best rooting performance in terms of fresh weight of roots (16.9 g) and dry weight of roots (5.7 g) was recorded

in the cuttings taken in July month as compared to June and August months. Rana et al (2004) reported that cuttings prepared during the active growth stage (July- Aug) gave better results than those prepared during the dormancy stage (January).

The application of pre-conditioning treatments viz blanching and girdling in combination with IBA treatment influenced the different rooting characteristics. The data in Table 1 reveal that the maximum fresh weight of roots and dry weight of roots were recorded with the treatment of blanching + girdling + IBA @ 5000 ppm.

Khoe (2005) studied the effect of some pre- conditioning treatments on the rooting of cuttings in peach cv July Elberta. She treated the semi-hardwood cuttings with blanching, girdling and blanching + girdling alone as well as in combination with 2000 ppm IBA. She recorded maximum rooting percentage (70.0%) in semi-hardwood

Table 1. Effect of pre-conditioning treatments, IBA and collection time on the fresh and dry weight of roots in semi-hardwood cuttings of kiwifruit

Treatments	Fresh weight of roots per cutting (g)				Dry weight of roots per cutting (g)			
	June	July	August	Mean	June	July	August	Mean
Blanching	6.2	6.8	6.5	6.5	1.8	2.5	2.0	2.1
Girdling	5.0	5.6	5.4	5.3	1.8	2.2	2.0	2.0
IBA @ 5000 ppm	12.0	12.5	12.1	12.2	3.5	3.9	3.7	3.7
Blanching + girdling	6.2	7.0	6.6	6.6	1.7	2.5	2.3	2.2
Blanching + IBA @ 5000 ppm	15.0	15.4	15.2	15.2	3.7	4.2	4.0	4.0
Girdling + IBA @ 5000 ppm	12.1	12.8	12.6	12.5	3.2	4.1	3.9	3.7
Blanching + girdling + IBA @ 5000 ppm	13.3	16.9	15.8	15.3	4.6	5.7	5.4	5.2
Control	4.2	5.0	4.8	4.7	1.4	1.7	1.6	1.57
Mean	9.3	10.3	9.9		2.7	3.4	3.1	
$CD_{0.05}$				0.8				0.4

Table 2. Effect of pre-conditioning treatments, IBA and collection time on the shoot length of semi-hardwood cuttings of kiwifruit

Treatments	Shoot length (cm)			
	June	July	August	Mean
Blanching	2.7	2.7	2.7	2.7
Girdling	2.6	2.7	2.6	2.6
IBA @ 5000ppm	2.5	3.4	2.6	2.8
Blanching + girdling	2.7	2.8	2.8	2.7
Blanching + IBA @ 5000ppm	6.2	7.7	6.5	6.8
Girdling +IBA @ 5000 ppm	3.5	7.0	6.2	5.6
Blanching + girdling +IBA @ 5000 ppm	8.5	11.3	9.5	9.7
Control	2.4	2.6	2.5	2.5
Mean	3.8	5.0	4.5	

$CD_{0.05}$

Treatment:	0.4
Collection time:	0.2
Treatment x collection time:	0.7

cuttings treated with blanching + girdling + IBA @ 2000 ppm.

The best shoot characteristics viz maximum shoot length (11.3 cm), shoot diameter, fresh weight of shoots (18.0 g) and dry weight of shoots per cutting (4.6 g) were recorded with blanching + girdling + IBA @ 5000 ppm treatment. However, this treatment was found to be statistically at par with blanching + IBA @ 5000 ppm treatment. These results may be attributed to the well developed root system in such cuttings which might have tended to promote shoot growth by ensuring adequate mobilization of water and nutrients from the soil or substrate to the growing apices. Consequently, there is a faster growth rate of the newly emerged shoots.

Table 3. Effect of pre-conditioning treatments, IBA and collection time on the fresh and dry weight of roots in semi-hardwood cuttings of kiwifruit

Treatments	Fresh weight of shoots per cutting (g)				Dry weight of shoots per cutting (g)			
	June	July	August	Mean	June	July	August	Mean
Blanching	16.0	16.2	15.9	16.0	3.4	3.6	3.3	3.4
Girdling	15.9	16.1	16.0	16.0	3.2	4.0	3.7	3.6
IBA @ 5000 ppm	16.6	17.0	16.7	16.8	3.8	4.2	3.9	3.9
Blanching + girdling	16.2	16.9	16.5	16.5	3.6	4.1	3.7	3.8
Blanching + IBA @ 5000 ppm	17.2	17.3	17.2	17.2	4.4	4.5	4.4	4.4
Girdling + IBA @ 5000 ppm	17.0	17.2	17.1	17.1	4.2	4.4	4.3	4.3
Blanching + girdling + IBA @ 5000 ppm	16.3	18.0	17.6	17.3	3.7	5.2	4.8	4.6
Control	15.0	16.8	15.5	15.8	3.3	3.5	3.3	3.3
Mean	16.3	16.9	16.6		3.8	4.1	4.0	
$CD_{0.05}$				0.3				0.8

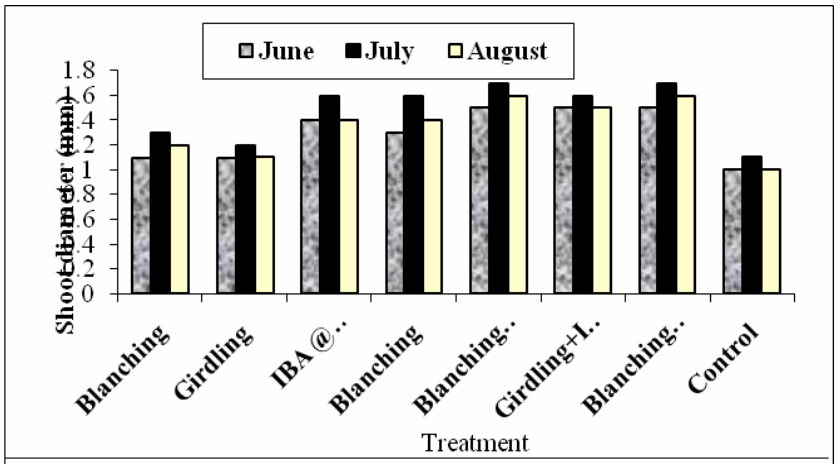

Fig 1. Effect of pre-conditioning treatments, IBA and collection time on the shoot diameter of semi-hardwood cuttings of kiwifruit.

The present investigations get support from the findings of Kuris et al (1980) who reported that auxin promoted root formation in *Origanum* sp, *Mentha* sp and *Melissa* sp cuttings. They also reported an increase in number of roots.

Aier (1988) obtained greater shoot diameter and length in plum cuttings, applied with pre-conditioning treatments combined with 3000 ppm IBA solution. Gautam and Howard (1994) also reported that pre-conditioning treatments combined with IBA application resulted in better shoot growth in hazelnut leafy cuttings.

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