

Effects of Stock Plant, Rooting Medium, and Time of Cutting Collection on Rooting and Growth of Cuttings of a Dwarfing Rootstock for Kaki[®]

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INTRODUCTION

We have developed cutting propagation of kaki (*Diospyros kaki* Thunb.) by using single-node stem cuttings (Tetsumura et al., 2000, 2001, 2003, 2009), although it was thought to be difficult to propagate kaki by cuttings (Tao and Sugiura, 1992). The single-node stem cuttings collected from root suckers rooted easily when put in a greenhouse installed with a mist system.

Kaki tends to grow to a large tree. Therefore, the necessity of vegetative propagation of dwarfing rootstocks has been urged for 60 years (Ito, 1988), but nursery stocks grafted on the dwarfing rootstocks have not been available yet. We collected the single-node stem cuttings from root suckers of the 'Saijyo' tree showing subdwarfing habit (1 m in height) in the orchard of Okayama Prefectural Agriculture Center, in which the height of normal-sized 'Saijyo' trees were 4.5 m, and propagated them by using a propagation fame (Tetsumura et al., 2003). The rooted cuttings were grafted with the scions of 'Fuyu' and 'Hiratanenashi', and then the investigation for over 7 years on the growth, flowering, and fruiting showed that the rootstock, 'Rootstock-b' (R-b), made both cultivars' trees dwarfed and improved their flowering and yield efficiencies (Tetsumura et al., 2010). Hence, we plan to develop sustainable mass-propagation of R-b for its practical use supported by the Ministry of Agriculture, Forestry and Fisheries of Japan.

In general, the earlier the time of cutting collection is, the higher the survival rate of the rooted cuttings in the following year is; the more vigorous the growth of the rooted cuttings is, because the longer growth period between rooting and defoliation brings more photosynthates to the rooted cuttings. However, an early collection of cuttings decreases leaves of the mother stocks during the growth season, and this reduction in the photosynthetic organ may make sustainable cutting-propagation difficult. Hence, the objective of this study is to investigate effects of time of cutting collection on rooting of R-b cuttings and growth of the rooted cutting in the following year, by using cuttings from root suckers and hedges and using rooting medium of Metro-Mix[®] 360 and Bora soil.

MATERIALS AND METHODS

The nursery stocks derived from the single-node stem cuttings of R-b were planted in March 2001 and were cut back to a height of 40 cm each winter for establishment of the hedges. In April 2006, some of the hedges were cut down just above ground level, and then the surface soil about 0.25 m² around the stump and 20 cm in depth was removed. Each winter, all suckers were removed for production of new root suckers.

In 2009, single-node stem cuttings with one bud and leaf were prepared from the root suckers and the hedges, dipped at their bases in 50% aqueous ethanol with 3000 ppm indole-3-butyric acid (IBA) for 5 sec, planted in plug trays (200 ml/plug) which were filled with Metro-Mix 360 and Bora soil (volcanic tuff, 2 to 3 mm diameter), and then placed under a vaporized aluminum netting in a propagation frame covered with plastic film. The propagation frame was intermittently misted (30 sec mist and 15 min stop in the daytime) and was ventilated with fans when the ambient air reached 38 °C. Ten cuttings per type for each treatment were planted on 15 June, 20 July, and 15 August.

The percentages of survival and rooting, and the number and the length of roots were investigated 2 months after planting. The rooted cuttings were transplanted to plastic pots filled with 300 ml of Metro-Mix 360. The pots were placed in a propagation frame covered with plastic film but opened at the sides. The percentages of survival, the length of shoots and the number of leaves of the rooted cuttings were investigated on 23 April 2010.

RESULTS AND DISCUSSION

The cuttings collected from the R-b root suckers tended to root better than those from the hedges (Table 1). However, cuttings from the root suckers and hedges rooted well (90% or more) when collected on 15 June and 15 August and planted in Metro-Mix 360. The previous report (Tetsumura et al., 2009) showed that only 45% of R-b cuttings from the hedges rooted. The improvement in rooting of cuttings from the hedges, which need easier maintenance than the roots for production of root suckers, may contribute mass-propagation of R-b. However, the roots from cuttings from the root suckers developed better than those from the hedges (Fig. 1) as reported previously (Tetsumura et al., 2009). Since the reason of poor rooting of cuttings collected on 20 July is unclear, we must continue to conduct the same experiments. As for rooting medium, Metro-Mix 360 was superior in rooting to Bora soil, which might be too porous for kaki cuttings to root well.

The rooted cuttings with short stem, 3–5 cm in length, scarcely sprouted during current year of cutting, and then overwintered. The rooted cuttings from root suckers survived and grew better than those from hedges (Table 2). The percentages of survival of rooted cuttings collected from root suckers and planted in Metro-Mix 360 were more than 75% irrespective of the time of cutting collection, while the average of those from hedges and in Metro-Mix 360 was 33%. It seemed that the rooted cuttings with developed root system survived and grew well.

CONCLUSION

Cuttings from root suckers of R-b rooted well when collected in mid-June and mid-August. We need further investigation of the effect of the time of cutting collection on growth of mother stocks in the following year. Improvements in the development of roots of cuttings from the hedges and their survival in the following year will also contribute to sustainable cutting-propagation of R-b.

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Table 1. Effects of stock plant, rooting medium and time of cutting collection on the survival, rooting and development of roots of R-b single-node stem cuttings 2 months after planting.

Factor	Survival (%)	Rooting (%)	No. of roots per rooted cuttings	Total length of roots (cm)
Stock plant (SP)				
Root	100	72	3.1	49
Hedge	98	57	2.0	29
Time of cutting collection (T)				
15 June	100	83	2.8	47
20 July	100	40	2.4	27
15 August	98	70	2.9	42
Rooting medium (RM)				
Metro-Mix® 360	100	75	2.8	44
Bora soil	98	53	2.4	34
Significance				
SP	ns ^z	ns	ns	*
T	ns	*	ns	ns
RM	ns	*	ns	ns
SP × T	ns	ns	ns	ns
T × RM	ns	ns	ns	ns
RM × SP	ns	ns	ns	ns

^z ns, * : nonsignificant or significant by LSD at $P < 0.05$, respectively.

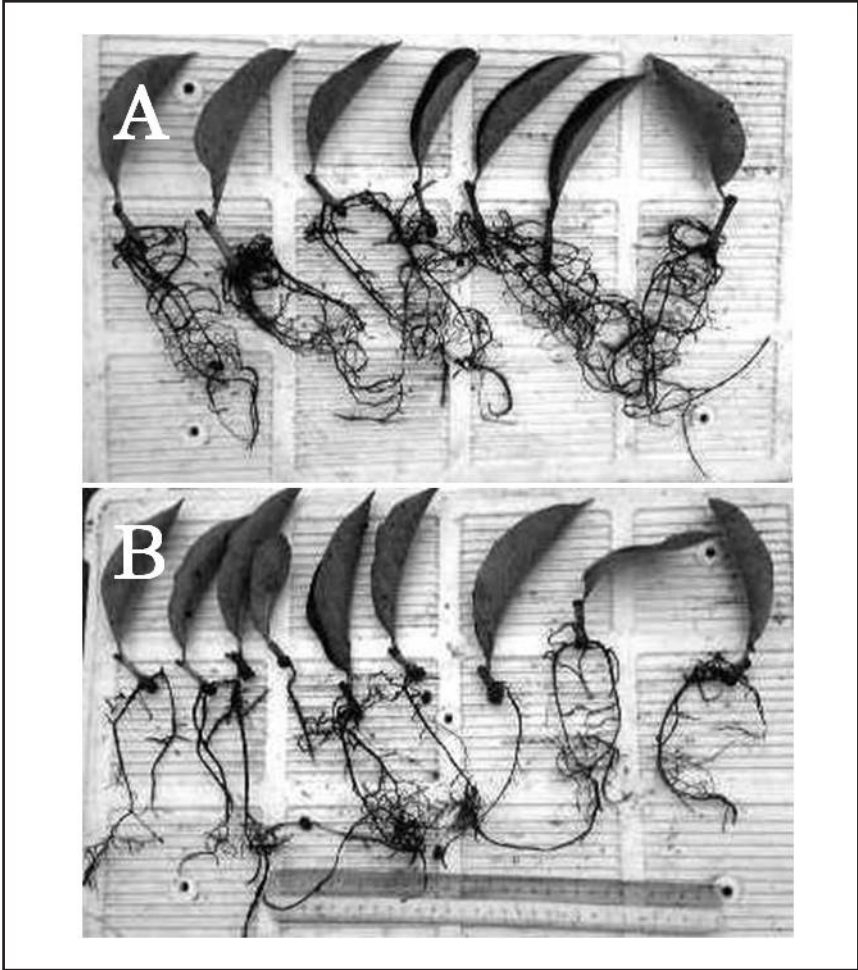


Figure 1. Rooted cuttings 2 months after planting on June 15 and in Metro-Mix[®] 360. (A) Cuttings from root suckers. (B) Cuttings from hedges. The ruler = 31 cm.

Table 2. Effects of stock plant, rooting medium and time of cutting collection of R-b single-node stem cuttings on the survival, length of shoots, and number of leaves of the rooted cuttings in the following year.

Factor	Survival (%)	Length of shoots (cm)	Number of leaves
Stock plant (SP)			
Root	77	7.7	5.2
Hedge	34	4.1	3.3
Time of cutting collection (T)			
15 June	65	7.0	5.5
20 July	33	3.8	2.0
15 August	70	6.8	5.1
Rooting medium (RM)			
Metro-Mix® 360	59	6.6	4.4
Bora soil	53	5.2	4.0
Significance			
SP	*	*	*
T	ns	ns	*
RM	ns	ns	ns
SP × T	ns	ns	*
T × RM	ns	ns	ns
RM × SP	ns	ns	ns

^z ns, *: nonsignificant or significant by LSD at $P < 0.05$, respectively.

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