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K-IBA concentration regulates rooting quality and plant vigor of *Prunus laurocerasus* L.

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Abstract

Prunus laurocerasus is an evergreen species of Rosaceae, native to southwestern Asia and southeastern Europe. It is a widely cultivated ornamental plant in gardens and parks in temperate regions. A new cultivar with 2-4 cm long and 0.5-1.5 cm broad leaves was collected and regenerated with the stem cuttings in November. All cuttings were treated with Indole-3-butyric acid (K-IBA) at 1000, 3000, and 8000 mg•L^{-1}. K-IBA concentrations had significant influence on rooting quality and after growth of *Prunus laurocerasus*. The rooting percentage was very high, ranged from 94.4% to 100% after two months. Although rooting percentage did not show the great difference, number of roots and root length were highly affected. As the K-IBA concentrations increased, number of roots increased significantly from 6 to 11 to 17. However, root length had the opposite trend than that of root numbers. The longest root length, 21.9 cm, was obtained from cuttings treated with K-IBA at 1000 mg•L^{-1}. Cuttings treated with K-IBA 1000 mg•L^{-1} had mean root length of 6.5cm, 4.0 and 1.9 cm for 3000 mg•L^{-1} and 8000 mg•L^{-1}, respectively. Rooted cuttings were transplanted to one gallon pots and placed in a heated greenhouse. The survival rate was recorded and dead cuttings were examined. The highest survival rate was 95.5% under K-IBA 1000 mg•L^{-1} treatment, while those treated with K-IBA 3000 mg•L^{-1} and 8000 mg•L^{-1} was 78.8% and 50.0%, respectively. Higher K-IBA concentrations might increase the number of roots, but kill the rooted cuttings or reduce the plant vigor afterward. For the propagation of *Prunus laurocerasus*, stem cuttings treated with K-IBA 1000 mg•L^{-1} are recommended.

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Introduction

Prunus laurocerasus, also known as cherry laurel, common laurel, is an evergreen species of Rosaceae, native to southwestern Asia and southeastern Europe. It is growing to 5 to 15 m tall, rarely 18 m, with a trunk up to 60 cm broad. It is a widely cultivated ornamental plant in gardens and parks in temperate regions and often used for hedges, as a screening plant, and as a massed landscape plant. Most cultivars are tough shrubs that can cope with difficult growing conditions, including shaded and dry conditions, and which respond

well to pruning, especially the cultivar 'Otto Luyken' have gained the Royal Horticultural Society's Award of Garden Merit (Dirr, 2009).

New cultivar selection is the tireless pursuit of breeders. Contretas et al. (2016) doubled the chromosome of *Prunus laurocerasus* 'Otto Luyken' and 'Schipkaensis' *in Vitro* for inducing fruitless and sterile plants. K-IBA (Indole-3-butyric acid) is a high efficiency plant growth regulator in plant rooting, which was used in numerous woody plants, such as mountain azalea (Knight et al., 2005), *Thuja occidentals* (He et al., 2017), *Callicarpa nudiflora* (Zhou et al., 2016). A new type of branch sprout with 2-4cm long and 0.5-1.5cm broad leaves from the flower inflorescence of *Prunus laurocerasus* 'Otto Luyken'. Overall for this type of new branches, we think about three aspects--regeneration stability, gene expression, and how these vegetative or reproductive structure changes from reproduction branch inflorescence to vegetative branch. In this study, the effect of K-IBA on the rooting percentage, and rooting quality, especially the survival rate and after growth of *Prunus laurocerasus* 'Otto Luyken' and new type branch were explored.

Materials and methods

Plant materials: New shoots with about 2.5 inches long from the inflorescence and hardwood cuttings of *Prunus laurocerasus* 'Otto Luyken' were obtained from full flush growth of plants. Cuttings were placed into water immediately after being removed from mother plants. They were trimmed to 5-8 cm and leaves of the bottom 3-5cm were stripped, and then were treated with various concentrations of K-IBA.

Experimental treatments: All cuttings were treated with I: Control (no hormone); II: K-IBA at 1000 mg•L^{-1}; III: K-IBA at 3000 mg•L^{-1} IV: K-IBA at 8000 mg•L^{-1}. For the application of liquid hormone, cutting were dipped into the concentrations for 10-15 sec, then air dry for at least 10 min before placing them into the rooting media.

Treated cuttings were randomly inserted into 32 cell flat trays filled with the rooting media, which contained Perlite and Peat at 3:1 (v:v). Thoroughly watered the cuttings before placing them on the mist bench. The mist bench was covered with 70% shade cloth and the mist system was set for 20 sec every 20 min at the first week, then 10 sec every 20 min thereafter.

Data collection: Rooting percentage, number of roots, mean root length of cuttings, and survival rate of after growth were collected. Root quality was by total root length (=number of roots × mean root length).

Experimental design: A randomized complete block design was applied in the experiments with 4 replicates for each treatment and 8 subsamples (cuttings) per replicate per treatment. All data were analyzed by SAS program and mean separations were the least significant difference with alpha at 0.05 level.

Results and discussion

Rooting percentage

K-IBA had significant effects on rooting of *Prunus laurocerasus* 'Otto Luyken' and all treated cuttings had greater rooting percentages, number of roots, and longer mean root length than that of control after two month (Table 1). For the small leaf cuttings, the K-IBA concentration did not significantly affect rooting percentage. All of them are higher than 94%, and the highest rooting percentage, 100%, was obtained under the treatment of K-IBA at 1000 mg•L^{-1} and 3000 mg•L^{-1}. Comparing the vigorous of vegetative branch from the reproductive tissue with the regular 'Otto Luyken' cuttings, the rooting percentage was much higher for these new shoots than the cultivars. In other words, the growing vigor of the new small cuttings had much stronger, much better than the cultivar's.

Table 1. Effect of K-IBA on rooting percentage and quality of *Prunus laurocerasus* 'Otto Luyken'.

Treatment	Small leaf cutting			Big leaf cutting		
	Rooting (%)	Number of roots	Mean root length (cm)	Rooting (%)	Number of roots	Mean root length (cm)
Control	0b	0d	0c	33.3c	1.2c	1.3b
K-IBA 1000	100.0a	5.7c	6.2a	88.9a	11.4a	3.8a
K-IBA 3000	100.0a	10.8b	4.7a	44.4b	4.0c	1.5b
K-IBA 8000	94.4a	16.4a	1.9b	44.4b	8.9b	1.4b

*Different letters in the same column indicate a significant difference at α=0.05.

Quality of roots

Root quality was measured by number of roots for cuttings and mean root length (Table 1 and Fig. 1). As shown in Table 1, application of KIBA did significantly affect the root quality. For new small cuttings, the number of roots increased significantly as K-IBA concentration went higher. However, the mean root length decreased significantly. Both these highest number of roots and mean root length, 11.4 and 3.8 cm were produced using KIBA at 1000 mg•L^{-1} for the regular 'Otto Luyken' cuttings.

Comparing the quality of roots of the small leaf cutting and regular 'Otto Luyken' cuttings (Fig. 1), 1000 mg•L^{-1} KIBA worked better on both cuttings. But 3000 mg•L^{-1} K-IBA and 8000 mg•L^{-1} KIBA cultivar cuttings quality did not work well as long as the new type cuttings'. From the above results, this new small leaf branch has much vigorous growth and better quality of roots under applying 1000 mg•L^{-1} K-IBA. At the mean time, the 1000 mg•L^{-1} KIBA also was good for the cultivar 'Otto Luyken'.

Survival rate

After transplanting for two months, the survival rate of new type cuttings was significant lower at 8000 mg•L^{-1} K-IBA treatment (50%), then 3000 (78.8%) and 1000 mg•L^{-1} (95.5%) (Fig. 2). The after growth of the new type cuttings was showing in Fig.3. Actually, half of rooted cuttings were dead under 8000 mg•L^{-1} K-IBA. As shown in Fig. 3 (right), they had nice roots but all roots were died. It is probably higher rooting hormone mixed up the cutting growth and kill the whole plant. Therefore, higher concentration K-IBA kills the cuttings. From the above results, we recommended 1000 mg•L^{-1} K-IBA for the new type cuttings for rooting.

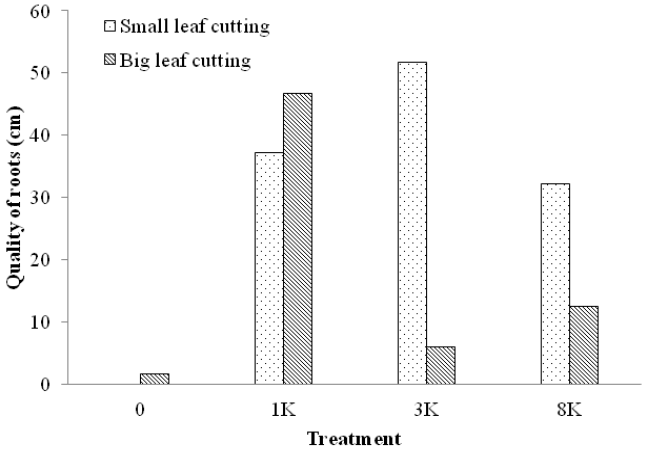

Fig. 1: Quality of roots under different K-IBA concentrations of new type cuttings (small leaf cutting) and regular 'Otto Luyken' (big leaf cutting).

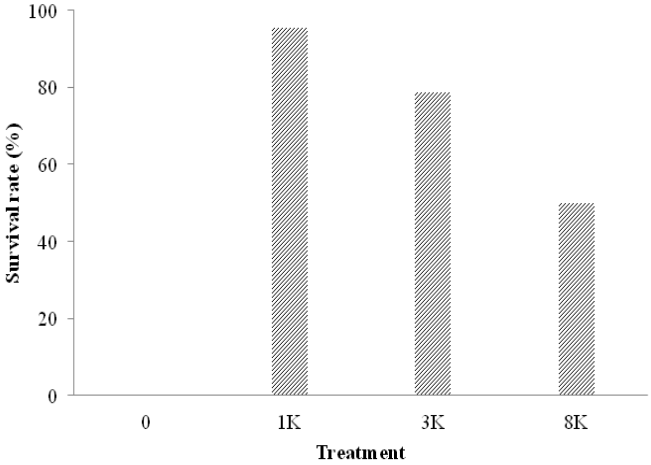

Fig. 2: The survival rate of new type cuttings under different K-IBA concentrations.

Fig. 3: The after growth of new type cuttings of *Prunus laurocerasus*. Left: Four months after transplanting; Middle: Six months after transplanting; Right: dead cuttings at K-IBA 8000 mg/L.

Conclusions

From this research, K-IBA definitely helps the plants rooting but too high K-IBA concentration especially for young branch killed the plants. To summery all of these, K-IBA doesn't only affect the rooting of the plants but also regulate the after growth. From the after growing, the new small leaf plants have much vigor than cultivar 'Otto Luyken'. Our further research will focus on how these reproductive structures change to vegetative structures and how hormone and gene expression control this change.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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