APICAL APPLICATION OF AQUEOUS SOLUTIONS TO CARNATIONS VIA FLOWER TUBES

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Abstract

Special flower tubes are available for the flower industry to provide a source of water during transport of cut flowers. In this study such flower tubes were fixed upside down to decapitated rooted standard carnation cuttings. By this method the amount of applied aqueous solution that moves into the plant is substantial and can be recorded. Water dyed with acid fuchsin showed that the solution moved via xylem vessels downwards to roots and leaves within one hour. In a week cuttings absorbed about 2 ml of water, with a maximum uptake of 1.4 ml during the first day. Application of 0.1 mg PBA (3.8 ml, 25 ppm) via flower tubes resulted in an increased number of side shoots of good quality (from 3.4 to 6.7 shoots per cutting). The presented technique may solve the problem of poor formation of shoots of stock plants of standard carnations with little axillary shoot growth ('budless' carnations). Preliminary experiments showed uptake of 1.3 ml of sucrose 10% per cutting of 1.6 g fresh weight. Application of other chemicals e.g. systemic pesticides or mutagens can be considered.

1. Introduction

Disbudding of standard carnation is laborious. Therefore, varieties have been introduced which hardly develop axillary shoots. However because of the lack of axillary shoots, propagation of these varieties is difficult. Foliar applications of the synthetic cytokinin 6-(benzylamino)-9-(2-tetrahydropyranyl)-9H-purine (PBA) have been reported to stimulate lateral branching in carnation (Jackson, 1975). Jeffcoat (1977) confirmed this finding but reported that under conditions of low light intensity, in glasshouses of northern Europe during winter, the stimulated tissue showed severe chlorosis and often a reluctance for continuous development after the initial stimulation.

Disadvantages of the usual techniques for treating carnations with substances like cytokinins (for example foliar spray) may be that the treatment is short lasting and with limited applied amounts. Moreover, the amount absorbed by plants is difficult to quantify, while application of substances like sugars is hardly possible. The new technique of apical application of aqueous solutions via flower tubes, already described for roses (Van de Pol and Marcelis, 1987) may overcome these disadvantages.

This paper presents data on the pattern of water uptake from flower tubes by rooted standard carnation cuttings and the effect of PBA on lateral branching.

2. Materials and methods

Flower tubes have been developed for upward supply of water during transport of vulnerable cut flowers like Anthuriums and Cymbidiums. Each polyethylene tube (Zwapak P.O.B. 13, 1430 AA Aalsmeer, Netherlands) has an elastic cap (rubber compound) with a hole (figure 1). In our experiments tubes were used of 6 ml with a hole diameter in the cap of 2 mm. Tubes were filled with substances dissolved in distilled water. Rooted cuttings (4 weeks old, with 3 to 4 pairs of unfolded leaves) of standard carnations cv. 'Astor' and 'Ruben' were transplanted and decapitated just below the third pair of leaves (counted from the base). Flower tubes were placed upside down on the freshly cut stem wounds.

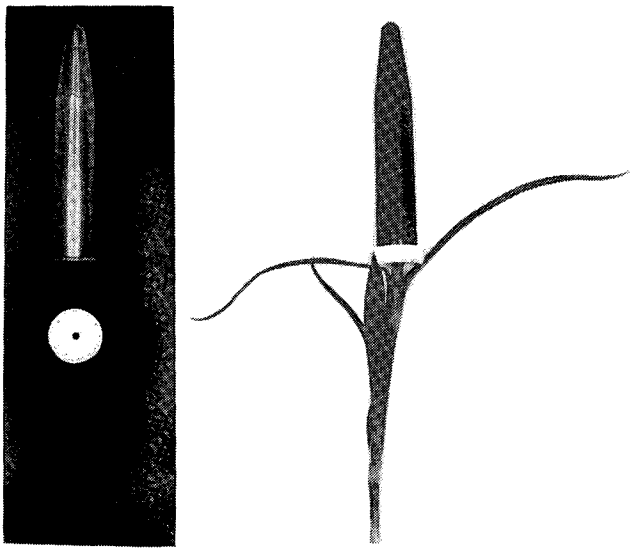

Figure 1 - Flower tube (6 ml), rubber cap and apical application of substances by placing the inverted flower tube on a decapitated carnation cutting.

Solutions could be made traceable with acid fuchsin 10 g l^{-1} (Van de Pol et al., 1986). For the experiment on water uptake, the cuttings were placed in a growth room at 21°C day and night. Relative air humidity was 70%. Sodium (SON/T) and Multivapour (HPI/T) Philips lamps of 250 and 400 W provided illumination of 35 W m^{-2} during 16 hours daily. Every day the water uptake of a different group of 22 plants of 'Astor' was recorded.

Application techniques of spraying and flower tubes were compared in an experiment on the effect of several concentrations of 6-(benzylamino)-9-(2-tetrahydropyranyl)-9H-purine (PBA) on axillary bud break of 'Ruben'. From Januaury to May 1987 this experiment was carried out in a glasshouse with natural light at a temperature of about 18°C. Immediately after decapitation 100 plants were sprayed with 5 concentrations of PBA to run off; Tween 20 was added as a surfactant at a concentration of 100 ppm. Sprayings with 25 and 50 ppm PBA were repeated after 10 days. Flower tubes, filled with 5 concentrations of PBA, without surfactant, were placed on the other 100 plants. After 10 days the tubes, still containing part of the applied solutions, were removed. Subsequently side shoots developed. Shoots longer than 9 cm were counted and cut back to 2 pairs of leaves 10 weeks after the start of the experiment. Six weeks later the number of shoots was recorded again. The experimental lay out was a randomized block design with 4 blocks and 5 replicates per block. The results of the 10 treatments were analysed by means of analysis of variance and Duncan's multiple range test, 5% level.

3. Results

The use of acid fuchsin showed that the solution moved via xylem vessels downwards to leaves and roots within one hour and that leakage did not occur. Figure 2 shows a rapid water uptake from flower tubes by 'Astor' cuttings during the first day, but it gradually decreased thereafter and it almost stopped after 3 days. The cumulative uptake was 2.1 ml ± 0.7 per cutting, while the original fresh weight per cutting was 1.6 g ± 0.4.

In the experiment with PBA the average uptake from flower tubes was 3.8 ml ± 1.0. So the absorption of a cutting treated with 25 ppm was 0.1 mg PBA. Ten weeks after the start, PBA applied by spraying or flower tubes did not affect the number of side shoots longer than 9 cm (table 1). However PBA 25 ppm applied via flower tubes induced a great number of axillary shoots smaller than 2 cm. Table 1 also shows the number of side shoots after 16 weeks (6 weeks after pruning the first side shoots). The application of 25 ppm PBA via flower tubes increased the number of shoots of good quality (longer than 9 cm), while the other treatments did not differ significantly from the control.

Preliminary experiments on application of sugar via flower tubes to 20 rooted cuttings of 'Ruben' at the same conditions of the PBA experiment gave an uptake of 1.3 ml ± 0.5 of 10% sucrose equivalent to 0.13 g ± 0.05 per cutting of 1.6 g ± 0.4 fresh weight.

4. Discussion

Use of flower tubes is a relatively cheap and simple method for the application of considerable quantities of various chemicals to plants. In our winter conditions PBA applied by spraying did not increase the number of shoots of good quality contrary to the application of 25 ppm PBA via flower tubes. The results showed that the absorption of water decreased after 2 days. Additional research is required on factors influencing the uptake, such as environmental conditions, evaporation, osmotic value of the solution, air pressure in the tube , plant type, wound development, vessel plugging, structure and water content of the plant tissue. The advantage of this application technique is that substantial and known quantities of chemicals can move into the plants. Flower tubes can especially be of interest for substances like sugars which are normally difficult to apply. Application of other chemicals e.g. systemic pesticides or mutagens via flower tubes can be considered.

References

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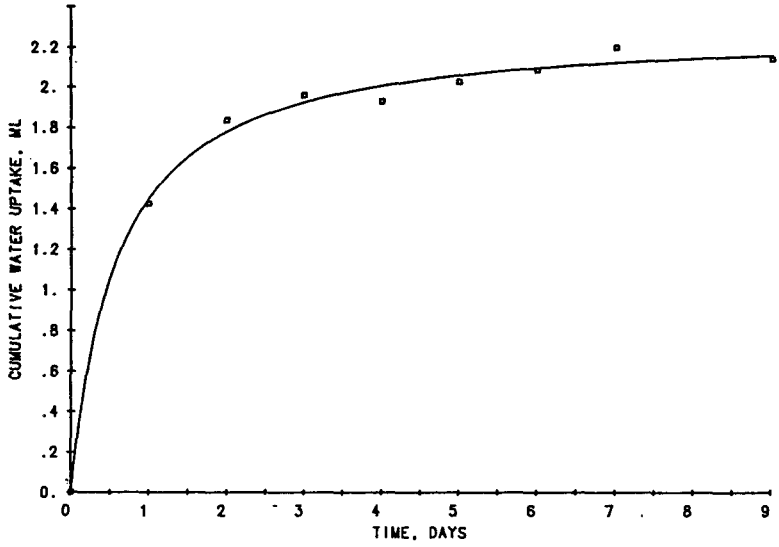

Figure 2 - Average cumulative downward water uptake from flower tubes (6 ml) by rooted 'Astor' carnation cuttings during the first 9 days after decapitation. N=22.

Table 1 - Influence of PBA applied via spraying or flower tubes on number of shoots longer than 9 cm, 10 or 16 weeks after decapitation of rooted 'Ruben' carnation cuttings. N=20.

* Significantly different from treatments with 0 ppm PBA at 5% level.

		number of shoots	
Application	PBA-concentration(ppm)	after 10 weeks	after 6 weeks
spray 1x	0	2.1	2.7
spray 2x	25	2.4	2.9
spray 2x	50	2.1	2.2
spray 1x	100	2.3	2.6
spray 1x	250	2.2	2.7
flower tube	0	2.2	3.4
flower tube	5	2.5	3.1
flower tube	10	2.1	3.3
flower tube	15	2.0	3.8
flower tube	25	2.0	6.7*