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APICAL DOMINANCE OF THE SCION IN BUDDED ROSA

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Apical dominance in newly budded plants of Cvs Apricot Silk, Peace, Alcc's Red and Golden Treasure was checked at an early stage using benzyl adenine (BA), 2,3,5 tri-iodobcnzoic acid (TlI3A), (2-chloroethyl) phosphonic acid (cthcphon) and chlormequat chloride (Cycocel). These treatments improved the commercial quality of the bush. Ethcphon and cycocel were better compounds for their use and led to the development of new shoots from the basal and axillary buds and from the bud union. Ethephon at *500* ppm with Tween-20 (1%) as a wetting agent caused significant increase in the number of shoots growing from the bud union in both the glasshouse and field-grown roses.

INTRODUCTION

The investigations reported here are concentrated chiefly with the possibility of using plant growth regulating compounds to check the apical dominance and to induce the growth of shoots from the bud after it has established its union with the stock. Parups (1971) reported that the growth of lower buds of greenhouse grown roses was induced by treating them with benzyl adenine (BA) and adenine in lanolin paste. A foam spray of (2-chloroethyl) phosphonic acid (ethephon), G-(benzylamino)-9-(2-tetrahydropyranyl)-9H-purine (PBA) and BA at 1000 ppm and 2000 ppm for each chemical applied at plant cutback increased the total number of flower stems per plant in roses (Carpenter, 1974). He also indicated that no chemical or variation in the method of application effectively promoted shoot development from the bud union. Zieslin *et al.* (1972) found the best branching response in cv, Baccara from a spray of cthcphon (500 ppm) when a thin score had been made above the basal axillary buds. The growth regulating chemical ethcphon at 500 ppm has been used successfully to induce basal shoot development in greenhouse grown roses. The treatment led to the production of a denser foliage canopy and good flowers. Kingham and Sharpe (1973) stated that none of the plants showed distress, there was no apparent damage to foliage and after about six weeks a number of basal shoots began to develop on cthcphon treated of roses.

The growth retardant chlormcquat chloride at 500 ppm or 1500 ppm induced earlier flowering, increased yield of blooms but reduced flower size in *Rosa gabrille* (Moc, 1970).

In the present study, BA, TIBA, chlormequat chloride (CCC) and cthcphon were tested both in the glasshouse and in the field. Later a mixture of urea and different concentrations of ethcphon were also tested in the field.

MATERIALS AND METHODS

Experiment 1. Effect of some plant growth regulators on the development of shoots from basal uxlllary buds: Forty-eight budded plants of the four cultivars Apricot Silk, Peace, Aloe's Red and Golden Treasure

were transplanted into 20 cm diameter plastic pods of John lnncs potting compost No. 2, in a glasshouse at 18 ± 1 ◦ C. The length of the new shoots was 15-30 cm at the time of treatment. Plants were sprayed with either BA at 350 ppm, TI BA at 350 ppm or ammonium nitrate at 1000 ppm. Dimethyl sulphoxide (DMSO) was used as an initial solvent for BA and TIBA before the solutions of desired concentrations were made up with distilled water and 0.1% Tween-20. The ammonium nitrate solution was given to the soil at 50 cm3 per pot. Three plants of each cult ivar were manually pinched to act as a control al each application time. The treatments were completely randomiscd with three replications. Counts of new basal and axillary shoots were made after () weeks.

Experuneut 2. Ellèct 01' plant growth regulutlng substances and urea on the development 01' brunches Irum the bud union and the basal buds 01' the canes: Onc hundred and twenty plants of four cultivars Apricot Silk, Peace, Aloe's Red and Golden Treasure were used in this investigation. The length of the new shoots was 10-25 cm at the lime of treatment, Ethcphon 1000 ppm, chlormequat chloride 1000 ppm, a mixture of 5000 ppm cthcphon and 2000 ppm ethcphon and 2000 ppm urea, a mixture of 500 ppm chlormcquat chloride and 2000 ppm urea, 5000 ppm urea or control (no spray) were the treatments. All plants were sprayed lo runoff with 5 replications and were placed on a bench with the complete randomisation in a glasshouse al 21 ± 1 ◦ C. Data were recorded after 6 weeks. Counts of the numbers of new shoots from the bud union and from the basal part of the canes were made separately.

Tablc I. Ellect of growth regulators and amnwnium nitrate on the productlon 01' shoots Irom scion 01' rose plants

Cultivars	BA (350 ppm)	TIIlA (350 ppm)	Ammonium nitrate (WOO ppm)	Control	Mcans
Apricot Silk	2.66*	4.33	2.00	1,66	2.66
Peace	1,33	1,66	1,33	1,33	1,41
Alcc's Red	2.00	3.66	0.66	2.00	2.08
Golden Treasure	2.33	2.66	2.00	2.00	2,25
Means"?"	2.08	3.08	1,50	1,77	

Al T 5%; LSD* = UJ3; LSD** = 0.81; LSD*** = OXI.

Expeı'imcnt 3. Ellèct 01' ethephun alone and with urea on the development 01' branches (null the bud union and the basal buds 01' the canes in field grown roses: Twenty budded plants of each of the four cultivars (Apricot Silk, Peace, Aloe's Red and Golden Treasure) were sprayed lo run off with either 500 ppm cthcphon and son ppm ethephon and 2000 ppm urea, 350 ppm cthcphon and 2000 ppm urea or they were not sprayed. There were five replicates of each treatment. Tween-20 (0,1 %) was used

as a welling agent for all the sprays. Six weeks after the last spray, counts of new shoots from the bud union and from the basal part of the cane were made. The experiment was laid out in a completely randomised design.

EXPERIMENTAL RESULTS

Experiment 1. New shoots grew from the bud union. Of the treatments used, TIBA alone produced significant increase in the number shoots but only Apricot Silk and

Table 2. Effect of plant growth regulutors and urea on development of shoots per plant from the bud union

Cultivars	Ethephon 1000 ppm	ICCC 1000 ppm	Ethephon + Urea 500 + 2000 ppm	ICCC + Urea 500 + 2000 ppm	Urea 5000 ppm	Control (nil)	Means" *
Apricot Silk	1.0*	0.2	1.8	0	0	0	0.50
Peace	2.6	0	1.6	0.2	II	0	0.73
Alcc's Red	1.0	0.2	1.2	0.2	0	0	0.43
Golden Treasure	0.8	0	0.8	0	0	0	0.26
Means***	1.35	0.1	1.35	0.1	0	0	-

At T 5%; LSD* = 0.78; LSD** = 0.32; LSD = 0.39.
lChlormequat chloride

Table 3. Effect of plant growth regulators and urea on development of shoots per plant from the basal buds

Cultivars	Ethephon 1000 ppm	ICCC 1000 rpm	Ethephon + Urea 500 + 2000 ppm	ICCC + Urea 500 + 2000 ppm	Urea 5000 ppm	Control (nil)	Means" *
Apricot Silk	1.8*	0	2.4	0	0	0	0.70
Peace	2.4	0.2	2.0	0.8	0	0	0.90
Aloe's Red	2.2	0.8	2.4	0.4	0.G	0.2	1.10
Golden Treasure	1.4	II	1.4	0.2	0	0	0.50
Means."?"	1.95	0.25	2.05	0.35	0.15	0.05	-

At T 5%; LSD* = 1.02; LSD** = 0.42; LSD = 0.51.
lChlormcquat chloride

Aloe's Red showed this response (Table 1).

Experlment 2. Ethephon alone and the mixture of cthcphon and urea significantly increased the number of branches from the bud uniun. None of the other treatments gave a useful effect (Table 2). A similar trend was found fur the development of basal shouts (Table 3), where ethephun alone ur with urea gave significant increase in the number of shoots. The flower size was small in all the cuhivars.

Experiment 3. All the eultivars responded similarly and the spray treatments caused a similar increase in branch production from the bud union and from the basal buds (Tables 4 and 5). All the spray treatments increased the number of branches compared with control, The size of the flowers and the quality of the bushes which had received the treatments was good.

Tablc 4. Effect of ethephon, urea and the mixture of branching shoots/plant from bud union in field grown roscs

Cultivars	Ethcphon 500 ppm	Ethcphon + Urea 500 + 2000 ppm	Ethephon + Urea 350 + 2000 ppm	Control	Meansv*
Apricot Silk	2.2*	3.8	1.8	0.4	2.05
Peace	2.0	2.2	2.6	0.6	1.85
Alcc's Red	2.2	2.0	2.0	0.6	1.70
Golden Treasure	2.8	2.6	3.0	0	2.1
Means***	2.30	2.65	2.35	0.4	-

At T 5%; LSD* = 1.27; LSD** = 0.64; LSD*** = 0.64.

Tablc 5. Effect of ethephon, urea and the mixture un slwots/plant from basal buds in field grown roses

Cultivars	Ethcphon 500 ppm	Et hcphon + Urea 500 + 2000 ppm	Ethcphon + Urea 350 + 2000 ppm	Control	Means··
Apricot Silk	2.4*	2.0	2.6	0.8	1.95
Peace	2.0	1.6	2.2	0.04	1.55
Alcc's Red	2.2	2.2	2.0	0.4	1.70
Gulden Treasure	2.2	1.4	1.8	0.20	1.40
Means"?"	2.20	.1.80	2.15	0.45	-

At T 5%; LSD* = 1.26; LSD** = 0.63; LSD*** = 0.63.

DISCUSSION

Ethcphon induced bud-break lowdown on the shoot and around the bud union in the greenhouse roses. The combined treatment of ethephon and urea gave a similar result to that of ethephon alone and the plants were compact and bushy.

Spray containing ethcphon increased the number of shoots from the bud union and basal part to 4.5 per bush compared with 0.85 per bush for the control plants in the field experiment. . All the four cultivars responded similarly. Kingham and Sharpc (1973) found that a spray containing cthcphon (500 ppm) on unpruncd bushes was the most effective for the development of basal shoots. Spray treatment of ethcphon to the lower leaflcss parts of rose plants promoted the formation of renewal canes (Zieslin *et al.,* 1972). Ethcphon increased the production of lateral buds in other species as well (Carpenter and Carlson, 1972; Skoog and Armstrong, 1970).

Ethcphon kills active shoots apices, the shoots lose their ability to mobilise nutrients and apical dominance is lost. Schaefer and Sharpe (1969) found that when apical dominance is destroyed, the control over the quiescent axillary buds changes abruptly to permit the net synthesis of deoxyribonucleic acid (DNA) and the elaboration of a new metabolic products associated with rapid growth and development. .

The discovery that TI BA caused the loss of apical dominance is an agreement with the reports on this chemical from Asen and Hamner (1953), Carpenter and Rodriguez (1971), and Ostcrbyc (1970) who worked with greenhouse roses. However, plants treated with TIBA did not produce new shools from the bud union and the possibility that basal bud inactivity in the rose is caused by a different Iype of inhibition from that acting on buds on the union remains (Carpenter and Rodriguez, 1971). Correlative inhibition of lateral buds is related to the presence of an apical bud or shoot above the bud, but there is no agreement as to how these organs act in this inhibition (Phillips, 1975).

The use of ethephon sprays on newly budded roses in the field and greenhouse as outlined above, may become commercially viable with certain cultivars and the technique could replace manual 'pinching'. The size and the quality of the bushes grown in containers receiving cthcphon (500 ppm) treatment was good (3-4 branches per bush). Fifteen weeks after propagation, the plants were ready for sale in the garden shop.

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