Dormancy Release of Tree and Shrub Seeds Using a Compost Activator Pretreatment

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Results from initial trials at Writtle College indicate that the germination of several economically important tree and shrub seeds, including *Acer campestre*, *Cratageus* spp., and *Tilia platyphyllos*, can be improved by a compost activator treatment developed initially for rose rootstocks. Treated seeds gave a higher field emergence and germinated earlier than untreated controls and subsequently produced better quality seedlings. However, the improvement was not as marked or as consistent as had been found with seed of rose rootstocks. Further work is now being supported by a grant from the Horticultural Development Council.

INTRODUCTION

Seed dormancy is common in many temperate tree and shrub species. There are obvious evolutionary advantages in possessing dormant seeds. For example, in many species the dormancy mechanism provides a means of avoiding autumn germination. In order to overcome dormancy the horticulturist must stratify these seeds to mimic winter conditions experienced in nature. Dormancy may also provide a means of spreading germination, so that in nature all the seedlings produced by a plant are not wiped out if a disaster should occur. This natural process gives the horticulturist the problem that as seeds do not germinate together the final grade-out of the seedlings will be very varied, as seedlings which emerge early will tend to suppress the growth of those which emerge later.

For those tree and shrub species which have been studied in detail, a range of different seed dormancy mechanisms exist which in turn has given rise to a varied set of pretreatment conditions being applied to overcome that dormancy. Gordon and Rowe (1982) have reviewed both dormancy mechanisms and pretreatments for a wide range of species.

Cullum et al. (1990) adopted a novel approach to the problem of seed dormancy in the rose rootstock *Rosa corymbifera* 'Laxa'. They demonstrated that a proprietary compost activator, Garotta (produced by Sinclair Horticulture and Leisure Ltd., Firth Road, Lincoln, LN6 7AH), can be used successfully to germinate the rose achenes in the following spring. The pretreatment used is 10 g moist achenes, 25 g moist vermiculite, 0.5 g Garotta compost activator, followed by storage at 20C

for 12 weeks and then at 4C for 12 weeks. Results over four years showed that the addition of Garotta significantly increased the germination rates compared with achenes which had received the warm and cold treatments only.

In 1990 'Forestart' and Writtle College agreed to start joint trials to investigate whether the pretreatment developed for *R. corymbifera* 'Laxa' could be effective for other dormant seeds.

In these trials some 10 species were treated with and without Garotta each year. Criteria for species selection was that their normal pretreatments were similar to *R. corymbifera* 'Laxa'. Any species which showed a response was then subjected to a more thorough replicated field trial in the second year.

MATERIALS AND METHODS

All seeds were supplied from commercial seed lots at 'Forestart', and soaked in water overnight before use. Moist vermiculite was prepared by adding 400 ml deionised water to 250 g vermiculite (medium grade) and stirring thoroughly. Twenty-five grams moist vermiculite were used for each 10 g seed being tested and the compost activator was added as required. The mixture was stored in a polythene bag, tied loosely to admit air and then weighed. The bags were kept at 20C for 12 weeks followed by storage at 4C for a further 12 weeks. Each week during the treatments the bags were shaken to aerate the contents and returned to their original weights by adding deionised water.

After the time of cold treatment was complete, seeds were sown into a seedbed treated the previous autumn with the soil sterilant dazomet, then covered with a layer of 4- to 6-mm gravel to prevent capping. Percentage field emergence was recorded.

Experiment 1: Initial Screening of 12 Tree and Shrub Seeds (1990). For each species, four batches of seeds were prepared, each batch containing at least 100 seeds. Each batch was weighed and added to moist vermiculite in the same proportions as described above. The first treatment was left without further addition to act as a control. The remaining three were then treated with Garotta at the rate of 0.25 g Garotta/10 g of seed (low Garotta), 0.5 g Garotta/10 g seed (medium Garotta), and 1.0 g Garotta/10 g seed (high Garotta). The following species were tested:*Acer campestre, Berberis darwinii, Carpinus betulus, Cornus mas, C. sanguinea, Cotoneaster divaricatus, Crataegus crus-galli, C. monogyna, Euonymus europaeus*, *Rosa canina*, *R. rubrifolia*, and *Tilia platyphyllos.*

All treatments commenced on 9 October 1990 and the field trials were sown on 27 March 1991.

Experiment 2: Initial Screening of Eight Tree and Shrub Seeds (1991). The following species were treated as in the 1990 screening: *Acer japonicum, A. palmatum*, *Carpinus betulus, Cornus mas, C. sanguinea*, *Crataegus laevigata* [syn. *C. oxyacantha*], *C.* × *prunifolia*, and *Elaeagnus angustifolia.*

All treatments commenced on 16 October 1991 and the field trials were sown on 1 April 92.

Experiment 3: Replicated Field Trial in 1991 of Two Species Which Appeared to Show a Response to Garotta in 1990.

A) *Acer campestre*. The treatments were:

- Control (treated as described in 1990 initial trials)
- High Garotta (1 g Garotta for every 10 g seed)
- Very high Garotta (1.5 g Garotta for every 10 g seed)

Each of the treatments was set up in duplicate and after the 12 weeks warm followed by 12 weeks cold treatment, four lots of 100 seed were counted from each of the replicates and sown in the seedbed using a replicated design.

All treatments commenced on 9 October 1991 and the field trials were sown on 25 March 1992. Field emergence was counted regularly and seedling quality was recorded 6 and 12 weeks after sowing.

B) *Cotoneaster divaricatus*. The treatments were:

- Control
- Low Garotta (0.25 g Garotta for every 10 g seed)
- Very low Garotta (0.125 g Garotta for every 10 g seed)

The method then followed that of *A. campestre* and field emergence was recorded regularly.

RESULTS

Experiment 1: Initial Screening of 12 Tree and Shrub Seeds in 1990.

Table 1. Percentage field emergence 12 weeks after sowing.

Species	Control	Low Garotta	Medium Garotta	High Garotta
Acer campestre	8	23	36	44
Berberis darwinii	0	0	0	0
Carpinus betulus	4	11	3	8
Cornus mas	0	0	0	6
C. sanguinea	91	61	70	61
Cotoneaster divaricatus	7	51	18	23
Crataegus crus-galli	1	0	0	0
C. monogyna	43	57	63	62
Euonymus europaeus	5	4	4	10
Rosa canina	8	73	79	85
R. rubrifolia	0	0	1	0
Tilia platyphyllos	14	13	18	20

Experiment 2: 1991 Initial Screening of Tree and Shrub Seeds.

Table 2. Percentage field emergence 12 weeks after sowing.

Species	Control	Low Garotta	Medium Garotta	High Garotta
Acer japonicum	0	0	0	0
Acer palmatum	3	4	5	5
Carpinus betulus	3	6	5	5
Cornus sanguinea	82	82	98	97
C. mas	0	1	1	0
Crataegus laevigata	5	14+2*	4+9*	15+1*
C. × *prunifolia*	3	13	19	12
Elaeagnus angustifolia	5	8	6	2

(+* = *C. prunifolia* - unexplained contaminant)

Experiment 3. 1991 Replicated Field Trial of Two Species Which Appeared to Show a Response to Garotta in 1990.

Acer campestre: field emergence.

Table 3. Mean percentage field emergence (weeks after sowing).

	Week 4	Week 6	Week 8	Week 12
Control	17.1 (a)	54.12 (a)	55.2 (a)	54.6 (a)
High Garotta	30.8 (b)	60.5 (a)	60.2 (a)	59.0 (a)
Very high Garotta	35.8 (b)	57.1 (a)	57.3 (a)	57.1 (a)

Different letters in column indicate significant difference between means at 95% confidence. LSD 5% = 5.83. For treatment details see method.

Acer campestre: seedling quality.

Table 4. Mean percentage of seedlings with first true leaves expanded to at least the horizontal stage measured 6 weeks after sowing.

	Mean
Control	9.2 (a)
High Garotta	20.8 (b)
Very high Garotta	25.0 (b)

Different letters indicate significant difference between means at 95% confidence. LSD 5% = 5.41. For treatment details see method.

Acer campestre: seedling quality.

Table 5. Mean percentage of seedlings over 20 cm in height, 12 weeks after sowing

	Mean
Control	13.3 (a)
High Garotta	21.3 (b)
Very high Garotta	19.8 (b)

Different letters indicate significant difference between means at 95% confidence. LSD 5% = 5.87. For treatment details see method.

Cotoneaster divaricatus: field emergence.

Table 6. Average percentage field emergence (weeks after sowing).

	Week 4	Week 6	Week 8	Week 12
Control	0.8	5.25 (a)	12.1	12.6 (a)
Low Garotta	8.7	19.5 (b)	24.2	24.3 (b)
Very low Garotta	8.5	15.1 (b)	20.4	20.6 (b)

Different letters in columns indicates significant difference in means at 1% confidence. Week 6 LSD 1% = 5.40, Week 12 LSD 1% = 4.61.

DISCUSSION

The initial screening in 1990 demonstrated the beneficial effect of Garotta on *R. canina* with a markedly increased field emergence (this confirmed previous unpublished work at Writtle—and it was decided not to investigate *R. canina* further).

Several economically important species, *A. campestre, C. divaricatus, C. monogyna,* and *T. platyphyllos*, also appeared to respond to the Garotta pretreatment. The percentage field emergence figures in Table 1 do not include any indication of seedling quality. For all four of these species the seedlings were much larger after 12 weeks. Only with *C. sanguinea* did Garotta appear to reduce field emergence.

Results for the second year of initial screening indicated a possible improvement in field emergence in *C. laevigata* and *C.* × *prunifolia* (Table 2).

Because of limited research time, only two species, *A. campestre* and *C. divaricatus*, were further tested. As *A. campestre* had shown the best response to the high Garotta, a very high treatment of 1.5 g Garotta for every 10 g of seed was included to check if the optimum rate had been reached. Similarly, as *C. divaricatus* had shown the best field emergence at the low Garotta rate, a very low Garotta treatment of 0.125 g Garotta for every 10 g seed was used too.

In the replicated field trial treating seed of *A. campestre* with Garotta led to significantly earlier germination (Table 3) with the Garotta treated seedlings being more advanced at 6 weeks (Table 4) and significantly taller at 12 weeks (Table 5). However, the marked improvement seen in the unreplicated trial the

previous year was not evident.

Seeds of *C. divaricatus* showed a significant improvement in percentage field emergence when treated with Garotta (Table 6).

The Garotta treatment developed for *R. corymbifera* 'Laxa' does appear to have potential for use on other species. But, the response to the pretreatment is not as marked, or as consistent, as was found with *R.* 'Laxa'. Variation between seed batches may account for some of these differences. Even in the first year of this work it became apparent that to investigate thoroughly the number of species which appeared to respond was beyond our resources. In 1992 funding to support the work was received from Horticultural Development Council. This has led to the appointment of a research assistant, David Morpeth, who will be conducting extensive field trials at Writtle College and investigating the physiological effect of the Garotta treatment on seeds. It is hoped that at the end of the project we will understand the effect that 'Garotta' is having on seeds and that this technique will then have a wider commercial application.

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LITERATURE CITED

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