

Improving Conifer Seedling Quality with CONFER®

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Abstract—CONFER®, a potent plant growth regulator containing the active ingredient paclobutrazol, was evaluated as a replacement for dormancy inducing treatments for container grown conifer seedlings. CONFER provided effective short term control of stem height growth of European larch, white spruce and lodgepole pine while allowing stem and root growth. At rates of 1.0 to 2.5 kg a.i./1000 m², root growth of white spruce was stimulated both while in the container and after outplanting. Rates of 0.5 to 5.0 kg a.i./1000 m² stimulated root growth of lodgepole pine seedlings both in the containers and after outplanting.

INTRODUCTION

CONFER® contains paclobutrazol, a potent plant growth regulator. When applied as a high volume broadcast spray, CONFER is taken up by the roots and is translocated acropetally in the xylem tissue to sites of action within the seedling.

CONFER is currently under review by Agriculture Canada for registration as a greenhouse application on container grown conifer seedlings. CONFER application results in a number of changes in seedling morphology. Effects include inhibition of stem elongation, stimulation of bud initiation, increase in stem diameter, increase in waxiness of needles and promotion of root egress. The inhibiting effect of CONFER on stem elongation is eliminated once

seedlings have passed through a cold dormancy period.

CONFER treated seedlings have shown increased tolerance to moisture and temperature stress. Roots of treated seedlings have increased starch content. The overall result of treatment with CONFER is improved seedling quality.

OBJECTIVES

1. Evaluate CONFER as a replacement for blackout and other dormancy inducing treatments on a range of conifer species.
2. Measure the short term effects of CONFER on height and caliper growth and on root and shoot dry weights.

3. Measure the short term effects of CONFER on root egress after planting.

METHODS

Container grown conifer seedlings were treated with a range of rates of CONFER using a CO₂ pressurized small scale boom sprayer. Rates of application ranged from 0.5 to 5.0 kg a.i./1000 m². Individual plots consisted of single styroblocks or trays with each treatment replicated four times at each experiment location. Treatments were randomized within each block with blocks identified by plot number only.

Experiments were conducted in cooperation with conifer seedling growers in B.C., Ontario and New Brunswick.

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Species tested include white spruce, lodgepole pine and European larch.

Height and stem caliper often preselected seedlings per plot were measured prespray and at four and eight weeks after treatment. Root egress was assessed by planting seedlings in six inch pots for four weeks under ideal growing conditions. Root growth was assessed using Burdett's scale where:

- 0 = no white roots
- 1 = white roots < 1 cm
- 2 = 1-3 white roots > 1 cm
- 3 = 4-10 white roots > 1 cm
- 4 = 11-30 white roots > 1 cm
- 5 = 31-100 white roots > 1 cm
- 6 = > 100 white roots > 1 cm

Root and shoot samples were collected at eight weeks after treatment and again after outplanting and dried at 70 degrees Celsius.

RESULTS

European Larch

CONFER provided significant control of European larch height growth while allowing continued stem caliper growth (Figure 1).

White Spruce

CONFER provided control of height growth of white spruce compared to the greenhouse control however height growth was equal to that of the blackout control (Figure 2). Stem caliper growth of white spruce was slightly reduced by all but the highest rate of CONFER com-

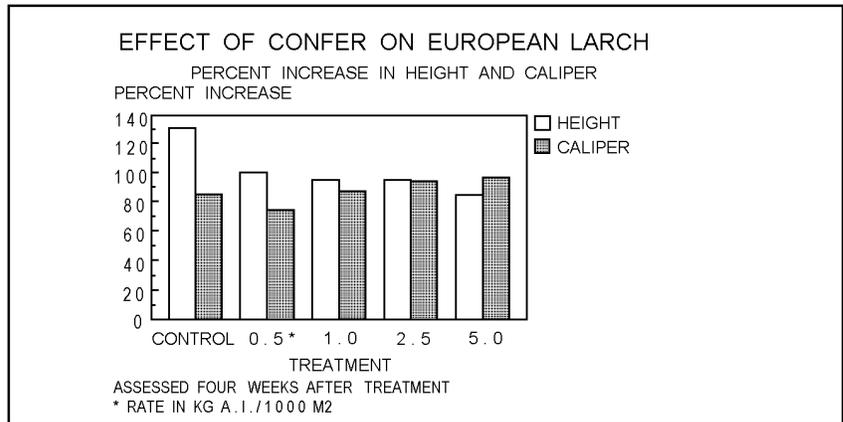


Figure 1. Effect of CONFER on European larch height and caliper growth.

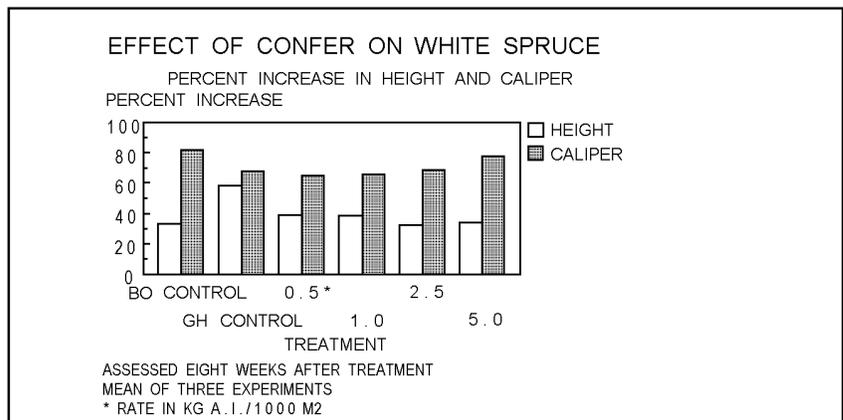


Figure 2. Effect of CONFER on white spruce height and stem caliper growth.

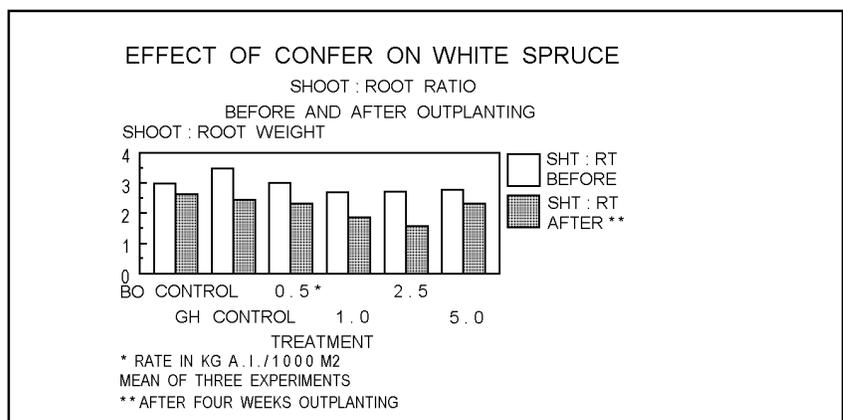


Figure 3. Effect of CONFER on white spruce shoot:root dry weight.

pared to the blackout control however was equal to that of the greenhouse control.

Shoot to root biomass was improved by CONFER treatment at rates of 1.0 to 2.5 kg a.i./1000 m². The most pronounced effect was observed after four weeks outplanting (Figure 3). Root egress as measured using Burdett's scale was improved with all CONFER treatments compared to the blackout control, however, the greatest improvements were recorded at rates of 1.0 to 2.5 kg a.i./1000 m² (Figures 4 and 8).

Lodgepole Pine

Shoot growth of lodgepole pine at eight weeks after treatment was reduced with CONFER at all rates of application while stem caliper growth was unaffected compared to the operational control (Figure 5). Shoot to root biomass was improved in favour of root biomass at both eight weeks after treatment and after four weeks outplanting at all rates of application (Figure 6).

Root egress as assessed using the Burdett's scale after four weeks outplanting was improved by all rates of CONFER compared to the untreated control (Figures 7 and 9).

OBSERVATIONS

Seedlings treated with CONFER were in most cases observed to be darker blue-green

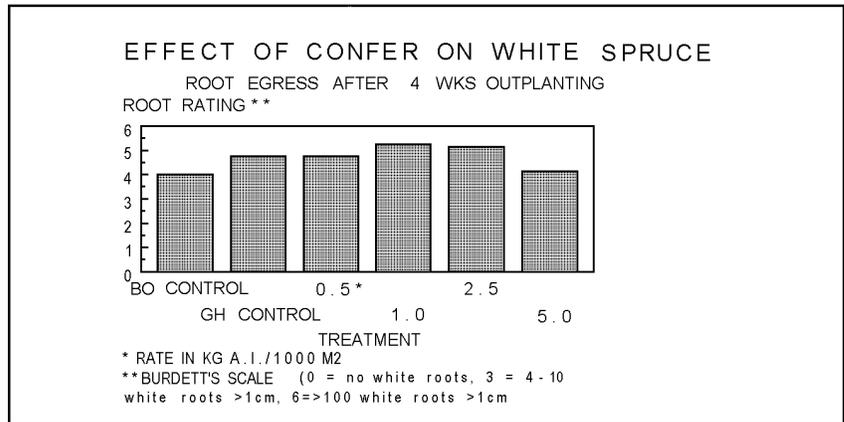


Figure 4. Effect of CONFER on white spruce root egress.

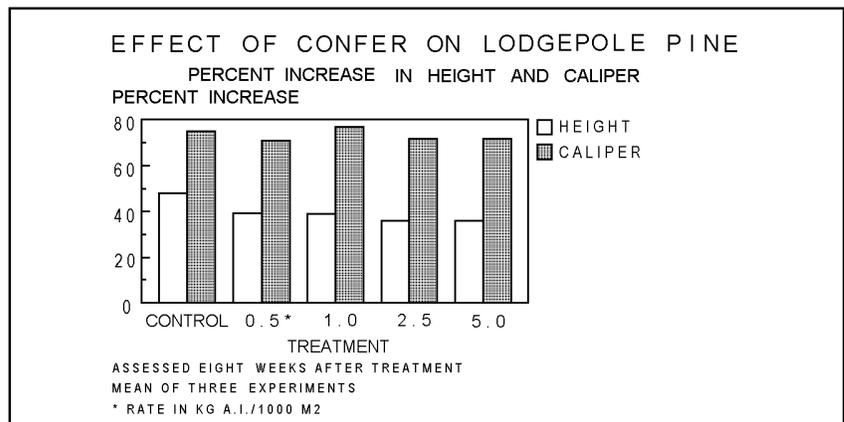


Figure 5. Effect of CONFER on lodgepole pine height and stem caliper growth.

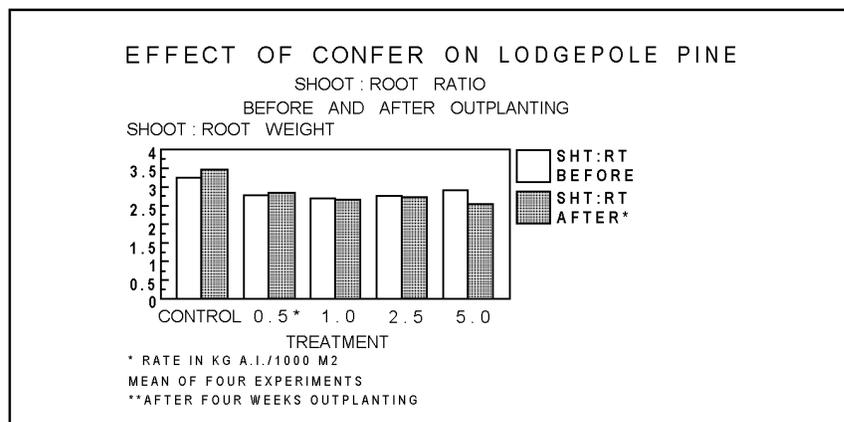


Figure 6. Effect of CONFER on lodgepole pine shoot:root dry weight.

than operational control seedlings which may indicate greater waxiness of needles.

Lateral root branching was increased in CONFER treated seedlings, especially at rates of 1.0 to 2.5 kg a.i./1000 m². Root growth was initially inhibited at the highest rate of application (5.0 kg a.i./1000m²) however was stimulated over a longer period of time, especially after outplanting. In some cases thickened roots were observed, especially at the higher rates of application.

Seedlings treated with CONFER used less water and wilted less when blocks became dry.

Dormancy, defined as the cessation of shoot growth and bud initiation, was induced in all species within four to eight weeks of application. Moving seedlings outdoors accelerated the cessation of shoot growth and bud initiation in all species.

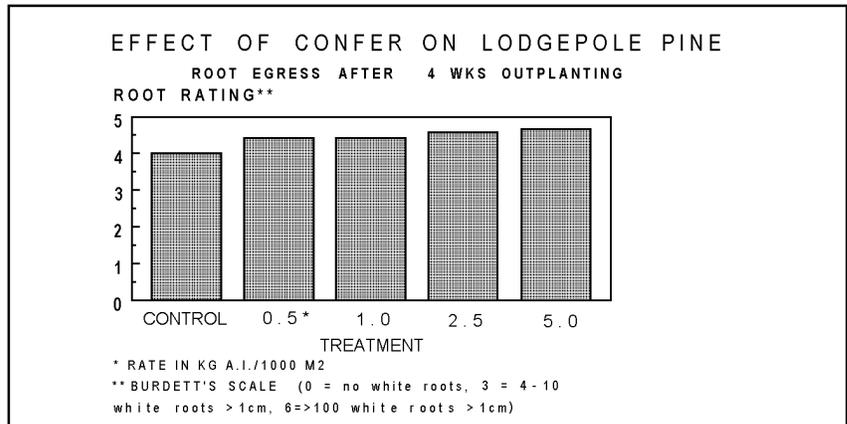


Figure 7. Effect of CONFER on lodgepole pine root egress after outplanting.

CONCLUSIONS

CONFER provided control of height growth for a period of eight weeks while allowing root and stem caliper growth of European larch, white spruce and lodgepole pine.

Shoot to root biomass of seedlings treated with CONFER was improved in favour of root growth both in the container and after outplanting for four weeks. Root egress was stimulated in both white spruce and lodgepole pine after four weeks

outplanting. The optimum rates for root egress in white spruce were 1.0 to 2.5 kg a.i./1000 m² while in lodgepole pine the optimum rates were 2.5 to 5.0 kg a.i./1000 m².

CONFER treatment resulted in better balanced seedlings with improved root growth potential compared to seedlings produced using conventional methods. CONFER treated seedlings should establish better at the planting site and reach free to grow status earlier than seedlings produced by conventional means.

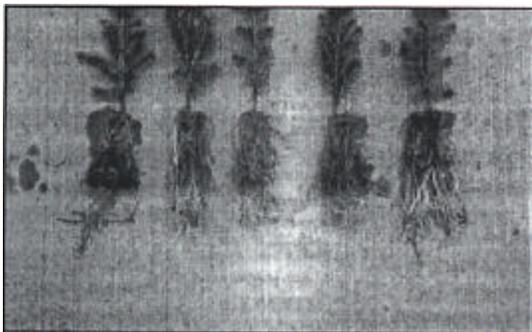


Figure 8. Effect of CONFER on root egress of white spruce. (left to right; blackout, 0.5, 1.0, 2.5 & 5.0 kg/1000 m²).



Figure 9. Effect of CONFER on root egress of lodgepole pine. (left to right; control, 0.5, 1.0, 2.5 & 5.0 kg/1000 m²).