FIRST YEAR GROWTH OF FIELD PLANTED CHEMICALLY ROOT PRUNED CONTAINERIZED SEEDLINGS

A Professional Paper

Presented in Partial Fulfillment of the Requirements for the

DEGREE OF MASTER OF SCIENCE

(Non-thesis)

with a

Major in Forest Resources

In the

GRADUATE SCHOOL

UNIVERSITY OF IDAHO

By

Yong Liu

May 1987

INTRODUCTION

Container trees may frequently become stunted or die several years following outplanting (Hellum 1978), and are sometimes prone to windthrow (Chavasse 1978). Primarily due to root system deformities, because of restricted space for growth the root system cannot expand normally, and all roots grow downward to and through the bottom of the container. An outplanted container seedling has a dense, fibrous root mass clustered around the tap root in the upper soil layers (Stein 1978). Therefore, the seedling has a low ability to absorb water and nutrients, and has poor mechanical stability. In contrast, natural seedlings generally develop well distributed lateral root system which provided maximum growth potential and mechanical stability (Stein 1978).

Mechanical instability can be prevented by using planting methods that do not cause persistent modification of the natural pattern of root growth (Burdett 1978). A chemical (cupric carbonate) root control method was developed by Burdett, that prevents the development of deformed root systems in containers. He reported that root growth of lodgepole pine (Pinus contorta Dougl.) seedlings was completely inhibited in their elongation upon contact with a container wall coated with cupric carbonate, whereas, untreated seedling roots usually grew down to the egress hole and spiraled around the container wall. Chemically pruned

roots of treated seedlings resumed natural growth pattern after removed from the container and outplanting. Untreated seedlings had few emergent roots, except at the bottom of the plug. The main lateral roots of treated seedlings emerged from the uppermost part of the root plug close to the soil surface, a pattern similar to a natural root system. Height growth of chemically root pruned stock was 15 percent greater than the conventional plug seedlings, but first season survival and growth of treated and untreated seedlings were virtually identical (Burdett 1981).

McDonald (1981) tested different concentrations of several chemicals, such as trifluralin, cupric carbonate and indole-3-butyric acid (IBA) to determine the effects of these chemicals on seedling root growth. Cupric carbonate at 100 g/l was effective in limiting root downturn at the wall as was 50 g/l IBA.

Woollen (1986) used containerized ponderosa pine (Pinus ponderosa Laws.), western white pine (Pinus monticola Dougl. ex D.Don), and Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings to determine their response to chemical root pruning. A randomized block design was used in a three-phase study (greenhouse, potted seedling and field trials). In the greenhouse, individual container cells were randomly assigned to one of five treatments: control; interior wall coating of latex paint; coating of 30 g cupric carbonate to one liter latex paint;

coating of 100 g cupric carbonate to one liter latex paint; and coating of 300 g cupric carbonate to one liter latex paint. Both Ray Leach pine cells and styroblock 4A containers were used in each treatment. The unpainted cells acted as a control for the effect of the latex paint on root morphology and seedling growth. The painted cells with no cupric carbonate acted as a control for the effects of different concentrations of cupric carbonate. Seedling height and caliper were unaffected by all treatments. In the potted seedling study, seedlings were removed from their treatment containers and potted individually in 1 gallon pots containing a 1:1 peat:vermiculite mixture to test root growth potential. After 21 days, the length and number of new roots greater than 1 cm in length in the upper two-third of the seedling plug were measured. Seedling root systems increased in total surface area as a result of chemical root pruning, especially in the upper portions of the root system.

Woollen also planted additional root-pruned seedlings on the University of Idaho Experimental Forest in April 1986, for the field trial phase. The experiment was a randomized complete block split plot design with two replications. Ten treatments of different cupric carbonate concentrations and container combinations were randomly assigned to each species, with each treatment containing ten seedlings. The planting site was a moderately steep, northeast facing clearcut unit (stand # 03-12-01) that had been harvested in June through August of 1985 and

treatment containing ten seedlings. The planting site was a moderately steep, northeast facing clearcut unit (stand # 03-12-01) that had been harvested in June through August of 1985 and broadcast burned in early October of 1985. The duff layer was not reduced by the prescribed fire. The soil is classified as a vassar silt loam. It is formed in volcanic ash over residuum derived dominantly from granite (Barker and others 1981). The habitat type is classified as: Thuja plicata/Clintonia uniflora/Clintonia uniflora (Cooper and others 1983).

My study is continuation of Woollen's from field trail. It involves an investigation of these field trials.

OBJECTIVES

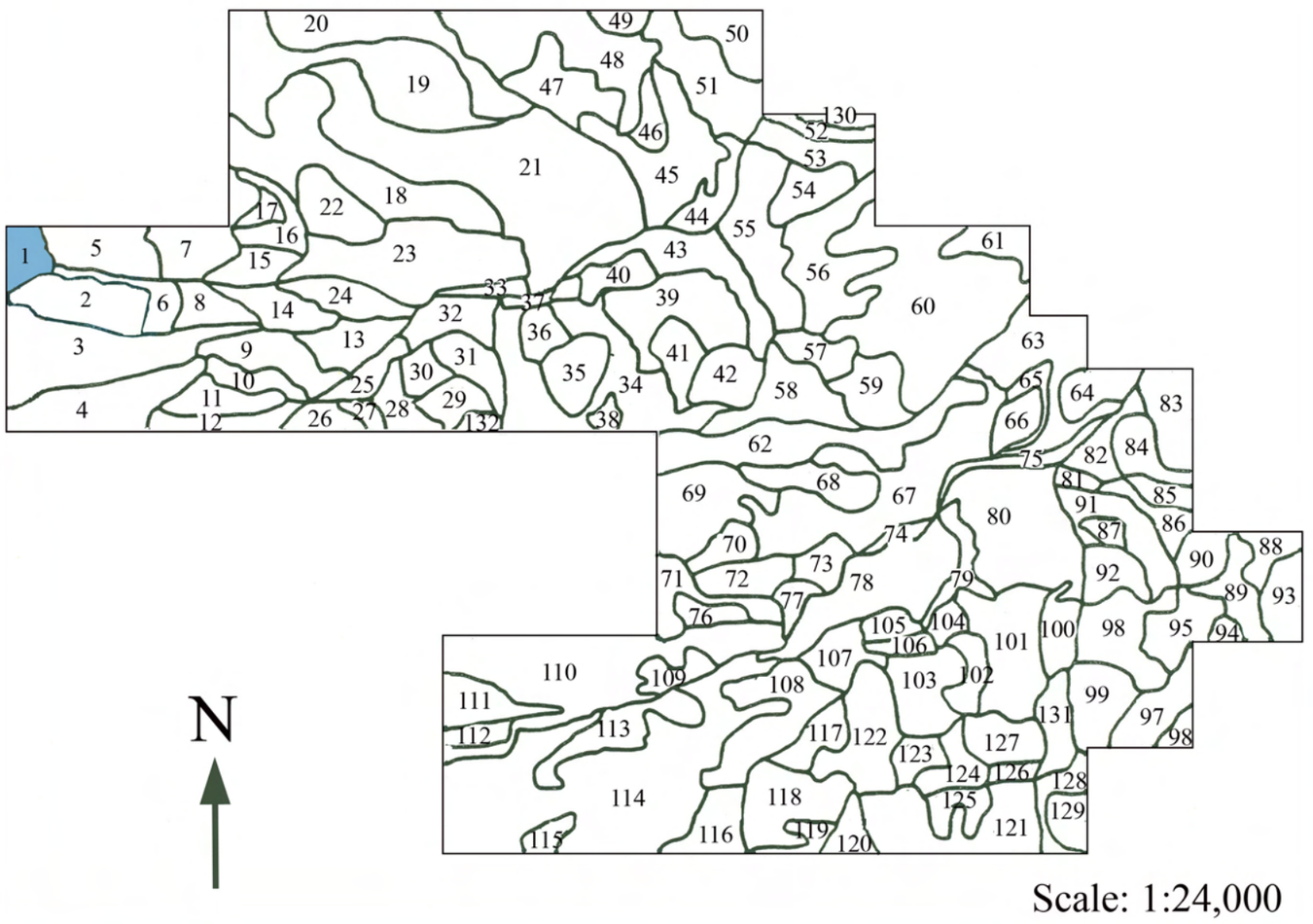
The specific objectives of this study were (1) continue previous work done with chemical root pruning using northern Idaho sources of ponderosa pine, western white pine, and Douglas-fir, (2) obtain and analyze first year field data for a comparison of treated and untreated seedlings, (3) determine the concentration of cupric carbonate at which the tree attain maximum root growth after outplanting.

MATERIALS AND METHODS

The seedlings were sampled after one growing season in the field. Seedling height, caliper, shoot dry weight, new root number, new root dry weight and total root dry weight were measured. Caliper was measured at the soil surface and height was taken from the soil surface to the top of the terminal shoot. The seedling roots were divided into three zones: top zone, middle zone, and bottom zone. For seedlings grown in Ray Leach containers, top zone was defined as from caliper downward to 5 cm; middle zone from 5 cm to 10 cm; and bottom zone below 10 cm. For seedlings raised in styroblock 4A containers, the zone length was 4 cm. Roots greater than 1 cm in length were measured as new root number for each separate zone. Root dry weights were collected after oven drying at 60^{o}C for 24 hours.

Conventional analysis of variance was used to test seedling height, caliper, shoot dry weight, new root number for each zone, new root dry weight for each zone and total root dry weight. Fisher's LSD test was performed on multiple comparison for comparing differences among treatment means. Multiple regression was used to determine optimal cupric carbonate concentration for root growth of these the conifer species.

Stand Map of the
West Hatter Creek
Unit,
College of Forestry,
Experimental Forest
1986



By finding the stand number on the table for the map, you are able to then find the stand number on the map an see where the research took place on the experimental forest. This map and table came from *A Combined Report For Fiscal Years 1980 Through 1986*

By
Forest Manager,
Harold Osborne
The maps were edited by
Rachel Voss

Table 6-1. Continued

STAND #	MAP #	STAND DESCRIPTION	HARVEST ACRES	HARVEST ACTIVITY CODE	FY HARVEST	SLASH/ SITE PREP CODE	FY PREP	REFOREST CODE	FY REFOREST	LOGGING METHOD
30707	42	CULVERT PILE CLEARCUT	9	CC	86	BB	87	P	87	G
31201	1	ROCKY POINT CLEARCUT	25	CC	86	BB	86	P	86	C
31202	2	ROCKY POINT SELECTION UPPER	40	SE	86	DP&B	86	NR	88	G
31203	3	ROCKY POINT SELECTION LOWER	26	SE	86	DP&B	86	NR	88	G
40201	6	KOHLER THINNING	3	T	86	L&S	86			C
40501	5	FIREWOOD THINNING	12.4	T	86	L&S	86			

TABLE 6. AN EXPLANATION OF CODES USED IN TABLES 6-1 AND 6-2.

HARVEST ACTIVITY CODES

CC - CLEARCUT
SHWD - SHELTERWOOD
ST - SEEDTREE
SE - SELECTION
T - THINNING
LT - LOW THINNING
N - NO HARVESTING
IMP - IMPROVEMENT CUT
P - CUT PRIOR TO FY80

REFORESTATION CODES

P - PLANTED
NR - NATURAL REGENERATION
IP - INTERPLANT

SITE PREPARTAION CODES

BB - BROADCAST BORD
DP&B - DOZER PILE AND BURN
L&S - LOP AND SCATTER
JPB - JACKPOT BURN
HPB - HAND PILE AND BURN

LOGGING METHOD CODES

C - CABLE LOGGING
G - GROUND SKIDDING
H - HORSE LOGGING

Location of Complete Research:

Author & Title: Liu, Yong
First Year Growth of Field Planted Chemically Root Pruned Containerized Seedlings

University of Idaho Library:

Call Number- SD404.3.L58 1987

College of Natural Resources:

Department- Forest Resources

Other Sources: