Auburn University
Southern Forest
Nursery Management
Cooperative

RESEARCH REPORT 01 - 14

SATURATED SEEDBEDS REDUCE FINE ROOTS AND OUTPLANTING SURVIVAL

by
Bill Carey and David South

INTRODUCTION

Extensive outplanted mortality can occur among seedlings lifted during periods of above average rainfall (Wakeley 1954). An extreme example of this occurred in 1994 near Georgetown, GA. Based on rainfall records, soil structure, and nursery analysis, we concluded that seedbeds had been saturated for days before and during lifting. However, seedlings collected at the nursery later in the month (January) and planted in sand at Auburn survived adequately and so the conditions causing the mortality must have improved and the seedlings recovered between the two harvest dates. Based on the difference between the two lifting dates, and because such episodes are unusual, we assume that seedlings must recover soon once beds again become aerobic. However, that investigation and others (Oak 1983) have been conducted after-the-fact and assumed that blackened root surfaces observed on dead seedlings in the field indicate periods of anaerobic conditions in the nursery. This report describes the analysis of seedlings affected by saturated beds before lifting. A more thorough coverage of the literature and history of such episodes was reported by South and Carey (1999).

METHODOLOGY

An opportunity to test assumptions about the affects of lifting from saturated soils occurred in October of 1998 when loblolly seedlings from a "wet-spot" were sent to Auburn for disease diagnosis. The blackened roots contained no pathogens associated with these symptoms and the color was attributed to insufficient oxygen (anaerobic periods) in saturated soils.

Five replicate samples of 25 loblolly seedlings from within the wet-spot and five samples from outside were lifted 10/27/98 and shipped to Auburn. Twenty seedlings were planted the next day in coarse sand and five per replicate were analyzed by electronic root scanner. This was repeated in November and in January to monitor recovery as a function of survival and fine root structure.

RESULTS

In October, the roots of the seedlings from the wet-spot were black and there was less total root length and fewer fine roots (see Table 1). These seedlings quickly lost needles and began to die within a couple weeks. Unfortunately, these seedlings were mistakenly harvested by a cleaning crew and all we have now are photographs taken just before their loss. Among seedlings lifted a month later (Dec.), neither total root length nor fine root lengths differed but qualitatively the larger roots from the wet spot had darker surfaces. After another month it was difficult to separate seedlings based on root color. Survival did not differ between the wet-spot (96%) and control (95%) seedlings lifted in either December or January.

Table 1 Root lengths by diameter class for loblolly seedlings lifted 10/27 and 12/2/98 and 1/27/99 from beds with or without saturated soil before 10/27/98.

	Total Root Length		Length of roots
Lifted	Wet Spot	in cm	≤ 0.25 mm dia.
Oct 98	Yes	224 a	12 a
Oct 98	No	316 b	19 b
Dec 98	Yes	375 a	16 a
Dec 98	No	377 a	13 a
Jan 99†	Yes	202 a	7 a
Jan 99	No	141 b	7 a

† Seedlings available for root scanning after planting the January seedlings were of less than average size.

MANAGEMENT IMPLICATIONS

The rapid loss of needles among seedlings with blackened root surfaces that were transplanted soon after their discovery in wet soils showed (as had been assumed) that they were predisposed to transplant shock compared to seedlings from normally aerated beds. The failure of seedling root structure to differ only 34 days later (after beds again becoming aerobic) and the fact that seedlings lifted a month after the wet spot dried, survived as well as those not previously exposed to saturated soil, reinforced our opinion that recovery occurs quickly after the soils dry. Every attempt should

be made to not lift seedlings from saturated beds and to postpone lifting seedlings exposed to anaerobic conditions for as long as possible (up to a month) after their beds dry to normal aerated conditions.

LITERATURE

Oak, S. W. 1983. Evaluations of a loblolly pine seedling survival and storage problem on the Sumpter, Chattachoochee, and Oconee National Forests, 1983. Forest Pest Management Rep. 83-1-22. Asheville, NC: U.S.D.A. For. Serv. 15 p.

South D.B. and W.A. Carey. Excessive rainfall prior to lifting adversely affects seedling physiology. In: Landis, T.D.; Barnett, J.P., tech. coords. National proceedings: forest and conservation nursery associations-1998. Gen.Tech.Rep. SRS-25. Asheville, NC:USDA, Forest Service, So. Research Station:63-64.

Wakeley, P.C. 1954. Planting the southern pines. Agric. Monogr. 18. Washington, DC: U.S. Gov. Print. Off. 233 p.