Auburn University
Southern Forest
Nursery Management
Cooperative

RESEARCH REPORT 01-7

WINTER TEMPERATURE FLUCTUATION IN LOBLOLLY PINE SEEDLING BEDS AND RISER LINES

by
Troy Beldini and Ken McNabb

INTRODUCTION

This experiment was conducted at the International Paper Super-Tree nursery in Union Springs, AL between November 14, 2000 and February 15, 2001. The purpose of the experiment was to monitor and compare the temperature at different positions in nursery beds and along riser lines. The seedlings were about 18-inches (46 cm) in height. We hypothesized that seedlings reduce ambient temperature extremes.

METHODOLOGY

HOBO H8 Pro Series data loggers (Onset Computer Corp., 2000) were used to record the temperature at 15-minute intervals between November 14, 2000 and February 15, 2001 (94 days) at three different positions (A, B, and C) in the nursery. Position A was 2-inches above the height of the seedlings, position B was 2-inches above the soil inside the seedling row, and position C was 2-inches above the bare soil on the riser line directly next to the seedling row. Three loggers were setup in these positions at two locations, 35 m apart. Wooden stakes and metal shelving pieces were used to construct supports to anchor the loggers in the desired positions. The loggers were protected from rain exposure by being screwed into the inside bottom of a plastic bowl and hung upside down over the seedlings and soil. The bowls were painted white to reduce the effect of direct solar radiation on the temperature readings. Variables of interest were daily maximum and daily minimum temperatures in addition to daily temperature fluctuation. Temperature fluctuation was determined by subtracting the average daily minimum temperature from the average daily maximum temperature.

RESULTS

Table 1 lists average temperatures for each position. Figure 1 shows the averages of these parameters for each position. A Student's "t" test for differences between loggers showed that the logger within the seedlings recorded significantly lower *daily maximum* and higher *daily minimum*

Table 1. Average daily temperature maximum, minimum, and fluctuation (°C) for each logger position.

Position	Maximum	Minimum	Fluctuation
Above seedlings	14.47	-1.08	15.55
Within seedlings	13.18	0.55	12.63
Riser line	14.54	-0.14	14.68

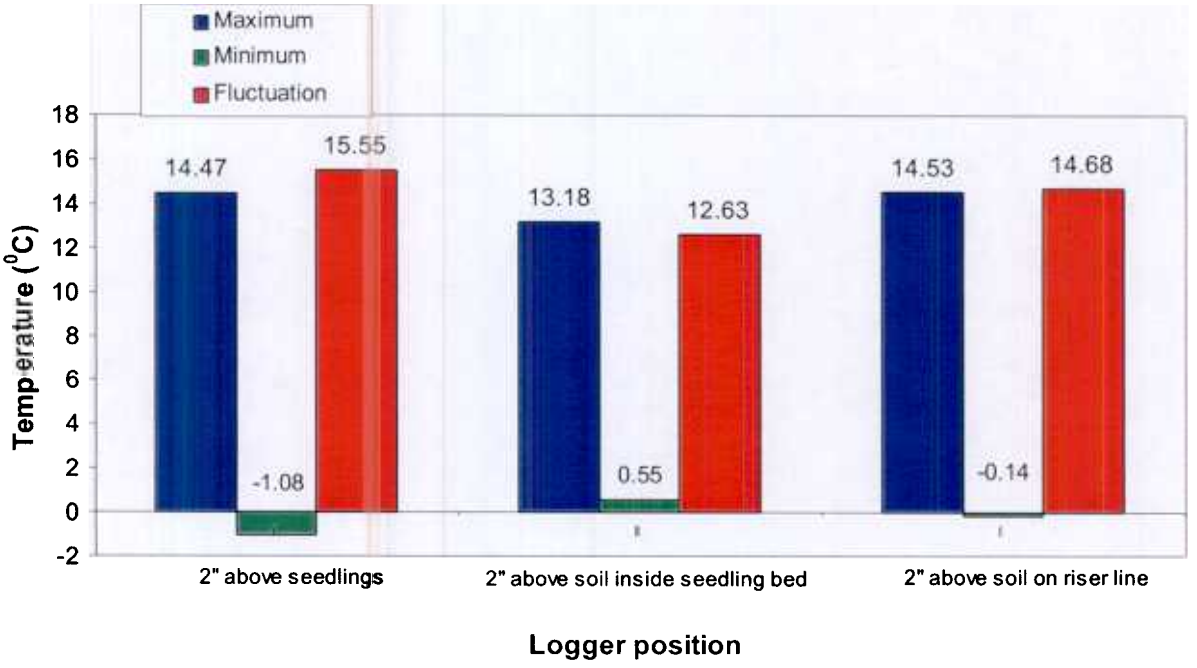

Figure 1 Average daily temperature maximum, minimum, and fluctuation (°C) for each logger position, 11/14/00 to 02/15/01, Union Springs, AL.

temperatures than did loggers above the seedlings and in the riser line. Loggers above the seedlings (A) and in the riser line (C) were not different from each other for these parameters (Figure 2). The

results from this experiment show there may be a moderating effect on temperature inside the seedling bed near the soil. The most extreme temperatures recorded, both maximum and minimum values and fluctuation (Figure 2), were at position A, 2-inches above the seedlings. The C-position, 2-inches above the soil on the riser line, was between the extremities of positions A and B (within seedlings). This hints at the possibility that the soil may impart a moderating effect on temperature. Additionally, with the seedlings being around 18-inches tall, the logger at position A (2-inches above the seedlings) is nearly 2-feet in the air and at this level the cooling effects of wind and the lack of a nearby moderating body may be a factor in the more extreme temperature readings.

Table 2. Intra-group comparisons of daily temperature maximum, minimum, and fluctuation.

Position		Maximum	Minimum	Fluctuation
Above seedlings:	A1	14.35	-0.97	15.33
	A2	14.59	-1.18	15.78
Within seedlings:	B1	14.15	-0.07	14.22
	B2	12.20	1.16	11.03
Riser line:	C1	14.98	-0.01	14.99
	C2	14.09	-0.27	14.37

We compared the daily temperature maximum, minimum, and fluctuation at A1 with that of A2, B1 with B2, and C1 with C2 to see if there were any differences in local site effects. The statistical tests of all 3 parameters for positions A (above seedlings) and C (riser line) were not significant. However, positions B1 and B2 (within seedlings) were significant ($\propto$=0.05)for differences in all 3 parameters. When comparing B1 data with B2 data, Table 2 shows that B1 had more extreme average daily maximum and daily minimum temperatures, and the mean daily fluctuation at position B1 was 3.19 $^{\circ}$C greater than that at B2. This variation may be due to lower seedling density in the immediate vicinity of temperature logger B1.

MANAGEMENT IMPLICATIONS

Ambient air temperatures are mitigated somewhat by the seedling beds with interior temperatures of beds 1 to 2 degrees C warmer than ambient air.

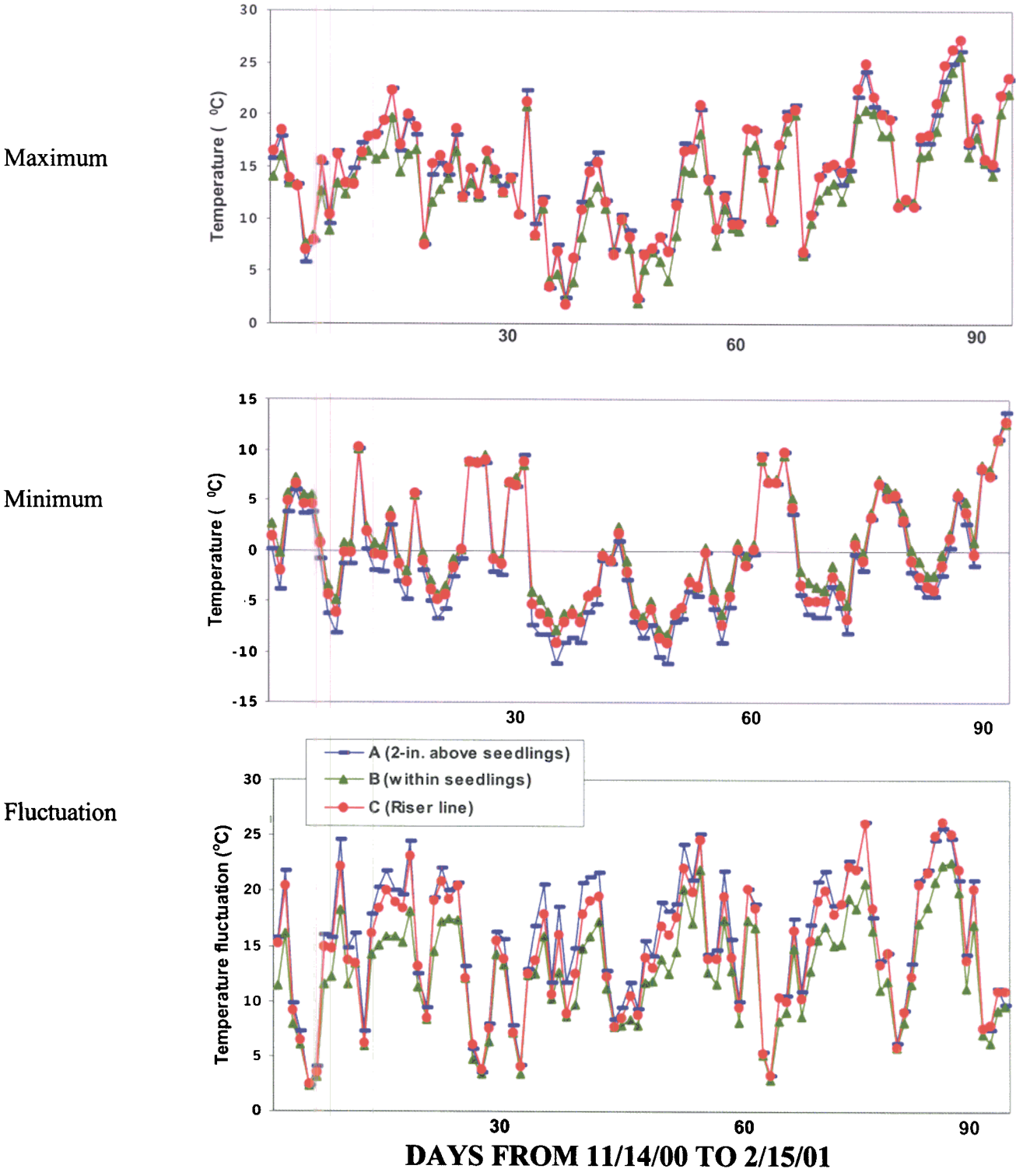

Figure 2. Average daily temperature maximum, minimum, and fluctuation for within beds, over beds, and along riser lines in a Coastal Plain nursery near Union Springs, AL.