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Warnell School of Forestry & Natural Resources

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Survival and growth of containerized slash pine seedlings related to planting location on mechanically prepared beds

David Clabo[1], James Jacobs[2], David Dickens[1] and Cassandra Waldrop[1]

[1]*Assistant Professor of Silviculture, UGA Warnell School of Forestry & Natural Resources*
[2]*Charlton County Extension Coordinator, UGA Extension*
[1]*Professor of Forest Productivity, UGA Warnell School of Forestry & Natural Resources*
[1]*Research Technician, UGA Warnell School of Forestry & Natural Resources*

INTRODUCTION

Bedding is a form of mechanical site preparation that creates mounds (hence the word "beds") or low ridges to improve physical and chemical soil characteristics such as aeration, higher temperatures, and improved rooting volume. Improvements to these conditions can increase survival and growth rates of southern pine seedlings planted on very poorly, poorly, and somewhat poorly drained sites. Another possible benefit of bedding is that it can be used to incorporate organic matter into sandy textured soils and increase decomposition and nutrient mineralization rates (Ashton and Kelty 2018). Bedding may also be used to create uniform microtopography conditions on uneven terrain in former agricultural fields and unmanaged forest sites (Kabrick et al. 2005).

Sites where bedding is needed in Georgia are often inundated for at least part of the year or have a very sandy texture with low amounts of organic material. In addition, bedding temporarily improves competing vegetation control, but this effect is short-lived (1-2 years at most) if chemical site preparation and/or herbaceous weed control are not utilized. Heavy machinery is required to bed a site. Skidders or large bulldozers pulling a bedding plow or a Savannah plow are used frequently. Ideal timing for bed creation is the summer months (when sites in the Coastal Plain are normally driest) followed by planting during the winter months. Soil in the raised beds is allowed to settle for a few months prior to seedlings being planted. Seedlings are typically hand planted down the center of 3-6 ft wide beds. Beds often settle and break down over time, which includes erosion or sloughing off of soil from the edges of the bed. The wetter the site, the more likely that beds will settle or break down more quickly.

Recently, concern was raised over slash pine seedlings being planted close (≤1 ft) to the edge of beds on a site in southeast Georgia. Concerns included decreased survival and growth of seedlings due to root exposure near the edges of beds caused by soil settling, wear, and stabilization. This situation presented an opportunity to compare survival and growth of newly planted containerized slash pine seedlings on a bedded site where seedlings were planted in the center of beds and within one foot of the edge of beds.

METHODS

The study area was located on a nearly level cutover site in Charlton County, Georgia with Bonifay[a] and Meldrim[b] soils. Both soil series are CRIFF group F soils. These soils are well-drained to moderately well-drained, and depth to an argillic horizon is more than 40 inches. Meldrim soils may be saturated or have a high water table during the wettest periods of the non-growing season (January) (National Cooperative Soil Survey 2007). The site was bedded and chemically site prepared during 2018, and containerized slash pine (*Pinus elliottii*) seedlings were hand planted on a 6x12 ft spacing during January 2019. Beds averaged 4.87 ft wide.

[a] Bonifay soils are classified as loamy, siliceous, subactive, thermic Grossarenic Plinthic Paleudults
[b] Meldrim soils are loamy, siliceous, semiactive, thermic Oxyaquic Paleudults

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Study plots were randomly established throughout the site during early June 2019. Four planting rows of ten trees with trees located ≤1 ft from the edge (point where the bed drops between one and two feet into a mechanically created ditch) of the bed (Figure 1) and four runs of ten trees located within a two foot range (one foot either side of midpoint) of the bed center (Figure 2) were flagged with different colors and assessed for survival. During late November 2019, all four of the middle bed rows were located while only three of the four side beds were located. A dense cover of hairy indigo (Indigofera hirsuta) made locating of all rows difficult. Seedlings were assessed for survival, groundline diameter (GLD), and height. Analysis of variance was used to test for differences in survival, GLD, and height.

RESULTS

Seedling survival was 100% across both seedling locations as of June 2019. Survival was still 100% for side bed seedlings as of late November 2019, but had dipped slightly to 97.5% for the middle bed seedlings. No statistically significant differences were observed for average GLD ($p=0.69$) or height ($p=0.99$) (Figures 3 and 4). Average GLD differed by only 0.4 cm between the two planting locations while average height only differed by 0.1 cm.

DISCUSSION AND CONCLUSIONS

Based on preliminary results from this case study, potential concerns with pine seedling planting location and possible survival impacts on mechanically prepared beds do not seem to be well founded after one growing season. Even after a droughty and hot first growing season (2019) in southeast Georgia and an influx of hairy indigo competition, seedling survival was still excellent. This result may not be the case on all soil types though as Shoulders and Terry (1978) reported soil texture has a strong influence on bed stabilization rate and changes to beneficial soil physical properties within a bed. As beds settle and stabilize over time, tree proximity to the edge of beds may become more of an issue due to possible root exposure. Seasonal poorly drained conditions on sites where bedding is used regularly coupled with wind events and root exposure may result in increased windthrow risk for trees as they grow taller and when planted on the edge of beds. This possibility warrants future monitoring of this site and locating other bedded sites on very poorly, poorly, or somewhat poorly drained soils where the water table is at or close to the surface most of the year.

Fig. 1: *Example of containerized slash pine seedlings planted within one foot of the edge of planting beds at the Charlton County, Georgia, site.*

Fig. 2: *Containerized slash pine seedlings planted near the midpoint of the bed at the Charlton County, Georgia, study site.*

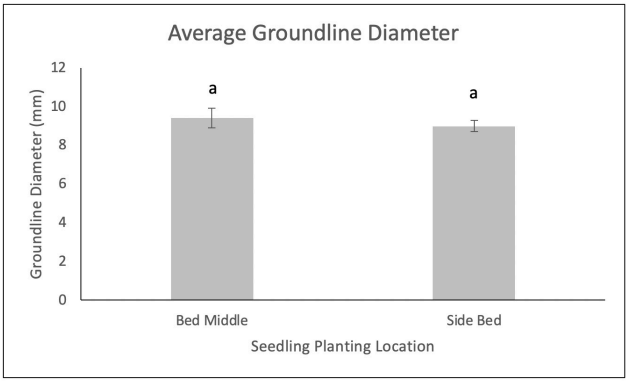

Fig. 3: *Average groundline diameters, standard errors, and letter groupings of slash pine seedlings after one growing season by bed planting location in the Charlton County, Georgia, study.*

Fig. 4: *Average height, standard error, and letter grouping slash pine seedlings after one growing season by bed planting location in the Charlton County, Georgia, study.*

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