Answer from Longleaf Alliance's Mark Haines

Are "deep plugs" better? Virtually all container-grown longleaf seedlings are produced in plugs that range from 3-6" in depth, and 1-2" in diameter. Most of these plugs have a volume of 5-7 cubic inches.

Dr. Jim Barnett with the USDA Forest Service has done most of the work related to longleaf seedling survival and growth-as related to the containers in which the seedlings were produced. I believe that Dr. Barnett's research demonstrates a relation between container volume, seedlings per square foot (in the container), and seedling size. Larger volume containers allow more resources to be directed to each seedling (water, nutrients, & light). Thus, seedlings grown in bigger containers tend to be larger and healthier. Early findings from research conducted by The Longleaf Alliance shows better survival and growth from seedlings with larger root collar diameters and better developed root systems. So, I believe you can correctly imply that: bigger containers=bigger seedlings=better survival & growth.

Returning to the question that was first posed "what are my thoughts on 4" verses 6" plugs?" At this time, unless there are unusual planting conditions, I have **no preference** for one plug length over another.

"Deep plugs" are often preferred in certain parts of the Southeast. In particular, there seems to be a preference for 6" plugs across much of Georgia. Similar to what you stated in your posting on the Longleaf Alliance Forum, I believe the theory is: a 6" plug allows the roots to reside deeper in the soil at the time of planting, and shortly there-after. If a dry spell sets in the spring following planting, there should be more moisture 6" deep, and there should be less soil moisture at a depth of 3-4". Following that logic, in a period of drought, a shorter plug will dry out and die faster than a deeper plug. So far, the limited research conducted on container-style has **not** backed this up.

Sandy Harris recently graduated from Auburn University with a Master's of Science in Forestry. His research focused on container style, root morphology, and resultant longleaf survival and growth. From his research, there did not appear to be a significant correlation between the depth of the container, and seedling survival and growth. At this time, I am not aware of any research which demonstrates better survival or growth from deeper containers. However, there are other factors which may give deep plugs an advantage in some situations.

I believe that some mechanical tree planters can better handle 6" plugs, than the shorter-fatter, 3" plugs. If you plan to hire a machine tree planter, ask them which plug handles best with their equipment.

On exceptionally wet areas, where water stands for days or weeks at a time, research conducted by The Longleaf Alliance has shown better survival with very shallow plantings. Thus, we recommend planting 6" plugs in very wet natured soils, and leaving about 1/2 of the plug protruding above the soil surface.

On may cutover sites, it is difficult to plant a 6" plug too deep, if you are using any of the standard hand planting tools; dibbles, plug tools, or hoedads. By too deep, we mean that soil is over the terminal bud. Time and again, research conducted by The Longleaf Alliance has clearly documented the harm caused by planting seedlings too deep. If your tree planters are inexperienced planting longleaf pine, you may be less likely to plant your seedlings too deep if you are using a 6" plug.

Deep plugs may have an advantage where the site preparation was a deep scalp and significant soil movement is anticipated back into the furrow. By planting a 6" plug with 2-3" of the plug exposed, you can allow for up to 2" of soil movement back into the furrow and your terminal bud should still be exposed. As we have stated many times, ***at no point should your terminal bud be covered by soil.***

On rocky, hard packed soils, short plugs may have an advantage. Since more longleaf are hand planted than machine planted, short plugs should be easier to get in the ground on some piedmont sites where it may be slower and harder to correctly plant the deeper 6" plug.

In conclusion, in the absence extenuating circumstances, I would advise you to focus more on plug volume, than on plug depth. Bigger, prettier, tree seedlings will survive and grow better than smaller seedlings grown in low volume containers. Until we have more data, I have no reason to believe that shorter plugs (3-4") are less desirable than longer plugs (6").

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Since we are the largest and oldest producer of seedlings in the Southeast, we have a variety of customers with a variety of needs. IFCO produces four different container sizes.

* Species	Container	Length	Diameter	Volume
1,2,3,4,5	120S	3.4 In.	1.6 In.	5.7 Cu. In.
1, 2, 3	120L	4.1 In.	1.6 In.	6.0 Cu. In.
1	IPL110	5.0 In.	1.6 In.	6.7 Cu. In.
1,2,3	128L	4.75 In.	1.6 In.	7.3 Cu. In.

- 1— Longleaf Pine
- 2—Loblolly Pine
- 3—Slash Pine
- 4—Shortleaf Pine
- 5—Virginia Pine

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