Some thoughts on growing young pecan seedlings in a nursery.

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In this article I mostly want to talk about growing seedlings for the first two years. At that point in time they should be large enough to graft or bud to the scion cultivar. We grow a lot of seedlings for our breeding program and have picked up some techniques that may be useful to the nurseryman.

The first step in growing seedlings is to pick out the seed to use for the rootstock. In the Southeast, two of the most common choices have been 'Elliott' and 'Curtis'. However, 'Curtis' is becoming more difficult to find as this cultivar is no longer favored for production. Nuts chosen for seedstock should meet several criteria including: 1) the nuts should be uniform with a well-developed kernel, 2) the nuts should be readily available so that you can get them each year, 3) the seedlings produced should be vigorous, and 4) the seedlings produced should have as much disease resistance as possible. The scab resistance of the seedling will not transfer to the grafted scion, but resistance in the seedlings helps the overall growth of the rootstock before it is grafted. Some observations we have made from examining the growth of our breeding progenies have led us to believe that 1) large nuts generally don't perform better than small nuts, 2) nuts with thin shells like 'Schley' often germinate poorly due to rot that develops in during stratification, 3) thick shells do not hamper germination. 'Elliott' performs well because the kernels are usually consistently well-developed, the seedlings have moderately good vigor, and on average the seedlings have good resistance to scab. We have also noticed that 'Elliott' has a lower stratification requirement than most other cultivars. However, 'Elliott' can sometimes be hard to obtain on OFF years because 'Elliott' alternates so badly. Other cultivars that have done well on average are 'Caddo', which produces very vigorous seedlings that tend to be more scab susceptible and 'Desirable' which has a medium vigor seedling. Cultivars which on average perform poorly are 'Schley' which often germinates poorly, 'Sumner' which always seems to produce low vigor seedlings, and 'Pawnee' which has scabby seedlings that are slow to emerge. Please remember that one half of the genetics of the seedlings comes from the pollen parent, so nuts from the same cultivar can vary in performance due to the pollinator.

Once you have secured the seed you wish to plant, you need to prepare the seed for germination. Dry pecan seed is in a state of dormancy. Without this dormancy, the seed would germinate in the fall, and the resulting seedlings would then be killed in the winter. Normally this dormancy is gradually broken down during the winter as the nut lies in the leaf litter and goes through several cycles of dampness and cold temperatures. In order to break this dormancy artificially you need to stratify the nuts. In order to stratify the nuts you need to provide two conditions, dampness and cool temperatures. We generally begin the process by soaking the seed in running water for 3 days. We put the nuts in large onion bags and put them in a tank with a hose slowly adding in fresh water. This allows the nuts soak up enough water to begin the stratification process. After the 3 days we pull the nuts out and place them in plastic tubs with damp cedar shavings. These shavings can be bought at Walmart and are used for bedding for hamsters (*Mesocricetus auratus*). We like the cedar shavings because cedar seems to prevent mold from growing, and the shavings don't hold too much water (they also are very good material for packing around graftwood for the same reasons). Let the shavings soak in water for a day, and then dump them over and let all the water drain away. If you pack dry nuts in the shavings it takes more shavings because the dry nuts will pull the moisture out of the shavings. Generally we put a layer of shavings in the bottom to capture any excess water, stack in the bags of nuts, and then cover with more shavings. You need to store the nuts at 35-45 F, which is about the temperature of a refrigerator, until you are ready to plant. The important thing to remember is that the nuts need to be cool, not frozen, and damp, not wet.

Generally nuts should be stratified for at least 10 weeks to get prompt germination (Sparks et al., 1974). If your seed is slow to come up, you increase the competition from weeds. More importanatly, slow germination increases the likelihood that the tender new shoot will be burnt off at ground level by the hot sun. This results in the tip turning black, and several secondary buds breaking and forming competing shoots. These may come up, but because there are several competing growing tips, the form of the seedling is often ruined. We undertook a project to determine the optimum time to plant stratified and unstratified nuts. We had three treatments 1) dry seed that was stored at 4 C before planting, 2) soaked seed where the seed was stored dry and then soaked for 3 days in running water before planting, 3) stratified seed where the seed was soaked for 3 days and then stratified at 39 F in moist cedar shavings before planting. We used 'Elliott' seedstock for this experiment and began all treatments on Nov. 1st. Five replications of 10 nuts were from each treatment were then planted on Dec. 1, Jan. 2, Feb. 1, Mar. 1, and Apr. 1. Seedlings were observed every 14 days to determine time of emergence, and seedling height was measured monthly. Averaged over all planting dates, dry seed was not statistically different from soaked seed in terms of final germination rate, seedling emergence date, or final seedling height. Stratified seed had a higher germination rate, quicker emergence, and greater final seedling height and caliper than dry seed. If we break down the results and look at the effect of planting date on the growth of stratified seed (Table 2) and dry seed (Table 3), we see that stratified seed can be planted at about any date up until April and not have an effect on seedling growth. With dry seed, emergence is delayed with later planting dates (Table 3), and later planting dates result in reduced seedling growth. In order to get a seedling emergence similar to the stratified seed, dry seed must be planted Dec. 1. By planting this early, you are basically stratifying the seed in the ground.

We generally plant our seed very close together (1 foot between seedlings) in the seedling nursery. Lately we have planted all of our seedlings on raised vegetable beds covered with white plastic mulch. We have found that the plastic mulch greatly reduces the competition from weeds, except for nutsedge which can penetrate the plastic. Aside from reducing weed growth, we have found a significant benefit in the growth of seedlings due to the mulch. Seedlings grown on white plastic mulch had a higher caliper, and more than double the shoot and root dry weight as compared to seedlings grown on bare ground (Table 4). However, black plastic mulch results in much lower growth and even seedling death, so if you can't obtain white mulch, stick with bare ground.

Growth of seedling in the first year is rather slow. Seedlings seem to grow to height of 12-18 inches, and then stop lengthening. We have tried high rates of nitrogen to increase this growth, but were unsuccessful. However, the roots continue to grow and can reach a length of 3 to 4 feet. Caliper of seedlings also continues to expand and we have found that with optimum conditions the caliper can be large enough to whip graft after the first year, especially if white plastic is used. Fertilizer does not seem to be a large factor in first year seedling growth, and we typically apply 50 lbs N per acre as 10-10-10.

The second year of growth sees an explosion of growth as the shoot appears to catch up to the root. Shoots will continue to expand the entire growing season if water and nutrition are optimal. We have seed seedlings reach 8-10 feet tall by the end of the second year. Really, this probably too large, as it is difficult to dig these trees without doing them harm, and they would definately be too large if you are planning on whip grafting them after the second year.

You will have some pest management problems on your seedlings. Probably the biggest issue is weed control. The number one thing you can do to make your life easier is begin clearing out your seedling area the year before. Unless you are planting on former crop land where weeds have been controlled previously, it is vital that you begin early. We typically spray the area with glyphosate in August, then come back and work up the area with a disc a couple more times after the weeds germinate. It is especially important that you kill out any bermuda grass in the area ahead of time. Once seedling are up, I hesitate to ever use glyphosate around seedlings.

Especially with hand sprayer there is a temptation to try and spray as close as possible to the seedlings. If you spray glyphosate near seedlings, you will see damage eventually. Often the damage doesn't appear for months, but once there it really stunts the seedlings. Glufosinate is somewhat safer around the seedlings and we try to use that if necessary. If you have grass weeds in your seedlings, we have used Poast (sethoxydim) herbicide. You will burn seedling leaves if you add crop oil to the spray. For nutsedge control we have used either Permit (halosufuran) or MSMA with good success. Please check the latest Georgia Pecan Pest Management Guide for the rates to use of these chemicals.

Insect control primarily revolves around two pests, the pecan bud moth and leaf phyloxera. Bud moth kills the developing shoot and can cause excess branching. Leaf phyloxera stunts leaf growth and therefore seedling growth. The key to controlling both of these pests is to act early. We apply a spray right as the first buds are expanding and then again 2 weeks later. Once you get these early generations controlled you will have much less trouble the rest of the season. Please check the latest Georgia Pecan Pest Management Guide for recommended control methods of these two insects.

Fungal problems in the nursery are usually limited to scab control. The best control method is not to use seedling from highly susceptible parents. Generally the more susceptible the parent, the greater to proportion of seedlings that will also be susceptible. Another factor to consider if irrigation. If at all possible, avoid the use of overhead irrigation in the nursery, and if you do use it apply water in the morning so that trees are dry before dark. Grafted trees should receive a regular fungicide spray program just like orchard trees. Otherwise, susceptible cultivars will have overwintering lesions on the stem and will be preinoculated with scab races adapted to grow on them.

Table 1. Effect of seed treatment on germination rate, emergence date, and final height of pecan seedlings.

Seed Trt.	% Germination	Emergence	Height (cm)	Caliper (mm)
Dry Seed	81 B	May 8 B	36 B	10.0 A
Soaked Seed	85 AB	May 6 B	35 B	9.8 A
Stratified Seed	90 A	April 18 A	41 A	11.1 B

Table 2. Effect of planting date on germination rate, emergence date, and final height of stratified seed.

Planting Date	% Live	Emergence	Height (cm)	Caliper (mm)
Dec. 1	86	Apr. 10 B	46 A	11.3
Jan. 2	98	Apr. 10 B	42 AB	11.8
Feb. 1	88	Apr. 12 B	38 B	10.8
Mar. 1	94	Apr. 17 B	39 B	11.2
Apri. 1	82	May 10 A	41 AB	10.7

Table 3. Effect of planting date on germination rate, emergence date, and final height of dry seed.

Planting Date	% Live	Emergence	Height (cm)	Caliper (mm)
Dec. 1	78	Apr. 12 A	41 A	11.1 A
Jan. 2	80	Apr. 28 B	38 AB	10.8 A
Feb. 1	74	May 5 C	37 AB	9.8 AB
Mar. 1	86	May 23 D	34 BC	9.4 B
Apri. 1	86	June 2 E	31 C	8.2 B

Table 4. Effect of white plastic mulch on growth of pecan seedlings.

	Caliper	Height	Shoot Wt.	Root Wt.	Total Wt.
Bare Ground	8.4	28.5	7.1	56.4	63.5
White Mulch	11.1	28.6	16.0	137.9	153.9

Sparks, D., J.W. Chapman, and D.W. Lockwood. 1974. Stratification promotes germination. The Pecan Quart. 8(1):13.