QUANTITY-BASED VERSUS QUALITY-BASED PRICING: DEVELOPING THE NICHE PINE SEEDLING

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Howell, K.D. 2002. Quantity-Based versus Quality-Based Pricing: Developing the Niche Pine Seedling. In: Dumroese, R.K.; Riley, L.E.; Landis, T.D., technical coordinators. National Proceedings: Forest and Conservation Nursery Associations-1999, 2000, and 2001. Proceedings RMRS-P-24. Ogden, UT.. USDA Forest Service, Rocky Mountain Research Station: 284-296. Available at: http://www.fcnanet.org/proceedings/2001/howell.pdf

Abstract

Demands placed on pine production in the southeastern part of the United States prompt managers to research and employ intensive cultural practices. Bareroot conifer seedling culture, like loblolly pine *(Pinus taeda L.), is* highly preferred in moderate regions of the South, since bareroot stock is relatively inexpensive to purchase, transporting and planting costs are reasonable, and field survival and growth measures are tolerable. For almost 50 years, Philip Wakeley's *Monograph No. 18* has been used as the "bible" for the cultivation of southern pines, because sound prescriptions have served many nurseries well. In recent years, some of the methods commonly employed have been challenged in different ways, like that of decreasing seedbed density. To lower seedbed density has been shown to increase seedling root collar diameter, and thus improve seedling survival and growth potential. Some conditions that result from using this method to produce new archetypical, "high-quality" seedlings will involve the elimination of stems from a nursery's productive capacity (for example, reducing sowing densities from 330 to 110 seedlings/m^2). Cost efficiency evaluation can be employed by a nursery to analyze this and other production operations for any species. If cost information were openly shared among firms, benchmarks would indicate a nursery's position among other nurseries. Since cost information unique to a nursery's operation is confidential, and cash flows are considered proprietary, it seems more proper to use publicly disclosed information, like values of seedling price and yield (in other words, diameter and height), when comparing firms. Price efficiency evaluation is an acceptable model, since actual expenditures can remain conspicuous. If pricing standards were designed according to a "quality-based" format instead of the current "quantity-based" format, then perhaps the lowering of seedbed density to produce high-quality seedlings could be justified. It is quite costly to take seedlings out of production, and so it is essential to increase prices for "niche" products. Some firms (public and private) are beginning to employ niche-pricing strategies. If quality-based pricing schemes were adopted, nursery managers would be motivated to find other ways to produce valuable niche products, without reducing seedbed density. There are other low-cost cultural measures that, if incorporated into current operations, would serve to increase production efficiency.

Key Words

Niche products, efficiency, quantity-based and quality-based pricing, seedbed density, *Pinus taeda*

AN ECONOMICAL/ECOLOGICAL PARADOX

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web he does to himself -Attributed to Chief Seattle 1854

With 25% of the world's population consuming about 80% of the timber, paper, and energy (Durning 1992), a large "ecological footprint" (Rees 1996) has been stamped on this generation (Lemons 2000). Most of us recognize that this situation demands immediate attention, and few would argue against restoring ecosystems to their pristine conditions (Hull and Gobster 2000). But the daunting task of how to regenerate our forests rests somewhere between natural and artificial means (Schultz 1997). While ecological and economical principles may seem separate, they are actually connected like strands in a web (Chief Seattle 1854). To illustrate this interaction on a national level, C. W. Lantz (1996) has pointed out that as logging becomes restricted in the West, the South is called upon to supply a nation's timber needs; unfortunately, planted acres have continued to decline and lag behind harvested acres, from 60% in 1989 to about 40% in 1996. This regeneration paradox is not only domestic but also international in scope, since our world is both economically and ecologically bound.

A partial solution to this regeneration dilemma may ultimately be found at its core level-the forest nursery. Whether public or private, forest nurseries try to balance seedling quantity (for cost reduction) with stem quality (for plantation success). In the South, loblolly pine *(Pinus taeda L.)* is a highly preferred and culturally propagated forest species (Schultz 1997), but in general this quantity-quality relationship can be applied to all species. Quality standards have been proposed and are currently utilized in nursery practice with the intent of producing the ideal seedling (Mexal and South 1991), but evaluating the additional costs involved in developing this seedling, and determining a fair-market value for its purchase has been elusive. The niche pine seedling is just another term used to describe what is targeted as an optimal quantity-quality compromise. Pricing this niche product, and promoting its development is the focus of this paper. To realize the value of the optimum is to recognize the value of common stock, and long-term value will be attributed to successful forest establishment. While nurserymen and landowners have commonly expressed their concerns, the planter's viewpoint should be no less important, because unless affordable stems are made suitable for planting, nursery gains may be lost in the field.

TREE PLANTER'S PERSPECTIVE

The planting of trees is the least self-centered of all that we do. It is a purer act of faith than the procreation of children - Thornton Wilder 1967

The southern forest industry has evolved tremendously over the last two decades (Lantz 1996), and so planting companies in the Southeast are pressured to keep pace with industrial demands. My initial perspective of forestry in the U.S. has been structured around supplying this demand for large-scale reforestation. From Texas to Florida (seasonally from 1982 to 1988), I typically planted conifers at rates from 3,000 to 6,000 stems per day, depending on factors like soil type and site preparation. Equipped with a hoedad (a mattock-like tool) and a planting bag (to carry hundreds of seedlings), the hand planter (paid on a piecework basis) is well motivated to perform high-volume planting. Quality control standards were often imposed by continually inspecting procedures of seedling handling and planting, but seedling size standards were not commonly emphasized. Bareroot loblolly pine seedlings (sizes averaging about 4mm in diameter) were commonly planted, and planting was greatly facilitated under workable conditions involving sandy soils and level terrains. In the Pacific Northwest (1984 and 1985), steep terrains, rocky soils, and variable weather conditions at high elevations were experienced. Most of my time was spent planting in Montana and Idaho, and containerized conifers with variable stem sizes were commonly supplied.

During the planting off-season in the United States, I visited 22 countries in Europe and demonstrated American tree planting tools and techniques for as many as were interested. As an entrepreneur, I would locate the office of forestry (or the like) in whatever city I was in at the time. Once located, I offered them a demonstration of the hoedad and tree-planting bag, promising to plant at a rate of 2,000 stems in 6 hours. Once accepting the piecework rate of pay (not typical in some countries), the demonstration was conducted for a limited time, involving from several hours to several weeks to accomplish. Since I had no prior knowledge of seedling standards for a particular region before my arrival, the guarantee of 2,000 stems in 6 hours was sometimes quite difficult to honor. In one instance (for example, Belgium), my brother (who attended me for a few months) and I discovered that some seedlings were not suitable for largescale reforestation; one sapling was a handful, instead of a handful of seedlings. In Turkey, forty seedlings were easily held in one hand, fitting the high-volume reforestation prototype. From country to country, and region to region, seedling standards varied considerably even for the same species in similar environmental conditions. As these experiences suggest, seedling standards are not only needed throughout the U.S, but throughout Europe as well, fostering the production of quality (niche) products.

Forest nurseries (whether domestic or international), and many groups involved in reforestation, frequently pursue the optimum (niche) seedling, but few offer tenable solutions. Because of growing consumer demand, nursery managers are continually pressed to produce more goods of higher quality with fewer resources in less time. If this were not enough, managers are also asked to certify plantation success in terms of stem survival and growth. There are measures that, if taken, ensure the production of high quality stems, but these result in reduced quantities because of lower seedbed densities. The quantity/quality conflict arises when nurseries attempt to balance high-quantity demands with high-quality standards. Although solutions may be proposed to address these quantity and quality issues alone, quantity-driven cost and quality driven yield factors must be addressed in an integrated form at the same time period. Truly, the magnitude of this cost/yield (quantity/quality) relationship needs more clarification. Utilizing the treatment scenarios in a study installed in 1999, the cost/yield impacts of some common southern forest nursery practices were contrasted with some uncommon (or unusual) practices, and should thereby serve to illustrate some of the dynamics involved in the development of the niche pine seedling.

TREATMENTS OF THE 1999 NURSERY STUDY; DEVELOPING THE NICHE PINE SEEDLING

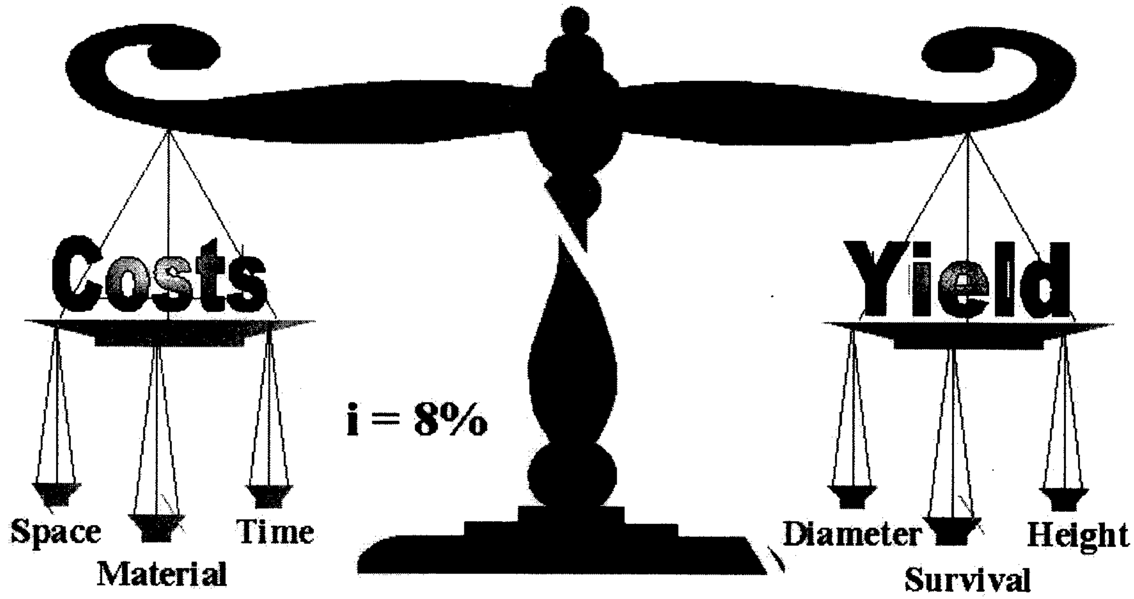
Art imitates Nature, and necessity is the mother of invention -Richard Franck 1658

If necessity is the mother of invention, then resourcefulness is the father-Beulah Louise Henry 1962

The four treatment factors employed in the 1999 nursery study for the culture of loblolly pine were: 1) seedbed density spacing (110, 330, and 550 seedlings/m^2; divide by 11 to convert to ft^2); 2) sowing mechanisms of symmetrical versus precision sowing; 3) fertilization regimes (organic, inorganic, and their mixture); and 4) tops trimmed versus tops left intact. Without going into great detail, these 36 treatment combinations represent an array of strategies that may or may not be suitable for southern pine production. For example, precision sowing at 330 seedlings/m^2, inorganically fertilized with tops trimmed is a commonly employed combination, but symmetrical sowing at 550 seedlings/m^2, fertilized with manures alone, and tops left intact is virtually nonexistent. All treatment combinations were randomly positioned, which includes 2 blocks having 3 replications per treatment combination.

Any cultural system, whether currently utilized or under consideration in nursery practice, can be priced from either empirical data or hypothetical estimation. Balancing these costs (the inputs involved in production) with stem yield (the output of production) can be a useful tool to illustrate cost/yield integration (Figure 1). The three basic elements of cost estimation include that which is involved in: 1) the acquisition of material; 2) the occupation of space; and 3) the employment of time. In our study, these dollar values were combined and compounded at 8% interest for each treatment combination. The three basic elements used to estimate yield include: 1) ground-line diameter combined with 2) stem height (offering a measure of individual stem parabolic volume); and 3) percent survival (adjusting yield estimation at both nursery and plantation levels). Once both sides of the equation have been developed, the cost-yield integration (in other words, cost efficiency ($/dm^3)) can be effectively used to evaluate any given treatment combination, and to select the optimal (niche) treatment or operation. This paper offers a summary of the results uncovered in the 1999 loblolly pine study. A more comprehensive discussion of the findings contained herein is yet to be published (Howell 2001).

Of all the cultural treatments observed in this study, seedbed density (Figure 2a) offers the greatest impact on stem diameter for all southern pines (Boyer and South 1987). The 3 densities in our study evaluated a commonly utilized density (330 seedlings/m^2), an upper extreme density (550/m^2), and a lower extreme density (110/m^2). It only stands to reason that crowded seedlings



$$C_t = C_{sum} * (1+i)^t \qquad E_t = C_t / Y_t \qquad Y_t = (\Pi * r_t^2 * h_t)/2 * S_t$$

$$(\$) \qquad (\$/dm^3) \qquad (dm^3)$$

Figure 1. The cost-yield scale illustrates the balance between the factors of costs (material, space, and time) with the factors of yield (survival, and diameter and height growth). The cost (C_t) equation sums up all relevant values ($) pertinent to a particular operation, and compounds C_{sum} forward to a specified time (t) at a given interest rate (i) which was 8% in our study. To discount future costs back in time simply divide instead of multiply. The yield (Y_t) equation averages the parabolic estimate of stem volume, which is determined by ground-line stem diameter (radius (r) at time t squared), multiplied by stem height (h) at time t, multiplied by Π (3.14159), and divided by 2. Since the yield value is expressed in cubic decimeters (dm^3 which equals one liter), all components must be converted to like dm units. Survival (%/100) adjusts for mortality the volume estimate when a nursery or plantation-level expression is required. Cost efficiency (E) at time t expresses the integration of costs and yield ($/$dm^3$).

promote upward growth as opposed to outward growth. This outward diameter growth, root collar diameter (RCD), has long-time been recognized as a good indicator of stem quality (Mexal and South 1991), and the archetypical (niche) seedling should have a large RCD. Exactly how large a RCD must be is yet to be defined; nevertheless, high quality stems are likely to have good root growth potential (RGP), and good RGP promotes long-term plantation success (Larsen and Boyer 1986; Schultz 1997). Over time and across regions, specifications are subject to change, depending on customer demand for RCD standards; and the nursery's ability to meet customer demands at the price the customer will afford. The cost-benefit balance pivots on what size a RCD should be in order to ensure good field survival and stem growth; and how much it costs to obtain the specified RCD. In the field it has been observed that crowding is regulated by the "self thinning" -3/2 power rule, which states that as individual stem diameters increase, stem numbers will proportionally decrease (Weller 1987). The results from our study support this rule, since the largest stems were found at the lowest seedbed density. To the frustration of many nursery managers, it is not cost justified to concede quantity (in other words, reduce seedbed density) in order to satisfy requests for higher quality (Foster 1956; Shoulders 1961); therefore, what should give?

If symmetrical sowing were utilized more in practice, nurseries might find a tool to effect high yields at high densities (Figure 2b). Mechanical, precision sowing is standard practice for sowing southern pines in the southeast, and specifications

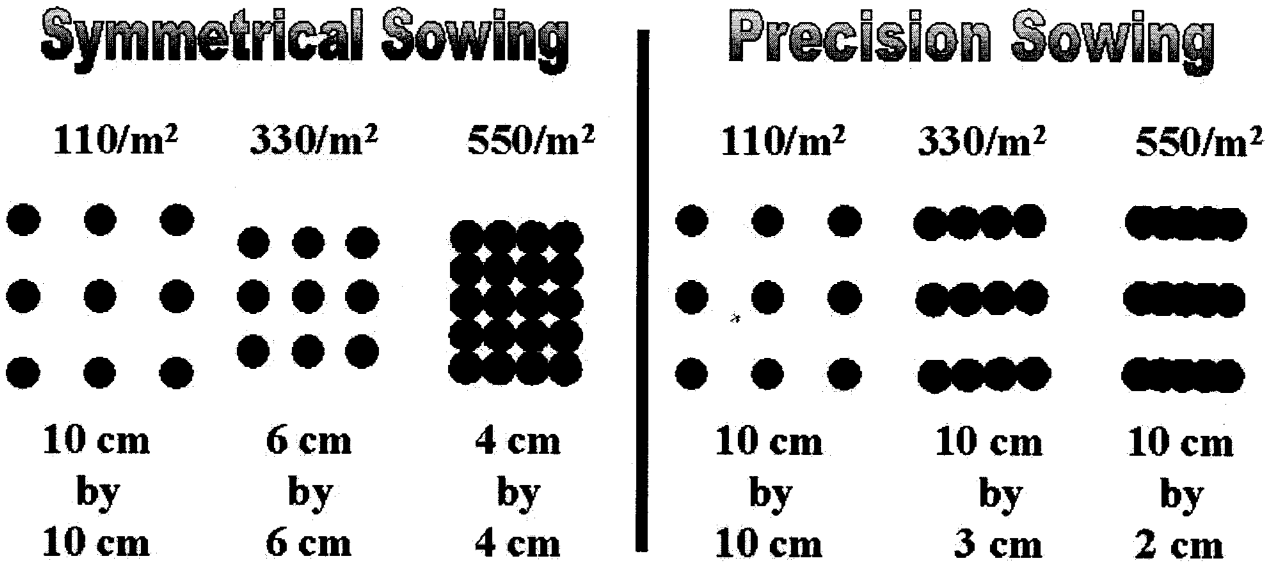


Figure 2. Seedbed densities are displayed from the very low (110 seedlings/m^2) to the moderate (330 seedlings/m^2) to the very high (550 seedlings/m^2) in order to illustrate the dynamics of initial spacing and the potential for crowding with seedling growth. Symmetrical versus precision sowing illustrates the trade-off that the 4-inch (10-cm) between-row spacing has on within-row spacing as density increases as compared to the lowest density.

retain 4 inches between rows for purposes of 1) lateral root pruning and 2) seedling lifting. Lateral root pruning trims only two of the four sides along the seedling's root system, and in some years the procedure is avoided. Lateral root pruning was not performed in our study, and field survival is so far unaffected, which implies that the procedure may not be cost justified. As for lifting, specially designed forks, extending before the lifting belts, effectively channel seedlings into the belts, regardless of tight spacing (Figure 3). In fact, seedlings were cleanly lifted from densities over 1,100 stems/m^2 (100/ft^2), which were broadcast sown. Since mechanized symmetrical sowing is not yet operational, we utilized the Hand-sowing Press™ for the preparation of seed sowing (Figure 4). Results indicate that nurseries symmetrically sowing can produce larger stems at current densities, or average stem sizes at higher densities. If utilized with other methods, large stems may be produced at high densities. It should be pointed out that precision sowing at the lowest density had a spacing configuration that was basically equivalent to that of symmetrical sowing. The main finding from this test revealed that maintaining a 4-inch spacing between rows is not cost justifiable at high densities, because spacing within the row must be restricted. However, to further validate these findings, a test involving mechanized symmetrical sowing on a large scale is recommended.

To maintain a soil's fertility and a site's productive potential for a particular species, nursery managers are obliged to find that delicate balance among the choices of: 1) what fertilizer to use; 2) how much to use; 3) when to use it; and 4) how to apply it (May and others 1984). Because there is the potential of declining soil productivity in heavily used nursery soils, it is essential to continuously test new nutritional enhancement (fertilization) strategies with those existing procedures. In our study we tested the effects of a relatively inexpensive organic fertilizer alone, in the form of municipal waste (biosolids), inorganic fertilizer, which is routinely utilized in nurseries, and a mixture of organic and inorganic fertilizers together. The high macro and micronutrient availability was a positive contribution that supported the use of the organic source, but the plant available nitrogen (PAN) aspect of the material was lacking. Organic manures may be

Figure 3. Forks that extend in front of the belts on the lifter, channeling seedlings into the belts (left). The lifting operation was successfully performed (right) with stocked seedbed densities greater than 1,100 stems/m².

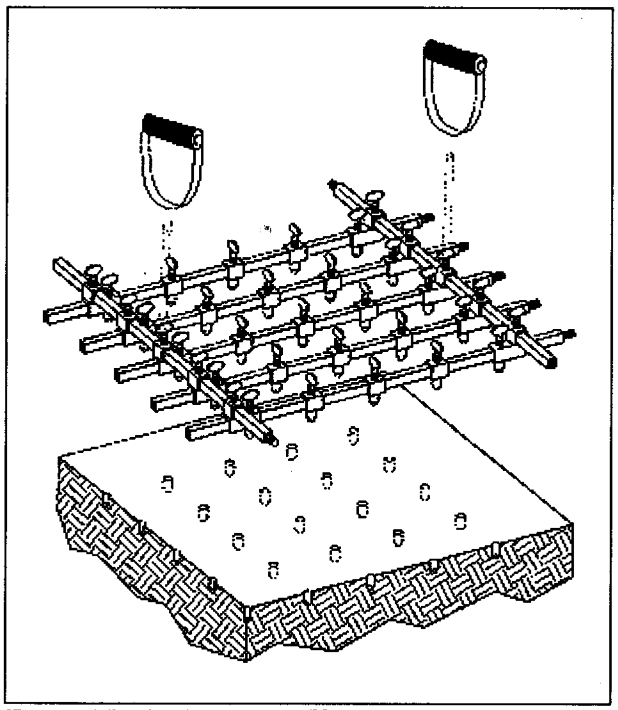


Figure 4. The Hand-sowing Press™ used for the preparation of seed-sowing impressions specifically for the symmetrically sown treatment.

used to supplement those nutrients typically neglected, because inorganic fertilizers are too costly, or because other sources are unavailability. The most conclusive findings of this test were to substantiate the proposition that nutritional enhancements can promote greater yield at higher densities (Schultz 1997). Fertilization is highly justifiable, because its monetary investment is far lower than some of the more conventional measures currently encouraged to promote stem yield (for example, lowering seedbed density).

The fourth treatment we looked at in our study was that which involved pruning only the succulent tops of loblolly pine versus not trimming the tops (Figure 5). More than 90% of all southern forest nurseries top prune (Duryea 1987). Some nurseries top prune to control height and slow down diameter growth at critical times (Schultz 1997), while others prune to increase the root-to-shoot ratio and improve uniformity among stems (Mexal and South 1991). Uniformity was the feature that supported top pruning in our study, since opening up the canopy permitted suppressed stems to get sunlight, and the size of dominant stems (those first to germinate) was partially reduced, and growth was temporarily slowed. Fewer culls result from this procedure, and seedlings are easier to pack and store (Davey 1982). As long as top pruning is not performed too late in the growing season or too low on the stem, the benefits of the procedure far outweigh the negligible costs involved in passing over the crop with a rotary mower.

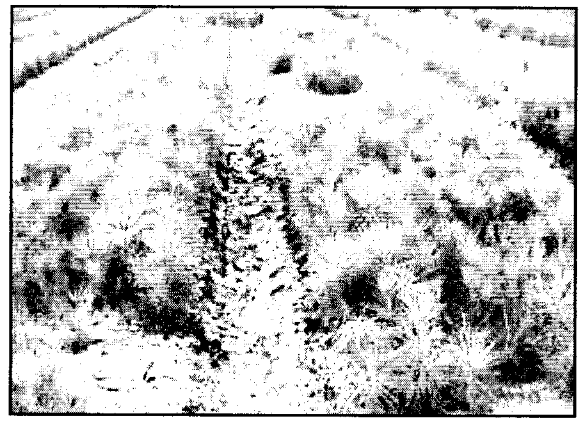



Figure 5. Top pruning (9-7-99) of succulent tops (left) versus tops left intact (right). The pictures were taken on November 11, 1999.

COST VERSUS PRICE EFFICIENCY: ASSESSING CURRENT OPERATIONS

To expect to increase prices and then to maintain them at a higher level by means of a plan which must of necessity increase production while decreasing consumption is to fly in the face of an economic law as well established as any law of nature -Calvin Coolidge 1927

That which is considered to be an ideal seedling depends on whether nursery practices are quantity based or quality based. When a nursery is designed for quantity-based production, high seedbed densities are preferable so that large numbers of seedlings can be produced, and therefore a relatively small RCD will be acceptable. On the other hand, a quality-based nursery operation will restrict seedling numbers in order to obtain recommended RCD specifications having larger than normal caliper sizes. Currently, grading standards for loblolly pine (as with other southern pines) are widely recognized (Figure 6), where stems with RCD sizes greater than 5mm are considered high quality stems (Grade 1). Typical RCD size standards range from between 4 and 5mm (Grade 2), and those RCD sizes below 4mm may be considered culls in some nurseries (Grade 3). It is important to note that grading standards of quality are subject to adjustment with region and with time. Thus, a Grade 1 seedling today in one state may be considered a Grade 2 seedling in another state today, or in the same state tomorrow.

Changing standards can promote technological progress, but currently prices are not designed to adapt with changing standards. The paradigm of pricing solely on a quantity-based ($/1000) system should incorporate quality-based measures ($/1000 according to RCD) in order to advance innovative technology, and to reward those firms that perform it. To illustrate this, consider a comparison of grades (Table 1) that are based on those average RCD sizes of Figure 6. Yield, expressed in dm^3/1000 (liters/1000), gives more weight to RCD in the volume equation than to height (held constant at 25 cm), and parabolic volume is sufficient to be a conventional measure of size. As found in the 1999 nursery study, the densities of 110, 330, and 550 seedlings/m^2 were shown to produce seedlings with respective average RCD sizes of 5.5, 4.5, and 3.5mm, and thus are assigned the grades of 1, 2, and 3, respectively. For illustrative purposes, suppose by the implementation of an innovative practice, like mechanized symmetrical sowing, grades 1, 2, and 3 were produced from respective densities of 220, 440, and 660 seedlings/m^2. And by further innovation, like fertilization, the same grades may be produced from respective densities of 270, 490, and 710 seedlings/m^2. What is the limit to innovation? Is it likely that by some innovative technology or tool the same grades could be produced from respective densities of 330, 550, and 770 seedlings/m^2? In this technological age, it is not only possible, but it is highly probable that these higher grades will be produced at higher seedbed densities.

As densities decrease, there is an associated increase in cost (Table 1) that must result when decreasing the number of seedlings offered to the market place. The sale price will reflect a firm's permission to markup (in other words, make profit or cover hidden costs) with respect to the market's cap on pricing. An acceptable price floor

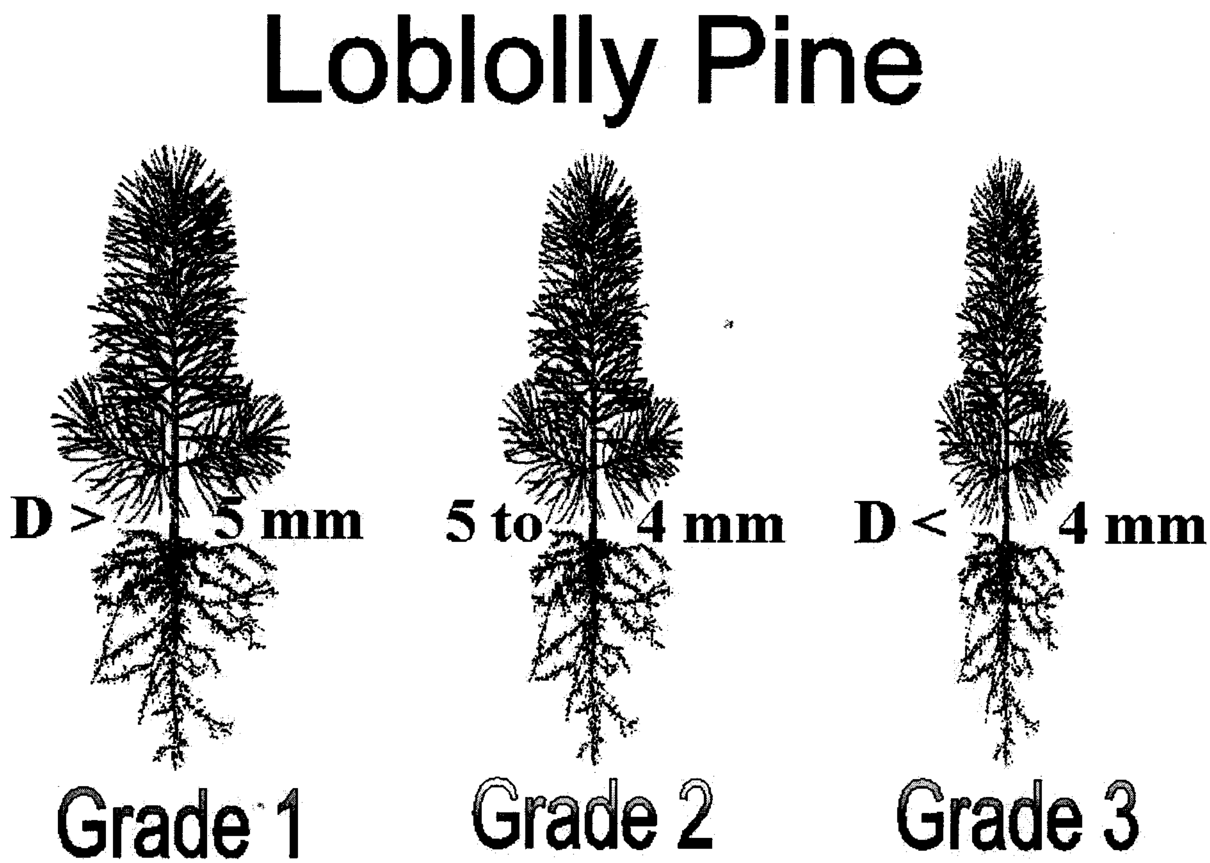


Figure 6. Three grades of seedling quality for loblolly pine based on root collar diameter (RCD) greater than 5mm (Grade 1), RCD between 5 and 4mm (Grade 2), and RCD less than 4mm (Grade 3).

Table 1. Comparing aspects of seedling size resulting from cultural practice. Grades are based on root collar diameter (RCD) in millimeters. Other factors illustrated are height (cm), and yield dm^3/1000. The comment column clarifies the row's function. The common density (Common: (stems/m^2)) shows common densities required to produce specific grades. The costs incurred to produce stems at common densities (ComCost ($/1000)) utilizing typical cultural practices are shown with respect to the common price (ComPrice ($/1000)) required to cover all costs (obvious and hidden) depending on a firm's convention to markup the price. Cultural practices can serve to produce larger RCD at similar densities as compared to that of common practice. Hypothetical examples of culture in additive fashion are: mechanized symmetrical sowing (MechSym: (stems/m^2)), soil additives, fertilization, hormones, and so on (Additive: (stems/m^2)), and other systems of innovative technology (InnoTech: (stems/m^2)).

	Grades According To Seedling Size			
	Grade 1	**Grade 2**	**Grade 3**	**Comments**
RCD (mm)	5.5	4.5	3.5	Average RCD provides the basis for grading
Height (cm)	25	25	25	Height is commonly controlled by top pruning
Yield (dm^3/1000)	3.0	2.0	1.2	Volume of liters/1000 is equivalent to dm^3
Common: (stems/m^2)	110	330	550	Common density produces the applicable grade
ComCost ($/1000)	77	31	22	Common production cost is a function of density
ComPrice ($/1000)	??	??	??	Common price depends on "all" costs & markup
SymSow: (stems/m^2)	220	440	660	Potential shift from symmetrical sowing
Additive: (stems/m^2)	270	490	710	Potential shift from additive, fertilization, and so on
InnoTech: (stems/m^2)	330	550	770	Potential shift from other technological systems

or ceiling must reflect the quality of the stock made available, which requires that new standards of seedling quality be promoted, and assumes that consumers will pay more for better products. There are some nurseries (for example, Private Firm #1) that lead the way in this endeavor (Table 2). Private Firm #1 claims it has Grade 1 seedlings with RCD sizes from 5.5 to 6.5mm, and its Grade 2 seedlings have RCD sizes from 4.5 to 5.5mm. One must assume that Grade 3 stems (less than 4mm) are not acceptable for the market with this firm. According to their 2001 price list, both grades are priced at $75 and $48/1000 for Grade 1 and Grade 2 seedlings, respectively. With respect to the sizes expected from seedlings grown in low densities (110/m2), the cost should be as high as $77/1000 (Table 1), but Private firm #1 has a price of $75/1000. Although this firm claims (while not offering specifics) that these seedlings were produced at a lower seedbed density than is typical, their price suggests that density has not been radically reduced. Even their Grade 2 stems are of better quality than the best some firms have to offer. How do they do it? Without knowing the specifics, supposition is necessary. Therefore, I suppose that they use in combination some cultural treatments like those mentioned above, and apply them on densities slightly lower than normal. More importantly, it is preferable to pay workers to separate stems into several grades, because grade prices significantly outweigh separation costs.

The dynamics of cost and price efficiency as comparative measures (Table 3) are illustrated among the following nurseries: Private Firm #1, Private Firm #2, and a Public Firm. For the sake of illustration, average RCD sizes are stated and grades are implied in yield (dm^3/1000). Accordingly, Private Firm #1 is the only nursery offering substantially Grade 1 seedlings ($75/1000), and the other examples offer Grade 2 seedlings (in other words, RCD = 5mm and Yield = 2.5 dm^3/1000). Private Firm #2 charges $50/1000 for Grade 2 stems, while Private Firm #1 charges $48/1000, and the Public Firm charges $41/1000. Which price is fair? On the surface, based on what is known (price and yield), the public firm offers the best price efficiency at $16/dm^3$. However, while price efficiency shows the consumer's gain, it hides the nursery's real situation, which only cost efficiency can show. If there were no proprietary costs (in other words, nothing secret), then one could look at cost efficiency across all firms, and in this case the real

Table 2. An illustration of how Private Firm #1 is leading the way in the promotion and pricing of loblolly pine seedlings based on RCD grading. As provided by firm #1, Grade 1 (6.5 to 5.5 mm) and Grade 2 (5.5 to 4.5mm) seedlings are made available to the market, but Grade 3 (less than 4.5mm) seedlings are apparently culled. Prices ($/1000) are also provided from firm #1effective for the 2001 growing season, but costs are not provided due to proprietary concerns.

	Pricing Scheme For Private Firm #1			
	Grade 1		Grade 2	Comments
RCD (mm)	6.5	5.5	4.5	Grade 1 = 6.5 to 5.5 & Grade 2 = 5.5 to 4.5
Height (cm)	25	25	25	Height is commonly controlled by top pruning
Yield (dm^3/1000)	4.0	3.0	2.0	Volumes in effect increase with respect to RCD
Price ($/1000)	75		48	Prices as quoted from firm #1 for 2001.
Costs ($/1000)	??		??	Costs are unknown due to proprietary concerns

Table 3. A comparison of firms using price efficiency and cost efficiency values. There are two private nurseries (private #1 and private #2) and one public nursery in this comparison. Prices are effective for the 2001 growing season, and costs are hypothetical for illustrative purposes. Lowest values are in bold text.

	Comparing Price and Cost Efficiency Among Firms				
	Private #1		Public	Private #2	Comments
RCD (mm)	6.0	5.0	5.0	5.0	Average RCD are shown for each firm
Yield (dm^3/1000)	3.5	2.5	2.5	2.5	Volumes increase with respect to RCD
Price ($/1000)	75	48	41	50	Prices quoted from Firms' 2001 price list
Price Efficiency	22	19	**16**	20	Divide price by yield to calculate values
Costs ($/1000) ??	42	30	35	30	Hypothetical cost values for each firm
Cost Efficiency ??	**10**	**10**	14	14	Divide cost by yield to calculate values

winner with the most efficient operation would be Private Firm #1, with respect to both of its grades at $10/dm^3$.

Since prices are adjustable, and "all" costs must be recovered in price, it is important that the difference between identified costs and the asking price be accurately estimated. Regrettably, unforeseen costs in a competitive environment complicate pricing schemes, leading to product devaluation. Comparing hypothetical profit margin scenarios among the firms in Table 4 should better illustrate this situation. The first scenario accounts for the Public Firm (assuming a 20% markup) having the lowest price efficiency value (Table 3), but sharing an equally high cost efficiency value with Private Firm #2. Intuitively, those firms with higher prices, with respect to their published costs, enjoy higher profit margins (for example, the exorbitant 80% of Private Firm #1). Even if this hypothetical gain were real for Private Firm #1, to avoid being accused of price gouging or profiteering, the firm could create new costs (for example, investments, salaries, and so on) and could report lower profits than would otherwise be revealed. Investments are justified to promote innovation, because when innovation transforms an operation, lower production costs can result in higher gains. As scenario 2 (Table 4) illustrates, the Public Firm develops an innovative system, and due to its fixed hypothetical gain of 20%, all cost savings are seen in the lower price to the customer. Moreover, if this Public Firm were to be even more industrious (scenario 3), adopting better systems to further lower costs (assuming unchanged product quality), the price might be lowered further to $25/1000. Suddenly, the Public Firm's innovation has introduced a pricing dilemma to the market place, and many established paradigms become challenged. Change can be good, but most businesses need time to modify existing operations, to adjust current prices, and to stay competitive. Upgrades are expected from private firms, because they are market-driven entities. However, what are the consequences of public firms developing new and innovative systems? A publicly owned firm currently has several alternatives, it can: 1) refuse to employ any innovative system until it has been developed by the private sector and becomes

Table 4. A comparison of hypothetical profit margins (gains) among nurseries. The first profit margin scenario (PM Scenario 1) depicts how existing increases might look. Changes of interest are in bold text. The second scenario (PM Scenario 2) depicts how an innovation can save money (Costs 2) and the savings are passed on to the consumer (Price 2), since the profit margin is fixed. Open quotes (") indicate that values are same as above. The third scenario (PM Scenario 3) depicts how increased innovation can continue to lower costs, which means more savings to the consumer, as long as the profit margin remains fixed. The fourth scenario (PM Scenario 4) depicts a situation of continued low costs, and increased profit margins respectively at 30% and 40%. This scenario rewards the firm for implementing innovation, while continuing to offer low prices to the customer.

	Profit Margins Observed Among Firms					
	Private #1		Public		Private #2	Comments
RCD (mm)	6.0	5.0	5.0		5.0	Average RCD are shown for each firm
Yield (dm^3/1000)	3.5	2.5	2.5		2.5	Volumes increase with respect to RCD
Price ($/1000) 1	75	48	41		50	Prices quoted from Firms' 2001 price list
PM Scenario 1	**0.8**	**0.6**	**0.2**		**0.7**	**How existing margins might look if known**
Costs ($/1000) 1	42	30	35		30	Hypothetical cost values for each firm
Price ($/1000) 2	"	"	**35**		"	**Savings are passed on to the consumer**
PM Scenario 2	"	"	**0.2**		"	**Profit margin held at predefined rate**
Costs ($/1000) 2	"	"	**30**		"	**After some innovation lowers cost**
Price ($/1000) 3	75	48	**30**		50	**More savings for the consumer**
PM Scenario 3	0.8	0.6	**0.2**		0.7	**Profit margin held at predefined rate**
Costs ($/1000) 3	42	30	**25**		30	**More innovation can lower costs further**
Price ($/1000) 4	"	"	**33**	**35**	"	**Customer saves & the firm is rewarded**
PM Scenario 4	"	"	**0.3**	**0.4**	"	**Profit margin shown at two higher rates**
Costs ($/1000) 4	"	"	**25**	**25**	"	**Cost savings held at the low value**

public domain; 2) employ innovations at will and continue to lower prices since restrictions currently forbid profit making; or 3) employ innovations and slightly increase the percentage retained in profit to offset declining prices (PM Scenario 4 in Table 4). This is the "niche" pricing alternative. With this pricing alternative the firm must add a "profit margin," but many public firms are only permitted to cover costs, and find it difficult to justify even the most essential increases in price. However, there are those who feel that this paradigm restricts sound business practice for publicly owned entities (Alchian 1965; Hayes and Pisano 1994). Nevertheless, when profits are increased slightly, declining costs are offset with the adjusted price, the firm (public or private) is then financially rewarded with increased revenue, and is also encouraged to employ efficient systems in the future. Niche pricing ensures that the quantity of a product purchased has the quality expected! Niche pricing puts a check (in other words, a price ceiling) on prices to prevent firms from exploiting the market with exorbitant prices. Furthermore, niche pricing can impose a price floor, permitting competing firms sufficient time to upgrade operations and adjust prices.

PRICING NICHE PRODUCTS: REWARDING INDIVIDUALS, BUSINESSES, AND SOCIETY

There is nothing man will not attempt when great enterprises hold out the promise of great rewards -Titus Livius (ivy) 59 BC

A satisfied individual (employee or customer) offers the greatest potential to reward a business (an organization of individuals). At the most basic level, the success or failure of a business hinges on how individuals are treated. In fact, creating worker incentive may be the best innovative measure to ensure a firm's success. Rather than resorting to the stick approach (continuously threatening employees with job security), incentive measures utilize the carrot approach, which treat all employees like fellow partners in the business. It is the spirit of teamwork that instills pride in accomplishing the task at hand and doing the best job possible (Alchain and Woodward 1987), as opposed to being an unappreciated worker who feels dissatisfied, and whose "chores" are reluctantly performed. While a business may stress high output volumes through quantity-based incentive measures, to neglect quality-based incentives will eventually damage a firm's reputation inside and out. If quantity-based and quality-based measures were engaged in a complimentary fashion, a firm might vertically integrate an operation, instead of resorting to contracts, which may cheapen the product's quality, and also damage the firm's reputation (Hayes and Pisano 1994). By educational measures of instruction, and with task-based incentive plans, satisfied employees will be determined to produce niche products, respectable to the customer; on the Other hand, the exploited, abased employee within the insensitive firm may deliver many suspect goods to the market. All the innovation in the world cannot replace the innovation that supports the individual, and why spend millions of dollars for innovations, while the operators are not motivated to operate them effectively? Reward conveys autonomy, stimulates positive action, encourages inventiveness, and permits a person to invest in the firm, and to feel responsible for company success.

A healthy business (a conglomeration of satisfied individuals) has great potential to reward society as a whole. Business health can be compared to a body of members working in unison to accomplish a given task, in our case to produce the niche seedling. Whether a business is publicly or privately owned, if it develops or cultivates similar products as other firms in the market, it may also be subject to most of the expenses experienced by other firms. Businesses hire from the same human resource pool and must offer competitive salaries, they suffer the same costs for resources (land, buildings, chemicals, equipment, and so on), they often strive for customers and must meet customer demands, and the list goes on. With respect to these similar constraints, the public firm's accounting methods are often distinguished from those of the private sector, because those unexpected, hidden costs can be conveniently covered with a profit margin by the private firm. Although "both public and private property can seek profit" (Alchian 1965), most publicly owned properties are not permitted to announce any intent toward the creation of wealth or the maximization of utility. In today's precarious market place this can cause a tremendous strain on any firm with genuine business concerns (for example, predicting future trends, meeting customer demands, and staying current in technology). With respect to the current paradigms that have predestined a firm's function in a particular field, there are competitive elements that tend to level the playing field with no respect to organization. Regardless of whether a firm is publicly or privately owned, to survive is to grow, and growth is contingent upon obtaining appropriate provisions. You will not grow if you are not permitted to eat! While most publicly owned firms are not permitted to be dominant among other firms, co-dominance may be suitable, to be intermediate may be tolerable, but to be suppressed among firms for an extended period of time will eventually compromise a firm's integrity. When satisfied individuals work together in a company to produce high-quality (niche) products, and when these products are accurately valued, society wins. Never in earth's history has it been as important as it is today to produce more products of higher quality in less time, and with fewer resources. To practice regeneration efficiency is to seek that quantity/quality, economical/ecological balance. If it were easy, then society would have stabilized these systems long ago, but reality testifies that our forests are declining faster than they are regenerated (Lantz 1996). Since present harvesting mechanisms have become state-of-the-art, businesses involved in reforestation must do more than keep pace, but they must exceed harvesting rates. Our focus in this paper was on the forest nursery, suggesting several key innovations in production, but plantation forestry should also be challenged to advance the niche product in the field and throughout its life span, producing higher volumes on less land, sooner. In other words, when planted stems are larger than normal, stands start out morphologically older, rotation lengths are chronologically shorter, and initial costs are not carried so far into the future. Moreover, this forestry-horticultural compromise will give some species that essential head start required to promote multiple-species plantations. Besides encouraging multicultural endeavors, lateral branch pruning, fertilization, and other cultural practices in the field may also facilitate stem growth sooner, at higher densities, and with greater stem and stand volumes. Since our wild lands are threatened on every side (urbanization, agriculture, forestry, husbandry, catastrophic events, and so on), better management practices on those lands that have already been manipulated should be encouraged to supply a nation's timber needs. Therefore, when the needs of the timber industry have been satisfied with fewer lands, then many of the regenerated areas may rest in peace, and most of our pristine wilderness areas that still remain will be preserved as an ecological reward to society. As the dynamics of an economical/ecological forest regeneration paradox unfolds, the consequences will surely be felt universally, and so resolutions should be sought everywhere and by everyone. Niche pricing is designed to encourage the development of niche products, which in turn "reward" those involved in the process (in other words, individuals, businesses, and most importantly society). To base rewards on achievements is not a new practice, as Titus Livius reminds us, but the best way to reward appropriately is questionable. Whether compensation is economical or ecological, monetary or aesthetic, physical or psychological, the one compliments the other like an interwoven web (Chief Seattle1854), and the recipient will decide if it has been satisfactorily implemented. If this natural bond were fully appreciated, every enterprise receiving monetary gain from the forest would gladly return financial aid to guarantee fast and sufficient restoration of all natural ecosystems. Although benefits may be hard to assess monetarily (Montgomery and Pollack 1996), payments must become tangible to all beneficiaries. Then in the course of time, by and by, our rejuvenated natural resources will continue to support incredible wealth, and will continue to create unbounded opportunity.

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