

QUEST - A SEARCH FOR THE PERFECT SHADE TREE

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In the future, the success of urban forests will be assured through identification and use of cultivars with superior genetic characteristics putting them in a better position to cope with the environment in which we place them.

BACKGROUND OF DISCOV-TREE RESEARCH AND DEVELOPMENT, LTD.

Discov-Tree Research and Development, Ltd's tree selection process has its roots back in the late 1930's when I was employed by the USDA Soil Conservation Service in southern Michigan and given a research assignment of investigating variable shrub growth on different soil types. Data collected gave indications of vigor for some shrubs not explainable by site or other apparently desirable conditions of the environment. At the time no answer for this observable difference was forthcoming. Later, with other employment, my interest transferred principally to landscape trees. In the early 1950's I began making selections of outstanding trees in nursery and urban locations.

As the work progressed it was apparent, from my point of view, that certain morphological features identified superior individuals which appeared more vigorous and more thrifty and which displayed characteristics which might aid and assist each in coping with the environment. These recognizable qualities appeared in individual trees as:

1. Thicker leaves than regularly observed for the species.
2. Shinier leaves, displaying more lustre.
3. A fuller crown, with a propensity to suggest a greater quantity of interior branches and leaves.

The question is, of course, do these and perhaps other physical characteristics produce measurable vigor and make trees selected for these qualities better able to cope with urban conditions? Are these better candidates for domestication as it is exercised in the science of urban forestry?

Early on, with the good advice of Dr. George Ware of the Morton

Arboretum and others, we decided to set aside, for the time being, any attempt to develop better trees by breeding. This decision was strengthened by the realization that natural selection in forest stands had undoubtedly produce superior individuals. The wisdom of going the latter course was reinforced by a search of the literature. One publication, *The Adoptive Geometry of Trees*, by Henry Horn (1971), was particularly helpful.

Discov -Tree Research has made a preponderance of its introduced selections from:

1. chance seedlings.
2. Liners in the nursery row.
3. Trees found under urban conditions.
4. Trees drawn to our attention by professionals in several fields.

None have been produce by plant breeding techniques.

To date, thirty-two cultivars have been introduced to the trade through Discov-Tree Research and Development. These have been or are being protected under the United States patent law, trademark registration or both. The cultivars are being grown by fifty-four licensees located in various regions of the country, but with the majority in the Portland, Oregon area.

WHAT MAKES A “BETTER” TREE?

As selections are made, account is

given to several criteria, each observable and each apparently indicative of a more adaptive tree within the urban environment.

SPEED OF GROWTH

This is a factor of prime importance. Unfortunately, two species with unwarranted popularity, silver maple (*Acer saccharinum*) and Siberian elm (*Ulmus pumila*) are both fast-growing but display unstable qualities in the urban forest. Yet speed of growth is not necessarily associated with weak structure (Record, *Timbers of North America* 1934). Indeed, speed of growth, which each of our cultivars displays over and above the species, may be an indication of vigor and desirability and, perhaps, stronger trees with a more favorable ratio of spring wood to summer wood.

GROWTH FORM

This is highly important for several reasons. Of immediate consideration is the relationship between branch angle, storm damage and the constant compression and torque of gravity. As previously indicated, our observations show that many faster growing trees have thicker and fuller crowns and may exhibit the ability to produce an greater population of interior leaves. Perhaps this greater leaf surface in the inner crown areas contributes to the photosynthetic process of food production and, in turn, contributes to the efficiency of the individual tree involved. Perry, Sellers and Blanchard (1969) found that the photosynthetic process in most leaves reached 90% of its maximum potential at 2% of full

sunlight. Do temperatures during the growing season rather than light penetration provide a limiting factor in photosynthesis and, in return, vigor and growth?

COLOR

At various seasons of the year, color may have a major influence in the decision-making of tree planners and planters. Fall color is of great value. In this respect, we have found importance in two characteristics over and above simply color hue and intensity, namely, the ability of the tree to color earlier than the species and to color completely. Those showing these two qualities can eclipse others in popularity as these attributes come into focus.

It should be noted that in landscape trees known for their bloom such as the flowering crabs, magnolias, cherries and others, color can become tantamount in selection. The ability to produce a timely and reliable annual bloom performance can add to a tree's popularity over and above an intermittent bloomer.

FRUIT

Fruit, or the lack of it, is a characteristic not to be ignored. We are readily reminded of the strong ornamental features of some flowering crabapple fruit and quickly consider the negative effects of fruit production by other species such as ginkgo, sweetgum, honeylocust and, in some years, even red maple. Fruit production can produce some uniquely

pleasing effects; I believe one of the most impressive sights I have seen is a huge Katsura with silver-frosted fruit on a mid-winter moonlit night.

BARK

The bark of cultivars is protectively effective although the full extent of variable bark thickness is not generally known. We do know that some trees' bark patterns appeal to utilizers such as landscape designers and, in turn, to consumers. In some instances this trait may materially enter into selection of certain cultivars in preference to others.

DISEASE RESISTANCE

This, of course, is a vital concern with any cultivar. Unfortunately, few cultivars other than the flowering crabapple selections have been introduced with disease resistance as a primary objective. The problem should be viewed as a complex one inasmuch as in many instances certain diseases are regional in their expression and must be treated as such in the selection process. Alertness to disease resistance has permitted us to introduce five cultivars showing resistance in one form or another.

INSECT RESISTANCE

To date, solutions to the problem basically lie in control efforts and little has been done to determine which species or individual cultivars are consistently resistant to insect attack or to understand the basic underlying mechanism of palatability or ability to repel insect advances by other processes.

ENVIRONMENTAL TOLERANCE

Requiring on -the - site evaluation of the various cultivars, an in-depth understanding of this subject as a part of urban forestry has yet to be fully pursued. In the early stage of evaluation, one primary problem appearstobethedefmingofthe specific environmental factors involved. Continuation of these studies must by regarded as long-term, unwieldily expensive but necessary.

ADAPTABILITY

This term is broader in scope and should be used rather than hardiness. Although a critical component to a tree's suitability as an introduction, data on adaptability for specific cultivars and especially those in the testing stages of development, or those recently introduced are difficult to collect. General information on the species may not always be completely accurate for those individuals selected as cultivars.

PRACTICAL CONCERNS of the professionals involved at all levels should be considered prior to introduction:

1. The Primary Grower

(the grower responsible for initially propagating and growing the tree, oftentimes as a bare-root "liner").

- Does it grow well?
- Does it lend itself to a reasonable production schedule?
- Does stock, once removed from the field, store well?

- Is it convenient to harvest, package and ship?

-In the nursery, does it present problems in pest control?

2. The Secondary Grower

(the market for the primary grower and the grower that cultures the tree into finished stock, either containerized or balled and burlapped) .

- Is the supply of the cultivar steady and adequate?

- Is it an easy keeper? Does it culture well?

- Will it sell?

3. The Utilizer

(landscape architect, arborist, site planner and private landowner).

- Is the cultivar available in sufficient number of the desired size and grade?

- Are the characteristics of the selected tree, including deficiencies, clear and well defined?

- Does the selection fit the site for which you are specifying and can it be accommodated in this area for a selected period of time, such as the next thirty years?

THE INTRODUCTORY PROCESS- IN SUMMARY

step 1. Select an outstanding cultivar, one which solves a current problem or has outstanding features making it superior to other available trees of the species.

- step 2. Propagate it asexually and make sure it reproduces true-to-form.
- step 3. Field and/or site test it to determine its limitations.
- step 4. Interest primary growers in producing the new cultivar.
- step 5. Promote the introduced cultivar with secondary growers.
- Step 6. Promote the cultivar with landscape designers, municipalities and retailers.
- step 7. Promote the introduction with consumers.

Figure 1 summarizes the process of introduction graphically.

A brief explanation of Illustration #1 showing the path of introduction for new cultivars would include a discussion of the increasing difficulty of accomplishing this task, due in part to the accelerating numbers of cultivars being introduced. Primary growers do not have the space or marketability to grow all introductions, however suitable. It should also be understood that currently an estimated 50% or more of the total landscape tree liner production by primary growers is in the hands of two operational entities. Each controls certain patents and trademarks.

Secondary growers are best reached through media advertising which makes it essential to have good graphics of the salient features of the tree being introduced and factual, tested data. The natural procession of the new cultivar is contingent on the availability

of finished material to landscapers, garden stores and other nurseries and, finally, to the hands of the consumer. Inasmuch as all paid promotion of each cultivar can depend on royalties received, promotion for the consumer market can be somewhat limited.

FORECAST - AN ADVENTURE IN POSSIBILITIES

* At some point in time it will be demonstrated that each cultivar develops a distinctive root system to fulfill its own needs. It will be adequately substantiated that a bud put on a seedling soon converts the seedling root system to its own specifications. Likewise, trees produced by micropropagation develop distinct roots morphologically and functionally different from roots of the species, in turn meeting the requirements of the particular cultivar involved.

* Cultivar introducers will have available the service of a Board of Cultivar Analysis composed of qualified individuals from the nursery industry, scientific community, arborists and others to check adaptability and to verify claims of all cultivars prior to introduction. Introductions meeting established standards will receive a certificate of approval.

* Research will eventually produce the possibility of rating and labeling each cultivar with a growth-energy ratio for various planting sites. "Pluses" on the chart will included performance of the crown, bole and roots to a wide range of environmental

conditions and adverse responses will delete from the positive rations.

* Demonstration plots of performance under urban conditions for all interested persons to view will be established and available. Financing of all evaluations and demonstrations will be, in part, carried by cultivar introducers who will find their royalty fees from approved trees lucrative to the point of permitting participation.

* Cultivars to fill gaps in the urban environment need special attention. Research is underway on both halophytes and xerophytes and some results have sufficiently progressed so that testing can be accelerated. A vast portion of the southern part of the United States could benefit from these efforts as well as the results of research tailored to other areas.

My comments are intended to describe a grand adventure in

attempting to find better shade trees. There are no illusions on our part. We have embarked on perhaps a Gallaadic quest for reasons discussed. Successful pursuit of this goal requires the skills of a research arborist, nurseryman, financier, promoter, gambler and politician. And, in some cases, requires admitted failure.

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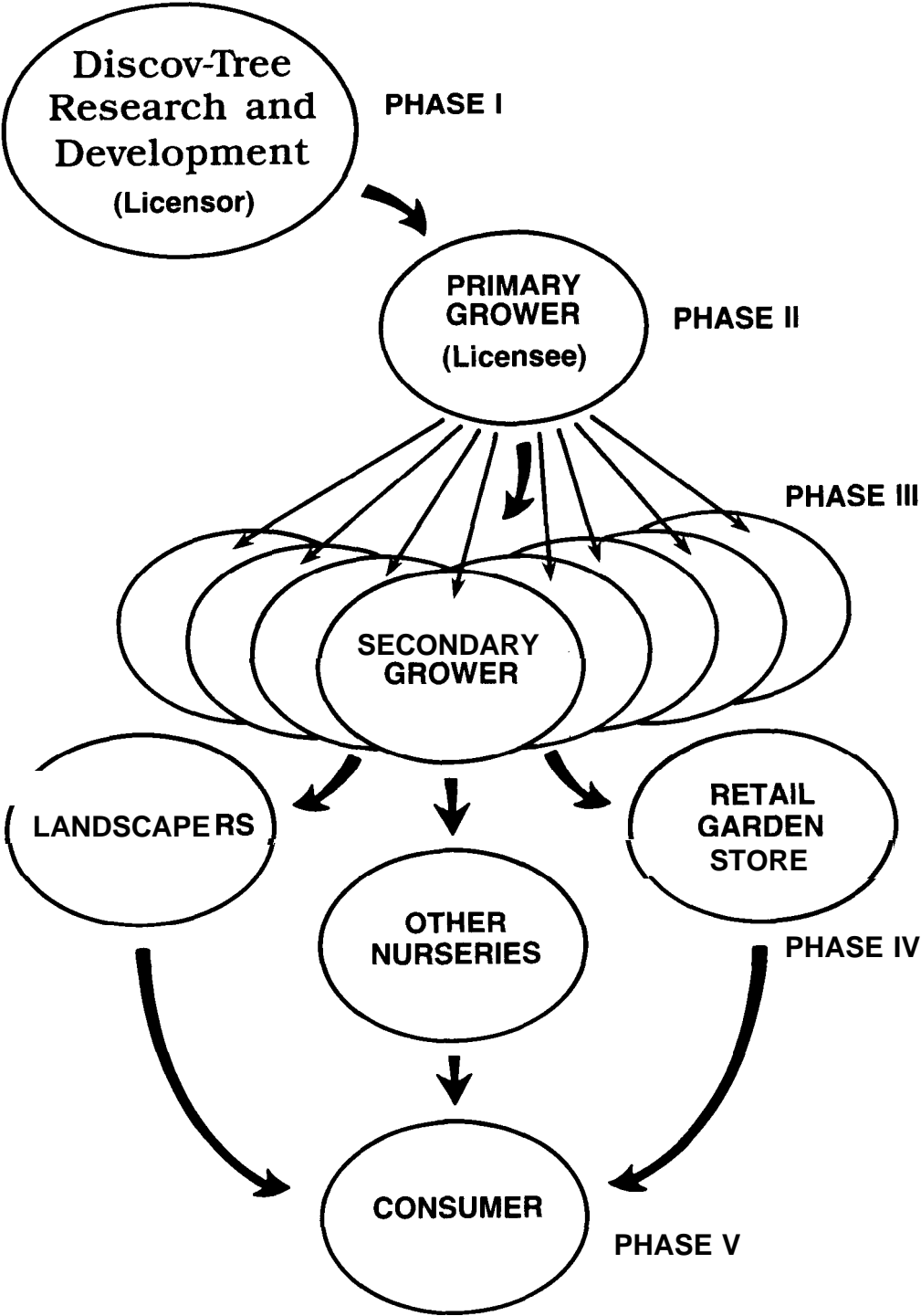
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Figure 1. Flow chart of the process of plant introduction.

THE PATH OF A DISCOV-TREE INTRODUCTION



(Illustration #1)

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