your own indicator plant data base and more on the pros and cons of accumulated heat degree days are found in Orton and Green (1989) and Delahaut (1996).

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Applied Grafting in the Production of Ornamental Trees

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BACKGROUND

The firm started in Spring 1980 as a part-time nursery on a rented area, without starting capital. Today we produce about 20,000 shade and ornamental trees and about 10,000 lilacs. We employ 4 to 5 persons all year round. It has from the start been our goal to produce trees of high quality with due respect to the environment.

TREE QUALITY

The quality of the trees is characterized by three parameters: (1) biological quality, which determines the vitality of the trees, (2) aesthetical quality, which decides its ability to accomplish a certain purpose and finally, (3) trade quality, which describes a standard level. There is no doubt about biological quality. Aesthetical quality and standard can in certain cases go against each other.

A high quality tree can be defined as having a strong and well developed root, a strong stem base, and a strait stem. The crown must consist of branches equally distributed around a central axis. Among several biological qualities we consider the energy level of the tree, the amount of energy which can be mobilized, as the most important single factor for a successful transplantation.

GRAFTING

In order to accomplish our quality goal, we start with the rootstock and the scion. Rootstocks are mostly purchased as 1/0 or 2/0 plants with well developed and branched roots. Poorly growing plants are not used. Scions are taken from 2-year-old trees in good growth. Only the lowest 1/2 to 2/3 part of the scionwood is used, which includes the most energy rich and most mature part of the scion. The grafting technique is the conventional whip graft. The grafts are made in January to March, stored in a cold store, and planted directly in the field in May.

Grafting materials used are rubber strips and commercial grafting wax, but these materials are considered less important. It is necessary to handle the plants under cold and humid conditions and to avoid unnecessary wounding. A strong union is assured by grafting so that the cambial layers fit together on both sides, downwards and preferably also on the top. The scion is cut, so a little piece is left for binding just above the top bud.

We graft many different trees: *Betula*, *Carpinus*, *Crataegus*, *Fagus*, *Fraxinus*, *Malus*, *Prunus*, *Sorbus*, *Quercus*, *Syringa*, and *Tilia* with good results. Species as different as these have very different growth rhythms, however, they can be treated in the same way because we believe the most important factors are the energy level and water content of the plant.

Transplanting is made in fertilized and deeply prepared soil that can be irrigated. Rootstock sprouts are removed in June when they are small, and again in August. New leader shoots are tied up in June and unnecessary shoots are removed.

INCOMPATIBILITY

False incomparability is due to poor grafting work and is a result of excessive callus growth which rejects the scion. Such grafts should be discarded during the first season as they will, in most cases, break before the saleable size is reached. Genuine incompatibility is often seen in *Quercus* and *Fagus* and is more problematic because the symptoms frequently are delayed 10 to 20 years.

Growing Pot Plants with Reduced Phosphorus can Improve Root Structure and Avoid Drought Stress

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INTRODUCTION

To increase consumer satisfaction, growers have to produce high-quality plants which are compact, stress tolerant, and free from diseases. This often does not harmonize with growers attempts to keep the production period as short as possible by growing bedding plants with optimum light, temperature, and a surplus of fertilizer to maximize growth rate. Such conditions often produce plants with elongated, lush shoots. However, this is at the expense of root development, and in turn poor stress tolerance. Therefore, it is recommended that before shipping growers harden their plants by giving a short period of lower temperature and reduced fertilizer and water at the end of the production cycle (Serek, 1990). This practice encourages root growth at the expense of shoot growth and is advantageous because plants with well developed root systems which exploit the medium uniformly and with room for further growth are best at withstanding the fluctuations in soil moisture which occur during shipping, handling, and in the hands of the consumers.

REDUCED PHOSPHORUS LEVEL

It is possible to improve plant quality and stress tolerance even more by encouraging strong root growth during production by reducing the phosphorus (P) levels in the root zone. Ornamental plants are typically grown with phosphorus levels much higher than those found in fertile soils. This may have detrimental effects. Studies using alumina-buffered phosphorus fertilizer (Al-P) show that plants can grow well at P levels as low as 10 µM P (Lynch et al., 1991). We have investigated the effects of reduced phosphorus (1/50 of the concentration traditionally used) on development and quality in marigold (*Tagetes* Janie Tangerine™). We specifically tested the