"Out-and-About" with Hannah

The Future is in Retractables:
Nursery Stock Production in Retractable Roof Greenhouses

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A progressive nursery grower told me several years ago, "if you really want to know where the nursery industry will be in the future, watch the greenhouse industry. What greenhouse growers are doing today, nursery growers will be doing in five or ten years." While out-and-about in June I attended a conference on growing nursery stock in retractable roof greenhouses, in Woodburn, Oregon. Cravo Equipment Ltd. and Woodburn Nursery Inc. hosted the conference. In June 2001, we also began construction of three flats- and one peaked-retractable roof greenhouse at the Columbus campus of The Ohio State University.

The flat roof houses have become very popular for nursery stock production in the Pacific Northwest, Texas and the Southeast. Many top greenhouse manufacturers such as Conley's, Harnois, Nexus and Van Wingerden offer various retractable-roof systems, but Cravo Equipment Ltd. is the only manufacturer that possesses a flat-roof. Prices for flat-roof houses typically run about $1.00 per sq. ft. For the peaked-roof houses the price is $3.00 per sq. foot. The peaked-roof curtain houses offer greater flexibility than the flat-roofs and are being used in colder climates because the A-frame roof when closed can stand up to inclement weather including heavy snow loads (Grey 2001). The principal advantage of the flat-roof houses is their reduced cost. Cravo Equipment has over 300 installations of their retractable roof houses worldwide with 36 of those being in the Midwest, Northeastern states and Ontario. None of these 36 growers are currently using their retractable roof houses for woody nursery stock production. They are used most often for finishing bedding plants, traditional floriculture crop production and perennials.

Change in Production

Retractable-roof greenhouses have been on the market for a little over 10 years and first caught on in greenhouse production because of the ventilation benefits. The idea of natural ventilation is driving innovation in greenhouse structures today, and retractables are clearly out in front (Grey, 2001). The retractable roof design allows for the roof to retract 90%, which guarantees temperatures are never above ambient. Many of the houses that use curtains also have roll-up end walls and sidewalls. This ability to retract the roof and sidewalls provides the ability to control temperatures, humidity, wind and light conditions. Some reports also indicate that worker productivity and retail sales can be improved with the

superior work environment afforded by the structures (Svenson personal communication). Construction of retractable roof structures at the Ohio State University, Columbus campus will allow researchers in the OSU Nursery program to do progressive applied research in plant shading, retractable roof environment propagation, temperature stress, improved nutrient utilization, improved water use efficiency and many other areas of investigation requiring controlled environment work in container production. Growing in the retractable roof greenhouses will allow researchers to explore production options for stock not currently grown in Ohio or traditionally imported from out-of-state.

Change in Market

In the past 10-15 years, a change in consumer preference has resulted in a need for more container production. Virtually all varieties and types of herbaceous and woody perennials that can be produced in the USA can be grown in containers. Recently, container production in “flat-roof retractable greenhouses” has joined the container production rage. Growing trees, herbaceous perennials and shrubs in above ground containers offers a number of production and marketing advantages compared with growing plants in the field (Ruter 1997). Listed below are some of these advantages. Plants grown in containers can be sold from spring through to fall, whereas bareroot stock has a very narrow window of marketability. The prime biological advantage of container stock over bareroot is the root system is packaged and protected from stress. Containerized trees and shrubs, therefore, are more resistant to poor handling practices in the field and suffer less root disturbance and transplant shock (Davidson et al. 1988). Container production versus bareroot also allows the nursery manager to grow three to eight times more plants per unit area, depending upon the crop, reducing the need for expensive and productive field soils. The container producer can produce more plants in a shorter period of time and increase mechanization, resulting in reduced costs and higher returns.

Advantages

Above ground container production, however, does have its drawbacks (Ruter 1997). Root hardiness during over wintering of container-grown nursery crops has become the most important factor limiting container production. Plants over wintered in containers suffer greater winter injury than those in the ground because the roots are surrounded by cold, circulating air rather than the relatively warm, insulating environment of the soil. The shoots also are more susceptible to injury from desiccation because the root zone is frozen in the container. With retractable production, the greenhouse roof can be closed in the winter during the day to increase the temperature inside the house. At night, the closed greenhouse roof helps maintain the heat that built up during the day. Adding supplemental heat can also provide warmer temperatures while providing the ability to melt snow off the roof. The main advantage in overwintering lies in the degree of outside exposure allowed to the grower to acclimate plants to the

natural environment and the ability to react in minutes to temperature changes to produce hardier crops (Grey, 2001).

Many Pacific Northwest nursery growers first started putting up flat-roof houses to replace their current overwintering poly-house structures; however, with experience they learned their prime advantage was during the growing season in the reduction of supraoptimal root zone temperatures and better light utilization by the crop. The retractable roof houses reduce extreme summer temperatures in warm climate states, including Ohio, where media highs of 138°F have been reached in the center of one-gallon containers on gravel beds (Struve, personal communications, 2001), via shading. Overheating in black plastic containers occurs because of the large influx of energy from the sun combined with insufficient loss of the incoming heat. At high temperatures, the membrane integrity of the root is lost and the roots are injured or killed. Conventional plastic containers act as “black heat-sinks” (Ruter 1999). In retractable roof production, the roof can be positioned for shading on a hot summer day. The retractable film coverings essentially allow for higher light transmission without the risk of higher soil temperatures. In current nursery culture, black shading clothes are used to reduce light transmission and reduce heat stress to containerized plants. The retractable films allow more light diffusion than conventional poly films and more light transmission than black shade clothes without the heat build-up (Svenson, 2000).

High root zone temperatures have a profound effect on plant growth. Root growth is retarded at temperatures greater than 30°C or 86°F. Root growth in many woody species stops at temperatures exceeding 40°C or 103 °F. Cessation of top growth and shoot necrosis also occurs at these temperatures. High root zone temperatures can result in decreases in photosynthesis. Normal root functioning ceases when root zone temperatures exceed 96°F for Holly (Ruter and Ingram 1992) and at even lower, approximately 90°F for less heat tolerant plants (Levitt 1979). Cooler substrate temperatures experienced in retractable roof houses protect the plant’s root from damage, leading to improved growth of the shoot and reduced substrate evaporation to support transpiration and further growth improvements (Svenson 2000). Canopy leaves are also cooler under poly films with diffuse light, which can increase photosynthetic rates on hot days (Svenson, 2000).

Summary

Due to the protection provided to the root systems and improved photosynthetic capacity of the plants, some West Coast growers are reporting cutting their production times of certain crops in half. Retractables also reduce wind throw problems often experienced in conventional above ground-container production and improve disease control versus conventional greenhouse production via improved ventilation. Several other advantages are offered by retractable roof systems that are too numerous to list in this article. Retractable-roof

greenhouses are being described as a brand new style of growing structure (Grey 2001). Retractable roof production allows for greater manipulation of the growing environment in winter, summer and spring and through research trials at Ohio State University we will be investigating their ability to produce superior nursery container stock, cut production time and their functionality and profitably in Mid-Western nursery production.

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