



Above Luminosa gutter connect greenhouse in Canada

High technology greenhouses: Improving tree nurseries efficiency

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INTRODUCTION

By incorporating advanced technologies and sustainable practices, a high technology greenhouse system can improve the efficiency and productivity of a nursery, as well as reduce costs and

time required to produce high-quality reforestation tree seedlings.

In this article, we will explore the various technologies and practices that can be incorporated into a greenhouse to achieve these benefits.

Above an Ovaltech free-standing greenhouse to grow tree seedlings



HIGH-TECH GREENHOUSE SYSTEM

Climate control and monitoring

One of the key benefits of a high technology greenhouse is the ability to closely monitor, control and optimize the growth conditions of tree seedlings. In a traditional nursery, the growth of seedlings is often subject to unpredictable weather conditions, such as extreme low and high temperatures and storms. In fact, those uncontrolled conditions will create a stress on the plant causing irreversible damages to seedlings and slow down their growth rates, resulting in a longer production time and lower overall productivity.

In contrast, a high technology greenhouse allows for precise control of the growth environment, including temperature, humidity, light, irrigation, nutrient delivery, and CO₂ levels. This level of control allows for faster growth rates, higher survival rates, and more consistent growth patterns, leading to a more uniform and high-quality crop of tree seedlings.

For example, the incorporation of climate control systems, allows for precise and automated control of the temperature and humidity through the control of natural ventilation from roofs to side openings and the control of exhaust of positive pressure fans, that can even be operated at variable speed to exchange the exact amount of air to maintain desired

climate conditions. For even greater control on humidity and cooling capacity, fogging systems can be implemented which can be particularly beneficial to maintain sufficient air humidity to prevent water stress in spring when the young seedlings root network is still not fully developed.

Shading systems

Greenhouses allow the incorporation of shading screens systems. With the ability to automatically control the deployment of shading screens allows to precisely regulate the amount of light reaching the seedlings.

Using this system, the nursery head-grower can create optimal growing conditions tailored to the specific needs of each tree species and their stage of growth. Automated shading screens help maintain consistent temperatures, preventing overheating and reducing stress on the seedlings as well as avoiding damage to young trees caused by excessive light early in their growth.

Moreover, it will not only contribute to healthier and more uniform growth but also allows for better energy savings (thermal) efficiency, as the need for supplemental cooling is minimized. Moreover, the automated system reduces labor costs associated with manual shade deployment.

Blackout systems

A major challenge for tree nurseries, is to reach the desired tree height, diameter, and growth stage at a precise timing in the season. High tech greenhouses, can be equipped with blackout system which is an extremely effective tool to tackle this challenge and give much better control to the grower by giving them an effective way to control the photoperiod (day length) in their greenhouses.

What is more, for some tree varieties, inducing dormancy is a crucial and required stage in their development before they are shipped. Controlling photoperiods with a blackout system allows the grower to induce dormancy exactly when required and much faster, ensuring they progress through the necessary stages of development at the optimal time allowing nursery professionals to plan and control production schedules more effectively.

Artificial lighting

Blackout systems allow the control of the photoperiod through the reduction of the day length, but greenhouses also allow the incorporation of artificial lighting systems to lengthen the day length to delay the induction of dormancy that would come from the natural reduction of the day length as the growing season advance.

In fact, photoperiods lighting system can give much more control to the grower for a relatively low light intensity requirement, making it a cost-effective investment. Higher intensity artificial lighting systems, can also be incorporated to increase growth rates, improve quality of seedlings. Those systems allow the ability to grow seedlings year-round, regardless of natural daylight conditions which grant the ability to do multiple crop cycles per year in the same greenhouse to maximise the use and output of the infrastructures.

Irrigation and fertigation

Greenhouses can feature sophisticated irrigation and fertigation systems that allow for the precise delivery of water and nutrients to tree seedlings, based on the precise light and climate conditions to synchronize the delivery with the exact trees water and nutrient requirements. Furthermore, a modern greenhouse can integrate irrigation booms, or ramps, that allows to program an almost infinite number of zones with flexible size in each greenhouse to adapt to irrigation requirements of different tree species and growth stage in the same greenhouse.

By automating these processes, nursery professionals can reduce labor costs and ensure consistent, even distribution of water and nutrients. This results in healthier seedlings, reduced waste of resources and ultimately reduce operational costs.



NEXT STEP: AUTOMATION AND ROBOTICS

With the current challenges of labor shortages in the agricultural industry, automation has been one of the most significant advancements in greenhouse horticulture, and its benefits have extended to reforestation tree nurseries.

Automation and robotics in greenhouse tree nurseries include automated handling, seeding, transplanting, pruning, grading, and packaging. Those technologies significantly reduce the need for manual and repetitive labor, improving efficiency and allowing workers to focus on more complex, engaging and rewarding tasks on the nursery.

NEW HORIZON AND CROP OPPORTUNITIES

We have seen that higher-tech greenhouse systems including semi-automation can have a major impact on the Return on Investment (ROI) of the reforestation tree seedlings nursery in North America. Such integrated smart greenhouse systems can revolutionize the agriculture of tomorrow!

Nowadays, many farms are affected by the climate change (more extreme weather variations) and labor shortage in Canada and in the United-States. Bringing some technology and efficiency inside a modern greenhouse will reduce many risks and consolidate your business model. Indeed, it will bring efficiency and consistency on your future production with lower operation losses. Moreover, growing healthy seedlings has a big impact on the future yield and quality of your crops.

Then, why not growing young apple trees and other crops under a modern



Young apple trees cultivation at Pépinière Rochon in Québec

greenhouse?

It is already a reality in some part of North America and in the world to have



a better control of the propagation stage and maximise the chances of growing healthy crops afterwards.

CONCLUSION

In conclusion, high-tech greenhouse systems present a promising future for tree nurseries, significantly improving efficiency, flexibility, and productivity. By integrating advanced technologies such as precise climate control, shading and blackout systems, artificial lighting, and sophisticated irrigation and fertigation systems, these greenhouses not only enhance seedling quality and output,

but also reduce operational costs and resource consumption. Additionally, the incorporation of automation and robotics addresses labor shortages and streamlines nursery operations, further increasing efficiency. As the technology continues to evolve, high-tech greenhouses will unlock new horizons and crop opportunities, providing a sustainable and profitable solution for the tree nursery industry.

Each nursery greenhouse project is unique, requiring a detailed analysis and an integrated design approach. It is

crucial to closely examine factors such as current growing cycles, operations, infrastructure, climate, and labor. The design approach should encompass all aspects of the structures, systems, and equipment, as well as their interrelationships. Evaluating technical, agronomic, and economic aspects is essential when developing the optimal solution, allowing growers to achieve their objectives, address existing challenges, optimize efficiency and maximize their profitability.