- Advanced flowering in azalea (evergreen shrub) *Rhodendron* in spring, but delayed it in camellia (*Camellia*) in autumn. On the other hand, had no affect on flowering in apple (deciduous tree) in spring.
- Advanced maturation in grape (*Vitis*), but delayed in persimmon (*Diospyros*) and orange.

N.S. Red

- Advanced flowering in long-day plants and thickened growth in onion.
- Delayed maturation in persimmon and orange, but had no affect in grape.

LITERATURE CITED

Tohyama, T., Y. Ishii, Y. Kamuro, and **K. Okabe.** 2001. Seasonal light quality for plant growth. Regulation of Plant Growth and Development. 36:202-207.

Designing a Brand-New Agriculture: Producing Consistent Quality Vegetable Seedlings©

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Yamaguchi-Engei Co. Ltd. was established in 1996 and our main product line, vegetable seedlings, is increased by market requirements. Last year, Yamaguchi-Eengei established a new company, named BERG-EARTH. This company's main purpose is to find new markets and to develop new products.

Currently, these two companies are developing together — trying to develop a stable product system of quality vegetable seedlings. Current production systems for vegetable seedlings have many production problems including: difficult to propagation cultivars, expensive human labor, it can be affected by weather and season, it is affected by disease and insect pests, and physical impediment. Because of the many problems associated with current production systems, we have tried to introduce new technology at every production step to improve the total production system and develop a stable production system.

OUR NEW PROCEDURE INCLUDES THE FOLLOWING

Process 1. Seeding to grafting stage: Closed sapling production system (Fig. 1).
Process 2. Grafting stage: Using grafting robot.
Process 3. Grafting to shipment stage: Open style seedling production system (Fig. 2).

Process 1. By introducing the closed seedling production system we can grow a seedling plant under controlled environmental conditions (such as temperature, humidity, wind velocity, and gas concentration); under such conditions, it becomes possible to grow a quality and uniform seedlings.

Process 2. The grafting robot that can do grafting work correctly and quickly will substitute for the grafting work performed currently by hand which results in high production cost.

Figure 1. The Equipment of Closed sapling

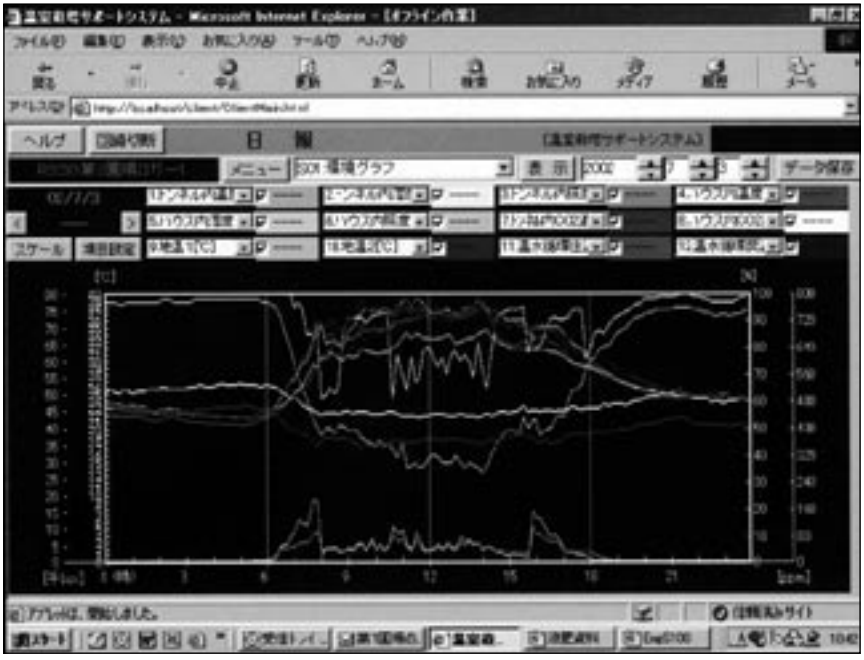

Figure 2. The measurement screen of open style

Figure 3. New generation nude-make sapling

Figure 4. A scene of test cultivation

Process 3. It is scheduled to transfer the seedling production phase in a greenhouse that needs advanced technology to a machine to some extent; to build the open-style seedling production system, to mitigate labor.

In the future, we will be able to demonstrate this new vegetable seedling production system, "New Generation Soil-less Seedling (provisional name) (Fig. 3, Fig. 4). This is the new grafting and cutting method, which makes it possible to store seedlings for a few weeks in environmentally controlled rooms. This method will also make it possible to package the production in a small size that will decrease packaging costs. We will be looking to apply this system in other new market and hope to change the current seedling production system in Japan.

We will continue to seek new technologies.

The Changing Greenhouse Environment During the Seasons for Grafted Vegetable Nursery Plants©

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INTRODUCTION

At Yamaguchi-Engei grafted vegetable nursery plants [e.g., cucumber (*Cucumis sativus*), tomato (*Lycopersicon*), eggplant (*Solanum melongena*), etc.] are produced and sold all year. Berg Earth Co. Ltd. supports Yamaguchi-Engei Co. Ltd. with research and development. It is very difficult to maintain nursery-plant quality through the year because environmental factors, such as air temperature, humidity, and light, change with the season and weather. To solve these problems we use heaters, shield-curtains, and plastic tunnels to control the environment in greenhouses. The object of this study was to investigate the environmental changes during the seasons and to improve culture techniques for each season.

MATERIALS AND METHODS

This research was carried out from early October 2001 to early September 2002 at the research facilities of Yamaguchi-Engei Co. Ltd. The environmental measurement system "Open PLANET" (Shikoku Electric Power Co., Inc.) was used to monitor air temperature, relative humidity, and luminance. Sensors were set both outside and inside the tunnel frames (Fig. 1). Data was logged as averages every 10 min.

RESULTS AND DISCUSSION

Figure 2 shows the change in environmental factors (air temperature, relative humidity, and luminance) in each area (open air, outside tunnel, inside tunnel). In the case of relative humidity and luminance, there was little difference between the outside and inside of the tunnel, 10% to 34% of amplitude, compared with the open air. However, the change in air temperature was large; there was a 57% and 62% of amplitude between outside and inside of the tunnel, compared with the open