

## **Plug Production of Bedding Plants within a Nursery Production Program**

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### **INTRODUCTION**

Bailey Nurseries has built itself a fine reputation for its bare root trees and shrubs. Over the years it has diversified to keep up with the changing markets. In the last decade, the trend in the nursery business has been an increased demand for containerized woody and perennial plants. To satisfy customer needs, a large expansion into these areas was undertaken and a larger propagation facility was needed.

Cuttings would need to be rooted not only for the field liners or sold as liners but for container-grown plants as well. In order to meet this demand, the Nord farm was bought in 1980. Since 1981, 90 polyhouses and a 45,000 ft<sup>2</sup> Van Wingerden gutter-connected range have been built. Still expanding, we are currently constructing a 1.5 acre Hanois Nordic range.

Back in the early 1980s when the first 20 polyhouses were built at the Nord farm, a small percent of these were used for propagation year round. The others were used solely for softwood cutting propagation. The rooted cuttings would be dug in the fall and be placed in cold storage and graded that year. This meant that those houses would remain empty until the following spring—the challenge was on to find the most effective use for those houses.

It wasn't long before a couple of interesting ideas were floating around. One of those ideas came from a couple of Bailey salesmen whose customers had asked them if they knew of a good source for bedding plants. Their original supplier was downsizing and not able to supply the amount these customers needed. The second related idea was given to Rod Bailey by a farmer friend that wanted to know if the nursery would start some vegetable liners so he could grow mass quantities of peppers and tomatoes. Thus the bedding plant program was implemented.

It didn't take long to get the ball rolling. With help from a Ball Seed Company seed representative, and the propagation farm staff and local growers, an intense effort was made to make the bedding plant production a successful operation at Bailey Nurseries.

### **THE TRANSITION**

How do you take a staff of woody plant propagators and make them greenhouse growers? In this industry you're usually one or the other. It took a lot of research, brainstorming, team effort, and networking. We had to simulate the same growing conditions in a real greenhouse range as best we could using polyhouses. Over the years, through trial and error, we have been able to achieve this goal. We have an excellent reputation for the quality of bedding plants we grow.

### **PLUG PRODUCTION**

Seeding of annuals and perennials has come a long way in recent years. The advent

of the plastic plug tray would mean better quality transplants, more even germination, and less labor for transplanting. Technology of seed selection and development has improved, especially with annuals, over the years.

The first year a local greenhouse grower seeded the flats for us. We germinated the seed in our main shop. Then they were sent by heated truck to the polyhouse to grow on until transplant stage. The next year a chamber was built and the seeding and germination was done on site. The plugs were still grown on in polyhouses until 1990 when the Van Wingerden gutter-connected greenhouse was built. This house, like any house we were to build from then on, would have to be compatible for both our bedding plant program and our woody propagation needs.

The plug flats are filled with a commercial-plug mix on our Javo flat filler. They next go by conveyor to the seeding machine and then on to the top coater. If the cultivar we are seeding needs a cover of vermiculite or plug mix they will be given the proper amount of covering. The last stage is the water tunnel. The media will get just moistened before going on carts into our fog chamber.

Each cultivar may have its own germination requirements of light, temperature, etc. Once in the chamber we monitor the amount of fog. Too much and the media gets too wet. Too little and the seed will not get enough moisture during germination or the medium will dry. The object is to keep even moisture and temperature. The carts are put into lighted stalls. Lights give you more flexibility to get the largest percentage of germination in the chamber without the plants stretching. Each cultivar is different so we make detailed notes on how long we can leave that cultivar in the chamber and at what stage to take it out. The stages are: (1) just cracked (the radicle is out and going down into the media), (2) the cotyledon emerging, and (3) number of days after the cotyledon emerges.

Some plants such as snapdragons, alyssum, and marigolds tend to stretch fast so you would take these out with the cotyledon just emerging—about 2 to 3 days. Others, such as petunias and impatiens, do not stretch as fast and can be left in until cotyledons are expanded straight up—about 4 to 5 days. Begonias take a long time to start germinating and may stay in for up to 12 days.

When the plugs are ready to come out, the carts will be put into a heated trailer. The trailer will be taken to the plug house.

## THE PLUG HOUSE

The plug house is a Van Wingerden (43,000 ft<sup>2</sup> gutter connected type).

We are able to heat and fill the bays one at a time. The bays have plastic curtains between them. To open up the next one we drop the curtain and heat that bay.

The wire-mesh benches each have a black bench cloth covering for more even heat distribution and more even drying. Polytubes run under the benches and are connected to a forced air heater—this arrangement provides the bottom heat. Four of these in each bay. Two auxiliary heaters supply heat for ambient air. Most greenhouse ranges use hot water pipes permanently installed under the benches. Since we do summer softwood propagation in this house we cannot have a permanent structure above the sand beds. The polytubes are easy to roll up when finished being used. So we sacrifice a little on the uneven heat we get from forced air.

The newly germinated seedlings will be placed on the benches. We maintain the proper temperature for each type. They will be acclimated by applying mist for 1 to 2 days until germination is complete. The six I.T.S. computerized booms are capable

of misting and irrigating in almost unlimited combinations. Plant types that damp-off easily are sprayed with a fungicide drench.

The plugs have different requirements according to the stage they are in.

- Stage 1. The germination stage, discussed above.
- Stage 2. We apply a low-phosphate fertilizer 13N-2P-13K CaMg to keep plants from stretching. Even while I am misting plugs to finish germination I have found a constant but low level of fertilization is very beneficial as nutrients can be leached easily from the small plug.
- Stage 3. In this stage the true leaves are out. At this point 100 ppm of fertilizer can be applied to strengthen the plants. It is still low enough in phosphorous to prevent stretching. We want to keep the plant as compact as possible. One method is growth regulators. The other way is to combine high light and negative diff. We leave the HID light on for 22 h. The more light the shorter the plants. Negative diff works this way: plants will generally put on their biggest "stretch" of growth during the morning hours during sunrise. Research has shown that if you reduce your nighttime temperatures just 5F starting 1 h before sunrise and ending 3 h later, then increase to normal daytime temperature, this will help eliminate top growth on most cultivars. Therefore, low fertilization, high light, and negative diff = less growth regulators.
- Stage 4. This is the holding stage. We want to tone the plant. This means lower temperature to harden any soft growth. Reduce fertilizer until the plant begs for it! We might fertilize every other watering. On flowering types we want to see flower bud initiation before plugs are to be transplanted. The reason for this is simple. If we get flower bud initiation, then after transplanting, the plants will not grow out of control by producing a lot of unnecessary foliage. This makes it much easier for the growers who will take care of the finished plant. High light through all stages helps achieve this!

In review, we need to produce a high quality plug that is short and compact, has a strong root system, flower buds initiated, and is disease and insect free.

Through the plug season (Jan to May) we will fill up all the benches in four out of six bays in the Van Wingerden gutter-connected range at least once. That's approximately 17,000 #512 plugtrays and 3000 #200 plugtrays. We do an additional 1000 #72 trays of seed and 2500 #72 trays of cuttings.

All cuttings and any plants bought in will immediately go into an isolation house to be grown on, rooted, and inspected before going in any other house.

## **TRANSPLANTING THE PLUGS**

It is important that the plugs are transplanted at the proper time. Holding the plugs too long will increase the chances for the plugs to deteriorate, such as decreased vigor, stem rot, and the plant literally stalling out its growth. We have recently acquired a mechanical transplanter. To make the most of the machine the plug quality really needs to be good with a quality root system and short top growth. If the plants are too tall they tend to fall over. The plugs will be transplanted into their

final packs—4 packs, 6 packs, and 3½-in. and 4½-in. pots. From there they go into each available polyhouse. In each house the sand beds are leveled and a ground cloth is put over the sand for the trays to rest on.

As space opens up in the Van Wingerden gutter-connected range we will fill it up with pack material. Usually 3½-in. and 4½-in. pots go into the two bays with no benches. Then the benches are filled as we consolidate the remaining plug flats. As soon as the temperatures are warm enough during the day we push the benches outside and put transplanted flats on the ground. At night if temperatures are too cold the benches get pushed back in over the crop on the ground until the next morning. This utilizes the maximum amount of space. Hanging baskets are hung in each bay and in the driveway, so we basically have three crops at a time in this range.

One grower is assigned to a certain set of houses and is responsible for knowing their specific crop requirements. This includes shipping dates so plants are at the desired stage. They will then control the rate of plant growth, as outlined in our growers manual by controlling temperature, fertilizer, and water, along with informing our pest department of any problems they see.

## CONCLUSION

How has the experience of growing bedding plants helped us improve our nursery propagation and growing techniques? As mentioned before, Bailey's was originally only growing bare-root stock. All propagation was done in sand beds. Now we found we can get a better quality juniper liner when we root these in #50 trays using soilless medium. Softwood cuttings that we can sell 1½ years from the field are planted mid summer from cuttings stuck that spring in flats.

Since we have a fog chamber with lights we were able to buy in unrooted tissue culture cuttings and root them in flats placed on carts. We've changed our methods over the years but that's how the idea got started.

The juniper cuttings we stick in flats are now put on raised benches with bottom heat, same as the plugs. Also, these houses and many softwood cutting propagation houses have the roll up side vents for better temperature and humidity control. This reduces diseases, such as *Phomopsis* blight on juniper.

Keeping the foliage dry on annuals at night is very important in preventing foliar disease. We have applied this same procedure with our softwood cuttings. Each taxa is treated so that no excess moisture will remain on the foliage over night.

Since the mist booms we use on our plugs in the Van Wingerden gutter-connected range are very versatile, we can use this house for rooting many plants where only small quantities are needed and be able to meet the mist requirement of each type. If a faster rooting type is ready to go off mist we can still mist the cuttings on either side.

We have found that the availability of information produced by the greenhouse industry is very up to date. Much of it pertains to media, fertility, and pesticides that can be of value to the industry in general.

In bedding plant production the effects of changes in pH and fertility such as high salt levels occur very rapidly. Because of this we are more aware now of the necessity to monitor this in all our production.

The addition of the bedding plant program at Bailey Nurseries has helped us improve our overall growing practices and maximize the use of our facilities.

## FACILITIES AND EQUIPMENT

**Seeding.** (Note: Items 3-6 are linked by conveyer so handling is minimal).

- 1) **Plug tray.** We use #512, #200, #72 rounds, # = number of plugs/tray.
- 2) **Plug mix.** Proper media for maximum aeration/porosity.
- 3) **Flat filler.** We use a Javo for plug flats and small pots.
- 4) **Seeder.** Many kinds available, we use a Blackmore.
- 5) **Top coater.** For seeds that require a covering of vermiculite or plug medium.
- 6) **Water tunnel.** To moisten media before plants enter the germination chamber.

### Germination/Sweat Chamber.

- Well insulated, temperature controlled
- Fog - We use air-over-water method
- Lighted stalls - (optional) Some growers feel they can control germination better with lights, others will simply sweat the seeds then finish the germination on the bench.

**The Plug House.** Van Wingerden 43,000 ft<sup>2</sup> gutter connected.

- Divided into 6 bays, 4 of which have roll out benches.
- High intensity discharge lights above benches.
- Bottom heat—we use polytubes under the benches.
- Traveling irrigators—six I.T.S. computerized “smart” booms.
- Drip irrigation with hanging baskets.
- Bench cloth covers each wire-mesh bench section to put flats on for better heat distribution and more even drying.
- Q Com environmental-control system to monitor temperature, light, wind, humidity, etc. This system will control heat, cooling/venting, or any other equipment that affects growing conditions.

### POLYHOUSES

- Overhead heaters and cooling fans with polytubes.
- Ground tarps—to cover sand beds in propagation houses.
- All polyhouses built in the last 3 years have roll up side vents.
- Drip irrigation hanging basket lines.