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Featuring For

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Growing With Plugs

Lloyd Traven
Ball Seed Company
West Chicago, IL

All over the country growers have been convinced of the many advantages of the plug system. Most growers still prefer to buy plugs from specialist propagators, but we see a rapid increase in the number of operations producing their own plug seedlings. There are several reasons, both pro and con, for each production style.

PURCHASE FROM A SPECIALIST PROPAGATOR

One primary reason growers purchase prefinished plugs is to eliminate germination risk. This is especially true for difficult seeds (impatiens, vinca, begonia, verbena). Certainly as important, though, are the tremendous advantages of reliable scheduling for finish, better space rotation, and the ability to produce full crops for major holidays (Valentine's, Easter, Mother's Day). Plugs allow growers to fill for Easter and still produce a full bedding crop by mid-May. An alternative is to simply keep the range closed until your plug crops arrive for transplanting — this gives major energy savings, as January, February, and March use approximately 55-60% of yearly fuel consumption (Grower Talks).

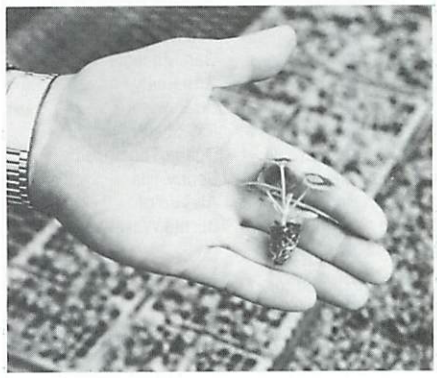
Another large savings is in transplanting labor. Plugs can be flatted at least twice, and up to **four times**, as fast as bare-root seedlings. Additionally, there is virtually no transplant loss of plugs, due to a well-developed root system which is not disturbed in planting. All of these factors, and several others, translate into savings for the grower.

From a psychological viewpoint, the elimination of grower risks greatly lessens the mental fatigue of growers and managers. This is a very difficult concept to quantify, but certainly there is a significant dollar value to freeing the owner/manager to do as the title suggest: to **manage**.

PRODUCING YOUR OWN PLUG SEEDLINGS

There is no doubt that it is very economical to finish flats or pots from plugs as compared to open-flat seedlings. This statement is based upon **48-plant flats or less**. Should your plant count be 60 or 72 plants, as in Michigan, the extra costs for plant materials must be weighed against the greater production and mechanization efficiencies available with plugs. Also, you must be sure to add the opportunity costs of extra turns of bedding plants, and the production of holiday crops prior to bedding season.

It must be mentioned that, given a higher germination percentage and rate, it **may** be cheaper to grow your own plug seedlings. This is true in many cases, but certainly not all. If a grower is germinating 80% or less, there is a definite question whether this would be an economic undertaking. The alternatives are either to purchase from a specialist propagator or to double-sow. Double-sowing is **not** recommended for expensive seeds like impatiens or geraniums.



A well formed geranium seedling grown from a Ball Spark-Plug. Note the highly-developed zonation on the foliage. The seedling was grown in flats similar to those shown in the background. Photo credit Ball Seed Company.

Sowing

Sowing seed is the easiest part of plug growing, but in order to be efficient, a grower must have a seeding machine which costs between $2,300 and $40,000. The differences in price are due to the seeding mechanism and the amount of automation. There is also some difference in sowing rates and the range of seed size and/or configuration.

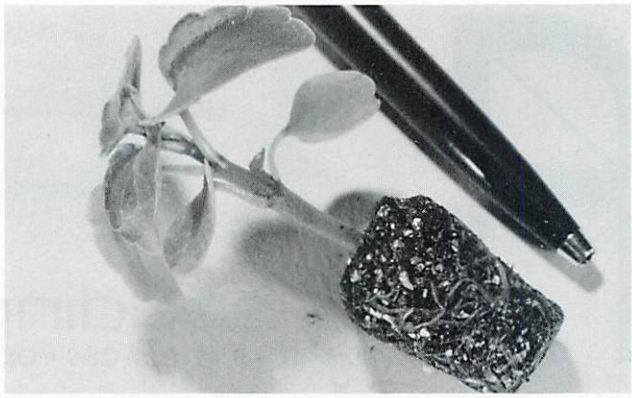
No mater what seeder is chosen, it is important that the machine be protected. A greenhouse is definitely **not** a friendly environment for a seeder. Additionally, care must be taken to exclude dust, soil, and water from the seeding heads. Regular examination is critical to assure that the holes are open to allow seed pickup. Obviously, if no seed is deposited, it is impossible to germinate that plug. Therefore, it is recommended that one of the best employees be placed on this job.

The plug sheets should be filled to the top with a slightly-moistened soilless medium. There is no place for a soil mixture here, unless the grower knows **precisely** where the soil is coming from. Peat-lite mixes can be reproduced with remarkable uniformity, and this presents a major advantage to the grower. There is no room for surprises in growing plugs.

The medium should be compressed slightly in the 273-406 plug sizes, which leaves a freeboard of 3/16 - 1/4''. The seed is sown on the surface, and covered, if necessary, with vermiculite (1/8'' granules). This size of vermiculite holds moisture, but also allows air exchange and some light passage.

Germination Facilities

This is by far the hardest part of growing plugs. On the surface, it would appear to be much easier to grow a plug than open-flat seedlings since each seed has plenty of space, soil, and water. However, this is simply not true. In fact, a grower producing his own plugs for the first time should not attempt to get more than 50% of his requirements the first year. Plans should be made to buy plugs from a specialist, or grow from open flats.



An impatiens seedling showing its relative size. Growers can expect to have plugs of similar size and shape in every flat they receive. Photo credit Ball Seed Company.

This difficulty is due primarily to the fact that the favorable microclimate of open flats is not present in plug trays. Whereas the high humidity and uniform conditions of seed flats makes germination "easier," this beneficial environment has been dramatically altered in plug trays to allow maximum space for growth. Also, the soil volume of a plug tray is only a small fraction of an open flat's, allowing **no leeway** on moisture content. If the sheet dries out, there is virtually no chance for success. Even with automated watering systems, there is no substitute for a grower checking 3-4 times daily for dry cells. Despite the tremendous labor-savings available with plugs, the germination stage is incredibly labor intensive.

It is highly recommended that growers set aside or create a controlled environment area for germinating plugs. This can range from standard benches with poly sheets over the plug tray to super-sophisticated growth rooms. In all cases, soil temperature and moisture must be accurately controlled.

Natural Beauty of Florida uses Gro-Carts, wrapped with poly, and placed in a chamber with vertically mounted fluorescent tubes. This works remarkably well for them, but they did have to account for the marked stratification in the chamber (i.e. vinca on top, Potato Explorer on the bottom). This system provides high relative humidity, proper temperatures, and an efficient way to move material into the greenhouse for growing-on.

Every grower using fluorescents for germination or growing should plan to change bulbs every **6 months**!! University research has shown that there is severe loss of illumination after this period, although this loss is not visible to the eye.

Also, wide spectrum "grow-lites" are not necessary. One warm-white and one cool-white in each double fixture will give excellent illumination.

A large, midwestern bedding plant grower uses porous concrete floor benches with the Rutgers subsurface heating system, along with conventional benches with bottom heat. Certain species are grown under HID lamps (geraniums and begonias).

Country Acres of Marysville, Ohio uses open benches equipped with Biotherm™ tubing for soil-heating, along with HID's.

Notice that all of these systems provide some method for maintaining **soil** temperatures at optimal levels. Dan Reed of Green Circle states that they follow the recommended germination temperatures very closely. Fully 85% of all seeds fall into the 70-75°F range; some run higher, and only a few run lower. It cannot be over-emphasized that provision must be made for accurate soil heating for successful plug growing. Natural Beauty solves this from a different approach; they use infrared heaters overhead to heat the shallow plug sheets.

It should be obvious that careful temperature is essential for plug success, but no less essential is moisture control. Water distribution systems can range from mist lines, to hoses with fine-mesh breakers, to capillary mats. The latter assures even moisture, but creates a risk of overly-succulent plants and roots growing into the mats. This negates the plug's advantage of not disturbing the root ball. However, this definitely provides a significant margin of error in the afternoon or on weekends.

The critical point is: Do not use water as a growth regulator!! It is far better to use fertilizer and temperature to control the size of plugs. In fact, Clarence Vandergraaf of Lafayette, Indiana holds petunias for 10 weeks in Blackmore 648 trays, by using low phosphorous fertilizer, 50-55°F temperatures, and light sprays of B-9. He then finishes these in AC 3/18's in 3 weeks at 70°F! Obviously, this is not for everyone, but it will work for the exceptionally diligent grower. For all intents, Vandergraaf is totally utilizing the advantages of plugs.

Germination Conditions

Dan Reed provides the following blueprint for Northern Ohio conditions:

Germination temperature: Follow recommended temperatures or use those slightly higher. Mike Mohlenhoff uses 75-80°F to start seeds on Long Island, but lowers the heat soon after to get short, stocky plants.

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Fertilizer: **After** germination, a light feed (50 ppm) is applied. This is especially important for begonias in order to avoid "begonia stall." Reed uses a mix of KNO_3 and $CA(NO_3)_2$ in order to minimize the dangers of ammonium toxicity during cold weather. Occasionally, they use 20-20-20 as a supplemental feed.

Mohlenhoff uses 15-16-17 on a constant feed program or alternate waterings. This formulation also tends to lessen ammonium problems; Natural Beauty uses 50-80 ppm feed.

GROWING-ON PLUGS

Temperature and fertilizer are the critical control factors here. Reed drops the temperature to 55-60°F at this time to control growth.

Impatiens require 60°F to control plant size and get stocky growth. He feels that last year, he held the heat too low and will raise the set point this season.

If plugs must be held for a time before transplanting, 50-80 ppm is recommended, along with lower temperatures.

In all cases, be sure plugs are **thoroughly moistened** before removal. This facilitates extraction from the cells. Additionally, there really is no need to firm around the root ball, as watering will firm the soil sufficiently. Dan Reed recommends 200-250 ppm as an initial feed for most species.

Fungicide drenches are recommended for many species. However, be careful of those that may act as growth regulators. Reed especially cautions against Terraclor. Reports have also been hard on Banrot, Benlate, and Truban. Subdue (Ridomil) should be used at the lower range of recommendations.

Air temperature after transplant should be 60-62° minimum for 3 days to get rapid root establishment. After this, "typical" growth regimes may be followed.

SUMMARY

It should be obvious that there are major advantages and disadvantages to both methods of plug utilization. The grower/manager must decide whether the possibility of lower costs is worth the risks and labor costs of self-propagation. He should also be aware of the opportunities available through increased production of extra crops by purchasing from specialist propagators.

The plug concept, and the remarkable technologic advances made in the last few years, have, and will continue to revolutionize the bedding plant industry. Additionally, the production method offers major possibilities for vegetable and cut flower crops. Imagine how much easier it would be to plant plug snapdragons!!

The advantages of direct energy-savings, coupled with tremendous opportunities for mechanization and efficient utilization of expensive labor, provide a major advance in the struggle to remain competitive in the market.