Organic Plug and Transplant Production

By Brenda Hedges

New England organic growers are waking up to the advantages of using plugs in their crop production. Plugs are containerized transplants with a self- enclosed root system. This past spring I was awarded a SARE grant to research the feasibility of growing organic plugs using different compost media and liquid organic fertilizer. I was looking to answer several questions regarding organic plugs:

Are organic plugs feasible for the small grower?
When should a grower purchase plugs rather than growing their own?
What production methods are needed for quality plugs?
What are the best media and fertilizers for growing plugs?

Conventional growers have known for years that plugs have several advantages over raising numerous seedlings in an open tray and then transplanting them by hand to a larger container. The traditional labor intensive method of transplanting results in considerable mortality from transplant shock or root loss.

Growing with plugs results in less labor and time needed to transplant. Plugs literally pop out of there containers and can be quickly transplanted into a larger container with little or no root loss. Plug seedlings tend to grow more rapidly and uniformly resulting in a shorter crop time. Transplants from plugs are not set back due to transplant shock. All of these advantages lead to increased production for the grower.

There are some disadvantages to growing with plugs too. Plugs are grown in small amounts of soil that results in rapid changes in moisture and temperature. When growing plugs, more attention must be paid to cultural practices and to scheduling. The need for labor may be decreased but the need for mechanization is increased. Producing top quality plugs requires greenhouses that are irrigated and environmentally controlled. Growers need to be knowledgeable about cultural practices and scheduling times.

All in all the pros outweigh the cons for growing transplants from plugs. Since the 1980's most seed germination in conventional agriculture has been done in plug trays. The numbers of annuals grown from seedlings that started as plugs has been increasing yearly.

Should you grow your own plugs from seeds or should you purchase them? There are a number of factors to consider when making this decision. Growing your own plugs provides efficient use of greenhouse space, you can grow the varieties that you want to grow and this adds a measure of self-reliance. You also need to consider whether you can provide the environment and expertise to grow plugs. Do you have a greenhouse that you can heat for the winter? How does the cost of heating and labor compare to the cost of purchasing plugs? How costly is the seed? Do you have the expertise to germinate and grow the varieties that you need? Each grower needs to analyze their own situation to decide what is best for them.

Most of the basics of plug production are the same whether you are growing organically or conventionally. If you decide to grow your own plugs, there are a few good references available that I would recommend, " Plug and Transplant Production," by Roger Styer and David Koranski. This thorough primer is available from Ball Books. ATTRA has an abstract on organic plug production that can be downloaded from their website; www.attra.ncat.org. This abstract has a useful list of references and resources.

In growing plugs, the differences between organic and conventional production come down to the media and fertilizer. Whereas conventional growers use soilless mixes for their plugs, organic growers use various composts blended with peat and vermiculite or perlite. Different types of organic fertilizers or rock powders can also be added to the mix. Mixes can be customized depending upon the needs of the seedlings being grown. There are several good composts available on the market that can be purchased by the bag or in bulk.

In order to test which media and fertilizer worked best, I set up six groups of seventeen trays each for a total of 102 trays. Each set of trays had a different combination of media and fertilizer. Three media and two fertilizers were tested. Fafard Organic Compost, Intervale Germinating Mix and peat with lime and vermiculite were used as the test media. Sea Plus Liquid and Squanto's Secret were the fertilizers chosen for the tests. Liquid fertilizers were chosen based on the need to deliver fertilizer through an irrigation system for quality plug production.

Plug trays are usually 10" wide by 20 inches long. Within this space can be as few as 50 cells or as many as 512 cells that actually hold the seedling. Each seedling has a small amount of soil for its development. Within this small space the growing media must provide nutrition for the seedling, it must have an acceptable level of pH for availability of nutrients and it must provide an environment where roots can grow and function.

The small volume of soil in each plug cell makes the media subject to rapid fluctuations in moisture content, aeration, pH and soluable salts. Producing high quality plugs requires careful monitoring of all these aspects. In additional, physical and chemical properties of the media are important as well. Composts vary in their ability to hold water, their porosity or the size of the particles in the compost and the amount of aeration possible around the particles. The three media tested varied substantially in these properties.

The Fafard organic compost was dark, dense and made up of even sized particles. This compost is formulated to a standard pH of 6.2. The best aspect of the Fafard compost was that it was highly consistent with no foreign matter. Its worst aspect was that it was too dense a mix to use for plugs. The compost also compacted too readily. Vermiculite was added to this compost in order to test it for use in plug production.

The Intervale Germination mix is made up of fairly dark particles of various sizes. This mix is lighter than Fafard and can be used unaltered for plugs. The germinating mix is

produced with a pH of 6.1, well within the range for seedling production. The best aspect of the Intervale mix is that it can be used right out of the bag. The biggest drawback to it is that in some bags you'll find large particles of wood and other debris that are too large for using in plug trays. You may need to screen these large particles out in order to fill smaller cell sizes.

The last media tested was a soilless mix of peat, vermiculite and lime. This mix was the lightest and most porous of the three. Dry organic fertilizers could have been added to this mix but I wanted to use it as a base line to test for the efficacy of the liquid organic fertilizers. The particles in this mix were quite small and allowed for less aeration of the roots but its water holding capacity was quite good. A drawback to this media was that it needed to be mixed and it was difficult to get the media hydrated. The peat is fairly resistant to water.

The two liquid fertilizers tested were Squanto's Secret which is made from liquified fish protein and has a formulation of 2-4-2. Sea-Plus I is made from liquid fish with seaweed and is 3-2-2 (N-P-K). Of the two, the Squanto's Secret worked best with the irrigation system. There was particulate matter in the Sea Plus which would plug the screens as the fertilizer was taken up into the system. This would lead to little or no fertilizer getting through to the plants until the screens were cleaned.

In order to measure our results, germination rates of the test varieties were counted and recorded. Growth rates were noted throughout the test period and samples of the plugs were sent for foliar analysis upon completion of the five week growing period. In addition, the plugs were given to another grower to transplant out and grow to maturity. Field notes were recorded during this period.

It is easy to surmise that the plugs grown in the peat mix had the poorest performance. In both germination and growth rates, the peat plugs were behind the other two groups. The peat plugs also dried out most rapidly. The graph below illustrates germination rates for the three media types. The Intervale Compost had the highest number of plants germinating with the Fafard group having the second highest number.

Of the six groups tested, the Intervale Compost with the Squanto's fertilizer had the highest overall growth rate. This group was closely followed by the Fafard and Squanto's Secret combination. Overall differences in height of the plugs between these two groups at four weeks of age was less than ½". Foliar analysis illustrated that the Fafard group had higher levels of nitrogen, calcium, and phosphorous but less potassium than the Intervale group.

Reports from the finish grower stated that all the test groups combining compost and fertilizer were of equal size and health within two weeks of being transplanted out. This finding led us to believe that regarding overall growth there were not significant differences between the composts and fertilizers chosen for this research. The differences in germination rates were worth considering and the Intervale Compost came out most favorably.

Upon completion of the research it was clear that growing plugs is feasible for any small grower with a greenhouse and adequate knowledge to start the plugs. Each grower needs to examine their own circumstances to determine whether it makes most sense to grow or purchase plugs for their operation. For top quality plugs the grower needs to pay attention to maximizing environmental controls as well as using quality seeds, media and fertilizer. There are significant differences in composts and fertilizers. The ones that were tested were both adequate for seedling growth but like anyone on a quest; I'm still going to search for ones that work better.

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