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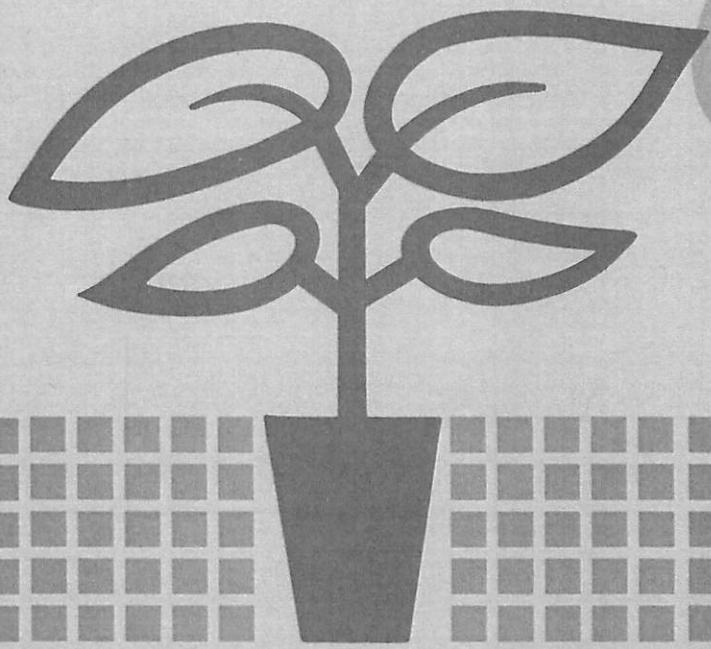

SHIPPING & HANDLING PLUGS

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Shipping and handling plugs is a very important aspect of the entire plug industry because such a large number of plugs are moved from their site of production to their site of use. Everybody knows what quality is, yet no one can define it precisely. Also, we must keep in mind that we have our ideals, or criteria, set for what a high-quality plug is, and this may be rather different from that of the person purchasing the plug. However, in terms of shipping a plug or receiving a plug, one thing that everyone must do is to reconcile between commercial acceptability and perfection. The laws of physics, chemistry, and marketing do not allow us to do some of the things we try to do with plugs. For instance, we often try to ship plugs many miles and get them there in perfect condition, as if they never left the greenhouse. Hopefully, this information will allow us to satisfy the needs of both the producer and the consumer of plugs.

In most cases, about 80% of the postharvest characteristics of a horticultural crop is determined by the grower. Such things as cultivar selection, nutritional regimes, watering practices, stress that's been induced before harvest, and so on, are important here. Therefore, you as plug growers have an important part in the shipping and handling process; it's important that you realize it. If one type of plug doesn't ship well, you should move away from that particular cultivar, because you'd be better off to not ship it than to ship something that is not satisfactory for the consumer.

The procedures that should be followed by the plug producer will vary with the plant species, the distances shipped, the physical facilities of both the producer and the consumer, and proximity to the market. These things are very important, and, in many cases, they must be defined for each type of species and each set of shipping parameters. The point here is that the procedures will vary from species to species, cultivar to cultivar, and so on.

One thing that the grower can do is to harden-off or tone the plants before they're shipped. Usually, this means that we reduce the water and nutrition that the plants receive. Therefore, we tone or harden them up. Some growers apply calcium nitrate or other types of calcium-based fertilizers during the latter stages of the production cycle. Calcium nitrate applications before shipment help increase the firmness, or tone, of the plugs.

Due to the nature of the individual plug, the fact that it is small and has a low soil volume, it will not have much water-holding capacity. In general, it's almost impossible to long-distance-ship a plug tray that has a soil volume smaller than that which we would see in a 406-type plug tray. A 500- or 600-series plug tray is difficult to ship a long distance because there is not enough water in the small soil volume to last the length of time of shipment. Plug trays certainly could not go 24 to 36 hours between waterings in the greenhouse.

If long-distance shipping is to be done, proximity to an airport is a must, so that the plugs can be boxed and remain in that enclosed box for a minimum amount of time. The more rapidly the plugs are moved through the marketing chain, the higher the quality will be for the purchaser.

You should not overwater or overfertilize just before shipping. They are the worst things that can be done to the plugs. In the case of overfertilization, water is lost by evaporation from the soil medium during shipment, and salt buildup occurs. When the boxes are opened after shipment, there is soluble salt damage that was not there before. In addition, plugs should not be overwatered, or even watered just before shipment, because the foliage must have a chance to dry off completely. I would recommend that you thoroughly water approximately 24 hours before shipment. If you do not allow the foliage to dry completely, you run the risk of foliar diseases, and they can be a devastating problem. Vinca plugs, for instance, will lose almost all of their foliage if they are shipped wet. The best thing that you can do is to pull all the orders into a shipping and handling area the day before shipment, do the final watering there, and get them completely ready for shipment. Then, immediately before shipment, box them and load them so that they are ready to go to the airport. Be sure to minimize the time period that the plugs remain in the box during or after shipment, because the quality of the plugs will decrease over time. The most notorious culprit for this is seed geraniums. Even one day in a box is bad for them, and they will lose their foliage rapidly.

Do not use poor-quality boxes and do not overload the shipping box. If you use a poor-quality box, there is a good chance that it will break or be damaged during shipping because it will be subject to rough handling. The value of the plugs you have in the box is so high that it warrants using a good, strong box for shipment.

Try to avoid temperature extremes. If we had to choose an ideal temperature range during shipping, it probably would be 45°F to 85°F. However, both of us know that the chances of maintaining that range are small. When

the plugs are at low temperatures, we increase the chances of, or make the plugs susceptible to, chilling injury and/or freezing injury. On the other hand, temperatures that are high will cause heat stress and water loss problems. Again, remember that the plug has a small soil volume in relation to the size of the shoot. The leaves will lose a lot of water through transpiration, and, because the soil does not have much water-holding capacity, it will dry out quickly and cause problems with desiccation. Heat stress should be avoided because it damages the tender plugs, and, many times, the plug will not overcome the results of this stress.

Do not ship if the weather is going to be bad. You should call the person who is to receive the plugs and tell them that there is several inches of snow on the ground. Do not try to force shipment, thinking that the plane is going to get off the runway anyway and everything is going to be fine. Call the person to whom you're selling the plugs, or shipping them to, and tell them that you will ship them in a day or so, when the weather conditions are better. All you are doing is asking for trouble if you try to ship during poor weather conditions.

Some growers have been using double boxes for shipping, and the reason for this is that double boxes can tolerate freezing temperatures for a longer period of time. I'm sure that almost everybody here has lost boxes or flats of plugs because they have been frozen during the transport process. Generally, a double box gives the shipper an extra hour or two of below-freezing temperatures, and sometimes that safety factor of one to two hours can prevent a disaster. Now, if the delivery person sets it down onto the stoop of your greenhouse on Friday after everybody has left, it's not going to be alive on Monday. Nothing will help it then! The point here is that, if there is some inadvertant error in shipping or if there is an inadvertant stop along the line, the double box will give the plugs a better chance of surviving. For similar reasons, a number of growers are using Styrofoam boxes. These boxes give better temperature evenness throughout the box during shipping. The use of Styrofoam boxes is responsible for the shipment of certain types of geranium cuttings into the United States. Before these boxes were used, when they were trying to ship with cardboard boxes, the temperature got so high inside the box that it caused tremendous problems with the quality of the cuttings. Once it was realized that a high temperature and rampant temperature fluctuations existed, Styrofoam boxes were adopted, and the problem was solved. Lining the boxes with small, thin sheets of insulating material, newspapers, or cardboard also

can reduce the temperature and temperature fluctuations.

I do not have any hard and fast information here, but the use of ventilated boxes should be researched by you and/or people at research institutions. I think that ventilation holes could provide for the movement of air through the boxes, and this should lead to better handling and storage characteristics of the plugs. We know that, for most fruits and vegetables, ventilation, not with large holes but small holes, provides enough air exchanges that an increased quality of the commodity is obtained.

The relative humidity in the box should be at least 80% during shipment, and the optimum is in the range of 90 to 95%. A relative humidity of more than 95% can cause serious disease problems for most crops.

Plugs are fragile, and you should exercise care in handling them. If you or someone else dropped a flat of plugs on the floor, how could you expect the plants to live? A good correlation would be that if a plug is about 2 inches high and you dropped it from 30 inches, it would be like you falling from about an 8-story building onto concrete. What would be your chances of surviving if that happened? Well, the chances of a plug surviving a drop from 30 inches to the floor also are not very high.

If you do your shipping through UPS, the U.S. Postal Service, Federal Express, or Purolator Courier, educate, or re-educate, them that you are shipping live plants and that they shouldn't just drop them on somebody's doorstep if they don't get an answer. Education of your shippers can save you many dollars in the long-run, simply because these people are able to handle the plants correctly. It's not that they're trying to kill your plugs; it's just that they don't know how to handle them. Proper preparation for shipping and handling does result in cleaner healthier plants and faster shipping of the materials. Subsequently, this will lead to happier customers and more plugs will be sold.

Finally, I think you should make a point of telling your customers that, when they receive a shipment, they should open it immediately and inspect it. Tell them they should not place it in the cooler until tomorrow, because it's 5:00 and they want to get home. Have them open the box, inspect it, and make sure that the plants have not been ruined during shipment. They also should ventilate it, apply water if necessary, and, in many cases, acclimatize the plants. Again, some research needs to be done on acclimatization, because certain plant species can be transplanted directly into cell-packs, whereas others must be acclimatized one, two, or three days before transplanting. It is important that you know the handling characteristics of each type of plug you sell

and that you relay that information to your consumer. Several growers have stated that they acclimatize both pansies and impatiens before transplanting into cell-packs, because the transition from an environment for hardening-off the plants to one inducing lush growth often is very hard on the plugs.

TRANSPORTATION ASPECTS OF PLUGS

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The transportation of floral products to, from, and within North America involves many types of organizations from the fully integrated trucking companies dedicated entirely to this industry to the part-time workers looking to fill niches using rental trucks. Data presented in Table 1 attempts to at least partially characterize this transportation industry. It goes without saying that the higher valued crops, such as plugs, can theoretically "afford" higher transportation charges. Hence, growers, brokers, and receivers of plugs should be aware of the many types of transportation avenues available to them which could possibly serve their needs. Such transportation systems should provide timely and reliable services, protect plugs from adverse environmental conditions, and do the above at a reasonable cost. Two such systems will now be briefly discussed.

Over-night delivery companies

All of us have learned to become familiar with such companies as UPS, Federal Express, Purolator, Emery, and Airborne. All of them offer door-to-door, next-day deliveries within most of the U.S. and with various levels of service outside of the U.S. From a size and weight standpoint, all plug shipping cartons would meet their requirements as far as this author knows. And, most would agree that they are generally reliable and provide timely services. But, what about environmental protection and costs?

None of these companies have focused any national attention on the transportation of perishables such as plugs. Hence, it is the sole responsibility of the companies in the floral industry to provide "insurances" by implementing procedures to minimize any high or low temperature-induced damages as well as to help protect against physical abuse damages. One not only has to consider the quality (i.e., insulation characteristics) and size of the shipping carton, but be aware of the weather conditions any given day along the entire shipping route. Also, it is suggested *never* to accept any service other than next-day delivery; regardless of the seemingly good price advantages offered as often such "savings" are paid later in the form of claims. Instead, focus your attention on trying to take advantage of the various volume and/or destination discounts that are available which can in turn reduce transportation charges by nearly 50% when compared to published prices.

Mid-West distribution system

Nearly three years ago, the U.S. and Canadian floral industries began to hear about a so-called St. Louis-based distribution center for the transportation of perishables including floral products such as plugs. Please be advised that such a system is still being developed, but has not yet reached an operational level. If and when such a system becomes a reality, then next-day services will be provided throughout much of the U.S. using solely surface (truck) equipment having temperature protection capabilities. However, at this point in time the possibility of such a system becoming a reality cannot be estimated other than it would start in 1987 if it is to start at all.

In conclusion, this author finds it difficult to even define a plug in terms of size (plant and/or container), function, economic value, and/or plant growth characteristics among other factors. However, regardless of any possible confusion in defining this industry, from a transportation point-of-view, it would be highly desirable to standardize the shipping carton as much as possible so as to avoid all of the present frustrations continually facing the potted plant and cut-flower transportation industries.

Table 1. Estimated volume and wholesale density value of some floral products transported in the United States, 1985

Product type	Truck loads/year[z]	Density value ($/ft^3)
Cut flowers	29,125	5.29 - 20.59
Flowering plants	47,690	3.64 - 4.85
Foliage plants	35,230	4.41 - 8.09
Bedding plants	33,400	2.98 - 3.68
Cut greens	7,950	5.62 - 10.55
Cuttings	na[y]	22.05 - 132.35
Prefinished plants	na	6.43 - 7.85
Plugs	na	36.67 - 80.05

[z]One truck load = about 2450 ft^3. Values reflect all products regardless if transported for any distance.

[y]na = not available.

FORECASTING PLUG GROWTH

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Forecasting developments in the plug industry can be hazardous to your health, especially if you expect to be around come time of due date. New technology can dramatically alter our mode of operation. We can expect to look back on the eighties someday with the same questioning eye much as one reviews the seventies today with a very critical eye.

I find that an audience was much more understanding of a professor going off the deep end in forecasting than someone from industry taking a look at the future. Regardless of that observation, change will occur and have rather dramatic impact on our industry.

Change, while having great impact on an industry, can come rather quickly; or more often, take a fairly long period of time before its full impact is realized by an industry. We do tend to adopt new varieties and chemicals such as pesticides in a fairly short period of time. The test results become known almost overnight. Growers are receptive to a new fungicide for control of a root rot or a new petunia variety.

Some truly significant developments have taken years and years to become common place in this industry. Recall the spread in time from introduction to adoption for the following:

a. artificial soil mixes;
b. plastic pots;
c. 4-color labels;
d. market packs.

The best example would be the topic at hand. Plug trays appeared on the scene back in the late sixties and early seventies. The first seeder goes back almost that far. Growers, while fascinated with the plug, really did not adopt the concept in large numbers until the early eighties.

Looking ahead to the end of the eighties and possibly early nineties presents very little challenge to the forecaster. Simply look long and hard at what is being done today by these individuals who are on the "cutting edge." What may appear a little far out will become common practice in the next five years.

A marketing textbook would identify four stages of a product or industry life cycle. Typically, one goes through a long introductory period followed by rapid growth. The product enters a mature phase before disappearing from the scene.