NEW CONCEPTS IN POT CULTURE IN PERENNIALS

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Last year Dr. John Mahlstede of Iowa State College carried out a research project for the National Mail Order Nurserymen's Association on the shipping and livability of hardy perennial plants. Perennials of several varieties were purchased from 20 mail order nurseries, without their being aware that the plants were being tested Differences in shipping methods, the type of plants sent, and the livability of the material when planted under ordinary conditions, were all carefully studied and compared One of the rather unexpected highlights of the test was a disclosure that potted plants almost invariably shipped better and had a higher survival than dormant bare-root plants, no matter how such plants were stored, packed or shipped. These weren't exactly joyful tidings as far as the mail order industry was concerned, for potted plants cost more to grow, more to pack and more to ship, than dormant bare-root material. But in this age in competition, the ultimate factor that determines who stays in business, and who doesn't, is customer satisfaction. The mail order nurseryman isn't the only member of the trade who should profit by these particular research findings. Anyone in any wholesale or retail segment of the nursery trade, who produces and ships hardy perennials could well look to his own house. The same findings will also probably apply in his case.

Now the potting of perennials isn't a new idea born in this age of rockets and sputniks. Various types of perennial plants have probably been potted ever since the invention of the potter's wheel. In comparitively recent times, three firms in the United States have made clay pots continuously for over 100 years. Whether they are all in business at this time, I do not know — they were or are — A. H. Hughes & Co., J. M. Thorburn Company and D. Landreth and Co. Prior to 1864, common flower pots throughout the world, had always been made by hand on the potter's wheel, which was propelled by foot or hand power. William Linton of Baltimore, Maryland, perfected and patented the first flower pot-making machine about 1865. Since that time steady improvement has been made in the preparation of the clay and the manufacture of the pot. Today, we have available throughout the country, a smooth, well-made clay pot, in a complete line of standard sizes.

In the matter of the production of potted hardy perennials for mail order sales, however, clay pots have distinct disadvantages and limitations. One, they are heavy and the handling of large numbers of them entails continued movement of a great deal of weight in pot alone. Two, they break easily and must be handled with a great deal of care. Three, because they are porous they are a haven for nematodes and the spores and bacteria of many plant diseases. Four, because of this same porosity, they are very difficult to sterilize, expensive steam sterilization under pressure being about the most satisfactory method. Five, because of the necessary thickness of the pot walls, the pots themselves take up a very great deal of bench, frame, or bed space. Six, plants

cannot be shipped in the clay pot that they are grown in because of the weight and fragility of the pots. Plants grown in clay pots, must be knocked out, wrapped in paper, or reset in paper shipping pots before boxing for shipping. This entails a considerable expense in time and money, and in addition, is apt to loosen many of the pot balls, so that the customer is very likely to receive a bare root plant and a handful of lose loam.

Before proceeding further with this talk, I would like to make one necessary differentiation. The subject assigned to me is "New Concepts in Pot Culture of Hardy Perennials." This talk, therefore, will deal entirely with perennials grown in pots, as differentiated from perennials grown in what is generally known as a container. For present purposes, we will define a container as being 6 inches or larger, made of tar paper, such as Cloverset pots, and Mennipots, or metal containers of one sort or another

I doubt there are many firms that ship all, or even any large percentage of their hardy perennial production, either wholesale or retail, in or knocked out of pots, because of the difficulties already mentioned, plus the added expense of the weight of the soil in the pot balls. In our own firm, the shipping of potted perennials in volume really began quite a few years ago when we decided that small potted chrysanthemums from softwood cuttings, or stolon pieces, gave far better results in the hands of the customers than over-wintered, field grown plants. Also, it was no easy trick to succesfully over-winter field grown chryanthemums in storage in those days when we had little in the way of refrigeration.

As is true of any procedure, there were some objectionable features to growing and shipping potted chrysanthemums, and we started at once to try to overcome them There were the previously mentioned difficulties caused by the use of clay pots, plus the added cost of handling and postage caused by the weight of the potting loam We learned that during the second World War, the Army had developed the use of ground sphagnum moss as a light weight potting medium, in order to fly large quantities of experimental plants in airplanes. We began potting chrysanthemum rooted cuttings, or rooted stolon pieces in a sphagnum moss potting medium fertilized as needed with liquid fertilizer, with very satisfactory growth results. The plants grew as well, or better than in ordinary potting compost, and the pot ball weighed about 1/5 as much. It was at this point that we experienced a new difficuty, however, in that many of the plants when wrapped and packed, reached the customer in a rotted condition, seeming to rot at the base of the plant, and in the section in the moss. From Dick Fillmore, who was at the Arnold Arboretum at the time, and who was growing test plants in a moss medium for shipping to other research centers throughout the world, we learned the source of our trouble. We do not fully understand the processes, but it seems that when the entirely organic sphagnum moss in the pot ball is entirely enclosed in a shipping container, heat is generated, and anaerobic bacteria multipy and cause deterioration of the soft plant stems in short order. Mr. Fillmore suggested the addition of finely ground styrofoam to the potting medium of about ¼

volume. These inert plastic particles would separate the ground sphagnum moss particles and prevent the trouble that we were having. It worked, and we have used a mixture of ¼ fine ground styrofoam and ¾ ground sphagnum moss for small pots and soft stemmed plants ever since.

The next problem we tackled was the pot itself. We not only wanted a pot in which we could grow and ship chrysanthemums, but we wanted that same pot for general all-purpose use, and re-use. We wanted a cheap, and thus expendable, light weight pot that could be easily sterilized, and re-used if desired, which would take up less space in the bench than a clay pot, and which would provide proper aeration and moisture drainage to produce plant growth as good or better than a clay pot. That was a large order At that time, we were growing in a 2″ clay rose pot. We knocked the plants out of them, dropped the plant balls into Neponset shipping pots, and wrapped the plants in waxed paper for shipping. It seemed to us this method was unnecessarily slow and expensive., The practical solution seemed to be to grow and ship in the same pot.

About this time many new type pots were coming on the market, and we tried all of them — aluminum, plastic, compressed pulp, compressed peat, dehydrated compressed cow manure, tar paper, Dixie cup types and heartwood bands. As soon as a new pot came out we bought a sample lot and started testing. We have tested better than 25 different types of pots. None of them would fulfill all of our requirements. From most of the pots we could not get the growth that we could with clay pots. Others were too thick and clumsy. Many of the compressed pulp, peat and cow manure pots eventually absorbed water and became too heavy, or disintegrated before we were ready to ship. In addition, we found the cost too high with some, many of them could not be sterilized and reused, and some that apparently should be the perfect answer to our problem, would not produce plant growth that would begin to compare with that of a clay pot. We finally narrowed down to plastic and aluminum, as it seemed that one of these materials ought to provide the pot that we were seeking. Plants would not grow well, however, for any length of time, in either aluminum or plastic 2″ rose pots. Finally, we decided it might be a matter of aeration, and cut a series of slits in a quantity of aluminum and a quantity of plastic 2″ rose pots The aluminum pots never did quite make the grade, and we suspect some toxicity from the metal. The ventilated plastic pots, however, produced plant growth as good as that of a clay pot, or better, had less moisture loss from the potting media, yet lost excess water quicker, and fulfilled all the requirements previously enumerated. We now grow practically every plant we pot in this ventilated pot, including a full line of house plants, and our softwood cutting deciduous liners. We have over a million in use at the present moment and would not trade them for any pot on the market.

We still were bothered with the bottom leaves of the potted chrysanthemums turning brown and dropping off in shipping before they reached the customers. Through research done for a sponsoring group of Iowa Nurserymen by Dr. John Mahlstede of Iowa State College, we

learned that we should not use waxed paper to wrap the plants, but that the proper material to use was polyethylene film. We also learned that polyethylene film should not be wrapped around the chrysanthemum plant itself in shipping in moderately warm to warm weather. We now drop our plants growing in a sphagnum and styrofoam potting media in a ventilated plastic pot, into a polyethylene boot, which just encloses the pot and the pot ball. We snap a rubber band about the boot to close it over the top of the pot,and thus the chrysanthemum plant itself is open, and the pot and pot ball are enclosed in a polyethylene container to retain the moisture in the pot ball.

We next tackled the label problem You know the trouble connected with trying to label pot plants and keep the labels where they belong as well as I do. If you stick labels into the soil in the pot, they get knocked out. Often you can't attach them to freshly potted stock because the plants are too small, or there is no place to hook or tie them. If you wait until you ship the plants to label them, you have to stick the labels somewhere in the package, or tie it on some place. Labels often get lost, plants get mixed up, and there seems to be no safe way out of the mess. It seemed to us that where we had our plants growing in the same pots in which they were going to be shipped to the customer, we ought to be able to label the pot somehow. We finally hit upon the idea of printing the plant names, continuously, on rolls of paper-backed adhesive tape. By spacing the printing properly, and using a good tape dispenser, we were able to chop labels off a roll of tape as fast as we could use them. Due to the fact that the pots are plastic, and no moisture can get behind the tape, it sticks to the pot indefinitely. As it works now, if we are potting 1000 plants of a variety, we stick labels on 1000 pots before we start potting. That method has several advantages When all the labeled pots are used, we know without further counting that we have 1000 plants potted. Also, from the moment that the plant goes into that pot, there is absolutely no possibility of further confusion regarding the variety of the plant. It is permanently labeled. Of course, if you have a heavy loss of potted plants, you automatically lose the labels too, but we think that such losses are entirely over-weighed by the many advantages of the system. Now if any of our plants are not true to name, we know that the mixup had to occur prior to the potting, and there is far less chance of that than there is ordinarily, of mixups after potting.

One thing still bothered us and that was the fertilization of our potted material. We used to fertilize upon potting and then repeat in a hit or miss fashion as the plants began to look hungry. Finally, we bought a Solubridge Electronic Soil Testing apparatus, *and it is one* of the best purchases we ever made. As we began to use it, we immediately realized that without some such device, it is impossible to properly feed plants We found that in waiting as we had before, until the plants *looked hungry*, we were waiting far too long and it took the plants a long time to regain their vitality, after the periods of starvation that were being imposed upon them. We also found that if you fertilized regularly with no information as to what is going on inside the pots, often in cold, cloudy weather, dangerous build-ups of nitro-

gen, can occur. We found that in 2″ rose pots, where either compost or sphagnum is used, that most of the available nutrients are leached out in three waterings. We now soil test everything regularly and fertilize accordingly.

It seemed as though there ought to be some sort of a delayed action, slowly available fertilizer, that would cut down the need for frequent fertilizings, and therefore, cut costs. When Uramite and Borden's 38 came out, we immediately tried them. We have a test lot of plants fertilized with Uramite started May 1, 1957. These plants showed 25-30 PPM available nitrogen (Spurway system) when we started, and still show 25-30 PPM. Our tests with Borden's 38 have not been underway as long but also continuously show 25-30 PPM. We think this is the answer to our fertilizer problem, and if so, it will tremendously lower our fertilizer and labor costs. As with any other operation, this method of fertilizing is not perfect, nor entirely safe. In our opinion, without a good soil testing unit, used regularly, this slowly available fertilizer can be extremely dangerous to the plants, as some users have already found out. I recall that after our trials with one of these fertilizers had been under way for a couple of months, and progressing very satisfactorily, the available nitrogen content in the pots suddenly shot up to the danger point. We immediately watered the pots heavily, and leached out the available nitrogen. That is when we learned what could happen in cold, cloudy weather with these slowly available fertilizers, and that, when using such compounds, you must be particularly careful in your soil testing during such weather conditions. We also learned that a particularly dangerous situation will arise during cold cloudy weather, if there is an unbalanced nutrient relationship in the potting media, particularly if the media gets low in potash.

After we thought that we were pretty well along with our chrysanthemums, we began to grow the Hardy Aster varieties the same way, and were equally successful with them. We also grew *Artemesia* Silver King, *Helianthus* Loddon Gold, and *Heuchera* varieties by this method It is our belief that we can eventually expand this method of growing perennials to include most of those we list.

We have often been asked if growing plants in sphagnum moss caused any trouble after the plants are planted in the field. I have often gone up and down rows of chrysanthemums in which part of the plants were from sales stock grown in sphagnum moss, and part were grown in flats of loam for planting, and were cut out in squares and planted along with the potted material, and I have yet to be able to tell which plant had been grown in the sphagnum medium and which had been grown in the loam. A plant that is seriously pot-bound in a sphagnum medium will react the same way as a plant that is seriously pot-bound in loam when knocked out of the pot and planted directly into the field. Unless the roots are torn up somewhat, and are spread out a bit, the plant is going to have a troublesome time growing, and always will have a ball of roots at its center.

According to our cost accounting figures, our growing, processing and shipping costs for field grown perennials shipped dormant and bare root, break down as follows: (1) Growing in the field — 44.80% of

the total growing and shipping cost, not including postage. This includes: propagation stock, payroll, depreciation of trucks and equipment, maintenance and repairs of trucks and equipment, employee insurance, payroll and property tax, rent of land, water, light and power, fuel, truck and tractor operating expense, and truck licenses. (2) Processing expense — 36.59% of total cost of production and shipping, not including postage. Processing expenses are the preparation of plants for shipping, and the storing of material until needed for shipping. They include: payroll, processing supplies, maintenance and repair of equipment, employee insurance, payroll and property tax, rent, water, light and fuel. (3) Shipping costs — 18.56% of total production and shipping costs, not including postage. Shipping costs include: payroll, shipping supplies, maintenance and repairing of equipment, employee insurance, payroll of property taxes, light and fuel.

In all probability, hardy perennials cannot be grown as cheaply as potted plants, as they can be in the open field. We do not have a cost breakdown on the pot perennial plant phase of our business, but perhaps the difference in cost between pot grown and field grown perennials may not be so different when you stop to consider that the processing of a dormant perennial costs almost as much as the growing of it. There is very little processing cost of a potted perennial. Shipping costs, of course, would be considerably higher. On the other hand, the more favorable appearance of the potted plants when received by the customer, and the increased livability, have a considerable value, it seems to me. I believe a very sizeable hike could be made in the price of ordinary perennials potted against dormant stock and the customer would willingly pay the difference. Such an increase would no doubt cover the increased cost of production and shipping, and also increase the profit per plant.

PRESIDENT VANDERBROOK: Thank you very much, George, for a very informative discussion I am sure all of us here are somewhat amazed at the strides that have been made in growing and packaging plants for dissemination and shipment.

As we are running very short on time, we will only allow five or ten minutes for questions. So if you have specific questions for either one of the panelists, please present them now.

MR. BELDON SAUR (Rocknoll Nurseries, Morrow, Ohio): Mr. Rose, are your plastic pots available in any sizes other than two inches?

MR. ROSE: No, they are not. Making a mould costs about $5,000 and you don't make many at that price. Eventually, we hope to make a three inch one.

MR. GEORGE BLYTH: Last year we found some roots coming out of the slits in the sides of the plastic pots. Did you experience anything like that?

MR. ROSE: Yes, but we haven't found that it hurt us much. May I say that I am not selling pots since we developed them primarily for our own use.

MR. BLYTH: When we shipped chrysanthemums this year the plants all came out of the pot by the time they got to the customers and as a result we had an awful lot of complaints.

MR. ROSE: Did you enclose the chrysanthemums in anything?

MR. BLYTH' Yes, we wrapped the root ball in plastic bags. When we took the plant out of the bed I think likely they cut the roots, which was the main part of the trouble. Some of the pots that were packed good and tight were better than the ones that weren't packed so tight. Do you pack the pots good and full with moss?

MR. ROSE. Yes, we do. These pots are extremely thin since we want them that way for lightness and cheapness. There is one danger when you turn a potter loose with the plastic pot who is used to the clay type. He will break many before he finally develops the touch. Since then we have found, and I imagine you have also, that you do not have to pound the plant in there like you were making a brick You aren't doing that. You are trying to pot a plant. If you will pot it gently, the way you should, you won't get any breakage at all. We do not pound the medium.

MR. BLYTH: How do you handle your shrub cuttings?

MR. ROSE: In the greenhouse bench we use only about a quarter inch of sand on which to place our pots containing the rooted cuttings. Actually, you don't have to use anything since they do not lose enough moisture. For deciduous shrub cuttings which were rooted under mist and then potted, we put them into outdoor frames and work sand in all around them for winter protection. They are entirely submerged in sand up to the top of the pot from late fall until the time they are taken out.

MR. HOOGENDOORN (Hoogendoorn Nurseries, Newport, RI): Does that retain the moisture so that they can go all winter without watering?

MR. ROSE: Yes. They are out in frames and they freeze up. No watering is needed

MR. HOOGENDOORN: I would like to ask Mr. Fisher, how he handles *Helleborus*?

MR. FISHER: We do not have *Helleborus* as such, but as I stated, one fellow in our area who grows a considerable quantity of the plants puts the seed in flats of chopped sphagnum moss, holds them in his deep cold house for two or three months and then brings them inside. He seems to have no trouble.

MR. ROGER SHERMAN (Elsberry, Missouri): Mr. Rose brought out his technique for labeling potted perennials. I am interested in knowing how Mr. Jones is labeling damp, band packs.

MR. JONES: Ordinarily for the fellow who sells them at retail level we have devised lithograph colored, waterproof, wedge-shaped paper labels. You do have the problem Mr. Rose spoke about, in that those labels could be misplaced.

PRESIDENT VANDERBROOK· Sorry, gentlemen, I have to interrupt the question period. Our time is at such a premium we will have to proceed with the next presentations I would like to have Mr. Bill Cole come forward and take charge of the next panel.

Mr. William D. Cole, The Cole Nursery Company, Painesville, Ohio, took the chair.

MODERATOR COLE Our first talk is by Dr. L J. Enright, Department of Horticulture, University of Maryland, on "Vegetative Propagation of *Mahonia Bealei*." Dr. Enright!

Dr. Enright presented his paper. (Applause)

VEGETATIVE PROPAGATION OF MAHONIA BEALEI

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Although *Mahonia bealei* can be propagated by softwood cuttings under glass, the percentage of success, the time required for rooting and the short period during which cuttings can be taken, have helped to place this plant on the long list of "difficult" woody ornamentals. The variability of seedlings also adds to the need for a propagation method which would produce strong rooted cuttings in a short period of time. Investigations at the University of Maryland have led to interesting responses by a number of woody plants during the past two years. Because it has been possible to stimulate roots on plants heretofore considered almost too difficult to propagate commercially, it was decided to try several of the techniques and methods on the Leatherleaf mahonia.

Cuttings were taken from mature plants and cut to a length of eight inches. In an earlier test it was discovered that all root development on this plant originated at a node For this reason, the treated cuttings were wounded at a node, immediately below a node, for one and one half inches below a node, and over an area which included a node and the area one and one half inches below it The original plan was to slice a thin portion of the bark to induce a wound but the material was so resistant to such treatment that abrasion with a coarse sandpaper block was used for the wounding treatment.

Several chemical root stimulants were used in the investigation but root initiation was brought about only by action of concentrated solutions of indolebutyric acid and water Solutions of 5,000 parts per million, 10,000 parts per million, and 20,000 parts per million indolebutyric acid were used as ten second dips of the basal portions of the cuttings After treatment, the cuttings were placed in a sand filled greenhouse bench under a system of intermittent mist. One hundred cuttings were used in each treatment of this investigation. Cuttings were taken on June 15, July 6 and August 10.

Of the cuttings made in June, none rooted in the check or the 5,000 parts per million IBA treatment In a period of 59 days 70% of those treated with 10,000 parts per million IBA and 97% of those treated with 20,000 parts per million IBA were rooted. Those taken on July 6 did not root in the check, while 2% rooted in the 5,000 parts per million IBA treatment, 74% rooted with 10,000 parts per million IBA, and 100% rooted with 20,000 parts per million IBA treatments. These rooted in 51 days. The cuttings taken in August responded in a similar manner in a period of 52 days. Treated with 5,000 parts per million