ing. Why apply a certain fungicide to a pathogen, for example, some of our water molds, that can be killed only by heat? Fungicides, insecticides and other chemicals could be used to correct temporary problems which may still arise. It would seem, though, to be of doubtful value to use repeated applications of chemicals merely to hold down a condition of *Phytophthora*, only to grow plants dependent on the chemical for survival. Such a practice would seem to have merit mainly on plants sold for a short-lived use, on cut flowers, on food plants, or on rare plants or those in short supply needed for propagating stock.

THE FUTURE

In the future, we may look forward to improving sanitation through the principle of inoculation, such as have been used on humans by vaccination for many years. Dr. Kenneth F. Baker, of the University of California, Berkeley, has been working on this principle in Australia during this past year.

The future holds much promise for our industry. We have just begun to scratch the surface. The key to our future success lies in research. Let us as teacher, student, research scientist, and nurserymen continue to put basic and applied research together to unlock the potential of the now still unknown.

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CHARLES HESS: Bruce, thank you very much for a very inspiring talk. Our next speaker is Mr. J. D. Murphy from the University of Illinois and he is going to talk to us about direct rooting media.

COMPARISONS OF VARIOUS INDIVIDUAL MEDIA FOR DIRECT ROOTING OF CUTTINGS

JAMES D. MURPHY, JR., J. B. GARTNER AND M. M. MEYER[1]
Department of Horticulture
University of Illinois
Urbana-Champaign, Illinois

The vegetative propagation of ornamental plants presents many problems. Some problems result from the number of times cuttings must be handled. They must be taken, made up, and stuck into a rooting medium. After the cuttings have rooted, they must then be removed from the rooting medium,

[1]Research Assistant, Professor and Assistant Professor, respectively, Division of Ornamental Horticulture, University of Illinois, Urbana, Illinois 61801.

potted into a growing medium or packed for shipping. This process requires several handling steps which results in high labor costs. When cuttings are removed from the medium, roots have a tendency to become desiccated and break. This delays establishment of the cutting.

These problems may be overcome by using small units or pots filled with a propagating medium in which cuttings can be rooted, grown, or shipped without removal from the rooting medium. This process saves labor and cuttings may grow better than those removed from the rooting medium because chances for root desiccation, breakage, and infection are reduced. Several individual, direct-rooting media have been developed for use with ornamental plants. Examples of these media are Jiffy-7's, BR-8's, Jiffy Pots, and a recent introduction to this group, Quickee Sure Start. Jiffy-7's and Jiffy Pots are made of peat and the BR-8's are a polymerized kraft wood pulp. Quickee Sure Start[2] is a specially processed, expanded, phenol-formaldehyde plastic foam similar to the material which is used for holding cut flowers in containers. The foam is light in weight, strong, easily handled, sterile and ready for immediate use. It retains moisture satisfactorily and holds its shape very well when either wet or dry. It is very simple to cut into cubes of the desired sizes, and cuttings are easily inserted without the necessity of preformed holes.

The ideal propagation medium should be sterile, durable, well-aerated, and capable of retaining adequate moisture and of holding the cuttings in the proper orientation. The cuttings should grow normally for a short time after rooting in an ideal medium. Individual direct-rooting media, in addition to these characteristics, should be suitable for moving or shipping.

Each individual direct-rooting medium has advantages and disadvantages. The roots do not uniformly penetrate some media in all directions and thus produce a layering effect on rooting. Others are heavy and increase shipping costs. Certain media lack durability and break apart easily when handled. Some media require considerable time to fully soak up water. Growers often experience basal rot of cuttings in media that hold too much moisture due to an improper air-to-water relationship.

Since there have been several individual-unit propagation media developed, experiments were conducted to compare the rooting of several ornamentals in the various media. The following individual-unit propagation media were tested.

BR-8's	Acrylonitrile polymerized wood pulp molded into cakes of 12 units each.
Jiffy-7's	Compressed pellets of peat which expand when saturated with water.
Jiffy Pots	Pots made of peat filled with a 1:1:2 mixture of soil, peat and perlite.

[2]Trade name of a phenol-formaldehyde foam distributed by Floralife, Inc., 4420 South Tripp Avenue, Chicago, Illinois 60632.

Quickee Sure-Start — A phenol-formaldehyde foam cut into the following cube sizes: 2¼″, 2″, 1¾″, and 1½″.

The foam cubes and BR-8's were soaked in a pan of water until saturated. The Jiffy-7's and Jiffy Pots were placed in flats and moistened by sprinkling. No additional fertilizer was added to any of the media used.

The following plant materials were used in the studies: *Poinsettia pulcherrina* Willd. 'Eckespoint C-1' and 'Paul Mikkelsen' *Chrysanthemum morifolium* Ramat. 'Golden Yellow Princess Anne', *Weigela florida* A. DC., Red-osier dogwood (*Cornus stolonifera* Michx.), Tartarian honeysuckle (*Lonicera tartarica* L.) and *Spiraea nipponica* Maxim.

The stems of the herbaceous poinsettia and chrysanthemum cuttings were dusted with Hormodin No. 1 rooting compound. The stems of the semi-hardwood woody ornamental cuttings were momentarily immersed in 1000 ppm 3-indolebutyric acid (IBA) in a 50:50 ethanol-water solution before being inserted into the various media. The individual units were then placed on steam-sterilized benches containing sharp sand. Cuttings were also rooted in the sand of the same bench. Mist was applied 5 seconds every minute during daylight hours for the first week. Then it was reduced to 5 seconds every 2 minutes until root initiation. Rooted cuttings were hardened off by misting 5 seconds every 15 minutes.

The degree of rooting was determined after roots had penetrated to the surface of the individual propagation media. Since the root system was difficult to remove from the Jiffy-7's, BR-8's and Sure Start media, the scale used to determine the extent of rooting was: *rooted, callused, unrooted* or *dead. Rooted* cuttings had roots penetrating the rooting medium or, in the case of sand, showed good root formation. *Callused* cuttings had developed callus tissue, but showed no rooting. *Dead* cuttings had lost their foliage and had black and rotted stems.

The effects of the rooting media on subsequent growth of the rooted cuttings was studied. Some of the cuttings were potted into a 1:1:1 mixture of soil, peat, and perlite. These were grown under long days (incandescent light supplied from 10:00 p.m. to 2:00 a.m.) to keep the cuttings in a vegetative state. The plants were measured after growing for several weeks.

The herbaceous cuttings rooted well in all the media tested and no visible differences were observed in rooting. The rooting observed with poinsettia cuttings is shown in Figure 1. These rooted cuttings were potted and grown to finished plants. There was little difference in their quality.

The influence of the various rooting media on the subsequent terminal growth of chrysanthemum is shown in Table 1. Cuttings rooted in Jiffy-7's, Jiffy Pots and foam cubes grew significantly better than cuttings rooted in sand or BR-8's. Cuttings rooted in Jiffy Pots grew significantly better than any of the others, but this may have been due to nutrients contain-

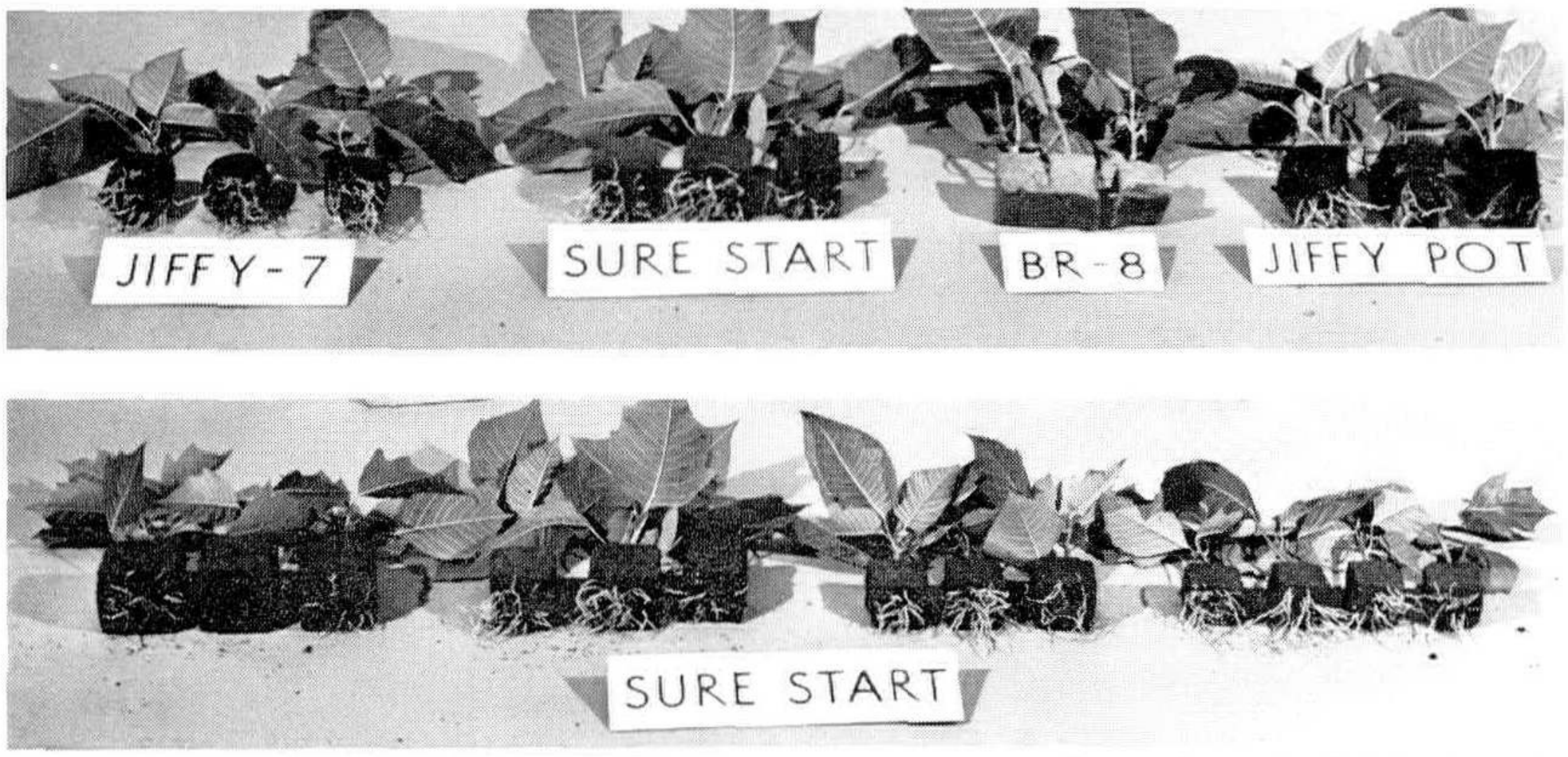

Fig. 1. Rooting of 'Paul Mikkelsen' poinsettia cuttings in various individual units media. *Top row*: Rooting in Jiffy-7s, Sure Start, BR-8 blocks, and Jiffy Pots. *Bottom row*: Rooting in various sizes of Sure Start foam — 2¼", 2", 1¾" and 1½"

ed in the soil, peat, perlite medium used to fill the Jiffy Pots.

Weigela cuttings, like the herbaceous cuttings, rooted well in all the media tested. The influence of the various rooting media on the vegetative growth after potting of weigela cuttings is shown in Table 1. It is evident that cuttings rooted in the foam material, Sure Start, grew better than any of the others. However, only the difference between cuttings in foam and Jiffy Pots is statistically significant.

Table 1. The influence of various individual unit propagation media on the terminal growth of chrysanthemum and weigela. Growth measured after three weeks under long days.

Plant	BR-8	Jiffy-7	Jiffy Pots	Start Sure	Sand	LSD at 5% level
			Length (cm)			
Chrysanthemum	9.88	12.27	14.16	12.31	9.71	1.26
Weigela	19.60	17.56	14.05	23.10	—	8.83

Cuttings of other woody plants were more difficult to root than those of the herbaceous cuttings, chrysanthemum and poinsettia, and took longer to root in many cases. Woody plants were also sensitive to timing, as the stock plants were grown out-of-doors. Therefore, difficulties were experienced with woody plants that did not appear with the herbaceous materials. However, there were some interesting results (Table 2). Red-osier dogwood cuttings stuck in the foam rooted better than those stuck in BR-8's, Jiffy-7's or Jiffy Pots, and the rooting was comparable to those stuck in sand. Honeysuckle cuttings rooted best in sand and about half as well in the individual unit media tested. Spiraea cuttings failed to root well in the individual unit media tested and did not root well in the sand. This may be due to the hardness of the cuttings and the poor performance of the foliage under the mist.

Table 2. The influence of various individual unit propagation media on the rooting of woody ornamentals. Cuttings stuck June 30, 1969. Data taken July 21, 1969. Basal portion of cuttings dipped in 1000 ppm IBA.

Plant	Media	Rooted	Callused	Unrooted	Dead
Cornus stolonifera Red-osier Dogwood	BR-8	7	—	2	3
	Jiffy Pot	6	—	—	6
	Jiffy-7	6	—	1	5
	Sand	12	—	—	—
	Sure Start	11	—	—	1
Spiraea nipponica	BR-8	2	—	10	—
	Jiffy Pot	3	—	8	—
	Jiffy-7		—	10	2
	Sand	5	—	7	—
	Sure Start	2	—	9	1
Lonicera tartarica Tartarian Honeysuckle	BR-8	6	—	6	—
	Jiffy Pot	6	—	6	—
	Jiffy-7	3	—	8	1
	Sand	12	—	—	—
	Sure Start	5	—	6	1

To summarize, several herbaceous and woody ornamental plants were rooted in various individual propagation media and compared to cuttings propagated in sand. Chrysanthemum and weigela rooted cuttings were potted and the growth of these was determined. The herbaceous materials were found to root well in all the individual unit media tested. Some difficulty was encountered with some of the woody plants, but some rooted fairly well in the individual media. Cuttings rooted in the individual unit propagation media did grow better after potting than those propagated in sand. There were also differences in growth noted among plants rooted in the different individual unit media.

The new phenol-formaldehyde plastic foam, Quickee Sure Start, performed as well as the other individual unit propagation media and sometimes better. This new material might be considered for trial by propagators of ornamental plants. Propagators could try unit propagation media as a method for reducing handling costs of cuttings. The labor saved may be more than enough to pay for the media, plus producing a high quality rooted cutting.

CHARLEY HESS: Very well done, Mr. Murphy. I would like to ask where the foam material which you used is available.

J. D. MURPHY: This material is available from the Floralife Corp., Chicago, Illinois. It's a new material which we have been testing and it looks promising.

VOICE: Is it advertised in the trade papers?

J. D. MURPHY: I don't think so.

CHARLEY HESS: This ends our morning session.