

FRIDAY MORNING SESSION

November 30, 1956

The third session of the Sixth Annual Meeting was convened at 9:45 a.m., President Scanlon presiding.

PRESIDENT SCANLON: The first paper on the program this morning is concerned with the cold frame method of propagation. It will be given by Kenneth B. Fisher of the Kingwood Nurseries, Mentor, Ohio

Mr. Fisher presented his paper entitled "Propagation by the Cold Frame Method" (Applause).

PROPAGATION BY THE COLD FRAME METHOD

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Propagation by cold frame method is one of the oldest methods employed by nurserymen. As such it would seem that it is unnecessary to go into the matter to any great extent. Yet methods vary considerably from nursery to nursery and, therefore, it would seem wise to go into these variations as there seems to be no hard and fast rule to go by.

CONSTRUCTION Construction depends upon materials available and the use of the frame itself. Since most of the material we grow in the cold frame is of the more easily rooted items, such as various *Euonymus*, ours is very simple. We chose a spot at the base of a low bank. By straightening up one side with a spade and leveling off, we obtained an area six feet wide and about fourteen inches deep at the back. We then laid out 1 x 8 inch planks, which had been treated with a wood preservative, the length of the frame and across the ends. On these we placed concrete blocks (8 x 8 x 16 in.) There are two tiers of blocks in the back and one across the front. The ends are built in stair step fashion and the sash are fitted inside the ends. The 1 x 8 inch boards prevent the tilting of the blocks as they are laid loosely with no mortar or cement. Here we have violated one of the rules of propagation as most references in textbooks will tell you to keep the frames air tight. The bank at the back, of course, prevents air flow there, but the other side and ends certainly allow some passage of air.

For more permanent construction, frames are made of concrete. The walls should be from four to six inches thick and extend below frost level. Several years ago, cross bars were used on all frames at three foot intervals. One former nurseryman in our area had cross walls every three feet. Here again, the idea was to keep the frames air tight. Cross bars every three feet are also used in wood construction but it is not essential as I know of several propagators that do not use the cross bars. By using T-irons in the cement frame, more bracing is given. Certainly some bracing is required if the frames are of considerable

length. Laurie & Chadwick in their book "Commercial Flower Forcing" recommend that if cement frames are more than 30 feet long, a cross wall should be inserted both to provide support and cut down on air circulation.

The type of soil or rather subsoil will have to be taken into consideration, particularly if you want to place your frames below ground level. You must have perfect drainage. One nursery in our area has reinforced concrete frames which are considerably below surface soil level but both the topsoil and subsoil are very sandy and drainage is no problem. Such a deep frame is usable not only for summer propagation but can be converted into a deep frame for winter storage of pot plants that might need the extra protection of the deep frame.

My good friend, Paul Otto of Perry, Ohio, on the other hand, even with a sandy soil, has his frames on top of the soil. They are of wood, using a 1 x 12 inch plus a 1 x 4 inch plank at the back, and a 1 x 12 inch plank in the front. His media is placed so that the surface inside the frame is about 3 inches above the outside. I think his frames are tighter than ours but there are a few cracks here and there, and a trip to his nursery will satisfy you that he can grow very good material in his frames.

The size of the frame is limited in one dimension by the sash used. Since most standard sash are 3 x 6 feet, the cold frame is usually six feet wide by any multiple of three that you want to make it. For ease of operation, some frames have hinged sash with sash cord and weights which take a lot of strain off the back, but I believe most commercial operations just lay the ash across the frames. Hinged ash would be disadvantageous if stock is to be uncovered and left in the frames all winter.

In laying out your frames, the accepted method is to run them east and west. We at Kingwood have again defied the textbooks by running our frames north and south. I don't recommend it but just bring it up to point out that you can get all the advice you need and read all the textbooks you want to, and still do as you please to a certain extent and make the frame work. Why north and south? Well we wanted the frame close to our greenhouse and water supply, and the area concerned was long and narrow. Running the frames east and west would make them too short or completely cut off a roadway to some beds behind our greenhouse. So the area concerned called for a north and south layout.

Generally speaking, however, the frames should run east and west. It all has to do with shading. If your frames run east and west, it is only necessary to shade the top and south sides. We, of course, have to shade the top, and the east and west sides as well. I should mention also that some nurseries use a combination of the cold frame and the hot bed, although I think this is becoming obsolete in most areas. Certainly if summer warmth is a problem, it should be considered. In such an instance, the frame is made at least 18 inches below ground level and up to one foot of manure is placed in the bottom to keep the propagating medium at a higher temperature. With a hot summer, this, of course, could be quite a disadvantage. In our area, this past

summer, it probably would have worked out well as it was so cold and wet nearly all summer. A friend of mine has a concrete frame with a concrete bottom in which he placed a network of pipe through which he can circulate hot water for bottom heat. This year he found it quite an advantage. He obtained quicker rooting than we did on the same items. If you are to pot off the cuttings or plant them out as soon as rooted, bottom heat could be quite an advantage.

In the matter of shading previously mentioned, you will find several types in use today. These will be discussed later. The mechanics is another thing that should be brought up at this time. Some propagators prefer fixed supports. This can be a wooden framework, whereas others use wires stretched about four feet above the ground, upon which the shading is fastened. Since our frames are not extensive, we built rectangular framework of 2 x 2"s which are ten feet long, supported at the four corners by 2 x 4 ft. legs. - The back legs are about four feet long and the front legs are three feet long. They are wide enough to straddle the frame. By being movable, we do not have to dodge framework once the cuttings can take the sun.

Wind is not too much a problem for us since our frame is protected on the west by our greenhouse and a rise in the general terrain. Once in awhile we have to weight down the framework in high winds. One or two heavy planks laid across the top will do the trick.

MEDIA. The question of media goes right back to the propagator. Many in our area use bank sand. I believe that by and large, it is used more in our area than any other medium. We at Kingwood Nurseries use silica sand. Why, I don't know except that we started with it and were successful and, therefore, have stuck to it.

Now several textbooks decry the use of sand alone. They admit that it is generally used but tests have shown that for a great number of items, and that includes most of the shrubs grown in our area, a mixture of peat and sand is best. Kains & McQuesten in their book "Propagation of Plants" refers to a test by A. E. Hitchcock of the Boyce Thompson Institute. Out of 96 varieties tested (which were included in 46 genera) only six varieties rooted best in sand alone. The other 90 varieties rooted readily in a mixture of peat moss and sand, and the mixture proved far superior. Unfortunately, the text did not give the six concerned but refers you to the Botanical Gazette LXXXVI, 2, 1928. It would seem from this that those of us who are using sand alone should do a little experimenting along this line.

Some propagators, I find, use the same medium year after year and certainly those who can steam sterilize need have no fear of carrying any infection over from one year to the next.

We have gotten new sand each year as our operation is on a rather small scale and so far have found uses for the old sand. Semesan has been used and probably the more recent Captan can be used for sterilization. Naturally, if the operation is big enough sterilization of some sort would be cheaper than buying new sand and the time and effort involved in removing the old sand and replacing with new sand.

CUTTINGS. Briefly, I want to go into the cytology of plants. As we all know, plants are made up of various cells. Seedlings develop from a single fertilized cell in the ovary of a flower. The growth of that seedling by enlargement and differentiation of its cells, is limited only by conditions unfavorable to development.

Therefore, with conditions favorable to growth, cell multiplication typical of that plant should continue without limit and supply parts suitable for vegetative reproduction. Theoretically, any one living cell is capable of producing a complete new plant. This obviously does not hold true in practice. Under well controlled conditions (and this is where an air tight frame would be employed), plants have been produced from a small number of living cells. This, of course, varies with the plants propagated, methods used, and the propagator himself.

Cold frame propagation is not generally thought of on such a scientific basis for we usually think of a normal size cutting. However, it must not be ruled out for with a proper frame and a good propagator many plants have been grown from very small cuttings.

Commercial growing by cuttage employs a larger cutting and therefore, a larger number of individual cells. Here again the size of the cutting can not be set down in black and white. It depends on the variety to be propagated and the propagator himself. Generally speaking, the cuttings are from three to five inches in length. I know of one nursery, however, that makes *Euonymus fortunei vegetus* cuttings eight to ten inches long, or even longer if they have enough wood.

The cuttings used are referred to as summer greenwood or perhaps more properly, half-ripe cuttings. As with other methods of propagation, the condition of the cutting at the time of taking is very important. Naturally, the cuttings should be taken from healthy, vigorous plants. Cuttings taken from plants with leaf diseases or in poor growth conditions usually prove disappointing. The wood used is of the current season's growth, but should be turgid rather than soft. This is one place where cold frame propagation and mist propagation differ in that cold frame propagation requires a more turgid cutting than is necessary by mist propagation. Here again, the best stage of growth differs with various plants and some are more particular than others. Experience is the best teacher. Generally speaking, the cutting is taken just as the wood is beginning to harden. If it will bend or partially break, it is too old. If it snaps off clean, it is just right.

We try to make our cuttings in the morning. If it is hot, they are immediately wrapped in moist burlap. Frequently, however, they are placed in baskets and when the basket is full, they are watered with a sprinkling can. When taken inside, they are spread upon the floor in a cool place and watered again. If we do not get around to them for some time, they are kept moist during that time.

The lower leaves are removed either by stripping or cutting off with a sharp knife. Our method is to strip unless there is a marked tearing of the outer layer of cells. *Potentilla*, for instance, strips quite readily whereas we have trouble with *Weigela* and *Prunus* to name a few. With most cuttings, we pay little attention as to where the cut is made. Many propagators claim you should cut to a node or just

below it — that a larger proportion of cuttings will strike. Kains & McQuesten report that in most cases experimental evidence has not sustained this theory. There are, of course, some items that have to be handled differently. For instance, we obtain best results with *Daphne cneorum* when we use heel cuttings. Yet just a few days ago, a nurseryman friend was telling about an experience he had with this same item. He was going away for awhile and told his boy what cuttings to take while he was gone. The boy misunderstood and made *Daphne* cuttings (this was in July) and, of course, there were no heels. Since the damage was done, the cuttings were made up in the hopes of salvaging some and that year, this nurseryman got his best strike ever. I think, however, that nurserymen will agree that *Daphne* cuttings should be made with a heel.

We do follow the practice of removing all the lower leaves, and if the plant produces large leaves such as *Forsythia*, *Weigela* and *Viburnum tomentosum* to name a few, those remaining leaves are cut back one half to one third. Now this is another common practice that has been proven unnecessary insofar as rooting is concerned. In fact, if the full leaves are left intact, the cuttings root faster, provided they are kept turgid, but it is more difficult to maintain a turgid condition in the cutting due to a more rapid transpiration.

Secondly, and certainly most important, is the saving of space in the frame. Naturally, cuttings with large, full leaves take up more space in the row and between the rows.

GROWTH PROMOTING SUBSTANCES. In the last few years, I think that most propagators have been using some growth promoting substance. This is particularly true if the rooted cuttings are to be removed for potting up or planting directly to the fields or beds. Since time is of the essence, growth promoting substances generally hurry up the rooting process so that a well rooted cutting is ready to go earlier than if no hormone is used. On the other hand, if as so often is the case, the cuttings are to be left in place over winter, growth promoting substances are not necessary, unless the subject is difficult to root. Certainly, they are not necessary on such readily rooted items as *Euonymus fortunei vegetus*, *Euonymus fortunei coloratus*, *Pachysandra* and the like. In fact before growth promoting substances were known, propagators of yesteryear did all their propagating without them and seemingly had no trouble even with many plants that some propagators of today consider difficult.

When we started five years ago, we used Rootone for everything and then changed to Hormodin No. 1 for most items and Hormodin No. 2 for those more difficult subjects we encountered. Recently, instead of Hormodin No. 1, we have been using Rootone F, which has a fungicide included. Actually, we have not made tests on this but figured that the addition of a fungicide was not detrimental at least.

(Time Table For Taking Cuttings — Lake County Ohio)

5/25 - 6/5	<i>Euonymus alatus compactus</i>
6/1	<i>Cydonias</i> (Hybrids and Aurea)
6/15 - 6/30	<i>Spiraea japonica coccinea</i> <i>Deutzia gracilis</i> <i>Viburnum opulus nanum</i> <i>Viburnum burkwoodi</i> Potentilla, Gold Drop Hydrangea, Domotoi
6/10 - 6/15	<i>Philadelphus coronarius aureus</i> Caryopteris, Blue Mist Forsythias { Lynwood Gold { Spring Glory
6/20 - 6/30	<i>Viburnum tomentosum, plicatum and grandiflorum</i>
6/20 - 7/5	Weigelas { Vaniceki { Fairy { Candida
6/30 - 7/15	<i>Hydrangea acuminata</i> Hypericum, Hidcote Variety
6/25 - 7/15	<i>Euonymus fortunei acutus</i> <i>fortunei coloratus</i> <i>fortunei radicans</i> <i>fortunei vegetus</i> <i>fortunei patens</i> <i>Berberis mentorensis</i> Thunbergi, atropurpurea and Nana
7/1 - 7/20	<i>Philadelphus virginialis</i>
7/15 - 7/25	<i>Azalea Kaempferi</i> Hybrids Gable Hybrids

PLACING IN FRAMES. Placing the cuttings in the frame is no major operation. The medium has been leveled off and tamped. We tamp ours rather lightly. We cut the sand with an old butcher knife and insert the cuttings about an inch apart, or so that the leaves are just touching. A depth of 1½ to 2 inches is sufficient. Some might argue this depth and I suspect that in peat or a mixture of sand and peat, you could run into trouble. By placing them in the sand at that depth, there is less chance of them drying out. We make it a practice to get at least one node below the soil surface of the media. Some cuttings such as *Vibrunum opulus nanum* which root at all nodes be set rather shallow, particularly if they are to be potted. Otherwise you cuttings such as *Vibrunum opulus nanum* which root at all nodes below the surface and those which root all along the stem should be set

rather shallow, particularly if they are to be potted. Otherwise you end up with roots above the top of the pots

We use a firming board of 1 x 2 inches. The cuttings are firmed in by striking the board sharply along its length and a new incision is made in the sand after the board has been removed. The next row is stuck in the sand and firmed as before. After the cuttings are stuck in the sand, the area is flooded with water to settle the sand around the cuttings and to make certain that the sand is wet. Immediately after an area the size of a sash is filled, that area is covered with a sash.

CARE DURING ROOTING. For the first week to ten days, it is desirable to keep the frames completely closed to provide the temperature and moisture wanted. On the other hand, some ventilation may be necessary on very hot days. Our practice is to ventilate some if the temperature within the frame gets past 90° F. After this first period, it may be desirable to ventilate a little each day as fresh air will reduce the danger of mold and fungi

In order to keep the air saturated and therefore have good turgid cuttings, it will be necessary to syringe the tops of the cuttings and the glass and sides of the frame. This should be done lightly two or three times daily, for the first few days or a week. Later the cuttings will begin to draw up moisture from the medium through their stems and less spraying is necessary. Watch them closely on very hot days, however, as they must not wilt. Remember that the syringing should be light and often. This prevents overwatering the propagating medium, as too much moisture there would cause rotting of the stems.

SHADING. As mentioned previously when discussing construction, shading is very important. As much light as possible should reach the cuttings as long as it does not overheat the frame. A moisture laden atmosphere inside the frame with a temperature between 70° and 90° F. is desirable. But direct sunlight must be avoided. Again, let us refer to direction of the frame itself. If set east and west, it is only necessary to shade the top and south side. Your shade, of course, should extend far enough beyond the ends that the first sash at each end are shaded.

In the past shade cloth meant muslin stretched on supports three or four feet above the frame and along the sides. It should be arranged so that it can be put in place readily in the morning as soon as the sun's rays begin to strike the glass. It should be removed in the late afternoon. This also holds true for dark cloudy days as during such times the shading should be completely removed. Today many growers are turning to Saran cloth. We use both muslin and Saran cloth. You will find the latter listed as to the various percentages of shade provided. We use 81% shade, and during very bright days and particularly in areas where the sun is normally quite bright, two layers of this may be necessary. Paul Otto uses two layers of varying percentages during the time the cuttings are rooting. His first layer is 67% shade Saran cloth which he leaves on day and night, as well as cloudy days. Then he uses a layer of 90% shade for covering during the time the sun is up. Since Saran cloth does not rot, mildew or tear easily, it has advantages over muslin

TREATMENT AFTER ROOTING. As rooting takes place, the cuttings are gradually hardened off. We pass from the early days of a well saturated, closed frame with daily syringing to one where there is some ventilation and, therefore, a less saturated atmosphere. This, of course, tends to harden up the cuttings somewhat. If the cuttings are to be left in the media through the rest of the summer, fall and winter, the glass is removed entirely when they are well rooted and shaded with lath. The cuttings are watered daily during hot weather and we believe it pays to do some foliar or liquid fertilizer (KAPCO 15-30-15 Liquid Fertilizer) feeding about once a week during the summer.

If the cuttings are to be potted up, it should be done as soon as properly rooted. This will be done while they are comparatively soft. Therefore, it is wise to place the potted cuttings where moisture and temperature can be kept similar to those in the frame. After a few days, they can be handled as any other potted plant.

Early rooted cuttings such as *Forsythia* can be planted directly to the field. It is advisable to have irrigation, however, for losses can be high if the weather should turn hot and dry for any length of time after planting. We have done it without irrigation by using our transplantor which has a water tank, and the cuttings are watered in as planted. This, however, is not entirely satisfactory during hot, dry summers. This past summer we lost hardly a plant in planting out directly such items as *Forsythia*, *Euonymus alatus compactus*, and *Caryopteris*. I suspect what loss we did have were from a super abundance of rain.

Those cuttings which remain in the frame over winter get no further protection other than lath shade, which prevents alternate freezing and thawing, and thus heaving.

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PRESIDENT SCANLON: Thank you, Ken, for the interesting and informative discussion on cold frame propagation. There is now time for questions

MR. WILLIAM BURTON (Burton's Hill Top Nurseries, Castown, Ohio): Have you used cable or manure for bottom heat for early or late materials?

MR. FISHER. We have not used any bottom heat.

MR. BURTON: I know it has been used quite extensively in the past and I wondered if you found that it was necessary to go to the extra cost of cable or manure?

MR. FISHER: As I stated before, I think it depends upon your operation. It might be advantageous if the plants are to be potted or set out in the field. If they are to be left over-winter in the frame, I see no necessity for it.

MR. PAUL F. OTTO (Perry, Ohio). I used bottom heat quite extensively for one year, then discarded it because I found too much condensation at night due to the differences in temperature.

MR. BURTON: We have had the same experience. Have you used Wiltpruf or related materials on cuttings before transplanting?

MR. FISHER: We have not, but perhaps someone here has had experience with such materials.

MR. PETER ZORG (Cartwright Nurseries, Collierville, Tenn.): We used Wiltpruf on most of our cuttings when planting them outside. We found it was really an asset because there was less loss.

MR. FISHER: I might add one thing along this line, but it has nothing to do with cuttings. One landscape man, who uses large *Berberis mentorensis*, sprays them in the field before digging them for transplanting. This past August he transplanted them without any difficulty. I can understand that, particularly in a hot, dry area, treating the cuttings certainly would be advantageous before putting them in the frame or planting them out in the field from the frame.

MR. CASE HOOGENDOORN (Hoogendoorn Nursery, Newport, R.I.): Did you ever try summer evergreen cuttings?

MR. FISHER: No, but I will ask Mr. Otto to tell about his experience.

MR. OTTO: We take cuttings of golden pyramid and dark green arbor vitae the latter part of June or early July. Usually, they root within three or four weeks. I use Hormodin No. 1 on these cuttings.

MR. HOOGENDOORN: Do you stick the cuttings in sand in these frames?

MR. OTTO: Sand is used and we water the cuttings once in three weeks. The frames are aerated every night. If you don't aerate, you get a lot of moisture condensing and that is what causes the damage. If the dampness is there at night and you aerate, it doesn't hurt, but if the frames are kept closed, it causes rotting.

MR. HOOGENDOORN: Do you also propagate *Taxus* and junipers in frames during the summer?

MR. OTTO: I propagate Andor juniper in the summer. *Taxus* are made in September.

PRESIDENT SCANLON: I think we should proceed to the next paper. Thanks again, Ken, for your information.

The next speaker is well known to most of you. He is Case Hoogendoorn from Newport, Rhode Island, and his subject is concerned with the successful establishment of cuttings and seedlings in the field.

Mr. Hoogendoorn presented his talk, entitled "Successful Establishment of Rooted Cuttings and Seedlings in the Field." (Applause).