

This next talk promises to be an interesting one. I am sure that some of you got up this morning and took a look at yourself in the mirror and said, "What is it worth?" Well, standards like those can be switched up and down, depending on the occasion. However, the standard of the red and blue of the ledger sheet is one that cannot be ignored in the industry and, therefore, it is with pleasure we have Mr. Henry A. Weller, Director of Perennial Production, from the C. W. Stuart Company, Newark, New York, to talk to us on "Propagation — Dollars and Sense." Mr. Weller.

Mr. Weller read his prepared manuscript. (Applause)

PROPAGATION — DOLLARS AND SENSE

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In the four years that I have attended these meetings, I do not recall anyone ever stressing the actual cost of propagation. Is not being aware of the cost of propagation, and doing something about it, just as important to the nurseryman as the "know-how" of propagating?

Although propagation has been practiced since almost the beginning of time, and procedures have been basically the same, there are ways of modifying these that will result in a better plant, greater yields, and an actual decrease in cost of production.

The two words, dollars, and sense, have a direct bearing upon each other. Using common sense when producing plant material does result in a greater profit, dollar-wise. We are all vitally interested in propagation, or we wouldn't be here today, but I wonder how many of us are aware of, or know how much a given item costs us to propagate and grow. Do we know if it is profitable to keep certain items in our line?

Since I have been keeping accurate cost figures we have eliminated approximately 10 varieties of plants, simply because, no matter how we propagated these, they were not profitable to keep in our line. This idea of keeping cost on every variety grown might seem unnecessary to you, but during one season of growing *Phlox subulata*, we showed a loss of \$900.00. If I had not kept accurate cost records on this specific item, we would probably have continued to grow it the same way, year after year, with the loss being absorbed by the profit of another variety. Now we will either have to find a more economical way of propagating and growing *Phlox subulata* or eliminate it from our line of growing.

Let me give you a brief explanation of our cost program. All expenses incurred from the time a cutting is taken until it reaches maturity are charged to that given variety. It requires a lot of time and effort to keep these daily records straight, but it gives us a picture of where and for what we are spending money. With this program we are able to determine: (1) if an item is profitable to grow, (2) the most economical method of propagation and growing, (3) the cost to grow the item, and (4) the sale price.

There are three phases of operation within our nursery where I feel we have been able to reduce cost considerably, namely: (1) storage of rooted cuttings, (2) weed control, and (3) mist propagation.

For seven years now, we have been storing cuttings under controlled refrigeration. This enables us to hold our cuttings in perfect condition from the time they are well rooted until the time they are to be planted in the field. By doing so, we are able to get two crops from the same greenhouse space that in the past produced only one. This idea of storing rooted cuttings was brought to our attention by the preliminary work done at Cornell University by Dr. William Snyder. We follow the procedure that when the cuttings have initiated one-half inch roots in the sand, they are fed with a water soluble plant food every two weeks to increase vitality. After sufficient rooting, the cuttings are removed from the bench, sealed in polyethylene bags and then placed in cold storage. The most important consideration during this period is that of temperature control. By maintaining a constant 34° F. we have been able to carry cuttings until such a time that they can be planted in the spring. This has been for as long a period as 4 months. The cuttings that we have successfully stored by this method include: *Teucrium chamaedrys*, *Buxus sempervirens*, *Ligustrum vicaryi*, *Chrysanthemum spp.*, *Aster spp.*, *Euonymus fortunei*, and *Euonymus fortunei vegetus*. This procedure has greatly reduced cost while increasing production and efficiency.

The practice of storing rooted cuttings under refrigeration, compared to that of putting them into cold frames, has reduced the total propagation charge by one-third, and has given us 2 crops of cuttings in the same greenhouse bench space. You can realize what this means when dealing with approximately 300,000 cuttings. I again want to stress the importance of maintaining a temperature of 34° F. On one occasion our refrigeration unit broke down and the temperature went up to 38° F. for a short period of time, resulting in some rotting and loss of foliage.

The second phase of operation where we have been able to save money is in weed control. During the past ten years that I have been with Stuart's, we have been keeping records of what it costs to keep our nursery relatively free from weeds. Up to 1954, we were spending approximately \$30,000 annually for hand weeding and cultivation. During this period of time, we tried every conceivable method of weed control. The results were very disappointing because whatever we tried seemed to control the plants as well as, or better, than the weeds. However, with some of the new herbicides, we have been able to actually cut our labor bill by 40%, in spite of continued increases in hourly wages. This 40% reduction is based on an average of 140 acres. Sounds pretty good, doesn't it? Well, believe me, it not only sounds good, but it looks good when you add up the total costs. In the nursery business, I personally think that this field has a greater potential than it has ever had before, because there are newer and better products coming out almost every day.

For our weed control program, we have been using 10% granular chloro IPC, made by the Niagara Chemical Company. We apply the CIPC with a tractor driven rotary seeder at the rate of 6 pounds actual per acre, or 60 pounds of the 10% material. When applied just after planting in the spring, we are able to control the first flush of weeds and delay hand hoeing by a month and a half.

In actual figures, this is the comparison we get between chemical weeding and hand weeding. It takes 15 minutes to treat an acre of ground by using the rotary seeder. After this application, it only requires an average of 48 man hours per acre to keep it free from weeds for the rest of the season. This 48 hours compares with 160 man hours required to keep an acre free from weeds if not chemically treated. This gives us a saving of approximately \$200.00 per acre. You are probably wondering if we have had any injury to the plants by using CIPC at the 6 pounds actual per acre rate. In most instances the plants in the treated areas grew as well as those in the non-treated areas. Of course, you must realize that an application above the tolerance level of the plant, will result in injury. As far as I know, there has never been any extensive testing done to determine the tolerance level of specific plants. Through our experience with the material, we have found that 4 of the plants we grow seem to be less tolerant than the others. These include *Phlox paniculata*, *Iberis*, *Ajuga* and *Dianthus chinensis*. By reducing the rate of application by one half, or to 3 pounds actual per acre, we were able to get a degree of weed control, without injury to the plants. I might add that, while this product is our main source of weed control, we are still not controlling all types of weeds with it. CIPC is too selective, and therefore we are continually searching and testing other products to find one that is even better. We have been working very closely with Dr. Pridham, of Cornell University, for the past few years. He no doubt has more information, based on good practical experience than any other person in the field.

Mist propagation has been most influential in reducing our propagation costs. With mist we have been able to get a higher percentage of cuttings to root, as well as to reduce the total number man hours and decrease losses in field transplanting. Like most nurseries, we were cautious with this new technique of propagation, so in 1953 we only rooted approximately 5,000 cuttings, using small quantities of many varieties of plants for testing. We were so encouraged with the results that each year since we have increased production to the point where we are now propagating approximately 400,000 cuttings, or 30% of our annual total, under mist.

In our outdoor propagation area, we now have 1000 mist nozzles spaced every 5 feet, giving us an area of 25,000 square feet of bed space under mist. The overall area is covered with 2 inches of one-half inch gravel for drainage. The beds are 5 feet in width and are edged with discarded railroad ties. The ties have already been weather proofed with creosote, and are heavy enough so that they stay in place without having to be staked. We are using Florida type nozzles and have been quite satisfied with them. In order to get better water coverage and less clogging we drill the orifice to 1/16th of an inch. By increasing the size of the orifice, more water passes through, which reduces the total pressure in the line. It would therefore be wise to check the pressure of your supply line before going ahead with this procedure.

Each bed is controlled with an individual timer and solenoid. The timers have a range from 2 minutes through one hour, and, in addition to this, have a switch which can turn the individual line off, hold it on constant mist or place the timer in control. Drying around the outside

of the beds because of wind drift was a problem. It was found that wind baffles had to be erected in order to keep the water where it was needed. Of all the rooting media available we have found that terra-lite works the best for our mist operation. This medium gives us good aeration and good drainage, even though we are applying relatively large quantities of water. The terra-lite also has a tendency to cling to the roots during transplanting which aids in keeping the roots moist.

Some of the factors that make mist propagation ideal are as follows:

1. The flexibility of timing. In our experience, cuttings can be taken over a longer period of time with excellent results. We can take cuttings earlier in the year.
2. Using flats and storage boxes that are normally put away for the summer, again is an advantage, in that the cuttings can be moved directly to the field in their growing units. This means the cuttings do not have to be pulled until the last minute before they are to be planted into the ground.
3. The rooted cuttings are led through the mist line, saving us the time and labor of hand feeding. A water soluble fertilizer containing the 3 basic nutrients and trace elements is used. By doing this, we increase the growth and vitality of the cuttings so that they can be transplanted the same season that they are taken. This allows you to plant at a time when you are not as busy as you are during the spring rush. It gives you a better and larger plant at the end of the normal 2 or 3 year period of growth, and in many cases you are able to produce a saleable plant in one less year.

The advantages of mist propagation also are numerous in many small ways. For example, with the plants we have tried, we have found that, in most cases, it does not make any difference whether the basal cut is made above or below a node. This enables the propagator to cut a handful of cuttings at one time, with a pair of pruning shears. In our testing, we have not found any advantage from using hormones on cuttings rooted under mist. There is no need for the constant vigilance which is required with most other methods of propagation.

The plants we propagate under mist in full scale production include *Euonymus fortunei*, Winter Glory and Winter King which are two new *Euonymus* hybrids, *Buxus sempervirens*, *Mahonia aquifolium*, *Pachysandra*, *Vinca minor*, *Chrysanthemum vars.*, *Plumbago larpendae*, *Ligustrum vicaryi*, and *Philadelphus virginialis*. Others we have had under test and that have shown good results are: *Cytisus scoparius*, *Viburnum carlesii*, *Taxus cuspidata*, *Juniperus hetzi*, *Cotinus coggygria atropurpurea*, *Berberis atropurpurea nana*, *Pachistima canbyi* and *Philadelphus coronarius aureus*. As far as I am concerned, mist propagation has contributed more to the nursery industry than any other development in recent years. The potential is beyond comprehension.

The storage of cuttings under refrigeration has decreased our handling costs, and has made our greenhouse more efficient. Our weed control program has enabled us to reduce our labor cost by 40 per cent. By rooting more of our cuttings under mist, we have been able to re-

duce our propagation costs. This was all brought about by keeping accurate cost figures on all the phases of our operation. So don't you agree that being aware of the cost of propagation and doing something about it, is just as important to the nurseryman as the "know-how" of propagation?

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(*Editor's note:* Mr. Weller supplemented his discussion with a series of colored slides. Some of the comments and questions follow).

MR. WELLER: I mentioned the weed control program. This happens to be a good crop of chickweed which was controlled by using a fall application of CIPC at the 6 pound rate.

MR. CASE HOOGENDOORN (Newport, Rhode Island): What is the latest you apply your CIPC in the fall?

MR. WELLER: We generally try to apply it in September. It doesn't break down until you get sufficient moisture to bring about a reaction.

MR. HOOGENDOORN: What happens if you put it on in November?

MR. WELLER: You would still get control, in fact it can be done in the snow. We have had good weed control in established plantings of *Ilex verticillata* with the 3 pound rate per acre. When we get into the 6 pound rate for this plant we are getting into trouble.

MR. HOOGENDOORN: Do you wet the roots of the cuttings before you put them in polyethylene for storage?

MR. WELLER: No, we do not. Incidentally concerning rooting of *Viburnum*, *Viburnum carlesii* cuttings taken on June 30, produced an excellent type of root structure.

MR. WILLIAM FLEMER: How did they winter over after planting?

MR. WELLER: All right. These were put in cold frames.

MODERATOR NELSON: Thank you, Mr. Weller. We have time for several more questions.

MR. RALPH FISHER (Morrisville, Pa.): What is the length of your mist beds?

MR. WELLER: Approximately 150 feet.

MR. FISHER: How high is the wind baffle that surrounds them around the outside?

MR. WELLER: Approximately six feet.

MR. C. DeGROOT (Oakville, Ontario, Canada): I would like to ask what your timing is on the application of the CIPC herbicide?

MR. WELLER: It is applied right after planting in all cases.

MR. HOOGENDOORN: You haven't had any bad results?

MR. WELLER: As I mentioned before, with some varieties we had to reduce the concentration to circumvent injury.

MR. HOOGENDOORN: I applied it last fall to beds when planted and I noticed this spring that the *Taxus* were off-color. I had

to bring them back with nitrogen, although I had two beds that never did come back. The chemical was applied right after they were planted.

MR. WELLER: I think it is a case of checking the tolerance of each type of plant material to learn when to apply the chemical.

DR. MAHLSTEDDE: You had ten perennials you said cost too much to produce, among them, *Phlox subulata*. Who grows them, or how do you reduce growing costs?

MR. WELLER: In a case like this we have to check through our records to see where we made an error or where we have been doing something wrong. In the case of *Phlox subulata*, as you all know, it is propagated by taking divisions, and if this thing isn't done efficiently you can run into quite a number of man hours in just tearing the plants apart.

MR. RICHARD VAN HEININGEN (Deep River, Connecticut): What is the water pressure in your mist line?

MR. WELLER: We are running at city pressure, which is 80 pounds. I mentioned that by the time it gets down to the end of the line it is probably down to around 65 pounds.

MODERATOR NELSON: Thank you, Mr. Weller, for a very informative talk.

Now, to move right along, the next speaker needs no introduction, in the person of Mr. Harvey Gray. I will now call on Harvey to speak on "Light Factors and Rooting Cuttings."

Mr. Harvey Gray, Farmingdale, New York, presented his prepared manuscript, on the effects of light on the rooting of cuttings. (Applause)

LIGHT FACTORS AND ROOTING CUTTINGS

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The original title suggested for this talk was "Rooting Cuttings with North Light." I asked permission to change the title so that details allied to "north light" might be considered and developed. This is a generalization of a few concepts held in the area of rooting cuttings. Such a generalization, for me, is possible through a series of demonstrational tests set up and developed over several years by students as part of their application and appreciation of the subject of plant propagation. The following remarks are offered for consideration and discussion, a learning process, if you please, rather than material of unquestionable fact.

We are led to believe that when all other factors are favorable, total food manufacture is in direct proportion to light intensity and duration. With this thought in mind it might be wise to attempt rooting all of our cuttings in long and strong sunlight. What happens to temperature in this strong and long light? It is here where we must go to an adjustment, making use of light reduction, misting or both. But