propagating beds are set on a bog area. The bog is covered with three inches of a 5 sand, 1 peat mixture. A fungicide in powder form is mixed well into the media. When the cuttings are stuck they are covered with plastic covered sash. The rising humidity from the bog eliminates the necessity of watering or spraying. In the evening both ends of the frames are opened to allow free circulation of air. The cuttings are left in these beds until the following spring. This is the method used by Mr. William Ellerbrok of Sydney River, Nova Scotia.

RAY HALWARD: Do we have any other unusual techniques to report?

DAVE PATTERSON: After hearing Bruce Briggs last year, I went home and took a deep flat, about six inches deep, and knocked the bottom out. Then I stretched black polyethylene over it and stuck the cuttings through the polyethylene. Then I put them in a mist bench. Most of the medium in the bench had been taken away. We had about 120 cuttings of about 10 different things and most of the things we rooted such as *Ilex crenata, Ilex glabra,* and *Juniper pfitzeriana* rooted 7 to 8 out of 10. We also rooted 5 out of 10 skiadoptis cuttings.

PETE VERMEULEN: Your mist was applied on top of the cuttings while in Bruce Briggs' case the mist was applied to the stems under the plastic.

BRUCE BRIGGS: This year we tried a few different things. We applied hormones underneath. We used fog as well as mist underneath and found it didn't make any difference as long as it was moist. Actually, soil (or a medium) is not an important thing at all, it actually can be eliminated. The thing we are after is control.

DICK FENICCHIA: I have been working with a chamber in which you can regulate both top and bottom temperatures. I have some interesting results and would encourage others to try the same thing.

CARMINE RAGONESE: I have found a technique which is very helpful to root hybrid Rhododendrons. If I place the cuttings in a plastic bag and leave them in a plastic bag with just a little bit of humidity and place them in the dark for about two weeks, they root like a weed. I also found that some cuttings which are not rooting in the greenhouse, if I exclude light for a day or so, they will then root.

CHIKO HARAMAKI: The next speaker needs no introduc- He is Mr. James S. Wells.

"COST OF PRODUCTION AND HOW TO DETERMINE IT"

JAMES S. WELLS
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A casual glance at this title would seem to indicate that our Society has gone "way out" in choosing a subject which would have very little direct connection with Plant Propaga-

tion. But I hope to show you that this is not correct, because with the highly competitive market and ever-increasing labor costs of today, we have to consider each and every operation and try to determine the most efficient and least costly method of producing our crop. To determine these costs we inevitably must consider some form of cost accounting.

That I, of all people, should get involved in cost accounting is really rather ludicrous because if there is one thing I dislike, it is office work and figures. But, before giving you what I believe to be a very simple but very accurate solution to this whole question, I want to explain how I became involved.

When I first came to America in 1946, to manage the Koster Nursery at Bridgeton, New Jersey, they were growing Rhododendrons entirely by grafting. During that first winter in 1946, we grafted about 35,000 plants. I hadn't been here very long before I was initiated into the problems of disease, particularly *Phytopthera cinnamoni,* associated with the production of Hybrid Rhododendrons. This was something quite new to me because the disease is practically non-existent in England.

As our crop progressed through the winter af 1946-1947 and on into the second summer, it became immediately clear that I had better get involved with this disease or stop growing Hybrid Rhododendrons, because losses were continuous in all stages of production. Thus it was in the summer of 1947 that I really got down to "brass tacks" with the problem of determining direct costs.

I was very fortunate to have the resources of the Seabrook Farms Company to draw upon. But even so, we were breaking completely new ground. At that time our operation required the steady employment of about thirty-five men. This was increased up to one hundred men during the Spring shipping season. How could one possibly determine where all these costs were to be allocated?

Well, a great deal of thought was given to this and the more we considered it, the clearer it became that it would be utterly impossible to record every fine detail of exactly where and how money was spent. To give a couple of examples: if we had a shipment of 500 bales of peat, which was going to be used for mixing rooting medium and preparing beds for planting Rhododendrons and Azaleas were we going to keep a close record of every bale of peat, where it was used, and charging it to the appropriate crop? Obviously we could not. To do this, each foreman would have to be a Certified Accountant. And then, what of the men who were engaged in packing and shipping . . . or the maintenance men? What about the foremen loading the trailers? Would you split up their time among the Taxus, Dogwood or Arborvitae which were being loaded on the various orders? Again, obviously "no." Some more simple system had to be devised.

Eventually, we decided to work on what we called "di-

rect labor costs," using this as a yardstick to gauge and allocate all other costs. A simple form was developed and one man was employed to record, four times a day, just what each man was doing, and to attempt to allocate as much of each man's time to a given crop as he could, with the assistance of the foremen.

This was what we called "direct labor." It was that amount of work which could reasonably be charged directly to some crop. We had a code which simplified the recording of the daily hours and we included symbols in this code which indicated indirect costs, such as packing and shipping, maintenance, etc. This system ran for nearly five years.

Before I give you the distilled essence of this five years recording, I would like to quote one or two figures that came out of the system at the end of the first year. A grafted Rhododendron, lifted from the bench, cost us 43.8c at that time and at the end of the first year the cost had risen to 62.4c. A rooted Rhododendron cutting cost us 13.9c and at the end of the first year the cost had risen to 32.2c, just half of the cost of the graft. But the Rhododendron graft cost us $6.04 at end of the second year and this was due to the fact that we had substantial inventory losses in the second summer, from the Rhododendron Wilt Disease, which attacked the understock used for grafting. But a two year old Rhododendron, raised from a cutting, cost us only .66c. The importance of these figures are therefore clearly of value in determining the method of propagation to use, especially in view of the fact that we were selling two year old plants then for $3.50, thus showing a net loss of $2.04, on each grafted plant sold.

But let me give you another example: grafting Hybrid French Lilacs. Again, due to inventory losses after planting, we found that our one year old plants were costing us 27.4c per plant. As we were selling these for $25 per hundred, we were losing .024c on every plant sold. But if we carried those plants over for a second year, the cost of production only rose from 27.4c to 35.4c, and our selling price for two year old material was $50 per hundred, thus showing a reasonable profit.

The value of these figures therefore, clearly indicated that we had to change our method of production or remove our one year French Lilacs from our sales list and sell them as two year olds. So much, therefore, for the immediate returns which appeared from this system.

Now, let us jump ahead five years and I will describe how I think you can use these ideas very simply and directly, to determine costs. At the end of the five year period, we found the following to be true: if the total amount we had to pay for operating the nursery amounted to, say $100,000, then our total payroll was almost 50% of this. Let me say that the $100,000 figure included every possible cost, depreciation, taxes, overhead costs of all kinds. Everything that was needed to keep the nursery running was included. Next, we found

that we could only charge one half of the total payroll to any given crop. Our direct labor costs were therefore one half of our payroll or 25% of our total operating expense. This is the important point which I want to get over to you, because we found that we could abandon the laborious and somewhat complicated system of daily recording, if we chose, and simply record whatever operation, or series of operations we wished and at any point we could draw a line, determine the direct labor cost involved so far, and then multifly this figure by four, to arrive at a total actual cost. This loaded cost, divided by the inventory of plants produced, gave a reasonably accurate loaded cost of each plant.

Example: Let us assume that we decide to raise a batch of Taxus. From the moment we commence to prepare the bench to receive the cuttings, the direct labor costs are recorded . . . the cost of filling the bench with rooting medium . . . the cost of gathering, making and looking after the cuttings while they are rooting . . . the cost of lifting and transplanting them and looking after them for one, two, three or four years, if necessary. All these direct labor costs are accumulated until the producer decides that he either wants to sell the crop or would like to know how much the cost has been for that crop, so far. Whenever this point arrives, the direct labor costs are totalled and multiplied by four. This sum is then divided into the inventory and the figure thus obtained is the unit loaded cost of each plant. It should be noted that in this system, no separate record is kept of any other costs other than direct labor costs. No recording or allocation of costs is made for materials . . . peat, sand . . . or light, power, paint, maintenance costs or any of the other multitude of costs involved in running a nursery. All of these are allocated in proportion, when the direct labor costs are multiplied by four.

Let me illustrate with a few figures. We will assume that a crop of 100,000 plants has been rooted and is now growing in the fields. The total cost recorded in direct labor is $10,000. The total loaded cost, therefore, is $40,000. This means that the individual loaded cost of each plant is 40c. If a Taxus liner is sold for 45c, then you are making 5c net profit. It should be obvious that the producer can choose to draw a line and make this simple computation at any point in the development of the crop. He can determine, within very close tolerances, the cost of the crop at any given point of development. He can use the same system for a rapid time-study, as related to these costs. For instance, if people are making a large amount of cuttings, or, in fact, are carrying out any operation, the direct labor cost can be recorded for one, two or three days or longer, if you prefer, and then arrive at the true cost of the operation — the sum spent in direct labor, multiplied by four.

This, then, is the very simple formula which developed from the mass of data which we accumulated over the five year period. Following this, I transferred the system to the

Hill Nursery in Dundee, Illinois, where I understand it is still being used.

In both cases, we found that this formula was very close to the actual recorded costs . . so close that it became unnessary to carry out the detailed and onerous task of daily recording all expenses. I believe, therefore, that this recording of direct labor costs only, multiplied by four, is a simple accurate and workable method that anyone can use to arrive at the true cost of any plant or crop that they are growing.

I am quite sure that if you apply this method, you are in for some shocks. We were astounded when we began this system, to find out just where the money was being made or lost. You may well decide that the application of this procedure to every plant and operation on your nursery is unreasonable, but rapid spot-checking, using the formula on any crop about which you are doubtful, can be most revealing. The real value of it, of course, becomes immediately apparent when there is a substantial inventory loss, for one reason or another.

I would like to give you one last illustration of the importance of this to the plant propagation methods used. Back in 1946 we were grafting our crop of Japanese Maples and placing the plants in sweat boxes. We had real problems with fungus disease while the grafts were callousing, and our loss was high. The actual cost of each graft rose to a point where it was obviously impractical for us to continue grafting in this manner. The cumulative cost of grafting, when taking into account the inventory loss sustained in the grafting process, showed that we were losing money and this meant that we had to bear down on the problem and either find an answer or stop growing Japanese Maples. As a result of this pin-pointing of the problem, we tried different methods of grafting and found that we could get excellent results by dipping the dormant grafts in parafin wax and placing them on the open bench, without double glass covering. When this was done the problem from fungus disease was eliminated, the cost of production dropped substantially and the crop was once more profitable.

I believe that every grower needs as much of this type of guidance as he can get and this brief discussion is presented in the hope that the relatively simple formula which we developed can assist growers with similar problems.

CHIKO HARAMAKI: This is a very important subject. I am sure there are many growers who have little ideas of their costs. We now have time for some questions.

JOHN ROLLER: Jim, can you determine the approximate cost on any item or is this a unit at the end of the year?

JIM WELLS: No, it is not instant cost accounting. You can't tell in a few minutes unless you have been recording your direct labor costs. You really have to run the system for at least a year.

JOHN ROLLER: Can you use this system to determine the cost on any given variety?

JIM WELLS: Yes. It all depends upon your recording completely. You've got to do it daily. You must record what is going on with that specific plant. One side effect of record keeping happened at Koster. We did record each day the production of each worker. The next day each man's production was put up on a notice board. This wasn't very popular for a few days. But after they got used to it, then they found it invigorating and we got into some healthy competition as to how many grafts they could do per day. Our production went up and the costs went down.

HUGH STEAVENSON: Now if I understand you correctly, you can apply this formula to any operation or activity if you recorded the time for this operation. For example, if you were balling trees and you found your direct labor costs for balling a tree is 25c, so do you multiply that by 4 to get your total costs including a 10% profit?

JIM WELLS: No profit, just total costs.

HUGH STEAVENSON: That's particularly pertinent because I've seen so many cases where fellows would figure out the cost of balling by just doubling their cost.

JIM WELLS: I talked with Roger Coggeshall about this and he gave me a bit of a stop. He made me realize that the basis of this whole formula is one ratio of labor costs to your total operating costs. You will recall that I said the formula works if labor costs were 50% of operating costs. You will have to look at your balance sheets to see if this is true for you or not. I've always felt that 50% of the operating costs as labor represented a fairly average level of efficiency and below 50% was more efficient and above 50% was less efficient. Now if your labor costs in relation to total costs are higher or lower this must be taken into account. If it is 50%, my formula will work fine. I define labor as total personnel payroll.