EXPERIENCES WITH THE USE OF THE "NISULA ROLL"

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With the continuing shortage of labour new techniques in producing forest trees had to be found. In May, 1970, I did an extensive tour of Finland to study nursery techniques. I looked firstly at the Japanese paper pot system, which is now widely used there. The main species to be reproduced by this method are Scots pine and birch, but this method has a good future for many species; most important I think is Corsican pine. Transportation to the forest will be a problem as the pots would have to be transported in trays.

At Rovaniemi Nursery, which is a State Nursery in the Arctic Circle, I was told that several million Scots pine had been produced by the paper pot system, and that field results were very encouraging. On closer questioning I learned that in Finland only three main tree species are used in the forest, namely Scots pine, Norway spruce and birch. The manager at Rovaniemi told me that although Scots pine are successful in paper pots he was not able to produce a large enough Norway spruce plant in one season. He had therefore tried a Finnish technique known as the "Nisula" System. The name Nisula comes from the inventor, a scientist, Pentti Nisula, of the Forest Research Institute of Finland. The system is simply producing seedlings in a roll of peat, fertilizer and polythene.

First trials were carried out in 1965; a length of polythene film 12" wide, 100 gauge, was laid on a bench, on this film fertilized peat was spread, seedlings were then placed on the peat on each side of the film, roots to the centre of the roll. The polythene, peat and seedlings were then rolled up like a Swiss roll and the end of the roll secured with Bostick. The roll was then cut into two with a hand saw. making two rolls 9" dia. by 6" in depth, and the rolls were then stood on a hard surface and allowed to stay in this position until taken to the forest for planting.

The machine consists of a conveyor belt on to which the polythene film is introduced at the conveyor end; fertilizer is then fed on to the film by a lawn fertilizer spreader, followed by peat; a reciprocating blade then spaces the peat into small heaps 9" apart; seedlings are placed on to these heaps by four men or women feeding the seedlings on to the peat from each side of the belt. To start the roll then proceeds towards the end of the conveyor. At this end are two rotating dimpled rubber rollers; the started roll is held between these rotating rollers and rolled

under pressure to correct size. The last man on the belt places a smear of Bostick across the film which joins the roll. The man operating the rollers releases the roll which is taken off the conveyor and placed on a cutting machine which has been produced in our own workshops. It consists of a power saw electrically operated and a spring-loaded cradle into which the roll is placed. The weight of the roll takes it through the saw, and the cut roll is then taken by conveyor to be placed on a specially designed trailer. This trailer was designed and produced in our own workshops. This consists of moving floor pivoted at the point of balance on to a trailer chassis: when loaded the moving floor is locked in position and is controlled by a handle. Rolls are placed on the end of the trailer and progressively wound forward until the trailer is loaded. The trailer is then taken on to the nursery by tractor; the moving floor is tipped and as one man winds the handle the tractor moves forward and the rolls are pushed off the trailer. This means that the rolls need only be handled once.

The method of feeding peat to the Nisula machine is by a converted Meal Mixing Machine which not only breaks up the peat but also enables lime to be added. Water is sprayed on to the peat and the whole thing is then mixed; it is then transferred to another mixer and from there to a conveyor and then on to the Nisula Machine.

The advantages of the Nisula Method are:

1. Approximately 3,000,000 seedlings can be produced on one acre against 4-500,000 by conventional methods.
2. No need to lift, grade, tie or heel-in plants.
3. Transplanting can be put on a factory basis, which means that it can go on no matter what the weather conditions. Seedlings to maintain the machine can be held in cold store.
4. Substantial reductions in costs as large quantities of fertilizer, spent hops and cultivations are not required and less land area needed.
5. The Finns claim a production of up to 120,000 seedlings per day for 12 operators. We have only managed to obtain 70-80,000 up to date. We hope to improve on this in the coming year.
6. In the forest it is no longer necessary to heel-in plants.
7. Planting can be carried on over a longer period.
8. A higher survival rate in the forest as the tree has its own plate of peat on the roots, which gives an almost root-balled plant.

The machine and the method is patented in 18 countries, which includes Great Britain, and royalties have to be paid to Finland for plants produced by this method.

We produced 200,000 plants by this method in 1971 using a variety of species, Scots pine, Lodgepole pine, *Thuya*, *Abies procera* [*A nobilis*], *Abies grandis*, Sitka spruce and Corsican pine.

As we were the first nursery to use this system outside Finland we have run into quite a number of problems, some we have overcome, while others have still to be solved.

Some of the improvements already carried out are as follows:

1. We have reduced the number needed to operate the machine from 12 to 9. This has been made possible by placing a knife at the beginning of the conveyor to cut the polythene through the centre instead of having to cut the rolls as a final operation.
2. By incorporating a bell that rings when 50 seedlings have been placed on the conveyor. In conjunction with the bell there is also a counter to record the number of rolls per day.
3. By removing the rear roller from the machine and placing a conveyor belt in its place to transport rolls direct to trailer. We have also improved on the spacing device; the object of this is to divide one seedling from the next to avoid root damage and loss of peat.

A major problem has been that the trees grew too fast; to overcome this we are holding the seedlings in cold store and rolling in April, May and June. By doing this we are hoping to reduce the plants' growing season.

Weed attached to roots and foliage of seedlings is another problem which we are hoping to overcome by using sterilized seedbeds.

We have had some good results with ornamental seedlings. Species tried include *Berberis*, *Araucaria*, *Quercus cerris*, *Thuya plicata*, *Chamaecyparis lawsoniana*, and *Acer*.

NUTRITION OF CUTTINGS UNDER MIST

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There is considerable evidence that nutrients are leached from cuttings under mist (1) and that cuttings deteriorate during propagation due to the dilution of existing nutrients in the cutting when new growth occurs on the propagation bench. Various