

# IRISH FORESTRY

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## THE HEATHLAND NURSERY

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DURING recent years a new kind of nursery for the production of forest planting stock has been developed in Great Britain. It is known as the "Heathland Nursery." It has obtained this name because the soils which are most suitable are characterized by the presence of a heathland vegetation. Heathland nurseries have two great advantages over nurseries of the traditional type. The first is that, given the right treatment, they can produce seedlings of conifers which are large enough to lift and handle at the end of the first year as against the two, and sometimes three, years which are usually required in normal nursery practice. This means a substantial saving. The second is that the heathland nursery, if properly sited and managed, remains remarkably free from weeds for a considerable time, thus saving the costs of weeding, which are often substantial. It must be admitted, however, that the development of modern methods of weed control with oils and spirit is making this advantage less weighty than it used to be.

The principal disadvantage of the heathland nursery is the relative scarcity of suitable sites, taking Great Britain as a whole. The other disadvantage is that, if for any reason, climate, late sowing, faulty technique, the seedlings are too small to lift at the end of the first season, and have to be left in the beds, then growth in the second year is usually so enormous that they cannot be used either for lining out or for planting. Fortunately, this is an event which very rarely occurs.

Generally speaking, the advantages of this type of nursery so greatly outweigh the disadvantages at the present time that it can be safely recommended for raising seedlings provided the conditions are suitable. Research into the nutritional requirements of young conifers has not yet progressed sufficiently far to offer any security that plants of equivalent size and quality can be produced wholesale in nurseries of the normal type; if this became possible the greater convenience of a more centralized nursery of the usual character could offset some of the advantages of the heathland nursery.

Although the most striking results in heathland nurseries are obtained with conifers these nurseries give excellent results with a wide range of broad-leaved species. They can also be used successfully for lining-out but the usual practice is to line the heathland seedlings out in normal nursery ground where they generally give good results, and confine the heathland nursery to the production of seedlings.

The technique of raising young forest trees in heathland nurseries was first worked out by the late Dr. M. C. Rayner at Wareham, in Dorset, where her new methods produced spectacular results on the dry, infertile heaths of that district. An essential feature of her practice was the siting of the nursery on land which had not previously been subjected to cultivation. The methods now in use in heathland nurseries all over the country follow closely those which were evolved by Dr. Rayner at Wareham, though in course of time various modifications have been introduced. The success of a heathland nursery depends in the main on careful choice of site and close attention to the details of technique.

### CHOICE OF SITE

A site for a heathland nursery should be sought on uncultivated land on which vegetation is composed mainly of plants such as *Calluna vulgaris*, *Erica cinerea*, *Vaccinium myrtillus*. A moderate admixture in the vegetation of *Molinia caerulea* or of *Deschampsia flexuosa* would not rule out the site, but one must be careful about grasses, which are apt to seed themselves after the land has been prepared, and very grassy sites should be rejected. A thin distribution of bracken over the ground may be accepted but any sign of vigorous bracken growth is an indication of unsuitability.

Vegetation of this kind is usually associated with a layer of peaty raw-humus or peat on the surface of the mineral soil and, provided this layer is no more than four inches deep, there is every advantage in its presence. Soils under this covering may vary in texture but, for a heathland nursery, it is advisable to select a soil which is light and sandy and with a low silt content. It should be deep and well-drained. These soils are acid in reaction, which is an advantage for conifers, the upper layers are generally bleached and there is sometimes a hard iron pan beneath the bleached layer. When this is present it must be broken by subsoiling because it interferes with the natural drainage. Ground with a hard pan is frequently very wet in the winter when water accumulates and lies on the surface. It is important, therefore, to examine the site carefully during the winter before any work is done; one can be badly misled by the appearance of the ground in the height of summer.

If the upper layers of the soil have an appreciable content of humus matter so much the better; small stones and gravel do not normally cause inconvenience but large stones or flints in the upper layers of the soil are apt to be troublesome as they make it difficult to obtain a good tilth for sowing.

It is preferable to plan the heathland nursery on a slight slope which will assist drainage but level ground on a freely-draining subsoil has proved perfectly satisfactory. Steep slopes, on the other hand, should be avoided on account of the risk of surface wash when heavy rains occur. Sites which are obvious frost hollows should not

be selected; the topography of the land should allow cold air to drain away freely.

Although some heathland nurseries have been established in exposed situations there is no doubt that their performance is greatly improved by shelter. The best, and usually the most convenient, form of shelter is that provided by adjoining or surrounding plantations. Good heathland nurseries have often been made in forest rides but narrow rides should be used only if the plantations on either side are still small. Successful heathland nurseries have been made on woodland sites which carried crops of young trees up to a small pole stage. The roots of small trees can be extracted from the soil without too much disturbance or without bringing up the subsoil. A convenient way of doing this is to leave high stumps when cutting the trees and then to use a bulldozer with the blade set clear of the ground, to push the stumps out of the soil. Little soil disturbance results if the trees are small and the roots come out cleanly.

It is otherwise with large trees the stumps of which cannot be removed without considerable disturbance and experience has shown that nurseries formed on woodland sites on which large trees were present are always very patchy in performance. Seedling growth is usually poor on and round the sites of the old stumps. Woodland of this kind is not recommended for heathland nurseries.

The size of the nursery will depend on the quantities of plants which it is desired to raise but care must be taken lest pieces of unsuitable ground are included mainly to give the area required. It pays to confine the work to really suitable land and it is better to find the necessary area in two separate blocks than to attempt to form one nursery on land which is partly suitable and partly unsuitable.

The nursery should, if possible, be conveniently placed for labour and for supervision, and a supply of water is a great advantage.

The site selected should be reasonably close to a hard road but main roads, with fast-moving traffic, are apt to spread those weeds the seeds of which are airborne. Since one of the great advantages of the heathland nursery is freedom from weeds, the site chosen should not be liable to ready invasion from adjoining land.

#### PREPARATION OF THE SITE

To prepare the land for use as a nursery it is necessary first to remove its existing plant cover and then to work the soil to a satisfactory tilth. In carrying out these operations certain important points must be kept in mind. Shallow cultivation is essential; the subsoil must not be brought to the surface; the humus content of the soil and the litter should be conserved as far as possible. These requirements rule out the use of deep-going cultivators while bulldozers or similar machines should not be employed to remove the vegetation (other than small tree-stumps) because they are apt to

remove the humus-bearing layers of the soil. Small areas can be prepared by hand-digging, but for areas of any size it is more convenient to use tractor-drawn implements.

If there is a dense growth of rank or strong heather this should either be burnt off or cut with a scythe or mowing machine and removed from the ground. If heather or other vegetation is short it is normally destroyed by the processes of cultivation.

The next step is to break the surface mat of heather, peat, etc. and for this the most suitable implement is a heavy rotary cultivator. This cultivation must be thoroughly done, preferably in dry weather, so that the peat and other matter can be broken up into fine fragments. The heavier, coarse root material and other debris which resists breaking up should be raked off by means of a tine harrow which drags it to one side. These two operations should completely destroy the surface vegetation, reducing part of it so that it is incorporated in the soil and removing the remainder which has proved intractable.

Subsoiling, if necessary to break a hard pan, should be done at this stage. The subsoiler should be run through the soil at two-foot intervals.

The ground should next be ploughed. Here care must be taken not to go too deep nor to bring up any subsoil. A depth of five inches is adequate. The land is then cross-ploughed and the fine tilth produced by a disc harrow.

By this cultivation the land should be brought into the same physical condition as one would expect to find in a nursery of the normal kind on a similar soil. It is important to leave ample time for the operations and in order to get a site ready for spring sowing the first cultivation should be started not later than the preceding December.

#### MANURING OF SEED-BEDS

In Rayner's classical work at Wareham great use was made of composts which were applied to seed-beds at the rate of twenty tons per acre, a very heavy application indeed. Various materials were used in the manufacture of the composts but Rayner finally used, as her standard, a compost made from bracken and hop waste which was extremely effective in promoting the growth of large seedlings. When heathland nurseries, on the Wareham pattern began to be developed in other parts of Great Britain, the compost treatment was naturally followed but it was soon discovered that raw hop waste, uncomposted, gave equally good results when fortified by the addition of fertilisers, while it was found, experimentally, that fertilisers alone, if used in adequate quantities, could give most excellent results. It was thought, originally, that composts, in addition to providing nutrients, encouraged the development of mycorrhiza but recent research has shown that not all compost-grown seedlings are furnished with mycorrhiza, while plants grown

with chemical fertilisers alone have been found with complete mycorrhizal equipment. It appears, therefore, to be almost certain that the presence or absence of mycorrhiza makes no difference to the performance of a coniferous seedling in the nursery.

A practice which has now become common in heathland nurseries is that of combining chemical fertilisers with organic manures. For seed-beds raw hop waste or a bracken-hop waste compost is applied at the rate of ten tons per acre and this is supplemented by an application of potassic superphosphate (16 %  $P_2O_5$ , 16 %  $K_2O$ ) at the rate of 14 lb. per hundred square yards of seed-bed. These are worked into the top five inches of the soil and are applied as early as possible in order to allow of early sowing which is essential if the best results are to be secured.

For Douglas Fir it is better to omit the organic manures and to apply the potassic superphosphate alone.

When a new heathland nursery is being established on a very acid soil with pH of below 4.5, a light dressing of lime is often beneficial. Ground limestone at the rate of 5 cwt. per acre is ample and this should be applied only at the start and again in five years' time. It must not be applied annually.

#### PREPARATION OF SEED-BEDS

There is no essential difference between the practice followed in heathland nurseries and that commonly followed in nurseries of conventional type, but there are one or two points which should be kept in mind in the heathland nursery.

In the first place, if bulky organic manures such as compost or hop waste are used it is very necessary to make sure that the seed-beds are properly consolidated before sowing because the heavy applications to the superficial layers of such substantial quantities as are used is apt to leave the soil in an open condition with the result that there may be heavy losses from drought. In order to give the beds time to settle it is, therefore, advisable to apply organic materials early, at least two months before sowing. Further, to aid consolidation, the roller should be applied, and it may even be necessary to tread the seed-beds in order to secure the right conditions for sowing.

Since weed-growth should not be a problem the seed-beds may be made wider than is customary, thus leading to a saving of space and, since the heathland nursery soils are not retentive of water, the beds need not be raised above the level of the alleys as much as is necessary in some ordinary nurseries.

#### SOWING OF SEED

The heathland nursery produces large seedlings and this must be remembered when sowing densities are being considered; one must visualize, at the end of the first growing season, a crop of seedlings not unlike those in a two-year-old seed-bed in the normal

type of nursery. Sowing densities must, therefore, be calculated to give adequate space to those large seedlings in their first year. We find that with seed of average quality the following numbers of square yards per pound of seed, sown broadcast, for the following coniferous species, has given satisfactory results: Scots pine, 55; Corsican pine, 35; European larch, 45; Japanese larch, 60; Douglas fir, 45; Norway spruce, 45; Sitka spruce, 85. Broadcast sowing gives individual seedlings more room than drill sowing; since there is no weed problem there is little advantage in drill sowing.

Seed-beds, after sowing, should be covered with sand or grit. Where the site is exposed a coarse grit should be used, otherwise the covering and the seed may be displaced or removed by the wind. Any grit so used must be free from lime.

#### TOP DRESSING OF SEEDLINGS

To get the best results it is advisable to apply top dressings during the growing season. If the seedlings are of pine or spruce Nitrochalk should be applied twice, at the rate of 6 lb. per hundred square yards, in early July and again about the beginning of August. If larches are being grown the applications should be at half this rate (3 lb. per 100 square yards) while with Douglas fir no top dressing should be given as it promotes a late lush growth which lays the plants open to damage from early autumn frost. In a dry year it is safer to omit the second top dressing, but in a wet year a third dressing may sometimes be applied with advantage. Nitrochalk is best applied when rain is in prospect, but while the seedlings are still dry, so that any of the fertiliser which remains on the foliage can be brushed off without difficulty.

#### LINING-OUT

Heathland nurseries can be used for lining-out but it is arguable whether they are not better employed in raising large one-year seedlings which can be removed and transplanted in nurseries of the standard type. They can, however, produce most excellent crops of 1 + 1 transplants of a wide range of conifers.

For transplant lines manuring should be on the same basis as for seed-beds except that the organic matter should be cut down to five tons per acre. Top dressings should be carried out as for seedlings.

#### SIZE OF SEEDLINGS PRODUCED

Coniferous seedlings, one year old, of the following species can be produced in a good heathland nursery in a normal year.

|                |           |               |            |
|----------------|-----------|---------------|------------|
| Scots pine     | 3½-7 ins. | Douglas fir   | 4½-10 ins. |
| Corsican pine  | 2-4 ins.  | Norway spruce | 2½-7 ins.  |
| European larch | 6-13 ins. | Sitka spruce  | 3½-8 ins.  |
| Japanese larch | 5-12 ins. |               |            |

Reference has already been made to risks of damage to Douglas fir by frost in the autumn, if full manuring is given, but apart from that and from a few isolated attacks by *Botrytis* in over-dense seed-beds of Sitka spruce, there have been no troubles and healthy stocks have been raised everywhere. There is no sign that the regime to which the young plants have been subjected in the nursery in any way impairs their strength or renders them unsuitable for use in the hard conditions of afforestation areas. For this purpose they have compared very well with plants grown in the normal nurseries.

#### MANAGEMENT

When we started heathland nurseries we had it in mind that they would be essentially temporary affairs, wearing out, or becoming infested with weeds after a brief number of years, but experience has taught us that their duration of life is likely to be much longer than we originally expected. With the manurial treatments prescribed it has been possible to continue already for six or seven years without loss in fertility or performance, and, so far as we can see, for a considerable time to come. This applies also to those nurseries which have been run on chemical fertilizers alone, although there are suggestions that there may be occasional slight disorders where the organic manures are not applied.

Similarly, the invasion of heathland nurseries by weeds has not occurred as rapidly as we expected, although, in one nursery at least, weeds were brought in with seedlings which had been introduced for lining out from a nursery on arable land. It appears, therefore, that if reasonable precautions are taken, that the freedom from weeds, which is one of the desirable features of the heathland nursery, may persist for at least a decade.

It is not easy to foresee the future of the heathland nurseries but, for some time to come, they are likely to play a very important part in the production of our seedling stocks. Any revolution in technique which would enable similar results to be achieved in centralized nurseries of the kind with which we are familiar, would lead, in all probability, to a movement away from the heathland type. But at the moment there are no immediate signs of this revolution.