The establishment of Alder on Peatland and its possible role in Afforestation

D. N. McVEAN,

The Nature Conservancy, Aviemore, Scotland.

THE only experimental plantings of alder on acid peat which I have come across have been on the Forestry Commission experimental forest at Inchnacardoch, near Fort Augustus in the Great Glen of Scotland. This is a fairly extensive area of blanket peat mostly over one metre in depth and lying around 150-300 metres above sea level. The alders were planted about 30 years ago, the species used being *A. glutinosa, A. incana, A. viridis* and *A. oregona.* None of these was a great success; all failed without the application of a few ounces of basic slag, and when I saw them in 1953 the best trees, *A. incana,* were those which had been given a top dressing of ditch cleanings from the A1 horizon in addition to slag; these had reached a height of four metres. The best *A. glutinosa* was only 1-2 metres high with sparse foliage and extensive die-back and the two other species had failed completely even where slag had been applied.

At the present day I think I am right in saying that alder, mostly incana and Oregon alder, is used for amenity purposes in small flushed areas along roadsides, where it forms thickets a few metres tall.

Between 1949 and 1952 I had gone into the ecology of *A. glutinosa* in some detail and it seemed to me that one should be able to do better than this. I therefore included alder in a programme for investigating the possibilities of establishing native trees by direct sowing on shallow blanket peat at Beinn Eighe in Ross-shire. The results of the alder trials have been published in the Journal of Ecology as Part VII of a series on the ecology of the species (McVean, 1959).

It was immediately apparent that nothing happened if one simply scattered alder seeds over the ground. In wet areas a crop of small chlorotic seedlings was certainly obtained in the first year but these generally failed to survive the winter. If sowing was followed by an application of ground rock phosphate at about 2 oz. per square yard seedlings still failed to appear on the drier peat with a vegetation of *Calluna, Erica, Trichophorum, Molinia* and lichens but a good crop of seedlings was obtained in damper areas dominated by *Molinia, Trichophorum, Myrica, Sphagnum* and other mosses and from this crop a small number of seedlings began active growth, turned dark green in colour and reached about 6 cm. in height by the end of the growing season. These actively growing seedlings were invariably well nodulated while the seedlings that remained small and chlorotic were usually without nodules.

In the spot sowing that was carried out in subsequent years, therefore, the sowing mixture contained an inoculum of crushed alder nodules in addition to ground rock phosphate. Results were extremely satisfactory and at least 90% of the sown spots gave groups of actively growing seedlings in the first season. Spots that had been inoculated without the addition of phosphate gave small green seedlings which were nodulated but failed to develop satisfactorily.

The earlier experiments on this ground were unfenced so that it was not long before the young alders reached a size at which they attracted browsing red deer during winter and early spring. Significant measurements of plant size do not extend beyond five years for this reason. Height measurements can, however, be given as follows:

Year	1	5-10 cm.
	2	40 cm.
	3	80 cm.
	4	110 cm.
	5	175 cm.

In other words these alders are making something very close to their maximum growth rate in virtually waterlogged peat with a pH of less than 4.0. There is as yet no sign of die-back although leaf curl fungi are abundant on the leading shoots as they often are on quick growing alder shoots. The plants have good surface root development among the mosses and *Molinia* leaf bases and these roots are abundantly nodulated. The best growth is obtained where water free from peat acids emerges from the underlying drift or bedrock and irrigates the slope. Plant indicators of this state of affairs are *Schoenus nigricans* and the moss *Breutelia chrysocoma.* Growth is nevertheless quite satisfactory in the absence of irrigation.

The original components of the vegetation also benefit from the added phosphate and show this by an increased growth rate and greener colour. Phosphoric acid will produce the same reaction but not lime,

thus indicating that phosphorus rather than calcium is the active ingredient of the rock phosphate.

The final size of the alders remains to be seen and we wait with considerable interest to see if the plants by themselves will bring about any drying of the site. Sowing is being carried out at Beinn Eighe on a sufficiently large scale for this effect to be noticed if it exists.

Bond and his collaborators in Glasgow have established that appreciable quantities of nitrogen are fixed in the root nodules of *A. glutinosa* and that this takes place under field conditions as well as in the laboratory (Ferguson and Bond 1953, Bond 1956). Crocker and Major have shown that increase in total nitrogen in soils developed on glacial moraine in Alaska is probably largely due to colonisation of the moraine by a scrub of *A. crispa* and that when the alder is replaced by *Picea sitchensis* and *Tsuga* forest at 60-70 years there is a fall in the rate of nitrogen accumulation and even a loss of nitrogen from the forest floor (Crocker and Major 1955).

Unlike alder, birch is not generally considered to be a phosphate demanding species. I was therefore slightly surprised to find that naturally occurring birch seedlings and small stunted saplings within the area of the above trials had begun active growth unlike the birches on the neighbouring untreated peatland. Experiments are now being carried out to determine if this is a response to phosphate under very wet soil conditions or if it is associated with the nitrogen fixing activity of the alders.

The alder sowings have so far been carried out without any ground treatment such as ploughing and draining and, in fact, establishment is definitely better on the wetter sites. This preference of the alder for wet or waterlogged ground is purely an establishment phenomenon and after the first season growth is not hindered and may be considerably improved by better drainage. Here then is a way in which nitrogen fixation by the alder might be utilised in peatland afforestation just as the broom is often used as nurse species in heathland plantations. It should not be difficult to arrange for the direct sowing of alder on suitably wet blanket peat one or two years in advance of the usual deep ploughing. The alders will survive ploughing sufficiently well to form a significant element in the resulting forest and this intermixture may prove to have a beneficial effect on the growth rate and productivity of the conifers.

References.

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