

stratum and the depth at which it lies, in order from those data to determine what mode of cultivation should be adopted.

In the province of Hanover, where thousands of acres of heather wastes have been purchased by the Government in the last few years, it was especially necessary to examine the ground carefully, as the expensive nature of the cultivation of moorpan has, of course, a very material influence on the value of the land. The average price of such land was from 24s. to 30s. per morgen\*, varying according to the depth at which the moorpan lay and the thickness of the stratum.

With regard to the component parts of moorpan, experience has shown that when "weathered" they exercise a very favourable influence on the growth of trees, and the moorpan should therefore never be removed from the cultivated tract. We saw two adjoining pieces of land, on one of which the moorpan had been left, and from the other removed. The growth of the Scotch fir was much better on the former. Moorpan is destructive to the growth of trees simply because their roots cannot pierce through it, and because it entirely hinders the beneficial influence of water between the upper and lower ground. It is especially prejudicial by long-continued drought, as the ground moisture is unable to pass through the stratum to the surface.

To the question if, after being once broken up, the moorpan is again formed, there is no definite or decided experience to reply. It can be fairly supposed though, that if on a tract which has been once cultivated the heather is again allowed to grow unopposed, moorpan will again be formed, but that, on the contrary, on tracts which are regularly planted and cultivated its formation cannot take place.

Sufficient has been said to show that it is absolutely necessary to break through the moorpan if planting is to be carried on with success. The methods of cultivation differ widely, and are dependent upon the depth at which the moorpan lies and the structure of the stratum. Where the layer lies two feet or more deep, it must be broken through with pickaxe and spade. This is the most costly method, and entails an outlay of from 30s. to £3, according to the hardness and depth of the stratum, to trench a morgen, the trenches being the same width as the spaces between them; in reality, therefore, only half of the morgen is cultivated. Should a still larger outlay be required, it is very questionable if it is judicious to cultivate at all. Small wastes in the middle of a forest might justify such an outlay, and in such places even more than £3 might be expended in order to make the forest compact.

The trenches are, as a rule, six feet broad and six feet apart. The manner of proceeding is the following:—After the trenches are marked out by means of a line, the workman throws the earth out of a part of the trench until the moorpan is also thrown up on the surface; then, going backwards, he fills the hole thus made with the earth won from the next part, and so on until the trench is finished. In this manner the surface earth is thrown in first, and the moorpan on the surface. It is of the utmost importance to control this work carefully, as it is only given by the job, and the workmen are therefore apt not to break through the stratum thoroughly. As it is impossible, when extensive areas are under cultivation, to be constantly superintending the work, the trenched ground is afterwards examined with the so-called moorpan-searcher, in order to see if there is any part of the stratum still underground. This instrument is a simple bar of iron five feet long and half an inch thick, sharpened at the point and furnished with a handle.

In places where the stratum lies deeper, and where the outlay incurred by this manner of trenching would bear no proper proportion to the receipts gained by the first felling, a different and less expensive method is used, called in German "*rabatten-cultur*." The process is the following:—Ditches of from four to six feet breadth are dug at a distance of from 12 to 16 feet apart; the contents of the ditches are thrown upon and equally spread over the broad undug beds, with the moorpan on the top. By this means the beds or *rabatten* are considerably raised, and the plants placed on them have therefore a deeper soil, the stagnation of the upper ground water is prevented, the atmosphere is enabled, through the open ditches, to act on the remaining moorpan, and thus cause it more or less to "weather," and the unfavourable influence of the formation on the growth of plants is greatly diminished.

In order to save expense, experiments have also been made by means of turning up the ground in holes of four feet square, the squares four feet apart one from another; but it has been found that the trenches and *rabatten* are much superior, as the plants on them have more growing room, and as the luxuriant growth of the heather encroaching from four sides is apt to choke the plants growing on the squares. The cost of this method averages from 24s. to 30s. per morgen.

Sowing was formerly almost without exception the rule, with from four to five pounds of Scotch fir seed per morgen. Latterly, planting is the only method in use, unless it is an object to grow at the same time material for planting elsewhere, and thus cover part of the expense of a nursery.

According to the experience gained in the Nienburg Forest, planting with strong healthy one-year-old Scotch fir has had by far the most favourable result. Plantations made with plants older than one year, as well as those grown from seed, have not the same favourable growth. The one-year-old plants are reared on deeply-trenched seed beds manured with humus of *Calluna vulgaris* and *Vaccinium myrtillus*, which has been brought some years before into heaps and been constantly turned. In this manner, unless the weather is very unfavourable, healthy strong plants are reared. The six feet broad trenches are planted with three rows of Scotch fir, the distance between them in the rows being three feet. Care should be taken to plant the two side rows as near as possible to the untrenched space, in order to favour the closing of the plants as soon as possible over the whole area. As it is most desirable to bring about the closing of the plants as soon as possible, a row of Scotch fir can also be planted down the middle of the untrenched space at a distance of from five to six feet of each other. Of course those plants cannot have the same growth as those on the trenched ground, but it is undeniable that they also profit from the cultivation, and that the closing of the wood is greatly furthered by them.

The cultivation of the spruce fir, the Weymouth and Austrian pine has also of late years been

\* One Hanoverian morgen = 0.6477 of an English acre.