

# Forestry ploughing

*Much of the timber we are harvesting now is planted on ploughed terrain. Ploughing was a very demanding task...*

When I joined the Commission in 1979, as manager of the Commission's Central Engineering Workshop at Chapelhall, ploughing operations were as important as harvesting. This was due to the on-going forestry expansion programme that was very much the main thrust of the Commission's objective to double the UK forest area. Consequently, mechanisation in forestry was focused on road-building to access the land and its subsequent cultivation for planting.

The ploughs used by the Commission were, in the main, manufactured by William Clark of Parkgate, and the various designs were a result of close cooperation between the Commission's ploughing experts, such as the late Jimmy Paterson, and the manufacturer's Murray Clark (father of the company's current director, Douglas Clark). This close cooperation allowed for ploughs to deal with the cultivation and drainage of soil conditions, ranging from steep, stony mineral sites with an iron pan at depths between 8 and 18 inches, through peaty gleys, to deep peat, frequently of unknown depth.

The designs fell into two generic types, one for steep and mineral sites, and the other for flat, wet and peaty sites. A number of different moldboard (bucket) designs were available for each plough type and they were designed to suit the planting or draining regime chosen for the site.

## Ploughs on soft/flat ground

Soft ground ploughs were trailed rather than mounted. On Clark's standard soft/flat ground plough carriage, the moldboard was mounted on one end of a beam, with the other end serving as the draw-bar which was attached to the towing tractor through a swivel link. This prevented the tractor from being damaged in the event of a plough roll-over. The beam was under-slung from a portal axle fitted with tractor wheels of a size and combination selected to suit the conditions. The beam could be raised and lowered by means of twin hydraulic rams controlled by the operator, mounted between the beam and the axle.

A further development of this plough carriage was introduced to give more clearance under the beam and was known as the 'Humpy'. The need for the Humpy was evident when cross-draining. (Cross-draining is the term used when a furrow is drawn across the previous furrows to collect the water and lead it down-hill to a disposal point.) My understanding was that originally it was common for the material cast from these drains to block, under the beam, when ploughing the cross drain. By curving the beam upwards (thus creating the 'hump') sufficient clearance was obtained to avoid blockages.

## Steep-ground ploughs

On steep ground the plough most commonly used was the Clark



*International BTD8 steep ground ploughing tractor with a Clark plough.*

mounted plough. The beam for this plough was mounted on a back-plate customised to suit the tractor chosen as the prime mover, and incorporated pivots that allowed the plough to be lifted and lowered, as well as to swing laterally.

This lateral freedom was to avoid undue stress being placed on the tractor when the plough was forced sideways by an obstacle. Compression springs were fitted to either side of the beam so that the plough remained central to the tractor when lifted. The beam could carry a range of optional buckets, some of which had an extended ripper tine fitted to the plough-point (sock) to break up any hard pan that would inhibit the root growth of the trees.

The technique for steep-ground ploughing seemed, at first, to be simple. Reverse straight up the slope, with the plough raised, until the tractor would go no further due to lack of traction, then drop the plough and run to the bottom again. If the site wasn't too steep, a forward gear had to be engaged – otherwise gravity did the work.

Problems encountered were all to do with traction. When reversing up the slope, the topsoil that was carrying the tractor could shear-off from the sub-soil and sledge down-hill, leaving the tractor with no contact with the hillside and, therefore, neither steering nor braking. The operator would drop his plough in the hope that it would penetrate the turf 'sledge' and line the tractor up with the slope. If he was really lucky, the plough would dig in sufficiently to bring the tractor to a halt. Details of the number of accidents of this type are not recorded.

The other, more common, possibility was that, when reaching the upper limit of traction on a slope, one track would lose grip before the other, and if the operator did

not react quickly enough, the tractor would turn sideways across the slope and possibly overturn. With a heavy plough in the raised position and a tin cab on the tractor, this could be nasty, but surviving operators became expert at immediately dropping the plough in time to prevent this from happening – a fine illustration of Darwin's theory of natural selection.

## Contour ploughing

This was a technique that involved, as the name suggests, ploughing along the contours of a slope, and was done to preserve water, but on soils where erosion and wash-off were a possibility, the technique was modified to slow the rate of water flow to below that which would erode the soils. This was done by ploughing across what were often steep slopes, at a shallow angle to the slope. The process was carried out by the same ploughs as were used for steep-ground work, but since they were working across the slope, the potential for roll-over-type accidents was considerable. For this work the tractor cabs were removed, not only to enable the operator to bale out more quickly, but also to reduce the repair cost in the event of a roll. On particularly steep side-slopes, the operators walked parallel (on the topside) to their tractors as they ploughed, steering by means of ropes tied to the steering clutch levers and hand throttle.

## Trailed-plough tractors

By the time I was involved, it had been established that the ideal power required was between 140 and 170hp for a trailed plough. This presented problems due to the weight and lack of ground clearance exhibited by crawler-tractors with this level of power. Furthermore, if they sank, and they frequently did,



*'Double head' ploughing with two 'long' Counties and a Cuthbertson plough.*

the subsequent debogging exercise was expensive and time consuming.

The solution that evolved was to use two tractors, preferably identical, of about 70hp each, with a rear-mounted winch. The lead tractor's line was attached to the second tractor – to which the plough was attached on a short line. This combination gave a number of options in the event of the plough becoming stuck: one or both tractors could move independently to find grip before pulling the plough through the obstructing patch. If the lead tractor became stuck then it could winch itself out using the second tractor and plough as an anchor.

With the development of good teamwork, the unit seldom become so bogged that a third unit had to be brought in and although this working method required two men instead of one, the overall cost per acre was reduced.

Although a range of different makes and models of tractor was purchased for this task, the most commonly used was based on the International BT88 – with what was called a Bowen 60 conversion. This kit was sold by Bowen International's Scottish agent, who developed the kit for use on the early version of the BT88 when they were rated at 60hp – hence the name – but the same kit was also used after the tractor was upgraded to 70hp. The kit was essentially an extended track-frame which, although it gave the tractor a bigger footprint, did not generate a proportionally greater pull. This was because the track was extended forward and, when the tractor was pulling, the weight transferred backwards, causing the front of the tractor to rise out of contact with the ground.

A second kit was developed to overcome this problem, and at Chapelhall, where the kit was manufactured and fitted, many BT88s were successfully converted. They were known as the CEW 70. This was more effective as the kit dropped the sprocket downwards and backwards, increasing ground clearance while allowing the track-frame to be extended both backwards and forwards, producing a well-balanced machine with exceptional ground clearance, for a tractor of its power.

### Domestic problems

The problems that arose, from this 'double headed' system of working, were not engineering ones, but domestic ones. It was common practice for operators of machines, working in remote areas to live in



Clark trailed single-furrow ploughs with double throw moldboards, fitted with cage wheels, belonging to Dalgleish Brothers of Moffat.

caravans through the week – going home only at weekends. Where two men were working on the same site, additional savings on their costs could be made by their sharing a caravan. This required very careful selection when pairing operators since these men were living and working in very cramped quarters for long periods of time. The best stories cannot be put on paper, but a fairly typical 'domestic altercation' that I had to deal with arose when one of the team insisted on boiling his socks and underwear in the same pot that was used for making the porridge. Apparently, he saw nothing unhygienic about this and claimed that he gave the pot, "A guided rinse oot eftir billin' ma claze."

### Debogging

To the best of my knowledge, the Commission has never left a unit underground, but I know for a fact that many of the debogging exercises have cost more than the value of the machine being retrieved. One of the first problems commonly encountered when a machine sank was that the only parts of the machine visible were not robust enough to attach a rope to. The pull-hooks, as supplied by the manufacturer, are usually under the nose of the unit, on the belly-plate. When a machine is sunk in a slurry of peat and freezing-cold water, how do you shackle a heavy-duty sling to the hook that is five-feet under the surface? The answer is you don't – you attach it before it sinks. Once this was realised, all ploughing tractors and machines, where sinking was a possibility, were fitted, immediately on delivery from the manufacturer, with a strop – one end of which was permanently attached to the pull-hook and the other to a bracket on top of the bonnet, or other such mounting, high on the superstructure.

Very few machines require to be debogged as a result of normal usage. Inevitably, expensive debogging exercises resulted from poorly executed attempts at a quick-fix. Machines stuck in wet areas are held by suction: the faster you pull the more pull you will require. Use the slowest pull-speed and the force needed will be surprisingly low. A two-tonne hand-winch will debog a machine that a ten-tonne, line-pull winch cannot move.

### Steep-ground tractors

A wide range of crawler-tractors were suitable for this purpose. The basic requirements were for about 70 to 100hp and a back-end that could easily be adapted to mount the plough. Normally, if the fixed draw-bar was removed, the mounting holes could be picked up and used to mount the plough. Tracks did not have to be too long since steep ploughing was, more often than not, on firm ground. Provided the track plates were sufficiently aggressive, there was no need to fit anything other than standard grouser plates.

With the weight of the plough

on the rear of the tractor, it was ideal for reversing up slopes – and to prevent the front from being too light when running empty, front-mounted, hydraulic winches were fitted, both as ballast and to give a means of self-rescuing if a problem arose.

### The future for ploughs?

Currently, most commercial planting is done on clearfelled sites, but, in response to the worldwide upsurge in demand for timber, there is a likelihood that forestry may have to spread 'downhill' onto marginal grazing land. Were this to happen, it is unlikely that we will revert to ploughing as a means of ground preparation. To understand the reason for this we only have to ask, "Why plough a great long furrow when we only stick a tree in every metre along its length?"

As for ploughing amongst tree stumps for restocking, we tried that: it ruins both machines and men, does not produce good planting sites, and is more expensive than the methods currently being used.

Jim Christie



A bogged Cat D4 awaits rescue.