Some reorganisation of existing tool-store layouts will be necessary to store tools in this manner. This is a job to be done on wet time. If one accident is prevented then the effort has been worthwhile. The visible gains should be the easier issue and check of tools.

THE LEDMORE MOUNTED LINING-OUT PLOUGH MARK III

By

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Introduction

The plough is designed to fill and level one lining-out trench and to cut and prepare the next simultaneously. An important feature of its operation is that it fills a trench in two stages, first turning and compacting well tilthed soil against the seedling roots and then turning in and levelling the bulk of the soil.

The Mark III plough is a much-improved version built for mounting on a wheeled tractor. The plough has been simplified and made more compact (it now measures only 6 ft. by 4 ft. length and width overall) and the depth control has been completely re-arranged so that the plough, which is tested and pre-set when made, largely controls its own depth of working.

The plough is not upset by soil conditions except where there are a lot of large buried stones, and it will operate on gentle slopes. Working with a well-organised squad and capable supervision, 10,000 seedlings per member of the squad (including tractor driver and supervisor) can be lined-out each working day at costs considerably lower than corresponding hand-lining costs.

The plough has been in use at Ledmore for some time and recently in other nurseries. From evidence at Ledmore the quality of plant produced is as good as by hand-lining and the percentage survival of plough-lined seedlings is at least as high as that of hand-lined seedlings.

Design (See Plate 20)

The main parts are named in Fig. 18. Two attachments have been omitted; these are the spring tine, which works immediately behind the compaction roller, and the fertiliser unit, which fits into the main frame alongside the compaction roller.

The main parts and their functions are as follows:

Tow Bar: By using tow bars of different lengths the plough can be mounted on different makes of tractors.

Front Skimmer: Pushes the fine soil from the bottom of the trench up against the roots of the seedlings.

Compaction Wheel: A pneumatic wheel with screw depth-adjuster. Its function is to compact the fine soil against the seedling roots.

Main Plough Share: Completes the filling of the trench and roughly opens the next trench.

Soil Leveller: Spreads and levels the soil as it turns from the main plough share.

Compaction Roller: Firms the soil and also helps to control the working depth of the whole plough.

Spring Tine: Spreads any surplus soil which may by-pass the roller if the main share runs too deep.

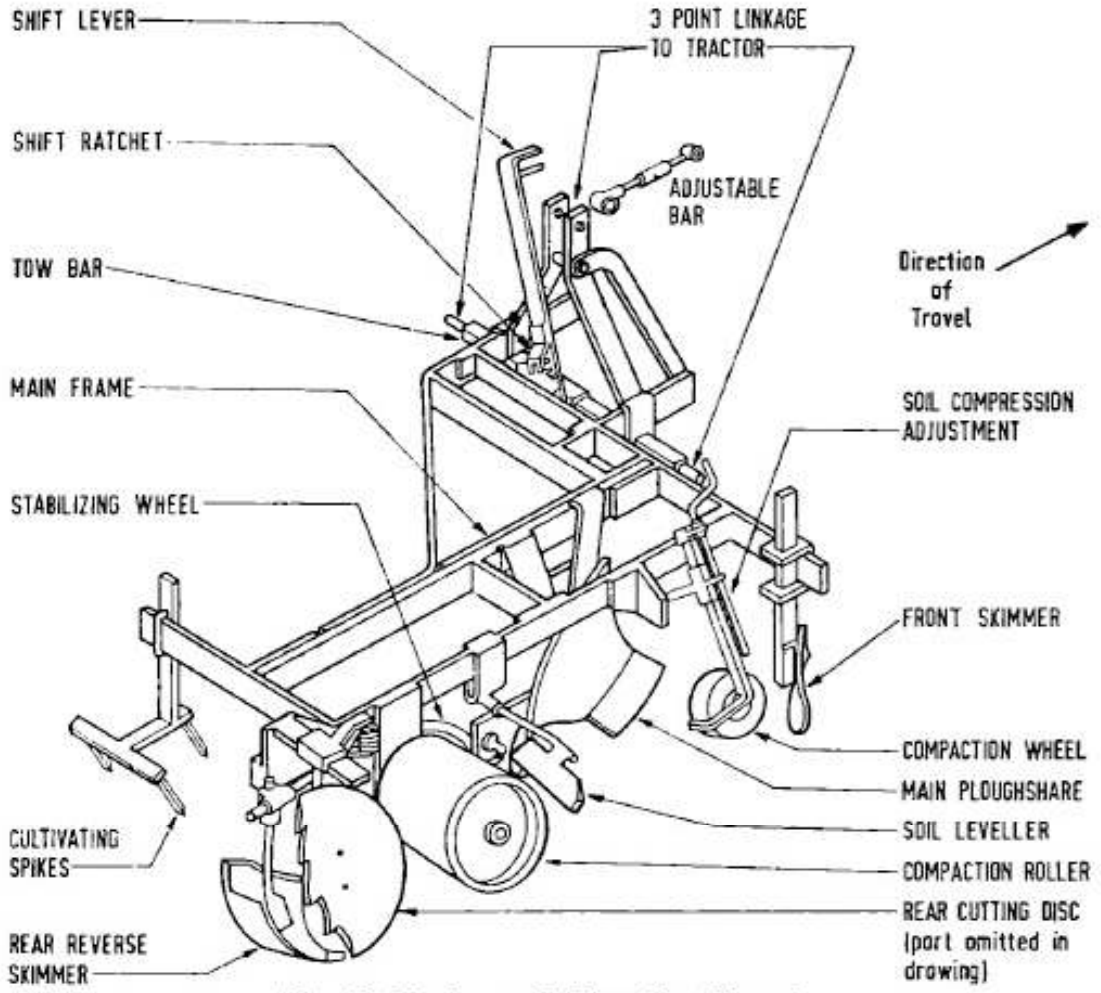


Fig. 18. Ledmore Lining-Out Plough.

Rear Cutting Disc: Cuts the new vertical edge ready for the next line of seedlings.

Rear Reverse Skimmer: Moves loose soil away from the new vertical edge to leave plenty of room for the roots of the seedlings.

Cultivating Spikes: Loosen the soil surface along the line of the next furrow.

Fertiliser Unit: Spreads fertiliser along the trench so that it is mixed with the loose soil ready to be pushed against the seedling roots on the next run of the plough.

The main sequence of operations done by the plough is illustrated in Fig. 19.

The Tractor

The instructions that follow are based on the use of the plough with a standard Ferguson tractor.

The best results are obtained when the tractor is fitted with a gear reduction unit, but tractors without reduction units can be used with satisfactory results.

Nursery Sections

The plough can be used in any length of nursery section but the most suitable length is 36 times the length of the lining-out board, e.g., if 10 ft. boards are to be used then a 360 ft. long section is most suitable. On sloping sections it is best for the plough to be worked uphill rather than across the slope.

Lining-out Boards

The Ben Reid board with the old-type notches replaced by sorbo-rubber strips is best. If nuts and bolts are used to secure the lids these should be reversed and countersunk to allow the compaction roller to run close beside the board.

Operation of the Plough

Preparation of Ground. After normal ploughing has been carried out, the ends of the section should be thrown up and edged. This edge gives the plough a "bite" at the start of each run. When soil conditions permit, the soil should be levelled ahead of the machine by harrow, discs or cultivator, especially when the ploughing has *not* been done by Ferguson one-way plough.

Hitching to Tractor. Front and rear tractor wheels should be set to 4 ft. 6 in. track centres (or nearest).

Important: The top link of the tractor, which is adjustable, should be set at 27 *in. overall, i.e.,* 25½*-inch pin centres.* Correct measurement is most important as the top link controls the functioning and depth of all attachments on the plough. The bottom links are fitted, one to each end of the tow bar, to complete the three-point hitch-up.

The levelling handle is situated to the rear of the driver's right hand on the right lift-arm of the tractor. This arm is telescopic and the levelling handle should be turned until the mark provided is at zero, i.e., the lift-arms are level. The handle should then be turned anticlockwise (*four/five complete turns*) so that the mark disappears into the tube. The plough is now ready for use.

Setting the Hydraulic Lift. With tractor and plough on cultivated ground the plough should be lowered and run forward until it is at correct operating depth, i.e., when the main plough share is turning over enough soil to keep the soil leveller fully employed and the roller is compressing the soil back to ground level. Once the tractor driver has found the correct setting of the hydraulic control lever (on the tractor, beside the driver's right hand), he should *set* the marker on this lever accordingly. In this way the tractor driver can lower the plough to the correct working depth quickly at the start of each run.

General Method of Working. The plough works up the section, filling one trench and cutting the next. At the top of the section the plough is raised and the tractor returns to the bottom of the section ready to start the next run. The tractor is lined-up, the plough lowered and the next working run started, and so on. Once the plough has passed, the boards are lifted from the filled trench and full boards are placed along the new edge.

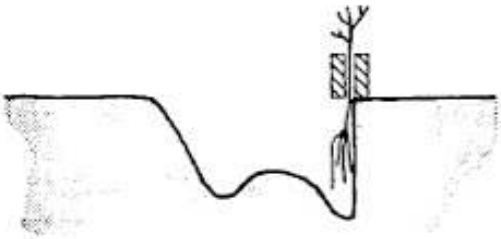
Starting a Section. A garden line should be laid along the section 5 ft. from the edge (6 ft. if starting from a hedge to allow for an alleyway next to the hedge). The tractor straddles the line so that about 3 in. separate the line and the left rear wheel. The driver takes this position as his guide while opening the first trench. When the first trench has been opened the garden line can be discarded and the straightness maintained by keeping the front right wheel in the previous plough track. The driver must ensure that the front right wheel is correctly positioned at the start of each run. *Experienced tractor drivers should be employed for lining-out operations.*

When the first trench is opened the first line of boards can be laid along its edge. Boards must be set straight and flush so that the seedling roots hang close to the vertical edge.

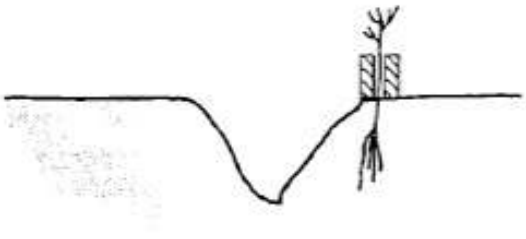
Points to Watch during Operation

(1) That the front skimmer is pushing fine soil against the seedling roots.

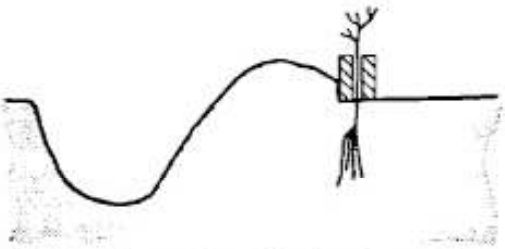
(2) That the compaction wheel is operating so as to press the fine soil firmly against the root tips. This pressure gives the seedlings their initial hold in the soil.



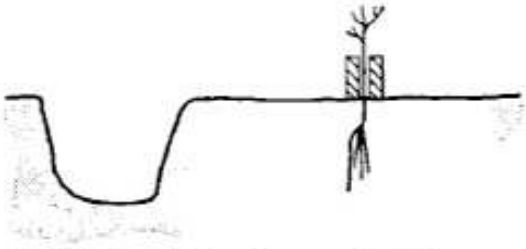
1. Lining out board in position.



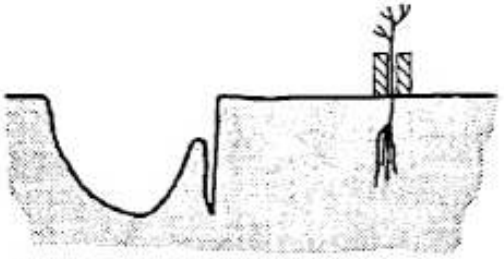
2. Fine soil moved against root tips by front skimmer and firmed by compaction wheel.



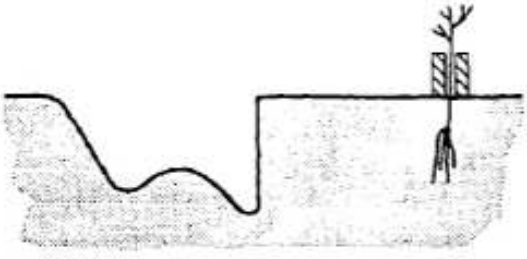
3. Trench roughly filled and next trench opened by main ploughshare.



4. Soil levelled and compacted by leveller and roller.



5. New vertical face cut by rear disc.



6. Soil moved clear of new edge by rear reverse skimmer – board is now removed.

Fig. 19. The Main Sequence of Operations done by the Ledmore Lining-Out Plough.

(3) That the main plough share is turning over the soil against the lining-out boards to slightly above ground level.

(4) That the soil leveller is spreading the soil satisfactorily. Overloading of the leveller indicates that the main plough share is operating too deep and the tractor driver should adjust for depth by raising the plough slightly on the hydraulic lift.

(5) That the roller compresses and levels soil to ground level.

(6) That the spring tine is spreading any surplus soil which may by-pass the roller.

(7) *Important:* That the rear cutting disc is giving a neat and unbroken edge. This is especially important when lining-out small seedlings. The disc should be set so that the leading edge does the work and the trailing edge is very slightly clear of the soil face, i.e., the disc should be set slightly oblique to line of travel.

(8) That the rear reverse skimmer is free to move against its spring loading and that it is set to give a depth of trench suited to the seedlings being lined-out.

(9) That the cultivation spikes are breaking the surface of the soil ready for the next run. The spikes should be running about 3 in. deep.

(10) That the tractor is geared to its lowest speed, especially when a gear reduction unit is *not* fitted.

Strip Lining-out

The plough produces lines at 9 in. apart. It can be used for continuous lining but is normally used to give lines in strips. Five runs of the plough complete one strip of five lines, i.e., a strip 36 in. wide. By making the sixth run without placing any boards a space of 18 in. is left as an alley between adjacent strips. If a wider alleyway is desired, the "shift lever" on the plough should be moved outwards two or three notches, and returned to the centre position once the blank run is completed.

The Fertiliser Unit (Fitted as an extra)

This comprises a hopper, agitator geared to the compaction roller, disc to control delivery rate and a cut-off, and should be removed when fertilisers are not being applied to the lines. The unit sprinkles fertiliser along the bottom of each trench so that it is mixed with the fine soil and thus turned in round the roots of the seedlings. Granulated fertilisers are best suited for even delivery.

The disc can be calibrated by putting a known weight of fertiliser into the hopper and measuring the distance run before the hopper is emptied (5 cwts/acre=3½ lb. per 100 lineal yards run). No fertiliser is needed during the "blank" run (i.e., when the alleyway between strips is being formed) and the cut-off is provided to stop delivery. The cut-off should, of course, be opened when the alleyway is completed and a new strip being started.

Organisation of the Squad

Close supervision is necessary. The success of the whole operation depends largely on a well-organised and well-trained squad. Allocating a daily task to each sub-squad encourages team spirit and makes the work competitive.

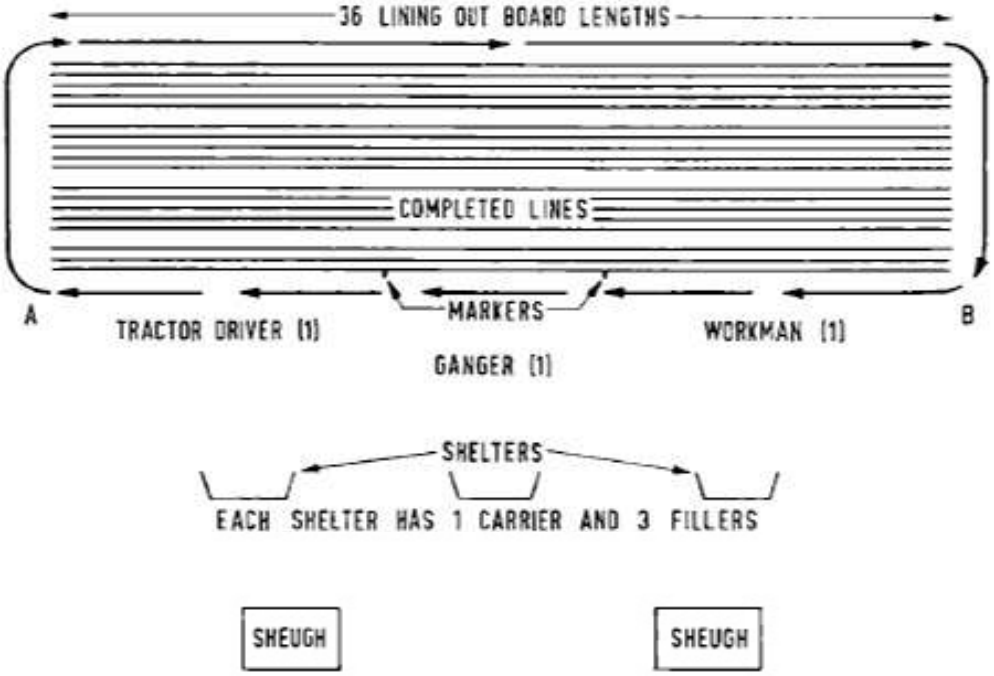
Each member of the squad must know the *correct* procedure for:

(1) Quick and accurate filling of boards.
(2) Lifting and carrying a board or boards.
(3) Setting a filled board on the edge of the trench.

The correct layout of sheughs and shelters in the section being worked is shown in Figs. 20 and 21.

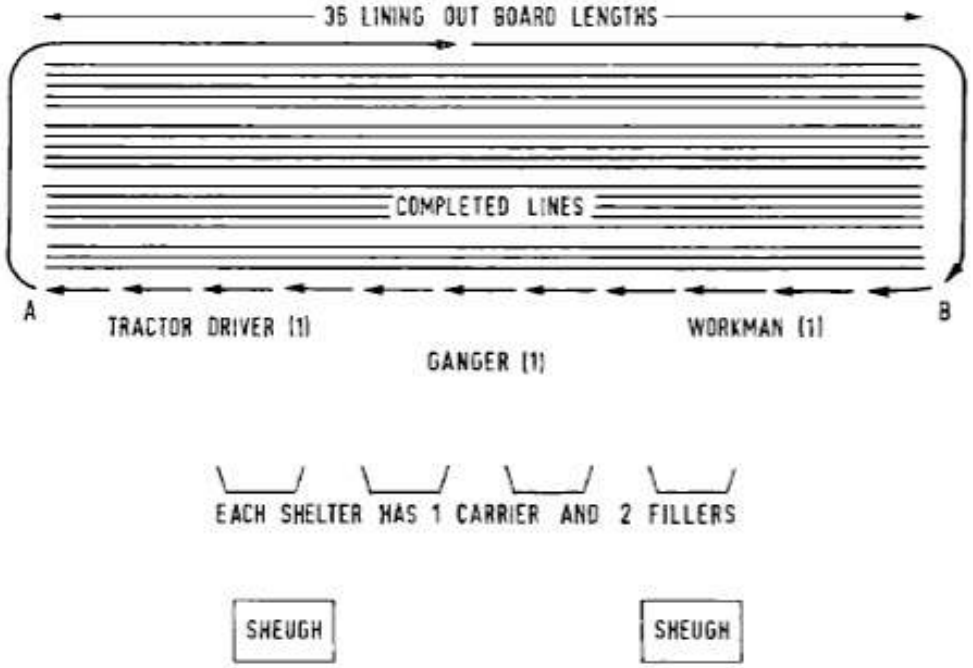
Figure 20 shows the layout for lining at 1-inch spacing.

The working length A–B is divided into three equal parts, each part being kept supplied with filled boards by one sub-squad of fillers and carriers. These



	NOS	WORK	REMARKS
Ganger	1	Supervision	
Tractor driver	1	Plough	
Workman gd. 1	1	Squaring-off behind plough	A man trained in lining out required
Carriers (1 each shelter)	3	Carry boards to line and return empties	Men or strong boys
Fillers (3 each shelter)	9	Filling boards	Women or girls
TOTAL	15		

Fig. 20. Lay-out for Lining-Out at One-inch Spacing.



	NOS	WORK	REMARKS
Ganger	1	Supervision	
Tractor driver	1	Plough	
Workman gd. 1	1	Squaring – off behind plough	A man trained in lining out required
Carriers (1 each shelter)	4	Carry board to line and return empties	Men or strong boys
Fillers (2 each shelter)	8	Filling boards	Women or girls
TOTAL	15		

Fig. 21. Lay-out for Lining-Out at 1½ and 2-inch spacings.

parts should be marked by pegs which are moved as the work proceeds so that each sub-squad can see where their part of the line ends. The ganger is responsible for seeing that the pegs are kept in the right places as the work proceeds.

Each sub-squad will need 12 boards and three in reserve, i.e., a total of 45 boards for the whole squad.

Shelters and equipment should be kept near to the work to reduce foot traffic and conserve the carriers, who have a tiring job. Shelters should not be moved more than one day's work ahead of the last completed line of transplants.

Fig. 21 shows the layout for lining at 1½ and 2-inch spacing. The routine is the same as with 1-inch lining except that each sub-squad needs only nine boards and three in reserve, i.e., 48 boards for the whole squad.

Maintenance of the Plough

All moving parts should be greased or oiled daily. Nuts and bolts should be checked frequently in the case of new machines; loose bolts can put the plough out of alignment.

The front sock of the main ploughshare needs replacement as soon as it is appreciably worn, otherwise the plough will be upset. The main ploughshare is an Oliver Redex and new socks (Code No. 8) can be obtained from John Wallace & Sons Ltd., Agricultural Engineers, 29 Paton Street, Dennistoun, Glasgow, or from any local firm which stocks Oliver Redex plough parts.

It is usually possible to repair normal breakages locally but spare parts can be obtained from the makers of the plough at Ledmore.

Orders for new ploughs or spare parts should be addressed to Mr. A. Rose, Forestry Commission, Ledmore Nursery, Bankfoot, Perthshire.

The ploughs are made in batches and it is important to order in good time, e.g., about July if the plough is needed for the following spring work.

The cost varies as steel prices fluctuate but is approximately £130, complete with the fertiliser distributor. Ploughs are made to mount on Ferguson tractors unless an order specifies otherwise.

When stored away, the mould-board and all working surfaces and moving parts should be carefully cleaned and greased. *Rust on the working surfaces greatly reduces the efficiency of the plough.*