NEW ZEALAND AGRICULTURAL ENGINEERING INSTITUTE

FARM ENGINEERING TOPICS

THE DUTCH HARROW, SHALLOW SEED-BED TECHNIQUE and CHEMICAL INCORPORATION

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THE DUTCH HARROW, SHALLOW SEED-BED TECHNIQUE

and

CHEMICAL INCORPORATION

Field Mechanisation Section

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E/8

Dutch Harrow, Shallow Seed-Bed Technique and Chemical Incorporation

All of our farm crops with the exception of potatoes are established from seed and in many cases this is done annually. Since the earliest days of cropping the importance of plant establishment has been recognised in the saying: "A crop well sown is a crop half grown." Surely good establishment is even more important now when we depend on mechanized methods in farming.

To get the best out of our machines when growing any crop we must present them with conditions which are as uniform as possible. Variations in growth rate, the habit of individual plants or time of maturity make it difficult to set machines to perform efficiently. Effective weed and pest control may be impossible. In many cases both quality and yield at harvest may be lowered.

Uniformity of crop depends largely on the start the crop receives and uniformity of establishment is dependent on the seedbed provided. We cannot hope for a uniform crop without an even germination of seed. As our cropping becomes more intensive and the use of machinery increases we must look at our seed beds much more seriously than many of us are doing today.

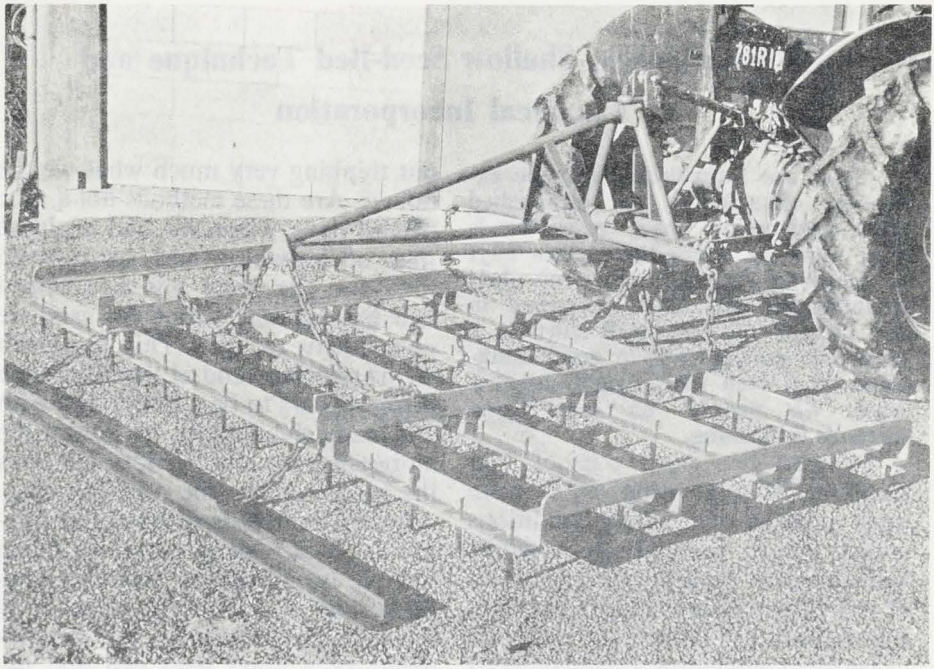
How were our present methods of seed bed preparation evolved? Are we not inclined to use methods which have become traditional without thinking very much what we are doing? Are these methods not a relic of the days when we had a dense mat of browntop turf to contend with and the more this was ripped and battered the better the crop we were likely to get? This approach seems to persist and at the same time there appears to be a belief that with the ready availability of power the more effort we can put into our soils the better will be the resulting crop.

Many thousands of man and tractor hours are most certainly being wasted in producing what is anything but a good job when it is finished. By looking at the requirements of a good seed bed and devising simplified methods to obtain them it is likely that results as good or better can be achieved, in many cases much more quickly and much more cheaply.

A seed bed should enable us to place the seed beneath the soil surface so that:

(a) it will be buffered against changes in the weather;
(b) It will be in contact with a supply of soil moisture;
(c) it is protected from birds.

In addition, it should be possible to place the seed uniformly at the required depth in soil having a suitable structure for the developing roots to penetrate for anchorage and



The Institute version of the Dutch harrow. Steel construction makes for simple manufacture.

to find water and nutrients.

Requirements

To mechanically introduce the seed and still obtain the uniformity sought a number of more detailed requirements can be added.
(1) The seed bed should be level. Most operations are carried out by wheeled tractors and implements. Consistent treatment in cultivating, sowing, and perhaps spraying cannot be given on an uneven surface. The local undulations formed mainly by previous cultivations can be removed by moving a relatively small volume of soil.

(2) The seed bed should be firm and of uniform density. A rolled surface, hard on the high spots and soft in the hollows, does not allow the setting and maintaining of working depth.
(3) The seed bed should be fine but this is necessary only on the top where the seed is placed. Fine soil around the seed permits rapid trans-

fer of moisture into the seed. If the ground was originally well ploughed with a mouldboard plough the underlying soil will have been sufficiently fractured in most cases to allow easy root penetration.
(4) The seed bed must be moist at drilling depth. Immediate germination is needed if our aim of uniformity it to be achieved.

The Shallow Seedbed

Having stated our requirements, how do we obtain them? A method of doing just this was developed in Britain and Europe and this shallow seed bed technique as it is called has been shown to work well under many New Zealand conditions.

For spring sowing in dry areas a maximum reserve of soil moisture can only be obtained by autumn or winter ploughing but in other districts spring ploughing is satisfactory.

If crop is to follow old grass the ground should be worked to destroy the sward, then ploughed as well as possible. Finishes should be kept shallow and all turf or weed growth completely buried.

After ploughing nothing further is needed until immediately prior to sowing so that weeds have no chance to emerge before the crop. With spring ploughing a partial treatment is given immediately ploughing is completed to consolidate the surface. However, the final preparation is not made until sowing time.

Although there is nothing unusual about any of this, there is a major difference in the method used to prepare the final seed bed.

In the traditional treatment, discs and grubbers are used to lift the underlying soil and at the same time the surface tilth produced by weathering is lost between the clods brought up. At each stirring moisture is lost, and in drying conditions clods often become baked so that the roller is brought out to crush them. A cycle of lifting up and squashing down the soil develops. Valuable soil moisture is lost and the fine tilth needed on top is lost in the depth of soil.

When something approaching a suitable surface tilth is obtained consolidation is difficult because of the depth of the working, and the drill sows at varying depth into soil which might or might not start the seed growing before the next rainfall.

In shallow seed bed practice shallow working from the surface down with a heavy straight-tined implement keeps any weathered tilth on the surface. The depth of tilth is progressively deepened and no raw soil or clods are brought to the surface.

Excellent seed beds can be produced on winter ploughed ground with two or three passes. One or two further passes may be required on spring ploughed ground. Discing, grubbing or rolling is unnecessary.

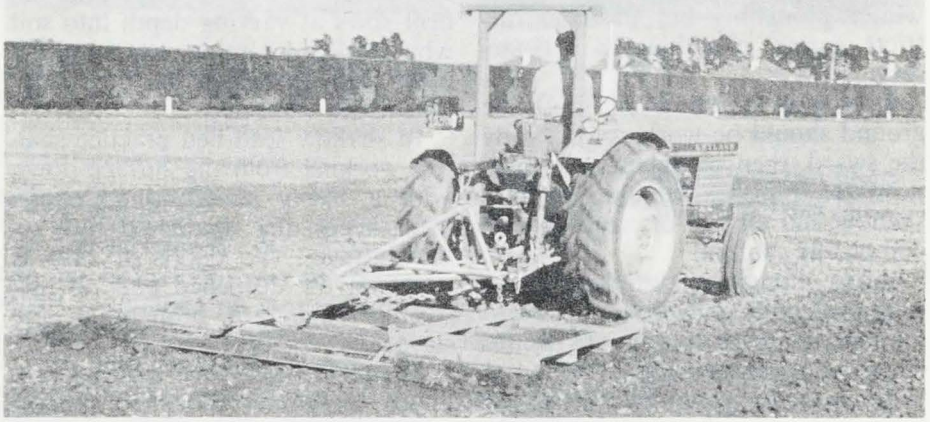
The Dutch Harrow

For this work the N.Z.A.E.I. has developed its own version of the Dutch Harrow. Similar implements made of timber bars with square tines have for some time been used in Europe. However, the recent model built in New Zealand has rounded tines set in steel bars. Tine length is limited to 4 inches.

The four bars combine the effects of clod crushing, harrowing and levelling in one operation. Surface tilth is retained on the surface and even consolidation is achieved.

As an aid to convenience and also as a safety measure a carrying frame was added. This is a boom pivoted on a simple A-frame carried by the tractor hydraulic linkage. Two heavy chains pull the harrow and four lighter chains lift the implement for transport or clearing trash.

While turning, the boom tends to stay in line with the harrow and pivots about one of the side members of the A-frame. This lifts the rear of the harrow partially out of work making turning easier.

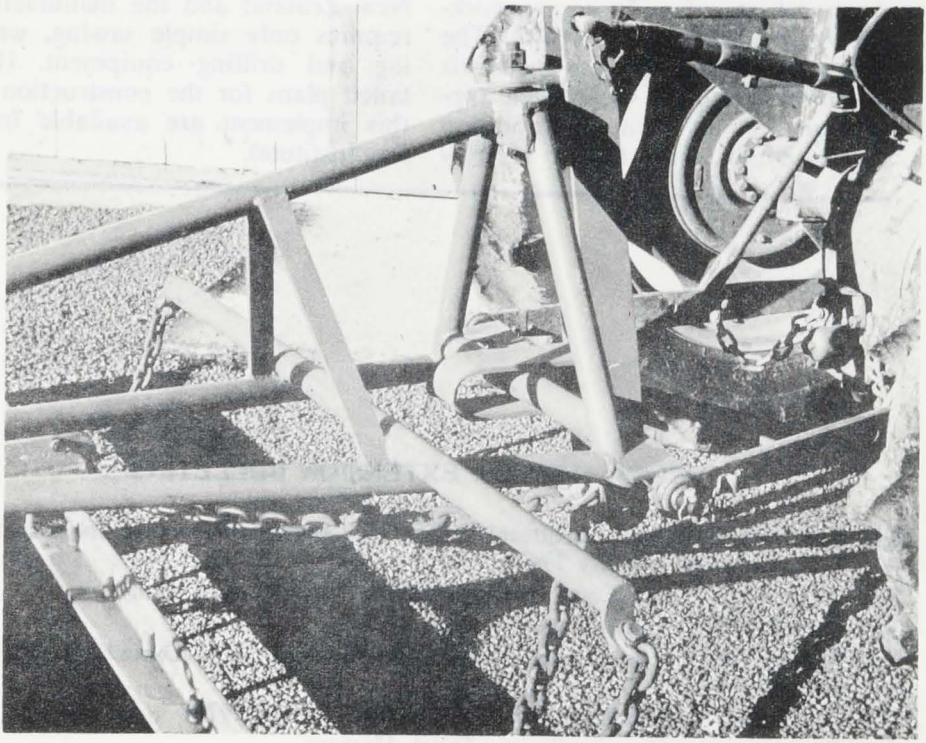


The Dutch harrow at work.

A safety strap is fitted to prevent the A-frame and boom from separating. In the unlikely event of the main tow chains breaking and a high hitch condition developing the strap limits any rearing of the tractor.

A safety frame, however should still be considered essential.

In work the tractor hydraulic lift is set so that the bottom pipe members of the boom are parallel to and about 12 inches above the ground. The suspension chains are slack to allow the harrow to follow ground contours. Slight adjustment of the height of the tow chains will prevent any build-up of soil on the



Detail of A-frame and safety strap

front tine bar.

The harrow can be operated at any speed. Six to seven miles an hour is quite realistic, although a slower speed is recommended for the first pass. This should be given in the direction of ploughing. Subsequent passes can be in any direction.

Soil Incorporated Herbicides

A recent advance in chemical weed control is the use of soil incorporated herbicides. These are worked into the top layer of soil. The dose rate of some of these chemicals is relatively critical so an even application and an even incorporation are essential. The Dutch Harrow has proved to be an ideal implement for this. Since cultivation is shallow there is no risk of over-diluting the chemical by mixing too deeply. Neither is raw soil carrying weed seeds brought to the surface to overlie the treated layer. Several passes at speed give a thorough and even incorporation.

Construction

The Dutch Harrow is constructed of materials readily available in New Zealand and the manufacture requires only simple sawing, welding and drilling equipment. (Detailed plans for the construction of this implement are available from the Institute).

OTHER N.Z.A.E.I. EXTENSION BULLETINS

E/1 The New Zealand Agricultural Engineering Institute—Purpose and Functions; J. R. Burton (February 1967)

E/2 Some Facts About Tractor Safety Frames (1968) (Out of print)

E/3 NZAEI. What it is and what it does. (1968)

E/4 Fodder Beet Cropping using Mechanical Methods: J. S. Dunn (3rd Edition in Preparation)

E/5 Trials with Trickle Irrigation: J. S. Dunn (October 1970)

E/6 Constructional Drawing for the Dutch Harrow

E/7 A Filter for Trickle Irrigation: Field Mechanisation Section N.Z.A.E.I. (1971)

8

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