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FODDER BEET CROPPING USING MECHANISED METHODS

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FODDER BEET CROPPING USING MECHANISED METHODS

INTRODUCTION

Fodder beet yields a high-energy low-fibre stock food which is attractive to dairy and beef cattle, sheep and pigs.

It produces a higher yield of feed units per acre than any other farm crop.

It is resistant to most pests and diseases.

It is more drought resistant than most crops.

The crop may be fed for eight months of the year or more without drying, housing or processing.

But because of the many hours of laborious hand work needed to thin and weed this crop the acreage under fodder beet has remained very small.

This bulletin outlines a method of sowing, cultivating and harvesting fodder beet which, if followed, will allow the farmer to benefit from the excellence of the crop as a stock food while eliminating the labour of hand weeding and thinning.

THE SEED

Beet 'seed' as it occurs naturally is a cluster of several seeds in a corky husk. If sown in this form several seedlings will often result from each cluster and these will be inter-twined so that individual root development is hindered.

By a process known as 'rubbing' the singleness of natural seed can be increased. From every 100 rubbed seeds which germinate perhaps 60 will produce single plants. Some of the others will give two seedlings, a very few may give three.

The seed must be graded after rubbing to remove small pieces of husk and undersize particles and also any large seeds which have not been rubbed sufficiently. In this way, a uniform sized seed is produced without affecting the germination greatly. The normal commercial size grading is 7/64 to 11/64in. Gradings of 8/64 to 10/64in or 9/64 to 12/64in may also be obtainable.

Most cereals, and the seeds of other crops, are treated now with a fungicide to help combat soil fungi. Fungi can, and often do, cause the death of small seedlings even before they emerge from the soil. Beet seeds have given up to 20% better germination when treated in this way.

No seed with a poor germination should be considered. All seed suppliers are legally obliged to provide a certificate of germination if requested to do so.

SEED BED PREPARATION

Fodder beet can follow any crop in the rotation but all trace of previous crop residue should be well buried in the initial ploughing. If the crop is to follow grass this should be surface worked (discs) before ploughing to prevent regrowth between the furrows.

It is important to remember that beet will not establish or succeed in acid soils. All paddocks for beet should be soil tested (Department of Agriculture 'quick test'). The minimum soil pH is 5.8 (unless on a peat soil) but a pH of 6.0 to 6.4 is better. Apply an adequate dressing of lime if below 5.8. The amount will depend on the soil type - your local advisory officer should be able to help. The lime should be worked into the soil before ploughing.

PLOUGHING

Ploughing should be done as well as possible and care taken to

avoid deep finishes and high ridges. In low rainfall areas it is advisable to complete ploughing by early winter to accumulate reserves of moisture.

FERTILISER

For beet, fertiliser is normally applied as an overall dressing immediately before final seed bed preparation. Phosphate is usually essential. Nitrogen may be, too, if the previous crop was removed from the paddock, but it could be omitted following the ploughing of a well stocked grass paddock. The requirement of potash, if any, should be determined from the initial soil analysis. A dressing of 5 or 6 cwt of No. 2 potato manure, now known as potato fertiliser (NPK 4-5-10), has been generally recommended in Canterbury. Extra nitrogen if required can always be applied as a top dressing at a later date.

In areas where boron deficiency occurs and heart rot in root crops is likely 12 to 20lb borax per acre should be applied.

FINAL CULTIVATION

After applying fertiliser to the furrow slice subsequent cultivations should be limited to straight tine working to a depth of no more than 4 inches. This will keep the weathered soil on the surface and at the same time conserve moisture. Many weed seeds in this layer will have rotted during repeated wetting and drying, and changes of temperature through the winter. Grubbers, cultivators and discs are not advised as they will only bring up raw, cold, unweathered soil with a fresh complement of weed seeds. (Weeds will not germinate from depths below two to three inches.)

A Dutch harrow* which combines the operations of clod crushing,

* The Dutch harrow is available from various manufacturers through New Zealand. A recent price was $208 for the 10ft wide model. If home construction is considered details and working plans are available from the N. Z. A. E. I. (75c/set).

levelling and harrowing has been introduced and developed by the N. Z. A. E. I. and this has proved ideal in forming the required seed bed. Similar implements are widely used in U. K. and Europe, for sugar beet and other crops. Two or three strokes with this implement have been sufficient to produce a firm, fine, level seed bed on a weathered furrow slice. Penetration on some of the heavier soils will be aided by adding weight to the harrow.

Seeds should be sown immediately after final working; the same day if possible. Any delay allows weeds to germinate and gain a lead over the beet seedlings.

SOWING:

Time of Drilling

As fodder beet is a biennial it does not normally reach maturity in its first season of growth. Provided conditions are suitable it will continue to grow and its yield will be dependent on the length of the growing season, other things being in adequate supply. It is wise, therefore, to sow early. Mid-September is not too soon unless in an area with many late frosts. The crop is not frost tender, but some beet, when subject to prolonged periods at low temperatures in their early stages of growth, may produce a flowering stem and run to seed ('bolt') in the first season.

Precision Spacing Drills

Most ordinary drills feed seed through a variable aperture by one means or another so that the seed is trickled in a steady controlled stream into the coulter furrow. No attempt is made to regularise the spacing between seeds.

With the spacing drill, the metering mechanism is capable of selecting individual seeds and placing them into the soil at a specified distance apart. Units are carried at ground level so that the regularity of feed is not interrupted by the seeds having to fall down lengthy

coulter tubes to subsequently bounce or roll out of position when striking the soil.

The grading of the seed being sown must be known so that the correct cell size in the metering mechanism can be selected. For 7 to 11/64in seed a cell size of 13 to 15/64in, depending on the drill, is used.

Two makes of spacing drill are currently available in New Zealand, the Stanhay and the Webb. The Stanhay employs a reinforced rubber belt in which the cell holes are punched, while the Webb uses an aluminium wheel with the cells machined in its circumference. Seed spacing may be altered by changing the belts or cell wheels and/or, in some models by changing simple gearing by lever or V-belt on the drill driving mechanism.

Row Width and Seed Spacing

The cropped areas must be completely covered with foliage as early in the season as possible for two reasons -

1. To trap the maximum amount of energy from the sun. Energy is potential yield.
2. To provide an effective weed smothering canopy.

Wide rows or gaps between plants allow the sun's energy to fall wastefully onto bare soil and also encourage weeds to grow unhindered.

The N. Z. A. E. I. uses a five unit Stanhay drill set at a 20 inch row spacing. Individual seeds are sown every 6 - $7\frac{1}{2}$ inches along the row. Approximately $1\frac{1}{2}$lb of seed is needed to produce the 25, 000 to 50, 000 plants required per acre.

Depth of Sowing

Seed should always be placed into moist soil. A depth of $\frac{3}{4}$ inch is normally adequate although this may be increased to a maximum of $1\frac{1}{4}$ inch if conditions are dry. The shallow seed bed technique already described should ensure ample sub-surface moisture for immediate germination.

All coulters should be checked for uniformity of depth.

Speed of travel when Sowing

The recommended speed should not be exceeded or each metering cell will not carry its full complement of seeds and the crop will be gappy.

WEED CONTROL

Selective herbicides can now control annual weeds within the beet crop without affecting the crop plants. However, they will not control established perennial weeds such as docks, Californian thistles or couch grass ('twitch').

Perennial Weeds

Where forward planning allows, these problem perennial weeds can be eliminated or reduced to a level at which they are little or no trouble by treatment the season before the beet is sown. This is particularly so if the beet crop follows grass.

Spraying with Asulam will give good control of docks if applied in the early part of the season before they flower.

Californian thistle patches can be considerably weakened by two spot applications of Weedazol when growing actively. DO NOT use a persistent residual hormone material e.g. Tordon or Picloram.

Couch grass has been eliminated by spraying 30lb TCA/acre in 100 gallons of water ahead of a rotary cultivator set to work slightly below the depth of rooting.

Annual Weeds

Two materials have given consistently good results in N. Z. A. E. I. trials but like most selective herbicides they have limitations and these should be understood.

Betanal

Distributed in N. Z. by Ivon Watkins-Dow Ltd. This is a post emergent material, it is applied after the beet and weed seedlings have emerged; and kills by contact only. As it has no residual properties

two applications are usually necessary. It is very safe on beet seedlings although these should have reached the full cotyledon stage before application. Most annual weeds occurring in the South Island are controlled or severely checked when sprayed at an early stage of growth. However, in the warmer conditions in the North Island, and to some extent around Nelson, weeds such as Amaranthus (Amaranthus retroflexus) are not affected.

Betanal is an oil based emulsion which mixes readily with water but it is most important to add water to Betanal and not Betanal to water. The emulsion is not very stable and overdilution causes the active ingredient to settle out as a white solid which blocks filters and nozzles. The remaining liquid has little or no weed killing power.

For small areas where inter-row hoeing equipment is not available overall application may be the most satisfactory treatment. Standard boom equipment is adequate provided the nozzles used apply the correct rate without overdilution. A knapsack sprayer has been used successfully.

For larger areas overall application is normally too costly. Mechanical inter-row weed control methods are then used and selective herbicide application is confined to a narrow band over the row of plants. A simple boom made from 1in water pipe with nozzle bodies inserted at the appropriate row spacing is adequate for such band spraying. Rows are sprayed in the same number and order in which they were drilled so that variation in row width at the join between bouts does not affect the accuracy of application.

Band width is adjusted by raising or lowering the boom on brackets on the tractor front axle. A 7in band gives sufficient margin for any steering errors.

N. Z. A. E. I. Band Spraying Procedure

Five row boom spraying a 7in band width.

Nozzles	-	spraying systems No 730116 Tee Jet inserted into boom at 20in centres.
Speed	-	3 mph (check speedometer: 3 mph = 88 yards in 1 minute).
Pressure	-	20 psi. Check gauge each season.
Nozzle height	-	Approximately 7 inches above ground. Check band width in work to take account of wheel sinkage.
Mixture	-	two and two thirds pints of Betanal in 7 gallons water per acre of beet.

No wetting agent is needed with Betanal.

A firm level seedbed keeps the tractor from rocking and rolling and maintains a consistent band width.

Overall Application

Boom width is immaterial but joins should be accurate to avoid both unsprayed strips and excessive overlapping.

Rate of application - 6-8 pints/acre overall in a maximum of 25 gallons of water. (Band spraying uses two and two thirds pints/acre with 7in band in 20in rows.)

Betanal at present (August 1971) costs $17/gallon with subsidy.

Venzar

Manufactured by Du Pont and distributed in N.Z. by Neill Cropper & Co Ltd.

Venzar has been used on beet crops for a number of years as a pre-emergent material i.e. applied immediately after drilling and before either weeds or beet have germinated. To be effective the soil must be wet when it is applied or approximately 30 points of rain must fall to wash it into the soil to the depth where the weed seedlings germinate. This cannot be relied on to occur in the first few days after drilling.

However, a new method of utilizing Venzar has been used by the

N. Z. A. E. I. and elsewhere with excellent results. Although the technique has not been extensively tested, the prospects are so promising that it is included here should you wish to try it in a small way under your conditions.

The chemical is applied as a spray to a partially formed but potentially good bare seed bed and incorporated in the top 3-4 inches ONLY. Working too deep will overdilute the material and result in poor weed control. There should be no hard baked clods or large stones, no surface residue or turf and no established weeds.

The N. Z. A. E. I. Dutch harrow has proved ideal for incorporation as it cannot work too deeply. Discs and rotary cultivators set shallow can also be used but normal seed harrows are not satisfactory.

The rate of application is 2¼lb Venzar in 10-40 gallons of water/acre on most soils. Higher or lower rates than this may be required on peat or light sandy soils so its use under these conditions cannot yet be recommended.

As with Betanal accurate joins in spraying are most important.

Venzar costs $6 per pound with subsidy (August 1971). In trials at Lincoln with this technique no hoeing or spraying was needed from sowing to harvest. During 1970/71 Venzar treated areas yielded 53 tons/acre (roots and tops) while the untreated control produced 10.7 tons/acre.

NOTE: Fodder beet is not a member of the Brassica family. Herbicides which are used on swedes, turnips, chou moellier and kale must not be used on fodder beet.

Do not use 'Fodderkleen' on beet crops.

Weed Control Between the Rows

Weeds growing between the rows can often be controlled more cheaply by mechanical means than by using a selective herbicide. Tractor hoes are not common in New Zealand, but as farming becomes

more intensive their use is likely to increase.

Front or mid-mounted hoes are operated solely by the tractor operator but they are usually designed with special mountings for specific makes of tractor. Rear mounted hoes will fit any tractor with a hydraulic lift, but require a steersman in addition to the tractor operator.

For the first hoeing, when seedlings are small, concave discs are usually fitted to the hoe stems to prevent smothering. The ground is usually cut to within $1\frac{1}{4}$in or $1\frac{1}{2}$in on each side of the plants. Discs are removed and a wider setting is used for any subsequent hoeing. The depth of working should not exceed $\frac{1}{2}$in to $\frac{3}{4}$in, otherwise weeds will be undercut and may re-root again. An old saying that hoeing should be done when there aren't any weeds is a useful guide. If hoeing is done in the cotyledon stage weeds will never present any problems to the hoeman or the crop.

Stale Seed bed Technique

Where a heavy infestation of weeds is to be expected the stale seed bed technique may prove useful.

The seed bed is prepared as described - firm and level with a fine tilth, but drilling is delayed until the ground is covered with weed seedlings, a delay of perhaps 3 to 5 weeks. Without further cultivation the crop is drilled into the weedy soil with as little soil disturbance as possible. Before any beet seedlings have emerged (4 to 7 days depending on the time of the year), the crop is sprayed overall with GRAMOXONE (paraquat), if any grassy weeds, or REGLONE (diquat), if only broad leaved weeds, at 2 pints per acre in 20 gallons of water + 1 pint of wetting agent. The beet seedlings will emerge into a perfectly clean undisturbed seed bed and it will be some days before any more weeds begin to appear. The normal post-emergence application can be applied when required. The beet seedlings will be well ahead of any weed competitors by then.

NOTE: There is an element of risk with this procedure.

If, for any reason, the GRAMONONE or REGLONE cannot be applied before the beet emerge, the weeds will have a considerable lead over the beet and trouble can be expected.

This technique is not recommended for beet crops in much of the South Island. Any delay in drilling while waiting for the weed seedlings to emerge is likely to reduce the eventual yield of beet, due to a shortened growing season.

PESTS AND DISEASES

Beet is a hardy crop and very little affected by pests and diseases. But it is susceptible to insect attack during the period of emergence and it is recommended that a close watch be kept at this stage (6 to 21 days after sowing depending on location and season).

Any sign of a general leaf puncturing or nibbling should be followed by an immediate overall spray of Folidol or similar formulation of parathion. This material is relatively cheap, it has a wide spectrum of control and is quick in action. Although short lived, one application is generally sufficient.

NOTE: This material is toxic so observe strict safety precautions.

HARVEST

Harvesting may begin before the crop is fully mature but care must be taken in introducing fodder beet into the ration of all classes of stock to avoid digestive upset. Actively growing fodder beet contains oxalic acid and certain nitrites which can prove harmful if fed to stock unaccustomed to them, or if fed in excess. On maturity, these materials break down and there is no risk at all in feeding.

The roots consist largely of carbo-hydrates but foliage has worthwhile protein content. Most farmers prefer to harvest and feed

the beet with the tops on.

Where drainage is a problem beet may be difficult to remove from the paddock at times during the winter. Some beet should then be harvested and stockpiled when conditions allow and drawn from as required.

Direct feeding in situ is possible for pigs, sheep and cattle.

Mechanical Harvesting

The N. Z. A. E. I. has developed a mechanical harvester for fodder beet and the lifting principle is being incorporated in commercially made machines.

Two forms of harvester are at present available. In one the beet are lifted and conveyed into a following truck or trailer, while in the second the beet are retained on the machine in a self emptying integral hopper. This latter machine will carry approximately 2 tons of beet and the load can be dumped in a heap while stationary or fed out as an irregular row while on the move.

VARIETIES

The variety of beet chosen has a considerable bearing on the ease of harvesting. Fodder beet are a cross between sugar beet and mangolds. This cross has been developed in different forms and extreme mangold and extreme sugar beet types are available.

Sugar beet types have a very high dry matter content, but as their roots grow mainly below the ground they are difficult to dig and clean. Mangold types, on the other hand, grow almost on the top of the ground.

The varieties Yellow Daeno and Korsroe are the most widely grown. These have a dry matter content of about 15-16% and about two-thirds of the root grows above ground. This makes them easy to pull and they require little or no cleaning.

MANGOLDS AND SILVER BEET

Although mangolds have a lower dry matter content than fodder beet they may be preferred by some growers. Exactly the same techniques and herbicides may be used with mangolds as for beet. Results in trials by the N. Z. A. E. I. have been equally good.

Of less importance, but as a matter of interest, silver beet has also been grown successfully this way by the N. Z. A. E. I. It is of the same botanical family as fodder beet and mangolds.

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

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)
E/8 The Dutch Harrow, Shallow Seed-bed Technique and Chemical Incorporation: Field Mechanisation Section N.Z.A.E.I. (September 1971)
E/9 Air Cleaners. Max Webb (November 1971)

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