THE CEDARA CONTRASEEDER

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ABSTRACT

A description is given of the design and performance of a contraseeder built for radically improving the veld (native range) and fortifying cultivated pastures. It can place two fertilizers and seed from two bins all in different bands at variable depths and it can be built from standard components in farm workshops. Detailed plans of the contraseeder are available from the authors.

INTRODUCTION

The need to radically improve the veld (native range) by sodseeding was discussed in detail by Krog, Theron and Andrews (1969). As no suitable implement was available to meet specific local requirements a sodseeder was built by these authors and tested with success on various soil types of Natal. In spite of this success it was found that where clover was sodseeded on acid soils, root development, and therefore nodule formation, was confined to the small volume (4 cm × 12 cm) of soil into which the superphosphate and lime were vertically banded.

The recent work of Graven and Theron (1970) has shown that when establishing clover in acid soils there is strong support for the application of heavy dressings of lime which are well mixed with the total soil volume while superphosphate is still banded vertically. As a result of the recommendations made by these authors, an implement designed to meet these recommendations was built and tested. A brief description of this implement is presented in this paper.

REVIEW OF LITERATURE

Krog, Theron and Andrews (1969) have reviewed the literature pertaining to the development of sodseeders, the importance of banding fertilizer and the need to control competition from native species when improved herbage species are introduced into an established sward.

Hutchings (1967) in reviewing the establishment of perennial pastures in south-eastern Australia points out that in spite of the importance of seed-drills and sod-seeders, few attempts have been made in recent times to improve the design of these implements. He adds that their most important deficiencies are the lack of precision in the depth to which seed and fertilizer are placed. This author also points out that the use of multi-seed and multi-fertilizer mixtures further aggravates the problem. This important point is also emphasized by Stonebridge and Mackie (1969).

To overcome the multiplicity of local sod-seeding problems encountered in different parts of the world, several different types of implements have been built. Breakwell and Jenkins (1953) described one of the earliest machines built. Decker, Retzer and Swain (1964) in an attempt to improve the success with which small seeded species are established designed a broadcut attachment for conventional sod-seeders. Hillsdon and Wilson (1966) have built a two row rotoseeder while various commercial firms have developed implements using a conventional rototiller as the basic implement to regenerate or establish pastures on arable lands (Allen 1967). Hutchings (personal communication) is building a "divitseeder" to overcome local problems in Australia while Krog, Theron and Andrews (1969) have designed and built an implement to overcome certain local specific difficulties in South Africa.

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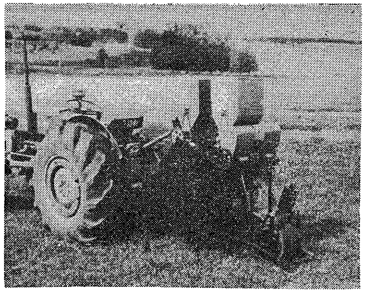
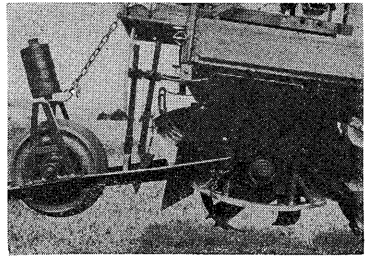
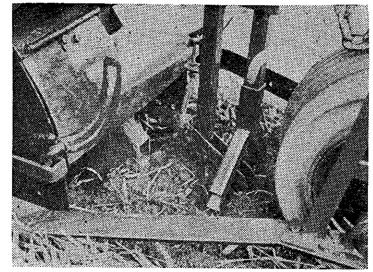
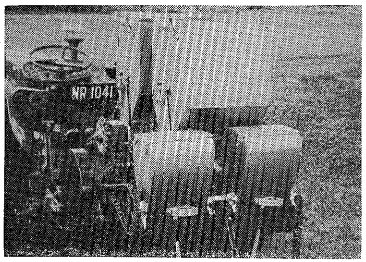
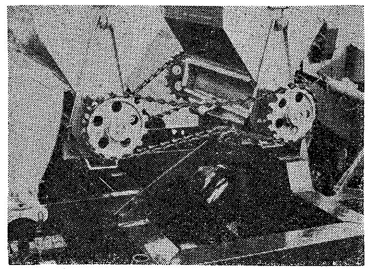
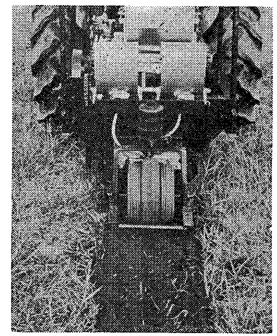

1.1 THE ROTOSEEDER

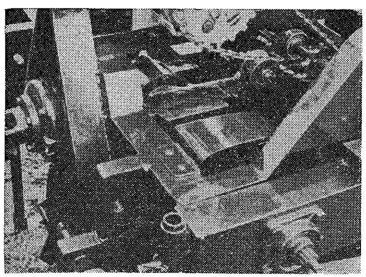

1.2 THE ROTOR TINES AND DELIVERING TUBES


1.3 THE SEED AND SUPERPHOSPHATE DELIVERY TUBES


1.4 THE FERTILIZER AND SEED BIN DRIVING MECHANISM


1.5 THE FERTILIZER DRIVE MECHANISM


1.6 THE ROTOSEEDER IN OPERATION


1.7 THE CLUTCH AND P.T.O. UNIT

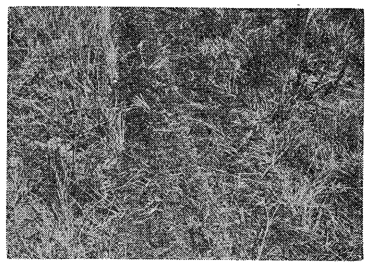

1.8 CLOVER DIRECTLY ESTABLISHED INTO VELD

PLATE 1

THE CEDERA ROTOSEEDER

PROCEDURE

When designing and constructing the implement, an attempt was made to fulfil the following objectives.

(i) The construction of the implement should be simple and such that it can be reproduced by most farmers who have arc or gas welding equipment.

(ii) The component parts should be easily obtainable so that construction is facilitated and breakages are easily replaced.

(iii) The implement should be robust and such that it can be used on a variety of slopes and soil types. It should also be such that it is not easily damaged by buried stones and tree roots.

(iv) A strip of vegetation 30-40 cm wide should be removed by the implement so as to eliminate competition from the native vegetation.

(v) The implement should distribute lime over this strip and then mix it with the total soil volume to a depth of 15 cm.

(vi) Superphosphate must be distributed in a vertical band about 15 cm deep and about 5 cm wide. To achieve this on different soil types it is necessary that the point of delivery of superphosphate be adjustable with respect to height.

(vii) The lime and superphosphate should be delivered from separate bins which must be such that the rate of flow can be easily controlled and varied.

(viii) The implement should be fitted with two seed bins which can deliver seed independently from one another and in such a manner that seed placement and burial is independent of fertilizer delivery and placement. Furthermore, it was felt that the implement should place seed of the legume crop over the band of superphosphate while the seed of the grass crop should be placed in rows 17 to 18 cm apart and on either side of the legume.

(ix) The implement should be fitted with rollers to compact the seedbed. The rollers should be such that the degree of compaction can be controlled depending upon the soil type.

(x) As a whole the implement should be as short and compact as possible so as to operate successfully on the contour.

(xi) The implement should be fitted with a suitable safety device so that when buried objects are struck it is not damaged.

To meet these requirements the implement as shown in Plate 1.1 was eventually constructed, tested and found to be satisfactory with respect to the requirements listed above. The nature of this implement is as follows.

(i) The basic frame is constructed of channel iron and flat plate.

(ii) The elimination of the existing vegetation and the preparation of the seedbed is done by a pair of conventional rotovator discs fixed 30 cm apart on an axle and to each of which are attached three conventional rotovator blades. The direction of rotation of these blades is the reverse to that of a conventional rotovator so that the herbage removed from the seedbed is buried and not left on the seedbed surface. By virtue of this action the implement may be classified as a contraseeder according to the definition of Stonebridge and Mackie (1969).

(iii) The rotor is driven from the tractor PTO through a slip clutch (Plate 1.7) and conventional power take off pulley of a tractor mounted so as to give a speed reduction and a right angle drive. The slip clutch meets the safety requirements of condition (xi) above.

(iv) The power transmission from the mounted power take off pulley unit is by a 2.5 cm pitch roller chain. The sprockets can be changed so as to alter the rotor speed.

(v) Lime is delivered in front of the rotor and outside the rotor housing as shown in Plate 1.7. It was found that this method of delivery was adequate and that the lime was evenly mixed throughout the disturbed profile by the rotor.

(vi) A conventional tiller tine is fitted, as shown in Plate 1.2, centrally and immediately behind the rotor shaft with the object of removing vegetation which may not have been chopped by the rotovator blades and which may consequently foul the delivery of superphosphate.

(vii) The superphosphate is delivered as shown in Plate 1.3 through a tube located immediately behind the tiller tine and outside the housing. The depth to which superphosphate is placed is controlled roughly by the depth to which the delivery tube is lowered and fully by adjusting the height of the metal flap (Plate 1.3) pivoted into the mouth of the delivery tube. Experience has shown that the depth of the vertical band is a function of the forward speed of the tractor, the physical nature of the soil and its moisture content.

(viii) Seed is delivered from the two bins fixed at the rear end of the implement (Plate 1.4) to two metal delivery tubes These tubes are fixed in such a manner (Plate 1.2 that they can be easily moved both horizontally and vertically thus providing ample scope for controlling the depth of seeding. One of the delivery tubes is fitted with an easily detachable outlet tube which enables two rows of seed to be established $\pm$ 5 cm on either side of a centrally established row (Plate 1.3).

(ix) Depth of seeding is controlled by adjusting the rear flap on the rotor housing so that the correct amount of soil is thrown over the seed (Plate 1.3).

(x) Compaction is achieved as shown in Plate 1.6 with a multiple roller comprised of three separate solid rubber wheels ground down to a V-shaped profile to ensure maximum compaction, which are able to rotate independantly on a common axle.

(xi) The nature of the micro-seedbed created by the implement is shown in Plate 1.8.

(xii) Detail plans of the contraseeder are available from the authors.

DISCUSSION

The implement was successfully tested on heavy clay soils (Killarney series) where clover was introduced into a dense *Paspalum dilatatum* sward. It was also tested in veld where it was used to establish clover and *Eragrostis curvula* in a thick sward of *Aristida junciformis* growing on a soil typical of the Loskop series (sandy loam). In this case the aerial portions of the native vegetation were buried at the bottom of the trench so that there was no interference from this material in the distribution of fertilizer or the placement of seed. The implement was also used with a great deal of success to reinforce moribund *P. dilatatum* pastures with a variety of root crops (turnips, kale and sweeds).

The results of tests showed that the only conditions under which the implement could not operate successfully were where the soil was stony, too wet or where the grass was excessively dense and tall. The latter condition was avoided by sodseeding in spring after burning.

A 45 horsepower tractor was adequate for sodseeding under all conditions tested.

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REFERENCES

ALLEN, H. P. (1967)—Paraquat as a tool for grassland renewal. *Outlook on Agriculture* **5**: 149-54.

BREAKWELL, E. S., and JENKINS, H. V. (1953)—A pasture overseeding implement. *Journal of the Australian Institute of Agricultural Science* **19**: 109-10.

DECKER, A. M., RETZER, H. J., and SWAIN, F. G. (1964)—Improved soil openers for the establishment of small-seeded legumes in sod. *Agronomy Journal* **56**: 211-4.

GRAVEN, E. H., and THERON, E. P. (1970)—Band placement of lime and superphosphate for Ladino clover in an acid oxysol. *Proceedings of the Grassland Society of Southern Africa* **5**: 106-12.

HILLSDON, R. A., and WILSON, A. P. M. (1966)—New machine for pasture improvement. Power Farming and Better Farming Digest (Sydney & Melbourne Publishing Co.: Sydney).

HUTCHINS, R. J. (1967)—Perennial pasture establishment in south-eastern Australia. *Farm Policy* **7**: 116-22.

KROG, M. M., THERON, E. P., and ANDREWS, C. (1969)—An experimental sod-seeder. *Proceedings of the Grassland Society of Southern Africa* **4**: 126-30.

STONEBRIDGE, W. C., and MACKIE, W. B. C. (1969)—The role and function of planting and fertilizing machinery. Proceedings of the National Agricultural Workshop, University of New South Wales, Sydney, pp. 63-71.

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