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A VERSATILE FERTILIZER APPLICATOR AND SEEDER FOR TRIAL PLOTS

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SUMMARY

The details of construction and operation of a machine for applying fertilizer and seed for vegetable trials are described. The machine treats two rows and incorporates two methods of fertilizer metering and two methods of seed metering. Special tine clamps allow precise positioning of fertilizer placement. The machine can be easily dismantled to allow easy transport between sites and rebuilt on the new site.

I. INTRODUCTION

In the past the execution of nutritional trials with vegetable crops has generally been an extremely tedious affair. The design of trial layouts and the lack of suitable types of fertilizing machinery have in most instances forced experimenters to apply fertilizer by hand. Not only is this method of application time-consuming and tedious but it is also inaccurate to the ultimate detriment of accurate experimental data. A similar situation has existed with seeding, there being no suitable equipment available that will meter small seeds accurately yet allow easy changes of seed variety and seeding rate.

Experimenters working in the Queensland Department of Primary Industries have long felt the need for equipment which would allow faster sowing of nutritional and variety trials. To be fully effective the following design features would need to be incorporated in such equipment.

(1) Equipment to be 3-point linkage mounted and capable of fertilizing and sowing 2 rows spaced from 15 cm to 125 cm apart.
(2) Provision made for applying fertilizer of any type at any rate over a range of set plot lengths.
(3) A method of applying fertilizer at various horizontal distances from the seed and up to 15 cm below the seed to be provided.
(4) Depth of fertilizer placement to be easily and positively adjusted.
(5) Equipment for the bulk application of fertilizer to be included.
(6) Equipment to allow bulk and plot sowing of vegetable seeds to be included.
(7) The equipment would need to be ground-wheel driven to allow change between different tractors and must be suitable for transport in a utility vehicle.

Numerous types of experimental drill and fertilizing equipment are shown in the IAMFE Handbook (International Association on Mechanization of Field Experiments 1968) and the Directory of North American equipment for the Mechanization of Agricultural Research published by the same Association (1972). The Directory of Special Fertilizer Application Machines and Devices prepared by the Subcommittee on Machinery for Research (National Joint Committee on Fertilizer Application 1956) and a paper by Hansen (1964) deal specifically with equipment for applying fertilizer to plots. All the equipment described in these references was designed and built in Europe and North America, there being no reference to any Australian-built equipment. Despite the large number of machines and devices built and described, there appears to be none which include all the design features mentioned above. Rather than restricting the use of the machine by compromising on some of these features and importing a machine already developed, it was decided to design and build locally.

II. DESIGN AND CONSTRUCTION

The general arrangement of the machine is shown in Figure 1. Basically it consists of a 2-bar tool-bar with the addition of a third bar for supporting the seeding units. All the tool-bars are of 5 cm square material as are the spreader bars. Attachment of components to the tool and spreader bars is with "McKay" clamps and wedges. The depth wheels, which are adjustable for height, can be located on either of the two tool-bars or on the spreader bar as shown in Figure 1. To avoid interference with tines the headstock and braces are adjustable horizontally.

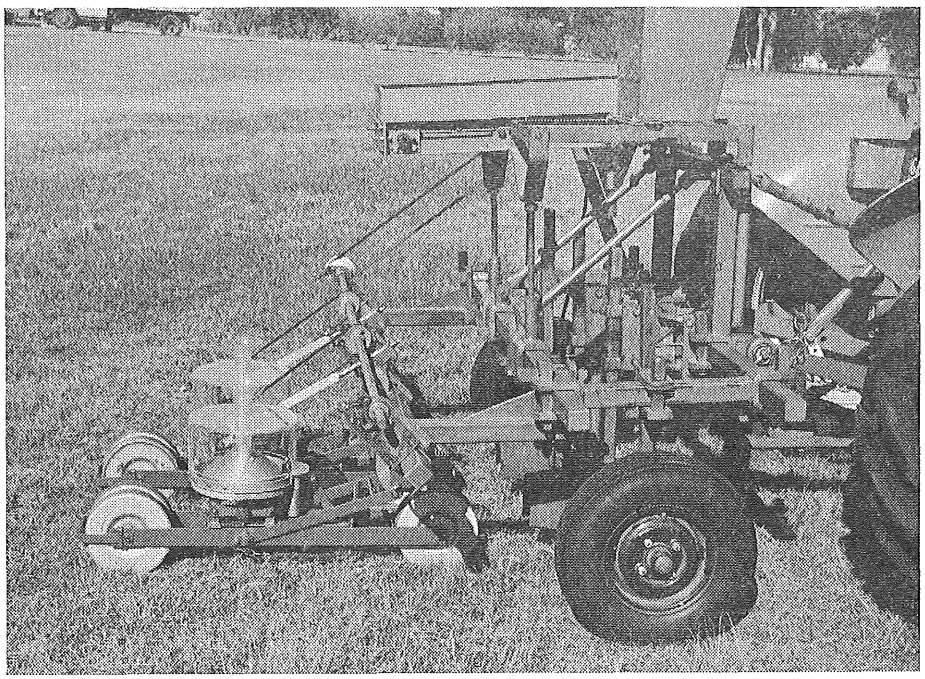

Fig. 1.—General arrangement of the machine.

Two devices for metering fertilizer are provided, one being a standard star feed box as seen in Figure 1. The other type of metering device is a small conveyor belt and this can be seen in Figure 2. The belt device is used for fertilizer trials where there is variation in the rate and the type of fertilizer applied to each plot. In Figure 2 the conveyor belt unit is shown with one central outlet; this can be changed if necessary to two outlets to roughly divide material flowing over the end of the belt. Normally two conveyor belt units or two box units would be used together, but one of each can be used if required. Drive to the metering devices is from a depth wheel *via* a chain and interchangeable sprockets.

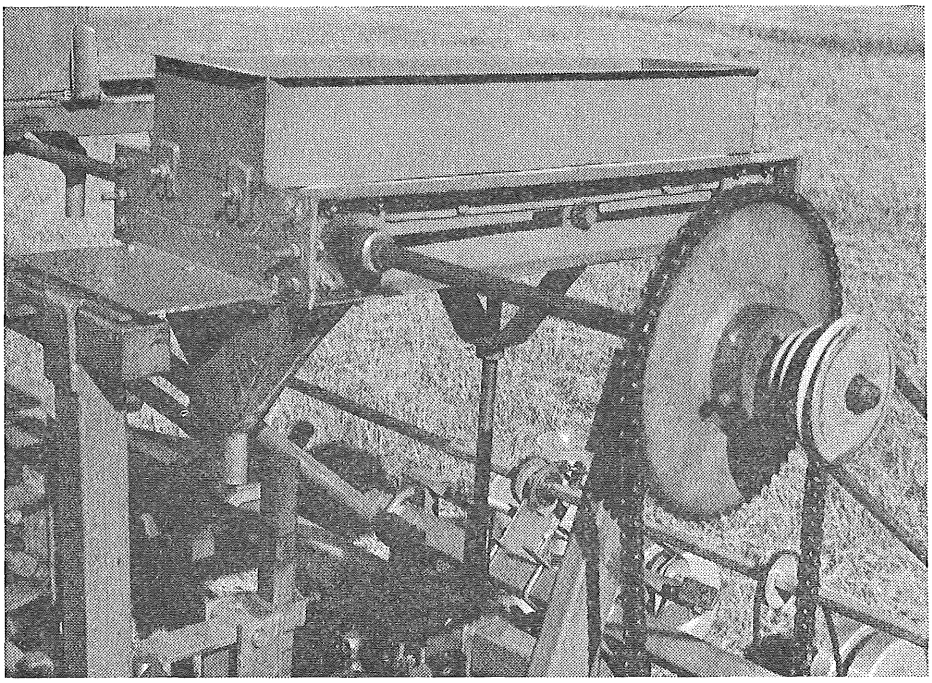

Fig. 2.—Conveyor belt fertilizer metering device.

Figure 3 shows one of the adjustable tine units used for fertilizer placement. The tine itself is a standard 3·2 cm square model to which have been added a delivery tube, a shield and adjustable coverers. A standard 3·8 cm point is used. The depth adjusting unit is locked to the tine by set screws; this allows the unit to be clamped in different positions along the tine. Adjustment of tine depth is obtained by the hexagonal head of the diagonal screw (see Figure 3). Adjustment over a depth range of 17 cm is possible with this arrangement. A shear bolt in one of the pins of the mechanism gives protection against buried obstacles.

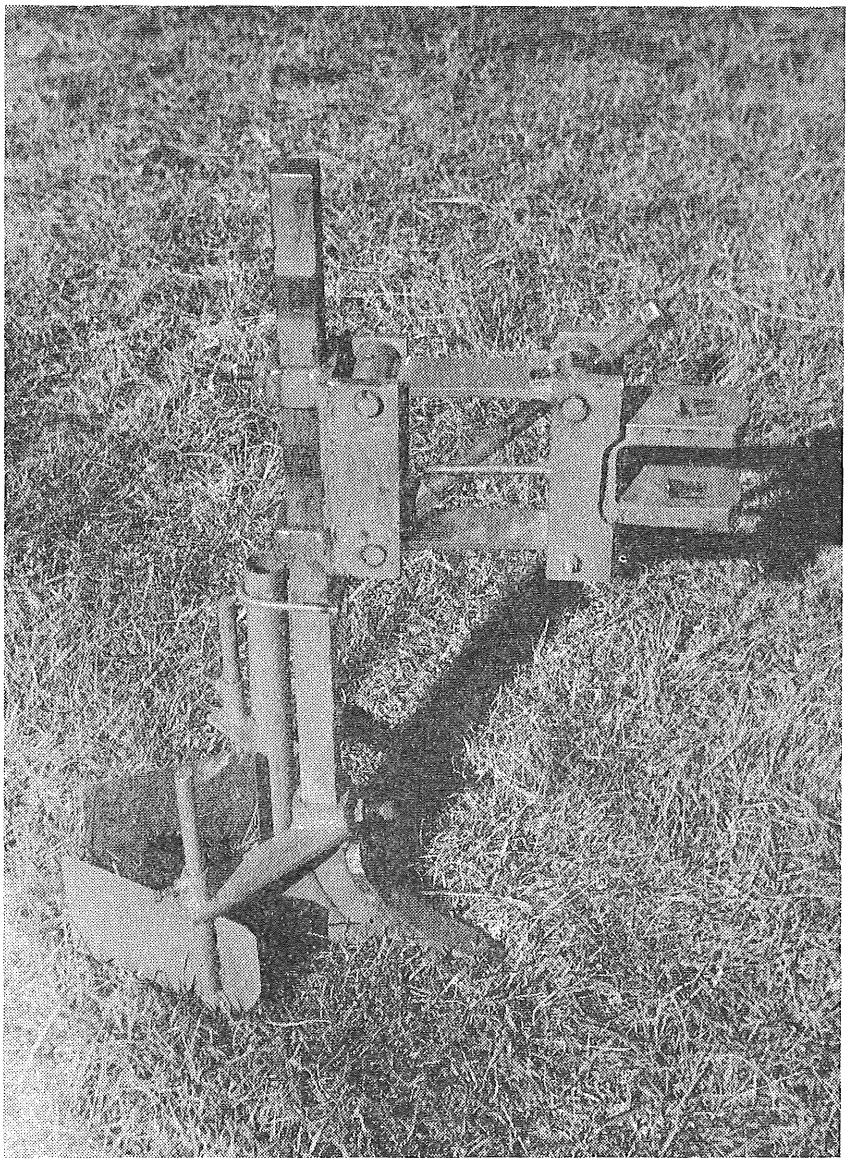

Fig. 3.—Adjustable tine unit for fertilizer placement.

The sowing units seen in Figure 1 are standard "Stanhay" model S.870 units converted to operate with metering cones. Figure 4 shows the metering cone and driving assembly which is easily fitted to the Stanhay units to convert them to plot seeders. Conversion of the standard Stanhay units to plot units or vice versa takes about 5 min. and involves changing two belt drives as well as the units themselves. When using the standard Stanhay metering units the drive is taken direct from the depth wheel using 4-step V-belt pulleys to obtain the optimum drive speed. When using the cone units the drive is taken from the fertilizer drive shaft *via* a 1 to 1 V-belt drive.

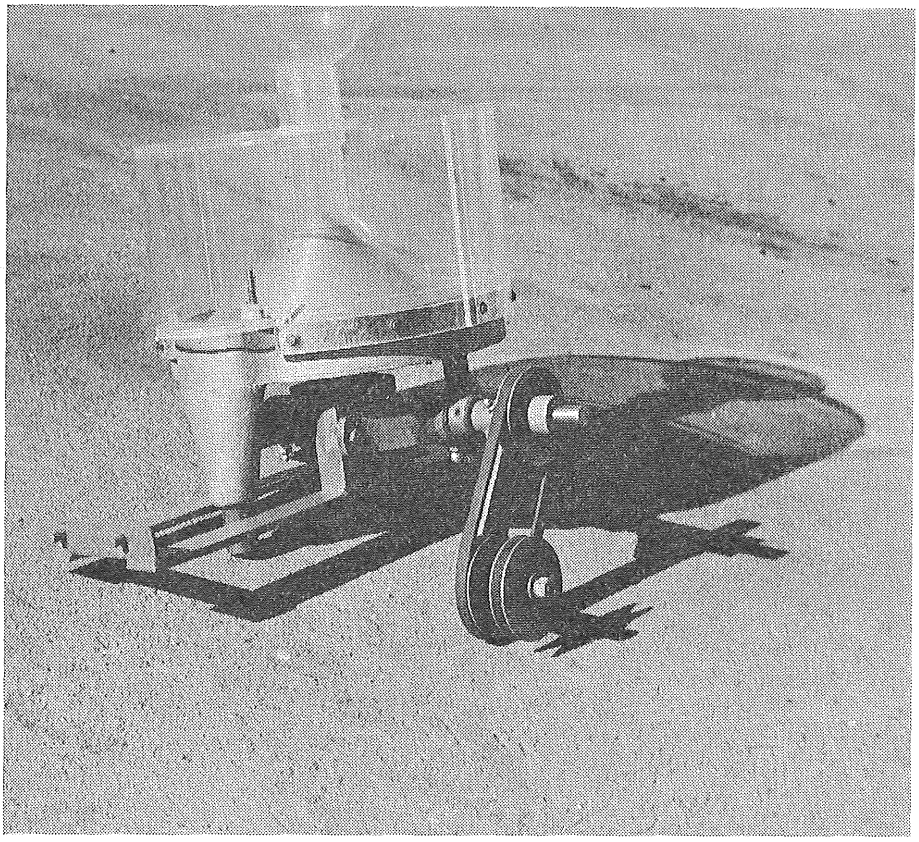

Fig. 4.—Metering cone and driving assembly for plot seeding.

III. OPERATION

Sprockets provided with the machine give plot lengths of 6 m to 12 m, but with alternative sprockets almost any length could be obtained. Normal calibration techniques are used to establish correct application rates with the fertilizer boxes and the standard Stanhay units.

Loading of the belt-metering units is helped with the aid of a V-shaped trough which is placed on the belt. The trough has an open bottom which allows material to fall onto the belt when the trough is raised. The weighed sample of fertilizer is spread evenly along the length of the trough with a paint brush or similar flat object. Uniformity of application depends on how evenly fertilizer is spread along the belt.

One of the most important design criteria was the need for easy transport of the machine. To make this as simple as possible the complete machine was designed to be readily dismantled and reconstructed. Few tools are needed to do this, as most of the major components are connected by clamps and wedges. When the machine is completely dismantled, the most bulky items are the fertilizer metering units and the Stanhay units. All components when dismantled will fit readily in a standard vehicle.

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