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THE ECCENTRIC DISC PITTER PLANTER - A SOIL CONSERVATION TILLAGE TOOL FOR MECHANIZED FARMING

By

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ABSTRACT

A planting technique which could enhance agricultural production is presented. The Edip planting technique which is discussed has low capital and operating costs. It also has reasonable and reliable yields as well as providing effective moisture and soil conservation.

INTRODUCTION

Many attempts have been made to increase agricultural production in Tanzania through mechanization. In view of the mechanization policies of Tanzania (Dagg, 1980) there is a need for both oxdrawn and tractor drawn equipment. Previous workers such as Have and Dihenga (1978) have compared the economics of different cultivation systems and have shown that reduced tillage techniques are much more economic to practice. It is also widely accepted that these techniques have considerable advantages for soil and moisture conservation (Hudson, 1971), Arnon, 1972, etc.). The conventional disced cultivation implements normally used in Tanzania do not achieve these requirements (Have and Dihenga, 1980) and most of the machinery developed in the west is designed to solve different problems from those existing in countries such as Tanzania. There is therefore a need for the design of appropriate cultivation equipment for Tanzania. In this paper is reported work carried out on design and development of appropriate equipment for tractor mechanization of maize production in Tanzania.

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A severe limitation to maize production in many parts of Tanzania, including Morogoro is that the rainfall is marginal for a crop with such a long growing cycle (Coe and Dumelow, 1982). Conservation of whatever moisture reaches the soil ar d control of runoff is therefore highly desirable. Although the annual rainfall in these areas is quite low the rainfall when it occurs can be very intense (e.g. a rainfall of 96 mm in a single day was recorded in the University Farm, Morogoro. during, 1981) and hence soil erosion is also a problem.

There is therefore a need to develop tillage systems and machines for dryland farming. These systems should have the following objectives:

1. Reasonable, reliable yields
2. Reasonable capital and operating costs
3. Effective soil and moisture conservation.

The Eccentric Disc Pitter Planter

The Eccentric Disc Pitter Planter, hereafter referred to as the Edip. Planter was described by Dumelow, 1982. However a brief description of the prototype constructed at the Faculty of Agriculture, Forestry, and Veterinary Science of the University of Dar es Salaam is given below.

In this prototype four rows are planted simultaneously. The machine is conventionally mounted to the three point linkage of a tractor (category 2). Fig.1 shows a plan view of the main moving components. These are mounted on a frame made from rectangular hollow section mild steel. Eccentrically mounted disc harrow discs (eccentricity = 120 mm.) are fitted to two symmetrically opposite shafts interconnected by means of a connecting shaft and universal joints. The eccentric disc shafts are mounted with their axes horizontal and at 60° to the direction of travel. As all three shafts are interconnected they all rotate in their bearings simultaneously. The eccentric discs are arranged so that they are out of phase with each other so that when they engage in the ground the draught force remains approximately constant and continuous rotation of the shafts is assured. The connecting shaft through sprockets and a chain. The seed metering rotors mounted on their drive shaft are designed to meter seeds from the seed hoppers at the correct rate and spacing to discs type furrow openers. Fertilizer is also metered to the furrow openers in a similar manner. Plate 1 shows a picture of the complete machine.

As the Edip planter is drawn over the land the eccentric discs rotate alternately digging pits in the soil. Figure 2 shows the arrangement of the pits in the ground. Figures 2 and 3 show typical dimensions of the pits. The seed metering rotors are designed to drop two seeds through flexible tubes to the furrow openers at each of the positions shown in figure 2. Synchronization between the seed metering rotors and the discs is obtained by suitably adjusting the timing of the chain and sprockets. Depth compensating springs automatically correct for the undulations in the soil created by the soil pits. A pivoting scraper which rests on the soil under its own weight covers the seed. Plate 2 shows a close up of this part of the machine.

The Edip planter was constructed with a view to use in conjunction with herbicides so that no other cultivation processes would be required. The main advantages of this system over other should be:-

1. The pits formed should retain rainfall thus preventing runoff and erosion and conserving moisture.

2. The seeds are planted at a point where there is likely to be plenty of moisture.

3. The number of tractor hours should be much less than that for conventional tillage.

Field Trials

During the 1981 and 1982 growing season a field experiment was conducted to compare to compare the tillage systems for maize listed below at Morogoro.:-

(a) Conventional tillage + machine planting + machine weeding

(b) Direct planting + herbicide weeding

(c) Edip planting, 1st year + herbicide

(d) Edip planting, 2nd consecutive year + herbicide weeding

Equipment was constructed to collect runoff from the plots and this, the soil loss, and the yield were recorded.

The results for runoff and soil loss for Edip planting are encouraging when compared to the other treatments. There was no significant difference between the yields for any of the treatments. This is thought to be because the yield was effected more by problems of weeds than any other factor. To date a satisfactory herbicide has not been found and the problem is still under investigation. Although not statistically significant Edip planting would appear to give lower yields after two consecutive years. This is presumably due to increased weed problems. The yields for all plots were rather low due to poor rainfall in the 1982 growing season.

Table 1 gives a summary of results obtained to date

	Run off 1981 (mm).	Run off 1982 (mm)	Soil loss 1981 (t/ha)	Soil loss 1982 (t/ha)	Yield 1982 (t/ha).
Conventional tillage	2.12	0.63	2.30	0.64	0.21
Direct Planting	1.82	0.28	1.52	0.15	0.13
Edip planting 1st year	0.94	0.35	0.58	0.11	0.20
Edip planting 2nd consecutive year	-	0.07	-	0.02	0.07
L.S.D.O. 05	0.77	0.38	1.27	0.45	0.22
L.S.D.O. 1	0.63	0.30	1.05	0.37	0.18

Table 2

	Cost per hour (T.shs)	Hours/ hectare	Conventional planting		Direct planting		Edip planting	
			Tractor hours	Cost (T.shs)	Tractor hours	Cost (T.shs)	Tractor hours	Cost (T.shs)
Ploughing	240	2.0	2	480	–	–	–	–
Harrowing	250	0,5x2	1	250	–	–	–	–
Spraying	270	0,2x2	–	–	0,4	108	0,4	108
Conventional planting	260	0,5	0,5	130	–	–	–	–
Direct planting	260	0,5	–	–	0,5	130	–	–
Edip planting	260	0,5	–	–	–	–	0,5	–
Machine weeding	250	1,0	1	250	–	–	–	–
Herbicide	5 litres/hectare x2 applications x 89/- per litre		–	–	–	890	–	890
Total			4,5	1110	0,9	1128	0,9	1128

<u>**Cost comparison of the different treatments**</u>

Table 2 gives a cost comparison of the different systems calculated from the data of Dumelow, 1981 and A.I.S.C.O. price lists.

The cost per hectare in all three cases is almost identical. However there is considerable saving in the number of tractor hours used with direct planting or Edip planting.

CONCLUSION

The results indicate that Edip planting is a promising new technique, but further research is necessary particularly with regard to the identification of appropriate herbicides or other weed control techniques.

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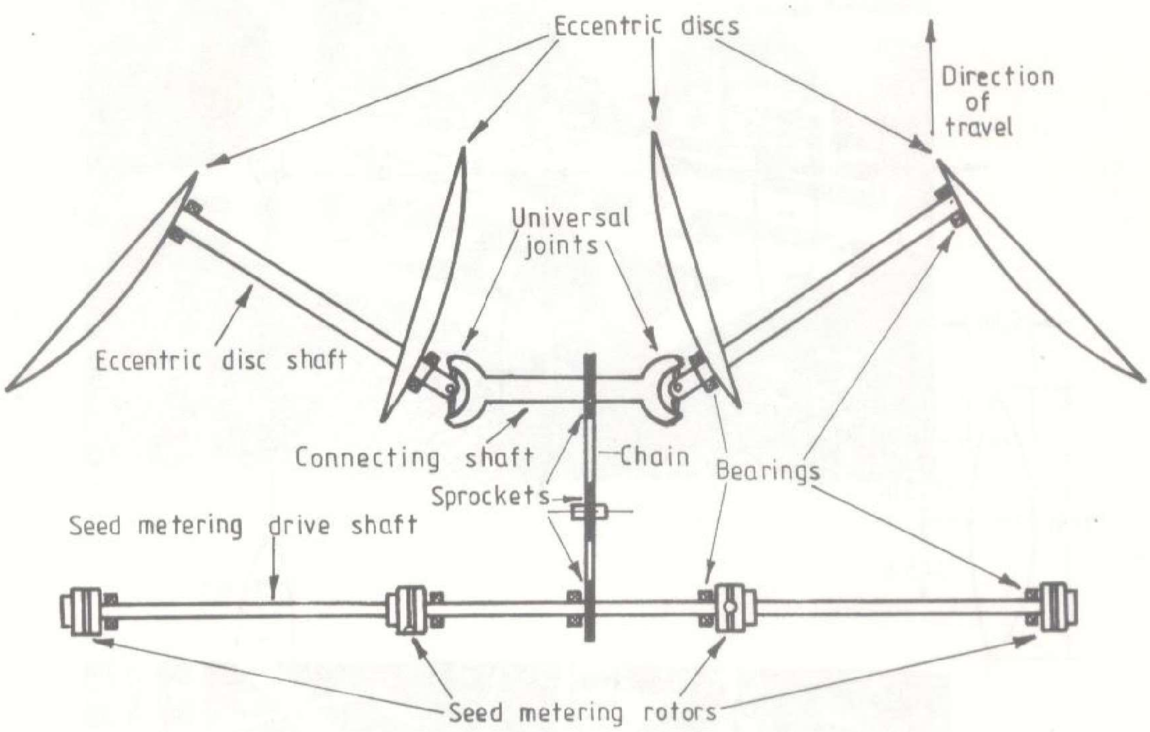

Fig.1 Plan view of general layout of main moving components of Edip planter.

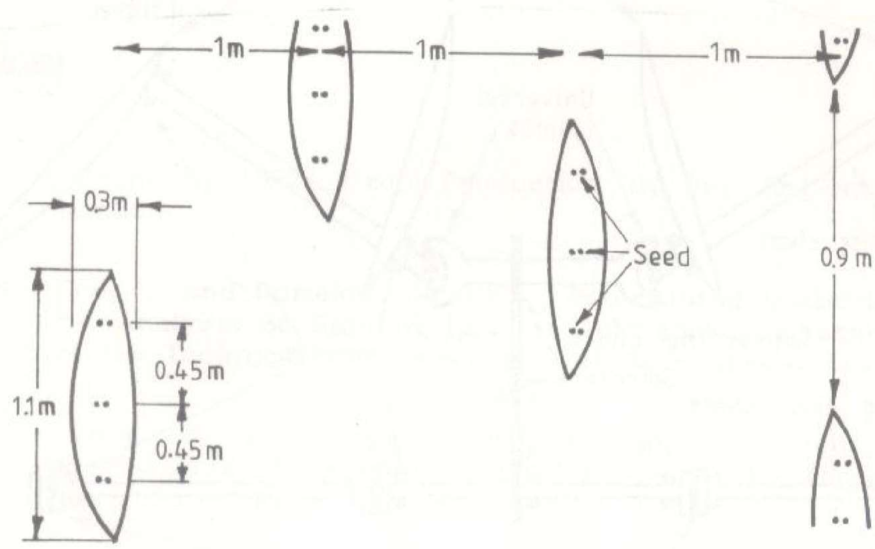

Fig. 2 Plan view of soil pits dug by Edip planter

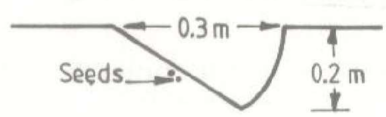

Fig. 3 Typical cross section of soil pits dug by Edip planter.

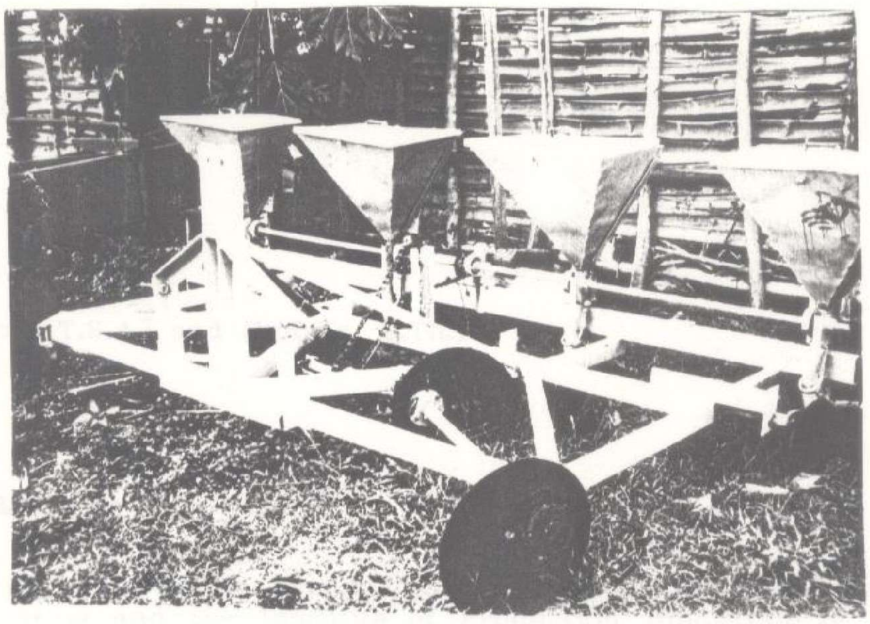

Plate 1

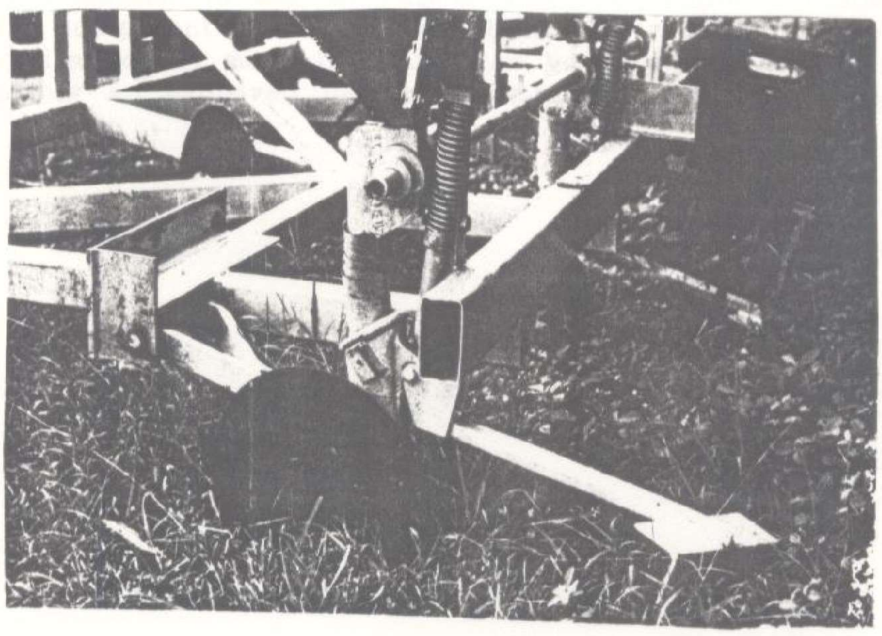

Plate 2