CHIPPING - A METHOD OF REDUCED TILLAGE FOR SUGARCANE AGRICULTURE

By C.P. SHERWELL

CG Smith Sugar Limited, Sezela

Abstract

Hand chipping has been shown to be effective in eradicating the old cane crop. This paper concerns the development of the technique on a large sugar estate and its use in conjunction with conventional ploughing and chemical eradication. Results and costs for a number of soil types and slopes, over a two year period involving 500 ha of land, are discussed.

Introduction

Chipping stools of sugarcane out of the ground by hand for purposes of eradicating the old crop, before replanting is not a new concept to sugar cane agriculture. It has particular value now, however, because of increased emphasis being placed on soil conservation practices. Hand chipping lends itself ideally to the steep south coast terrain. The technique was initially introduced at Sezela in order to minimise the fallow area.

Development of the chipping tool

The common hand hoe was the only tool available to chip sugarcane in 1987. Productivity from this implement was low because it was unable to penetrate heavy soils around the stool. Hoe handles made on the farm from the Syringa berry tree fitted the hoe's eye poorly, further impairing productivity. The hoe blades were tending to bend and break before completing 5 ha. Handles were breaking at a rate of one per 2 hectares, due to excessive force on them when they were used to lever the stool from the ground. These factors caused a considerable amount of downtime, and contributed to the low productivity.

Vine hoes (Anon[1]) were then tried the following year. After about 5 ha in heavy Glenrosa farm soils, the tines began bending and reduced the efficiency of this implement. On the lighter Fernwood farm soils the vine hoe tended to pull through the stool rather than remove it from the ground. Although the vine hoe is fairly wide, it does have a good lever action which assists in the removal of the stool. Productivity was still not satisfactory, due mainly to the weak tines and repetitive strikes necessary to remove the stool. At least one vine hoe will be required for 8 ha.

In the 1989 season pick mattocks were used, with the pick section removed to lighten the tool. There was an immediate increase in productivity, due to reduced downtime from fewer breakages. Penetration into the soil was better because of the tool's shape and weight. The action of the mattock is to cut through the stool below ground at about 200 mm. This leaves the roots behind and removes only the stool. The implement was still regarded as inferior, and a further increase in productivity was considered possible. One mattock would chip 50 ha before being replaced. Typically available implements are the hoe, vine hoe and mattock.

Ideally, the implement needed to be constructed so that with minimum weight the leading edge could penetrate the soil up to 200 mm and cut off the stool below ground level. The action following this initial penetration stroke should be the labourer pushing the handle away from his body to lever out the stool, rather than pulling the tool up towards him, to remove the stool from the ground. This action would reduce fatigue and make the operation easier. A foot was then fitted, replacing the pick section of the mattock. Because of the abrasive action of sand, the chipper's leading edge is hard faced. Based on the above requirements, a 'chipper' was developed and tested at Sezela. The design characteristics of the chipper are featured in Fig 2.

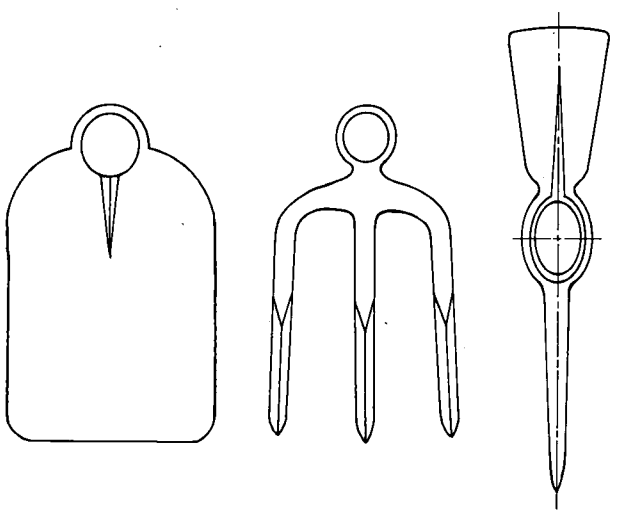


FIGURE 1 Diagram of the different implements.

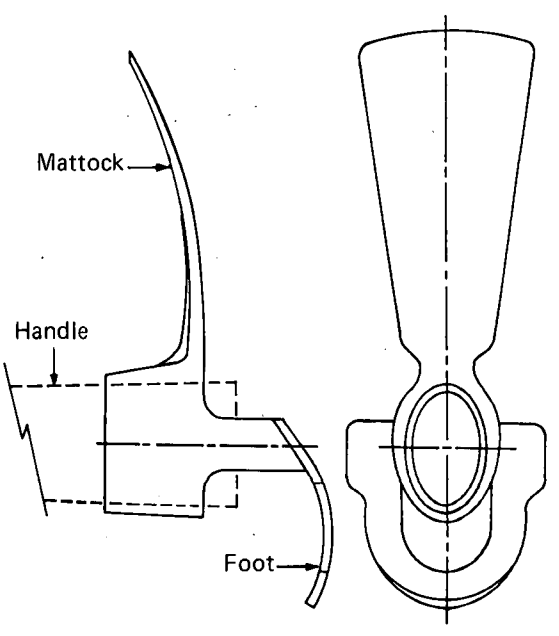


FIGURE 2 The prototype chipper.

All the implements were tested on the estate over a two year period and on a number of soil forms. The results of the tests are presented in Table 1.

Table 1
Comparison of the different implements

Soils	Hoe		Vine hoe		Mattock		Chipper	
	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Task m's	164	182	171	195	182	205	205	234
md/ha	50	45	48	42	45	40	40	35
time, min/m	3,2	2,9	3,0	2,6	2,3	2,0	1,8	1,6
No. str/m	26	20	18	15	20	18	15	10
Cost/ha	420	378	403	353	378	336	336	294

Heavy soil = Glenrosa form Trevanian series
Light soil = Fernwood form grey recent sands
Task = Number of metres required for each person to dig out per day.
Md/ha = man-days per hectare
Time = Time in minutes measured to chip out stools per metre in a 6th ratoon crop.
No. strokes/m = Number of strokes taken to chip out stools per metre.
Cost/ha = Cost in rand to chip out stools per hectare.

Integration of chipping in the annual re-plant programme

Timing

The main advantage of chipping is its application in the drier winter months, compared with chemical eradication which is generally restricted to summer months.

At Sezela conventional ploughing, using track or wheel machines, has been reduced to a minimum for a number of reasons, including the fact that, after ploughing lands are exposed and vulnerable to soil loss through erosion. Most fields at Sezela have been laid out according to the conventional design with established roads and waterways. It is therefore difficult for wheel or track machines to operate on the steep slopes. Costs for preparing land mechanically are also very high.

Chemical eradication of the old crop is practiced on the estate, but it has limitations in application due to the minimising of fallow land. Ideally cane needs to be harvested during August so as to be ready for Roundup treatment (Anon[3]) in November (maximum tillering with minimum stick growth). Planting this late in the year at Sezela usually encourages mosaic infection.

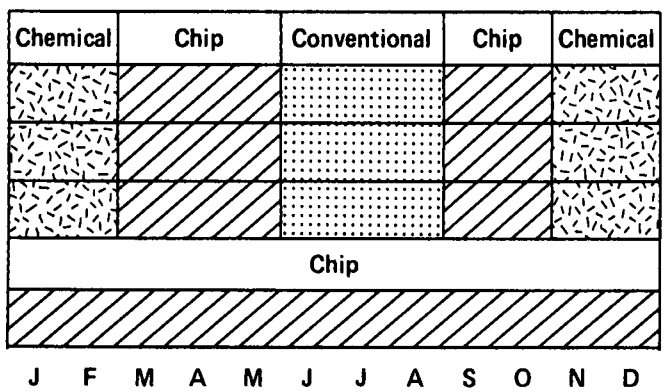


FIGURE 3 Comparison of timing between the 3 different operations of eradicating the old crop.

The optimum time to start chipping is when the cane plant has tillered sufficiently after harvesting (about 5 weeks), although it is possible to chip at any time during the year as shown in Fig 3.

Cost analysis

On average 37 man-days are required to chip a hectare of sugacane. Usually it will take 30 man-days to chip out the old stools, and six man-days will be required to windrow the chipped stools into rows 5 m apart. One supervisor is required, and hoes are required for windrowing only. The latter is an important and essential operation and should take place about 3 or 4 weeks after chipping. The windrowing operation ensures that no cane stools are left behind. At least 8% of the chipped out stools are still attached by the odd root to the ground. Any excess soil clinging to the stool is knocked off with the back of the hoe. Visual inspections are carried out more efficiently once the windrows have been made. After desiccation the windrows can be burnt, together with any loose trash or tops that might have been pulled up into the row. The standard of the operation will determine if any stools have been left behind. Should there still be odd stools that have not been chipped out, they will be removed by the planting labour.

Costs

1. *Chipping operation with chipper (for 1 ha)*

Materials

30 × chipping tools at R25.00 each	= R750.00
6 × hoes at R 7.13 each	= R 42.78
	R792.78

Each chipper depreciates over 100 ha = R7.92/ha.

Manpower

36 man-days at R7.50	= R270.00 (unskilled)
1 supervisor at R17.00	= R 17.00
	R287.00
Plus materials	R 7.92
Total	R294.92/ha

Note: Labour costs include transport.

2. *Chemical eradication (1 ha)*

Materials

1 × knapsack at R 8.00/ha	= R 8.00
1 × Tractor for 8 h/18 ha at R29.00/h	= R 13.00
9 litres Roundup at R30.00/litre	= R270.00 (1 litre for follow-up)
	R291.00

Manpower

1 × labourer at R11.00/ha	= R 11.00 (skilled)

Total costs = R302/ha.

3. *Mechanical eradication*

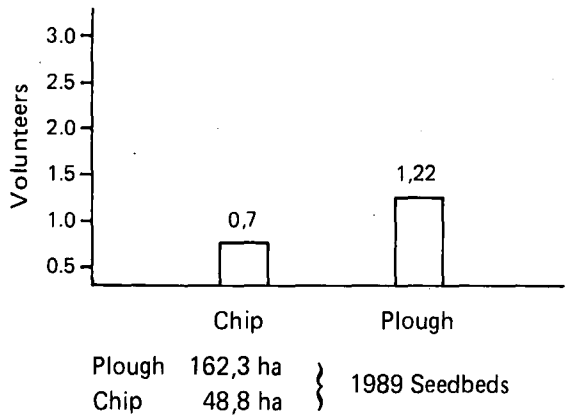
Conventional medium soils

Material and manpower

Shallow mouldboard plough × 2	R262/ha (Anon[2])
Disc harrow × 2	R214/ha
	R476/ha

Volunteers

The method of chipping, with a windrow operation follow-up about 4 weeks later, ensures minimum volunteer regrowth as seen in Fig 4.



Conclusion

Chipping as a method of reduced tillage, will play an increasingly important role in sugarcane agriculture. This is illustrated by the increasing trend in this direction on the Sezela MCP.

Table 2
Increasing role of chipping at Sezela MCP

Method	88/89 season		89/90 season		90/91 season	
Chip	161,1 ha	18,8%	305,5 ha	43,0%	382,6 ha	40,0%
Chemical	392,8 ha	45,9%	262,4 ha	36,9%	227,0 ha	23,8%
Conventional	302,0 ha	35,3%	143,0 ha	20,1%	345,5 ha	36,2%
Total	855,9 ha		710,9 ha		955,1 ha	

Although it is a labour intensive operation, it is possible to confine the operation to the winter months, when there is a low labour demand for other operations.

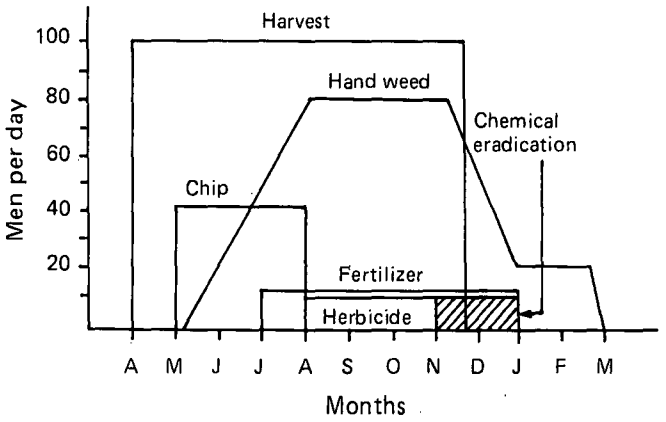


FIGURE 5 Labour spread over a year on a Sezela farm.

With the chipping method, a large percentage of the plant fields are prepared in July and are ready for ridging operations with the onset of spring rains. Mechanical eradication begins in May, but will usually take two months before the land is ready for ridging. Chemical eradication begins in November. Chipping does therefore buy time and prevents planting bottlenecks in November. It is also the most cost effective alternative to reduced tillage on the estate.

REFERENCES

1. Anon. (1986). *Stool eradication* : Information Sheet No. 1. S Afr Sug Ass Exp Stn.
2. Anon. (1989). *Mechanization Report 89/2.* S Afr Sug Ass Exp Stn.
3. Turner, PET (1980). The efficacy of Roundup for killing sugarcane. *Proc S Afr Sug Technol Ass* 54 : 140-145.