

A NO-CHAIN CANE DELIVERY SYSTEM

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Abstract

A cane harvesting system which eliminates the use of chain slings has been developed on Illovo's mill-cum-planter estate. A semi-mechanised "split harvesting system" has been adopted. Conventional type trailers are used for infield haulage which off-load loose cane into windrows on the loading banks. Grabloaders then transload the cane from the windrow into "Hilo" cane lorries for transportation to the Illovo mill. Reductions in staff on the loading banks have been achieved and the running costs of the grabloaders are found to be similar to those of the conventional Moba-mech cranes which are operated by Illovo on the growers loading banks.

Introduction

In a bid to reduce costs and increase productivity, a split cane harvesting system, incorporating a loose cane trans-loading system using no chains, was introduced on Illovo Sugar Estates coastal section, during the 1973/74 season. From the outset this method of loading cane proved successful and by 1979 all miller-cum-planter cane, as well as all the cane from black growers in neighbouring Kwa Zulu was loaded without the use of chain slings.

The concept of "no chains" has far reaching implications with regard to the various aspects of harvesting, transloading and transporting cane to the mill. The purpose of this paper is to outline the cane cycle from harvesting to the mill, the type of machinery used, operating techniques required, and to discuss the merits and demerits of the "no chain" system.

Outline of the No-Chain System from Field to Mill

Bartlett¹ in 1974 described the "split harvesting system" that Illovo's management began implementing during the 1973/74 season. All miller-cum-planter cane is now harvested in this manner. Cutters are employed solely to cut cane. Daily tasks, payments and bonuses are determined on area as opposed to weight of cane cut. During the 1979/80 season, 58% of miller-cum-planter cane was either stacked or loaded mechanically. On the steeper coastal section three

Bell loaders are used to stack the cane into five ton stacks, while on the flatter terrain at Illovo's Stoneyhill section in the Eston district, a Tamhe pushpile grabloader is used to load windrowed cane into self-tipping box trailers.

The remaining 42% of Illovo's cane is stacked by hand. Togh labour is used and paid on a weight basis, stacks being weighed on portable scales situated on the loading banks.

Rear loading Bell trailers are used to load the stacked cane. The loading rope is wrapped around the stack only once and provided the rope is kept tight and is centrally placed, very little spillage takes place. Once the stack has been winched onto the trailer, the rope is secured to ensure that the bundle remains tight. The trailer then transports the stack to a loading bank.

A key criterion in the "no chain" system is that cane must be off-loaded into a windrow. Thus, on arrival at the loading bank, the tractor reverses the trailer into the head of the windrow. The loading rope is loosened and the off-loader rope is secured around the capstan. The tractor PTO is then engaged and by allowing the tractor to creep forward, the operator allows the stack on the trailer to be pushed off tightly against the head of the existing cane windrow.

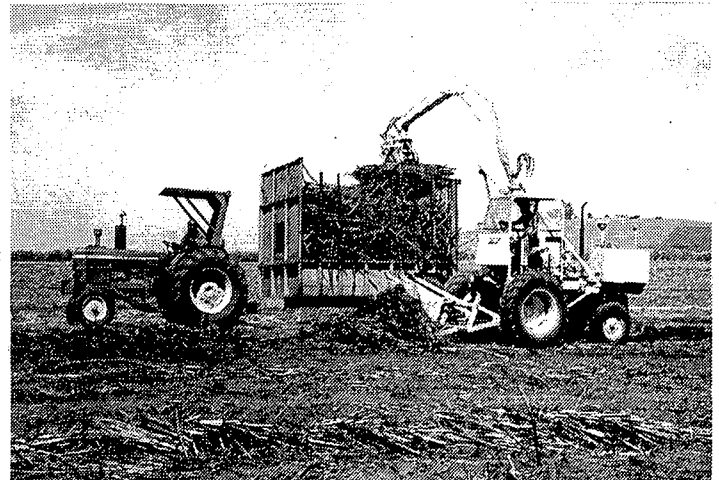


FIGURE 2 A self-tipping box trailer being loaded infield.

On the other hand, the infield box trailers are loaded with the cane sticks lying parallel to the direction of travel of the tractor and trailer. (This is to reduce the hazard of loads lodging in the trailer when tipping).

On arrival at the loading bank the tractor reverses the trailer up to the head of the windrow but in this instance the tractor and trailer are at 90 degrees to the line of the windrow. To ensure maximum density, the trailer is reversed as close to the windrow head as possible. The trailer is then tipped and again it is essential that the tractor be allowed to creep forward to ensure that the cane does not spread out, but remains in a loose stack.

To transload the cane from the windrow into the "Hilo" cane lorries, Tamhe high lift pushpile grabloaders mounted on Massey Ferguson 50 industrial tractors are used. For reasons of stability, the tractor operates in the reverse direction (i.e. the operator's cab is mounted over the back wheels). The loader consists of the tractor, pushpiler and boom plus grab mechanism.



FIGURE 1 A Bell trailer off-loading a cane stack into a dense windrow on the loading bank.

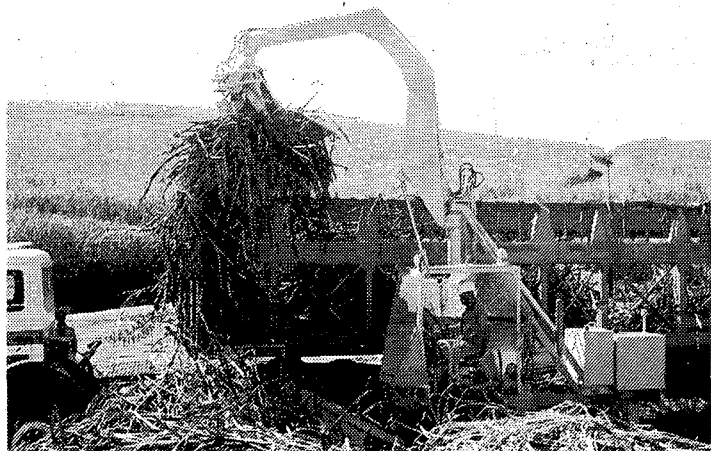


FIGURE 3 A Tamhe grabloader loading a "Hilo" cane lorry.

To load the lorry the grabloader operator drives the loader into the head of the windrow and uses the pushpiler to compact the cane in front of him. The hydraulically activated boom and grab are then used to load the lorry, which parks alongside the loader on the right hand side. For reasons of stability cane is loaded into the rear of the lorry first. The tractor operator then works his way down the windrow until he has reached the front of the lorry. In normal circumstances it is found that at this stage the lorry is half full. The lorry is then moved forward and the loading cycle continues until the lorry is full.

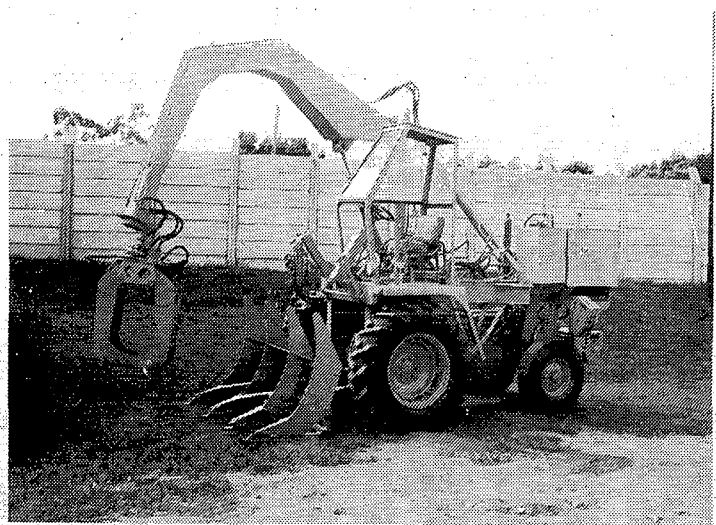


FIGURE 4 The wide pushpiler and grab jaws of the Tamhe loader.

On arrival at the mill yard, Hilo spiller cranes are used to off-load the lorry. The Illovo mill yard is such that all cane arrives at the mill loose and approximately 70% of the cane is off-loaded directly onto the moving table with the remaining 30% being off-loaded loose onto the mill yard floor. This loose cane is then stockpiled and later fed onto the moving table using two Caterpillar 950 loaders fitted with Cameco grabs.

Technical Aspects and Advantages of the No-Chain System

As a result of the implementation of the "no-chain" system, the full advantages of the "split cane harvesting" principle are now obtained. In the past cutters cut and stacked an average of 3,8 tons per day. During the 1979/80 season cutters averaged 12 tons per day. It is found that the motivation of cutters is now higher because daily tasks can

be more easily varied according to the condition of the cane to be cut. Daily tasks are set at a given number of 20 m "ropes". Bonuses are paid for extra cane cut, over and above the daily task.

Bell loaders were chosen to stack the cane on the steep coastal sections because of their ability to operate on such terrain. Two units were purchased in 1977 and a third unit in June 1978. All three units are equipped with dual wheels to assist in negotiating the steep slopes. Prior to 1977 hand made stacks averaged 3,8 tons, but with the Bell loaders, stack sizes have been increased and an average weight of 4,8 tons was recorded for the 1979/80 season. This has resulted in fewer tractor trips per day to fulfil daily allocation. As a result of the steep terrain, output of the Bell loaders is relatively low and an average of 12 tons per hour was obtained during the 1979/80 season.

The operating costs recorded for the three Bell loaders over the last two seasons are shown in Table 1, and it is felt that these figures compared very favourably with present day labour costs.

TABLE 1
Running cost for three bell loaders

	1978/79 Season	1979/80 Season
	R	R
Fuel and oils	4 188	7 164
Spares and maintenance	4 583	5 515
Tyres and tubes	1 087	516
Total	R9 858	R13 195
Total tons loaded	60 403	67 552
Cost/ton	16,3c	19,5c

Average cost per ton for the last two seasons is thus 18,0 cents. The increase in fuel price in 1979 increased stacking costs by 3,7 cents per ton.

As stated earlier, a Tamhe pushpile grabloader, which has a lower lift and centre of gravity than the transloaders, is used infield on the flatter Stoneyhill section. This unit, because of its design, is limited to areas with a slope of less than 15%. Infield tests show that this unit can average 0,5 tons per minute over a full working day and the average output for the 1979/80 season was 27,5 tons per hour, thus making this unit capable of loading in the region of 250 tons per day. The running costs of this unit over the last two seasons are shown in Table 2.

TABLE 2
Running cost of the Tamhe infield loader

	1978/79 Season	1979/80 Season
	R	R
Fuel and oils	786	2 690
Spares and maintenance	2 983	5 208
Tyres and tubes	0	187
Total	R3 769	R8 085
Total tons loaded	25 075	31 856
Cost/ton	15,0c	25,4c

Average cost per ton for the last two seasons is thus 20,8 cents. The increase in fuel price in 1979 increased loading costs by 5,3 cents per ton.

The introduction of this loader, coupled with the self-tipping box trailers was a significant factor in allowing

Stoneyhill section to return a labour use standard of 0,83 man days per ton of cane delivered for the whole section during the 1978/79 season. A total of 50 585 tons was harvested while the total number of man days required for all farming operations was 41 899. A saving of 2 617 man days was contributed by the grabloader.

As previously stated, it is essential that with the type of transloader used, cane is offloaded into a windrow from which it is loaded into the lorry. A second criterion is that lorry payloads are proportional to windrow density.

Experience has shown that the rear loading/off-loading action of the Bell trainer fulfils both criteria adequately, in that :

- The self loading action compacts the stack when loading
- The trailer can be easily reversed into the head of the windrow on the loading bank
- by not allowing the tractor to run forward when off-loading, the driver can force the stack off the rear of the trailer into the head of the windrow, thus creating a high density windrow.

On the other hand, the tipping box trailers do not produce a windrow as neat or dense as that from a Bell trailer. As a result, lorry payloads for Stoneyhill average 18,9 tons compared to a 20,6 ton average for neighbouring Klipspruit section, where only Bell trailers are used.

A consequence of the windrow concept is that loading banks have to be larger than normal and vary in size from 5 000 to 10 000 m². The ideal shape is a rectangle, to allow for long windrows but sufficient turning circle must be allowed for lorries.

At the introduction of the "no-chain" system in 1973 a basic infield grabloader was used for transloading. All four

grabloaders presently being used are basically of the same design except that the base frame has been elevated. So as to remain within road ordinance regulations, the tractor unit remains standard and ballast weights are used to stabilise the unit. When in operation the curved boom clears the side of the lorry by approximately one metre and because of the boom shape, cane can be pushed into the lorry, as opposed to some loaders that merely drop the cane into the lorry. This is an additional advantage in maintaining economic pay-loads.

In a bid to reduce dirt contamination, various pushpiler designs have been tried over the last seven years. In trans-loading, the chief function of the pushpiler is to maintain windrow density. Thus a pushpiler stretching the full width of the tractor is used. All ground-engaging sections are made of broad plate thus allowing the pushpiler to slide over the hard surface of the loading bank in order to reduce disturbance of the surface. On completing a loading operation, loading banks can be quickly cleared of "tramp" cane by simply filling the grab with a "bite" of cane; and by lowering the grab onto the front of the pushpiler the operator can sweep the loading bank clean.

The running costs of the grabloaders are very competitive and Table 3 shows a comparison in operating cost with the fleet of twelve cranes operated by Illovo Sugar Estates on the private grower zones in the Eston and Mid Illovo districts.

The greatest saving in the "no chain" system occurs in the saving of labour on the loading banks. To operate this system only two people are required namely :

- a loader operator who, because of the two-way radio installed in his machine, performs the duty of a zone clerk as well.
 - a labourer to trim the edges of the lorries before leaving for the mill. (Due to the loading action, a small percentage of cane does protrude from the side of the lorry which has to be manually trimmed. In the cases where secondary roads are used in transporting cane to the mill, this practice is not necessary).
- In comparison, on the growers zones five to seven people are required to operate one crane, namely :
- a clerk
 - a crane operator.
 - between three and five labourers to handle chains, re-stack broken bundles, and keep the loading bank clean.

A full time clerk is required in this context because up to eight different growers supply cane to the same loading bank.

The saving of between two and four labourers with the "no-chain" system becomes very significant when such items as monthly salary, rations, housing and protective clothing are taken into account. (See Table 4).

TABLE 3

Running costs for grabloaders used in transloading

	1978/79 Season	1979/80 Season
	R	R
Fuel and oils	5 621	13 974
Spares and maintenance	11 741	15 840
Tyres and tubes	859	1 633
Total	R18 221	R31 447
Total tons loaded	163 477	221 363
Cost/ton	11,1c	14,2c

1978/79 Season Three grabloaders
 1979/80 Season Four grabloaders

Average cost per ton for the last two seasons is thus 12,9 cents.

Running costs for crane fleet used in transloading growers' cane

	1978/79 Season	1979/80 Season
	R	R
Fuel and oils	11 196	26 462
Spares and maintenance	44 426	44 022
Tyres and tubes	4 559	3 219
Total	R60 181	R73 703
Total tons loaded	448 059	571 362
Cost/ton	13,4c	12,9c

1978/79 Season Twelve cranes
 1979/80 Season Twelve cranes

Average cost per ton for the last two seasons is thus 13,1 cents.

TABLE 4

Labour costs in operating loading banks during the 1978/79 season

	Cranes	Grabloaders
	R	R
Wages (operators and labourers)	65 321	10 175
Rations and housing	30 222	2 628
Protective clothing	1 595	140
Total	R97 138	R12 943
Total tons loaded	448 059	163 477
Cost/ton	21,7c	7,9c

General Advantages and Disadvantages

In 1974 Bartlett¹ enumerated the merits of the "no-chain" system as seen at that time. Many of these advantages have already been mentioned, but in the general context, other advantages can be listed as follows :

- there are no hold-ups of infield transport due to a shortage of chains and there is thus an increase in tractor and trailer utilisation
- there is a saving in the capital cost and maintenance of chain slings
- the fact that transloaders are within road ordinance enables them to be driven on provincial and national roads. This is a great advantage when loading Black Growers' cane, as loading zones are widely dispersed and tonnages are generally small
- high differentials in lorry payloads are reduced because of the loose cane principle.

Conversely, certain disadvantages are envisaged with the present system and can be listed as follows :

- Self off-loading trailers only can be used.

- With the "no-chain" system, maximum lorry payloads cannot exceed 25 tons with the present lorry designs used at Illovo.

Conclusion

The "no-chain" system, for reasons already stated, fits in very well with the present system of cane supply to the Illovo mill. This system has been developed as a result of the over-all harvesting system being used on the miller-cum-planter estate, the geographical layout of Illovo's black growers, and as a result of the contract Illovo has with its present road haulier. The "no-chain" system is by no means a new or revolutionary system but provided favourable circumstances exist, the system can be implemented economically and the feasibility of extending this system to the growers' zones is being considered.

REFERENCES

1. Bartlett, G. S. (1974). The integration of bulk handling of cane and a manual harvesting system at Illovo. *SASTA Proc* 48 : 113-117.