

HARVESTING SYSTEM AT SIMUNYE

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Abstract

The increasing labour supply together with sucrose losses and higher operating costs of mechanized harvesting have led to the discontinuation of chopper harvesting on the estate and the crop is now hand cut and loaded by continuous loaders. Windrows of four cane lines are hand cut and placed across one interrow and then lifted, chopped and loaded by the continuous loader into infield tractor and trailer units which carry bins. The bins are transhipped by forklift trucks onto road haulage units for transport to the factory. The loaders are high capacity machines loading at more than 130 tons/hour and on a twenty-four hour basis. The system is able to handle large tonnages per day. Performance data and operating costs are given.

Introduction

Simunye Sugar Estate is a 9 200 hectare irrigated sugarcane estate situated in the Swaziland lowveld producing over 1 000 000 tons sugarcane per annum. Winn¹ detailed the background of the estate and covered aspects of the proposed harvesting system. This paper describes the current system used and the reasons for the changes that have taken place since the estate's first crop in 1980.

In the latter half of the 1970's labour for the hand cutting of sugarcane in Swaziland became increasingly scarce, and it was therefore decided to purchase mechanical harvesters to cut 60% of the estate's crop. The remaining 40% was to be cut by hand and mechanically loaded. Continuous loaders were chosen as they produce chopped cane and this would enable the estate to have a uniform transport system and the factory would receive cane in a similar state; chopped cane requiring less preparation than long stick cane. Extraneous matter levels had been found to be lower with continuous loaders than push pile loaders. The possibility of picking up stones is dramatically reduced and stones occur over a wide area of the estate. A Cameco pota box cane handling system was being installed at the mill which required all cane to be delivered in bins.

The labour availability in the first two seasons (1980 & 1981) was poor and it was difficult to maintain a force of 300 cane cutters. In the next two seasons the labour supply improved so that in 1983 70% of the crop was cut by hand.

Losses from the chopper harvester were sizeable especially in lodged cane. A number of attempts were made to measure these losses but high variabilities prevented conclusive results from being drained. There had been over the four seasons a consistent difference in Pol % cane between hand and machine cut cane. Extraneous matter levels from the chopper harvesters were high, especially under wet conditions when serious problems were experienced in the mills and boilers. Machine cutting was the more expensive option and it was decided that from the 1984 season all cane would be hand cut.

The labour supply has been good over the last two seasons and the estate is now committed to hand cutting for as long as possible.

The estate has only one grower delivering cane to the mill and as this grower's rateable deliveries is only 10% of the

mill throughput, Simunye has to provide the balance of some 5 500 tons per day. As all cane is delivered in chopped form and deterioration is a major consideration, a 24 hour delivery system is used to minimise stocks and bin requirements.

The harvest programme is drawn up to minimise the number of moves made by the machines. Transport distances on the estate are up to 40 km and moves have to take place without disrupting the cane deliveries to the mill. Fields are grouped into consolidated blocks of about 600 hectares, from which 50 hectares are cut and the cane delivered each day from a single harvesting front. The original planting was done on a block by block basis and this has assisted in the groupings. The replanting of fields can disrupt the groupings which are then regrouped and rescheduled over two seasons in order to bring them back into the original groupings. The period between cutting and replanting has also been minimised to assist with this problem; in the dry months this period can be as short as 5 weeks.

The sequence of cutting fields within a block is determined at the time by burning and haulage considerations. Burning is carried out each day.

Description

The Harvesting Department at Simunye is centralised and sub-divided into three sections – namely, two hand cutting and one mechanical. Each section is controlled by a Section Manager who is assisted by Assistant Section Managers and supervisors.

Handcutting

Each handcutting section consists of three hundred cane cutters who are seasonal employees controlled by eight Supervisors and one head Supervisor. A labour transport system consisting of seven lorries plus five tractors with trailers is controlled by one of the Harvesting Section Managers.

All cane is burnt prior to cutting and approximately 50 hectares are burnt each day. The long handled Australian type cane knife is used. Each cane cutter receives a basic task aimed at achieving eight tons per cutter. The daily task is fixed for each season based on the estimated yield. The task consists of four cane rows of a predetermined length. The cane is cut and four lines are windrowed and laid over an interrow and not over a line as in conventional Southern African grab loading. To assist with the loading the cane rows are on a ridge some 250 mm above the interrow. Topping is carried out using the following procedure: The first two rows are cut and laid over an interrow with the tops facing one way and the second two rows are laid in the opposite direction. The cane cutter then tops both sides of the windrow. Having completed their tasks, cane cutters have the option of cutting more cane for which they are paid a bonus.

The cane cutter performance over the last three seasons has been 11,5 tons per man day. With the introduction of various incentive and accumulative bonus systems, absenteeism in the final months of each season has been minimised.

Mechanical loading

The Section Manager controlling this section has considerably more supervisory staff, due to the twenty-four hourly operation. The mill has a sixteen hour schedule stop once every fortnight.

The Section Manager operates on a daylight basis and is called out at night whenever major problems occur.

Machinery used

- Eight Continuous Loaders are powered by 186 kW six cylinder turbo charged motors, with hydrostatic transmission. The rest of the drives are hydraulic. The width of the machine is 3 metres and it weighs 12,000 kg and has a fixed loading elevator discharging to the left.
- Four forklifts (2 × 25 ton capacity, 2 × 15 ton capacity)
- Twenty four tractor trailer units designed to accept 37 cubic metre bins. The trailers are fitted with walking beam axles and high flotation tyres. Three of the units are fitted with 10 000 litre water tanks which are used in the burning and machine cleaning operations.
- Three grab loaders

At the start of each season, three drivers or operators are allocated a machine (haulage unit, continuous loader, forklift etc) for the duration of the season. All tractors have had tachographs fitted and the cards are changed and analysed every twenty-four hours, with the results entered on a driver record sheet. These records are examined weekly by the Section Manager and appropriate action is taken against drivers exhibiting poor operating performance. This system allows for strict control to be maintained.

Infield loading

Four continuous loaders are used at any one time and rotated on a twelve hourly basis. Depending on mill demand, it is possible at times to use only two machines. Sixteen infield haulage units are used with the continuous loaders.

When entering a field to start loading, the continuous loaders begin loading on what is called "opening lines". These are lines where six cane rows are windrowed and spaced at set intervals throughout the field. This allows for sufficient space for the haulage units to travel next to the continuous loader without trampling the adjacent windrow. Having a fixed elevator the machine is required to travel in a "race track" route.

A continuous loader straddles two cane rows allowing the pick-up tynes to travel in the interrow under the cut cane. As the continuous loader moves forward the cane slides up the pick-up tynes and is conveyed up the machine by bottom and top revolving chains equipped with closely spaced fingers. The cane is then fed into nine circular saws spaced 340 mm apart. The chopped cane falls onto the loading elevator which conveys it into the haulage unit.

Method of transhipping

The loaded haulage units proceed from the field to the loading zone which is normally within 3 km. At the zone empty bins are removed from road transport by the forklifts and full bins from the haulage units are loaded onto the road transport vehicles which are designed to carry four bins. No bin stocks are kept on the zone. Prior to the road transport moving off to the mill, a clerk fills in a weighbridge ticket, which also acts as a consignment note, containing the following information:

Burn time	Field number
Burn date	Loader numbers
Cut time	Road transport number
Cut date	Zone number
Bin numbers	Delivery date

This ticket is taken by the road transport driver and is handed in at the mill weighbridge.

When the road transport is weighed after unloading the net weight is entered on the weighbridge ticket. These tickets are conveyed to the factory laboratory where all information is punched into a computer. Daily and weekly reports covering time delays, machine and vehicle outputs, field yield and road haulage information are produced by the computer.

The off-loading system used in the mill yard is the Cameco Porta-box system featuring semi-automatic and automatic off-loading sides. On the automatic side, the road transporters move into set positions where the bins are automatically removed onto the offloading conveyor. The vehicle then moves forward to an onloading position where empty bins are automatically loaded. On the semi-automatic side, forklifts feed bins onto and off the conveyors. Also on this side sufficient bins for one hour crushing are kept in stock and these are turned around every twenty four hours. As a result of this, close communication is required between the mill and the harvesting staff.

Gleaning

During the loading operation about 2.5% of the cane is spilt, or left behind. All this cane from the previous day and night operation is manually gathered into piles and loaded by the grab loaders into five haulage units. This is a daylight only operation controlled by a supervisor.

A fully equipped mobile workshop and staff are always within close proximity to the loading operation and are in twenty four hour attendance. Maintenance and repairs are carried out infield or at the mobile workshops, and only major repairs are carried out at the main workshops.

Results

The performance of the equipment for the 1985 season, when 1 003 600 tons of cane were cut by the estate in 33 weeks, is given in Table 1. The running costs given cover fuel, tyres and spare parts only. The total costs include salaries, wages and associated benefits but exclude depreciation on equipment and buildings.

Discussion

The disadvantages and advantages of the system under the estate's conditions are:

Disadvantages

- The system is vulnerable to muddy conditions because the infield haulage unit is prone to bogging down.
- Although compaction is possible under damp conditions it is not considered any more severe than other systems.
- A possible disadvantage of the system is that it depends totally on labour with its associated risks. If there is a labour shortage, the possibility of incorporating a wholestick harvester could be considered and this would obviously increase costs.

Advantages

- A very clean method of harvesting and transporting cane. No cane is found on zones and/or haulage routes.
- The continuous loader is an extremely reliable machine with only routine maintenance required each day. Down time of the loaders is normally minimal. The life of the machines is likely to be very long, 15 years or more.
- Due to the high output of a continuous loader, fewer machines are required than where chopper harvesters or grab loaders are used, one loader replacing three chopper harvesters or grab loaders.
- Very little extraneous matter including stones, is loaded with the cane.

Conclusion

The three continuous loading machines purchased for the 1980 season have now each loaded almost 700 000 tons. These units which are on tracks, will be phased out over the next 4 to 5 years in favour of the rubber tyred version, as the under carriages are more expensive to maintain and movement around the estate requires a low bed trailer.

This system could be recommended to any large estate having a high rateable delivery, provided labour availability is good and that the terrain of the area is reasonably level. The maximum slope on which the units can operate is about 1 : 6.

REFERENCE

1. Winn, SJF (1979). An introduction to Simunye Sugar Estate. *Proc. S. Afr. Sug. Technol. Ass.* 53: 66-69.

Table 1
Performance & costs for 1985

Machine	Tons unit season	Tons/h	Fuel Litre/h	Running cost/ton Rand
Continuous loaders	122 500	134,7	35,7	0,69
Haulage units	47 790	30,8	12,0	0,57
Forklifts	248 511	149,8	9,3	0,08
Grab loaders	7 825	12,3	4,1	0,94

Total cost per ton R4,06
Average bin mass (tons) 8,04