

THE APPLICATION OF A FLAT LAND CROP REMOVAL SYSTEM TO AN ESTATE WITH STEEP SLOPES

By G. C. SPALDING

CG Smith Sugar Ltd, Sezela

Abstract

During the 1989/90 season a detailed feasibility study of the crop removal operation on Lewisham Section, CG Smith Sugar Limited, Sezela, indicated that the application of the split cut and stack 'flat land' method of crop removal offered important benefits. This paper discusses the problems associated with the traditional cut and stack system, and compares its performance with the newly implemented flat land system. Implementation of the flat land system has resulted in a 54% increase in labour performance and a 10% increase in hauler payload. The cost saving associated with these improvements amounted to R3,23 per ton in the 1991/92 season. The flat land system is most productive when all cane is burnt. The effects of cane quality on Lewisham Section are discussed.

Introduction

Lewisham Section has an area of 1 167 hectares under sugarcane on slopes varying from gentle to 40%. Mechanisation is difficult on these slopes and harvesting operations are labour intensive. The cut and stack method was cumbersome and strained the limited resources. Furthermore, the inconsistent availability of contract labour, combined with the younger generation's reluctance to harvest cane, resulted in an aging cutter force.

The implementation of the new split cut and stack system has been of mutual benefit to management and the worker. Management has reduced costs by improving productivity, and the worker is better paid and has more use of recreation facilities, due to the reduced number of hostel dwellers. These benefits, together with the reduced span of control, have improved communication and boosted the morale of the work force.

The cut and stack system

The cut and stack system required a crane and the use of chains to offload trailers, record stack weights and tranship cane into road transport before delivery to the mill. There were many problems associated with this system:

- When cutters achieved more than five tons per day they usually produced two stacks each averaging less than three tons. This resulted in poor haulage productivity
- The cut and stack method was not conducive to good cane quality control as cutter remuneration was based on the mass cut. High infield cane delays also exacerbated cane quality problems
- Small areas which were not harvested affected productivity and delayed bonus feedback, as did the inability to remove stacks during wet weather
- Cane spillage on infield roads reduced cutters' earnings and made roads impassable
- Crane weights were often inaccurate, the crane was slow to move and any breakdowns disrupted the total haulage operation

- Chains were a safety hazard, required labour to operate and were costly to maintain.

These concerns, together with improved labour productivity achieved with a similar harvesting system on Mgayi Section, CG Smith Sugar Limited, Sezela (Chatterton and Braithwaite, 1985), were the main motives for changing from the traditional cut and stack system to the split cut and stack system.

The split cut and stack system

The new split cut and stack system divides the old harvesting method into cut only and stack only activities. This necessitated a change in the method of cutter remuneration. The cane haulage system now did not require cane chains as cane was transhipped by grab loader in place of the traditional crane. Although this system may be applied to burnt or green cane, it was decided to burn all cane to improve productivity. By paying cutters for length of row cut and stackers for length of row stacked, each worker is able to perfect the techniques required within each activity. Performance feedback is instantaneous as earnings can be calculated directly from the length of row cut or loaded at any stage. Previously, the workers waited for feedback on their performance from the crane weights. Workers now also stacked the cane according to a size and mass as pre-determined by machinery requirements. This change has resulted in a labour productivity improvement of 54% and an improved haulage productivity of 62%.

Remuneration based on the length of cane row allows for accurate topping of cane, as topping height does not influence bonus earnings but is central to the achievement of good cane quality (Inman-Bamber and Wood, 1987).

To accommodate the new system an intensive redefinition of old field boundaries was undertaken, resulting in fields greater or less than 20% slope being combined into single fields along the contour line. After using contours as boundaries, a form of strip cropping is in place. A total of 98% of the farm conforms to the new layout and is compatible with conservation practices on the estate (Landrey, 1978). Because all infield roads are water carrying and are installed at a vertical interval of 10 m regardless of slope, the criteria for minimum soil loss are well met even in a burnt situation (Platford, 1987).

A fleet of four haulage tractors with side loading rear tipping trailers are used on the farm. These versatile trailers can be readily converted into box trailers to cope with the small amount of cane that may be mechanically loaded. Because of improved stack placement, the split cut and stack system reduces the risk of infield compaction by ensuring that haulage rigs travel only on infield roads. Sucrose loss due to severe infield compaction could be as high as 50% in ratoon cane (Swinford and Boevey, 1984).

The grab loader used to tranship cane during the night has accounted for a 10% increase in hilo payload.

Comparison of the two systems

When making a comparison of the two systems the following parameters were used:

- A crop of 60 000 tons
- A season length of 210 days for contract workers
- A season length of 312 days for permanent workers
- The use of 1991/92 rates for all calculations.

Table 1

A comparison of labour requirements between the old cut and stack system and the new split cut and stack system

Labour Category	Old system		New system	
	Standard	Total man-days	Standard	Total man-days
Cutters	3,5	17 143	5,4	11 112
Loaders	nil	nil		
Supervisors	4	1 248	3	936
Drivers	4	1 248	4	1 248
Conductors	4	840	4	840
Gleaners	2	420	2	420
Zone crew	8	1 680	2	420
Total		22 579		14 976

Harvesting productivity has improved by 54% resulting in a man-day saving of 35%. As a result of reduced manning levels, a 25% reduction in the level of supervision has been possible. Haulage drivers, infield conductors and road gleaners remain unchanged, and the introduction of a grab loader has reduced zone crew requirements by 75%.

Reducing labour requirements by 7 603 units to remove the same size crop has resulted in a saving of R109 711. A percentage of this saving is paid back to workers in the form of increased bonus earnings; this is reflected as bonus under costs in Table 3.

Table 2

A comparison of machinery requirements for the old and new systems

Machinery Category	Old system		New system	
	Tons/hr	Total hours	Tons/hr	Total hours
Infl haulage	12,4	4 839	20,1	2 986
Trans loader	nil	nil	31,8	1 887
Trans crane	31,5	1 905	nil	nil
Total		6 744		4 873

Increased and consistent stack payloads, better stack placement and improved zone turnaround times have accounted for a 62% increase in infield haulage productivity. The introduction of a grab loader to replace the conventional crane has marginally increased productivity while reducing operating costs by 13%.

The introduction of a no cane chain haulage operation and the use of a grab loader, have reduced total machinery hours by 1 871, saving R54 485.

Table 3

A cost comparison of the two systems

Costs Category	Old system		New system	
	Cost/ton	Total cost	Cost/ton	Total cost
Labour	5,43	325 815	3,60	216 104
Bonus	0,88	52 800	1,54	92 400
Machinery	3,10	185 745	2,19	131 260
Chains	0,39	23 400	nil	nil
Transport	8,21	492 600	7,49	449 400
Rations	1,08	65 069	0,69	41 446
Overtime	0,06	3 869	0,02	1 248
Recruiting fees	0,08	4 512	0,05	2 867
Paid holidays	0,18	10 826	0,12	7 210
Chemicals	2,18	130 956	2,66	159 684
Total	21,59	1 295 582	18,36	1 101 619

The implementation of the new split cut and stack system has accounted for a labour saving of R1,83/ton, from which an average of 66 cents/ton is paid back to the worker in additional bonus earnings. Therefore a saving in labour costs of R1,17/ton has been realised.

Improved machinery efficiency has resulted in a R0,91/ton saving, and not having to use chains saves a further R0,39/ton. The grab loader, by increasing hilo payloads, has reduced transport costs by R0,72/ton.

In addition, the split cut and stack system has resulted in reduced labour costs for rations, overtime, recruiting fees and paid public holidays amounting to R0,52/ton. These savings however are reduced by R0,48/ton due to the increase in chemical requirements.

A saving in crop removal of R3,23/ton, combined with reduced manning levels and a better paid work force, have contributed to ease of management, which makes Lewisham Section one of the most productive farms within the Sezela entity.

Cane quality

During the 1991/92 season three factors contributed to improved cane quality:

- Burning – 100% of the crop was burnt during 1991/92 compared with 60% in the 1989/90 season
- Bonus earnings – by removing the emphasis on weight and rewarding cutters on length of cane row cut, topping height and base cutting does not influence bonus earnings.
- Cane delay – cane quality has been further improved by the reduction in cane delay. The new system allows for up to 50% of cane cut to be delivered to the mill on the same day.

Of concern to the Sezela miller-cum-planter over the past seasons has been the decline in cane quality. A comparison between Sezela and the sugar industry, based on season values of actual pol % cane, fibre % cane, purity % cane and cane burnt % total over the past seven seasons is noteworthy (Lionnet, 1991):

- Between 1985 and 1990 fibre % cane at Sezela increased by 4%, whereas for the same period it decreased in the sugar industry by 3,5%
- At the same time pol % cane deteriorated at Sezela by 6,7% while increasing in the industry by 7,2%

- Purity % cane also deteriorated by 2,4% at Sezela and increased for the industry by 2,3%
- Finally, the percentage burnt at Sezela decreased between 1985 and 1990 from 53,7% to 44,6%, whereas it increased for the industry from 73,0% to 75,30%.

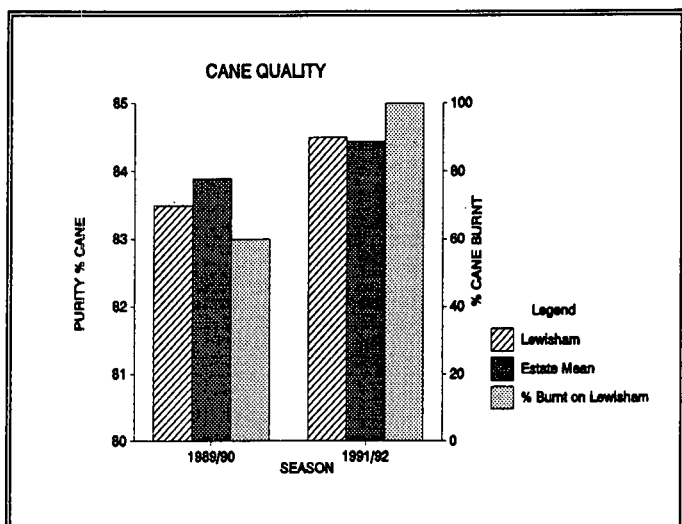


FIGURE 1 The effects of burning on purity % cane for Lewisham Section and the Sezela entity.

A similar trend is evident with the Sezela miller-cum-planter when compared with Lewisham Section, as shown in Figure 1; as percentage burnt cane increased, purities improved. This indicates that trash has an adverse effect on cane quality.

Conclusion

The cost of implementing the new system was R128 470, being the purchase of a grab loader and the modification of existing trailers. The first season after introduction produced encouraging returns, but it was during the past season (1991/92) that the decision to change the harvesting system was economically justified. An annual saving of R193 963 on a 60 000 ton farm realised a payback period of less than one year. An additional two estates will be converting to the new system during the coming season and the following year it is planned that all nine Sezela farms will operate the split cut and stack system.

The disadvantages of the system are the high ethanol values recorded due to the use of a grab loader, and the increase in chemical costs if an increased percentage of cane is burnt. However, in addition to advantages covered in this paper, man-days per thousand tons of cane delivered have decreased from 4,2 to 3,55 man-days per 1 000 tons. Furthermore, the disabling injury frequency rating is down from 6,8 to 1,7 man-days per million man-hours.

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