THE USE OF STRIP CROPPING ON A LARGE SUGARCANE ESTATE

By M. A. BARENDSE AND J. E. LONSDALE

Tongaat-Hulett Sugar Ltd., Darnall

Abstract

A strip cropping layout incorporating spill-over roads on a large Estate is nearing completion. Practical layout techniques for minimising the area of roads and optimizing surface water control are presented. The advantages of this method of conservation are discussed.

Introduction

Approximately 10 years ago a strip cropping programme was initiated at Darnall. A land use plan was prepared for Sinkwazi Estate by the SASA Experiment Station. Farms throughout the industry were visited to evaluate techniques and develop a system which would minimize the number of roads, and optimize surface water control while ensuring efficient haulage from every part of the farm. The system which was developed is described.

Methods

Sinkwazi Estate is a 718 hectare farm with predominantly Willowbrook, Glenrosa and Longlands soil forms. There is a range of slopes from flat hilltops and valley bottoms to some relatively steep hillsides. About a third of the area comprises valley land.

Roads

Roads doubled as field boundaries, fields being about 15 hectares in size and consisting almost entirely of areas requiring the same management, i e valleys, hillsides and hilltops.

Before roads were constructed an overall plan was drawn on a map. The object of the plan was to minimise roads but ensure continuity for conservation and cane haulage. Every road and break had to be essential for cane haulage or surface water control and all field boundaries were then established on these necessary structures.

Where possible, roads fell from spur to waterway but practical considerations occasionally made it necessary to do otherwise. Four types of roads were used: valley isolation, slope break, hilltop isolation and crest roads.

Valley isolation roads were positioned just above the wet land or slope change. Gradients of 1 in 40 to 1 in 200 were used to isolate as much valley land as possible or to intercept a slope break road for crop extraction. Steep roads were avoided where possible. Where roads were required to fall away from waterways the initial stage climbed to help divert surface water into the waterway. On Sinkwazi Estate valley isolation roads run for an unbroken 35 km.

Slope break roads were put in at 1 in 80 to 1 in 150 to obtain strips that were 50 to 70 metres wide on all slopes. Carefull planning was necessary to group steep land within a field and ensure continuity with a minimum of roads (Figure 1).

A small error of judgement could have necessitated an extra road or adversely affected the continuity of roads e g correction strip roads may have become necessary.

Hilltop isolation roads separate all mechaniseable land by locating them at the point where a cane line situated on the crest would become too steep. To achieve this, gradients of 1 in 80 to 1 in 200 were used. Hilltop isolation roads were used for haulage in preference to crest roads. They were slightly longer but their gradients were more suitable for haulage and resulted in less erosion. As with valley isolation roads hilltop isolation roads occasionally fell from a catchment to a spur.

Crest roads were avoided on the hilltop by using the crest line as a master line. They were used only for continuity.

Road construction

Isolation and slope break roads were constructed by cutting into the slope and dumping soil on the outer side. The resulting bank was then shaved off to provide open access for haulage equipment from the land (Figure 2). Where a steep road was necessary, diversion bolsters were constructed at regular intervals. These were large enough, shaped and angled to ensure haulage equipment did not have to reduce speed and the cane being hauled did not bounce on the trailer.

Crest roads were built up from both sides making sure that there was free drainage away from them. Slope break roads and cane lines were dropped sharply away from crests and extended up the slope of the crest to help with drainage. Mitres were used to make sure surface water was diverted.

Waterways

Trapezoidal waterways were constructed as shown in Figure 3. This method of construction ensures that the water flows over the sods and not on one side of the flat base. The sizes were similar to those described by Whitehead *et al*[2]. Where banks of streams exceeded a stable height they were stabilized by planting trees.

Generally waterways were extended up to the hilltop to ensure proper surface drainage where lines dammed. Where 4 roads met in a saddle or surface drainage was required, waterways from both sides were extended over the crest.

Cane lines

Cane lines were all free draining at a slope of about 1 in 100 but if there was a risk of rows damming they were run at steeper gradient e g in valleys or on hilltops with soils of Dwyka origin.

Results and discussion

During cyclone Demoina in 1984 it was clear that strip cropping was adequate to control infield surface water but inadequate to cope with surface water from roads, zones, housing and other external sources. The system described in this paper not only provides direct control of this external surface water using diversion bolsters, mitres, storm drains and waterways, but, by reducing the number of roads has reduced surface water volume. This reduction in the area of roads also increases the area of cane land and reduces the area of road to mow and maintain.

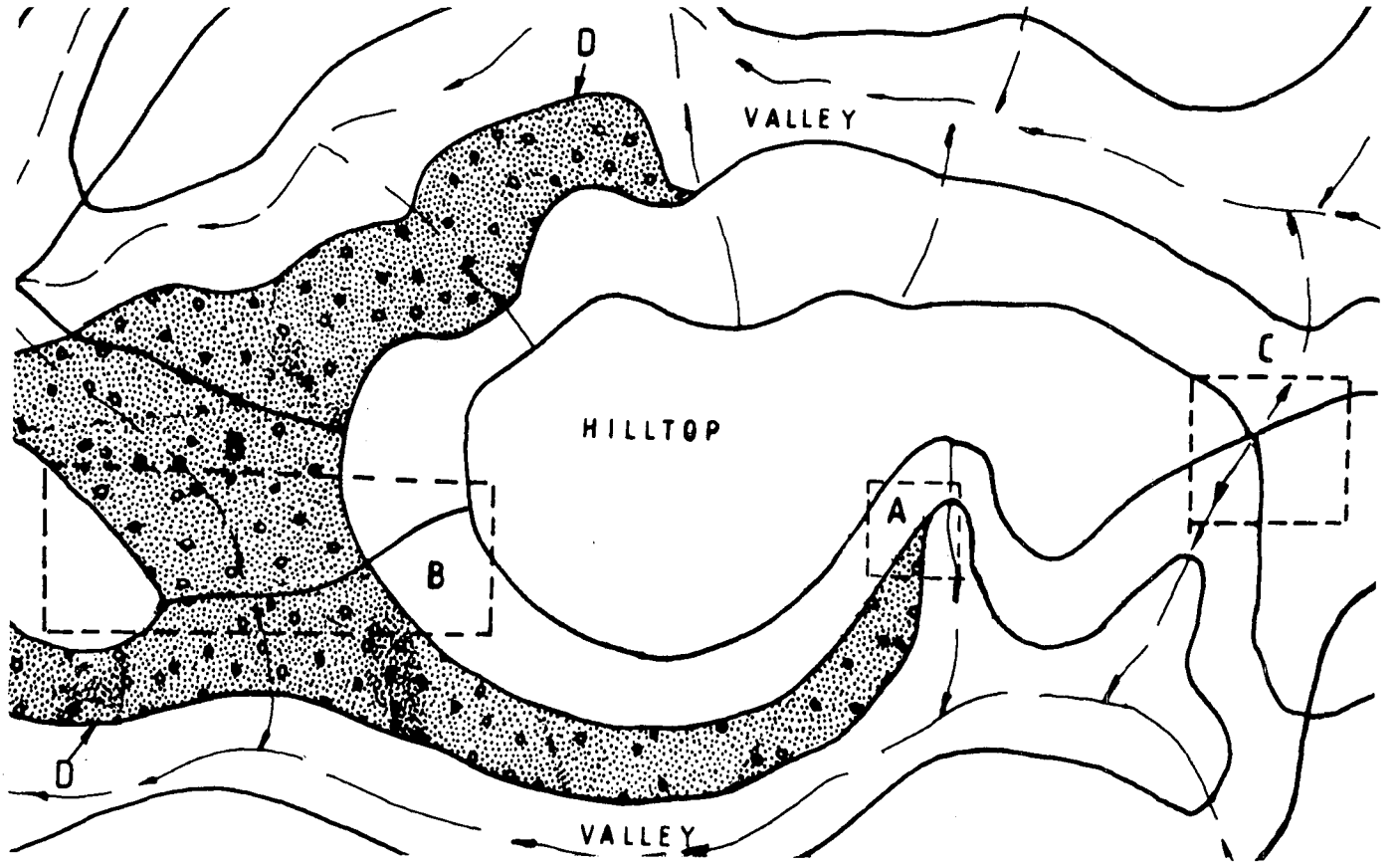

FIGURE 1 A typical part of Sinkwazi Estate showing
A- Valley isolation and slope break roads intercepting.
B- A staggered crest.
C- Waterways going over a saddle where 4 roads meet.
D- How roads double as field boundaries.

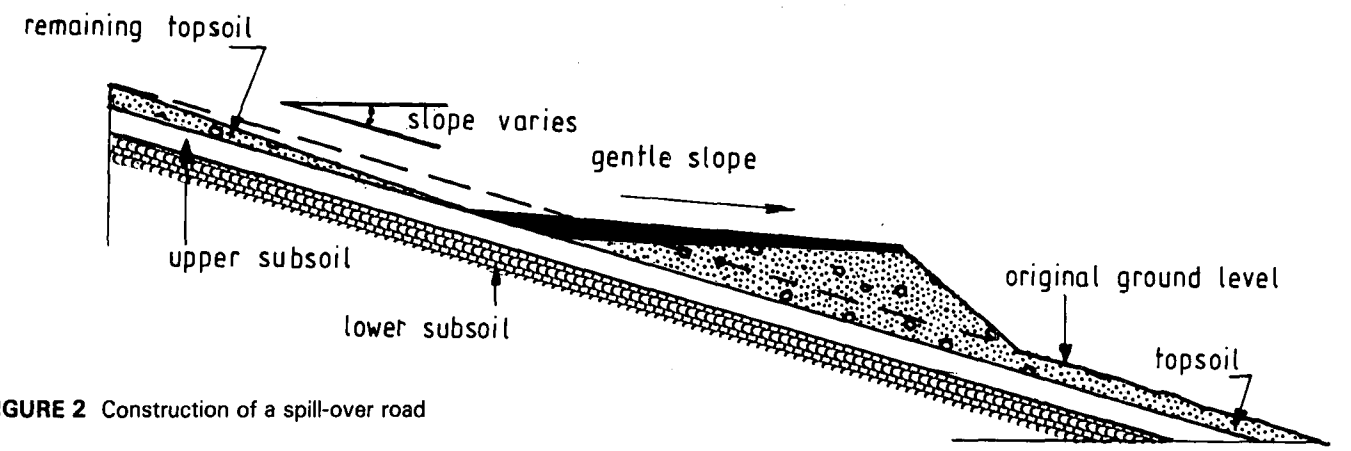

FIGURE 2 Construction of a spill-over road

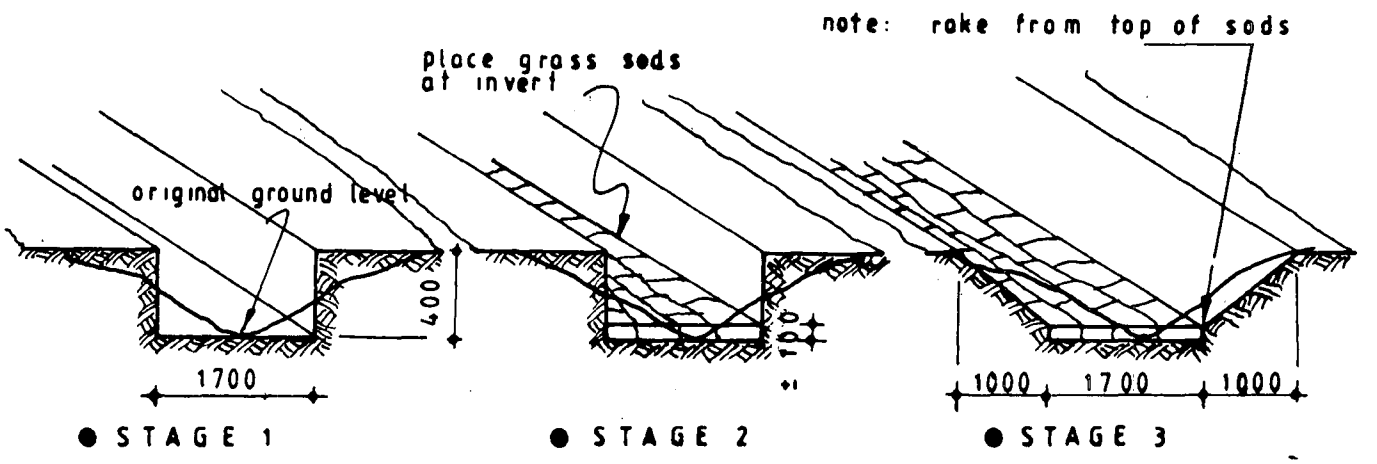

FIGURE 3 Three stages in the construction of a trapezoidal waterway

The fact that there was little erosion during cyclone Demoina also indicates that the spacing of slope break roads on Sinkwazi Estate was adequate for the conditions experienced. The spacings were similar to those used by Wise[3] but greater than those recommended by Whitehead, *et al*[2] and it appears that strips can be wider with the use of spill-over roads than with water-bearing terraces. Wider strips are an advantage on large farms.

The use of spill-over roads permits greater flexibility of gradient and direction of fall than the water bearing terraces used by Landrey[1] and recommended by Whitehead, *et al.*[2] This flexibility was a major factor in reducing the number of roads. Figure 4 shows how few roads are used for this system as compared with structures and roads in a Land Use Plan done by the SASA Experiment Station.

A major advantage of this layout system is that fields consist of cane land requiring the same management i e valleys, hillsides and hilltops. The specific problems of each unit e g drought on hilltops, erosion on hillsides and drainage in valleys can be solved without having to compromise because of different requirements within a single field.

The need for subsurface drainage has been entirely eliminated on Sinkwazi. This was achieved by controlling surface water, deepenening waterways, planting valleys in winter and by strip cropping. Strip cropping reduces runoff because entire hillsides are not exposed at one time. On the heavier soils of Sinkwazi, cane lines must be free draining as water damming reduces yield and increases eldana infestations. The fact that Wise[3] put lines in on contour probably indicates that his problem was not encountered on lighter soils.

On some farms in the industry strip cropping has resulted in dead end roads and relatively inefficient cane extraction systems. Several techniques have been developed to overcome these problems e g ensuring that slope break and valley isolation roads intercept, and the use of short crest roads have ensured a continuous and efficient cane extraction network.

The investigation and elimination of the cause of potholes and ruts in the roads has not only resulted in a big improvement in the road surface, but also excellent surface drainage. The improved road surface is expected to increase haulage speeds and reduce both cane spillage and maintenance costs of vehicles. However roads have been made wider partly to reduce the risk of head-on collisions at the higher speeds.

One of the major causes of potholes in roads is lack of shape. If a road is neither sloped to the side nor on a gradient potholes will form. On Sinkwazi Estate roads are both sloped to the side and on a gradient.

Unless roads are properly maintained they will quickly deteriorate. After heavy haulage or rain and especially after haulage on wet roads, diversion bolsters and mitres should be renovated and spilt cane should be removed.

Even on spill-over roads it is necessary to grade to prevent wheel ruts carrying water. Grading must always be from the downhill side up. It is important to avoid a ridge on the lower side of the road as this makes the road water bearing and can cause serious erosion and drainage problems in valleys.

Burning and the control of runaway fires has improved under strip cropping. If valley, plough-out and carry-over† fields are burnt in winter they provide good protection against runaway fires in the dry winter.

Conclusions

A strip cropping system with spill-over roads and good surface water control can provide efficient cane extraction and effective soil conservation at low capital and maintenance costs.

Acknowledgements

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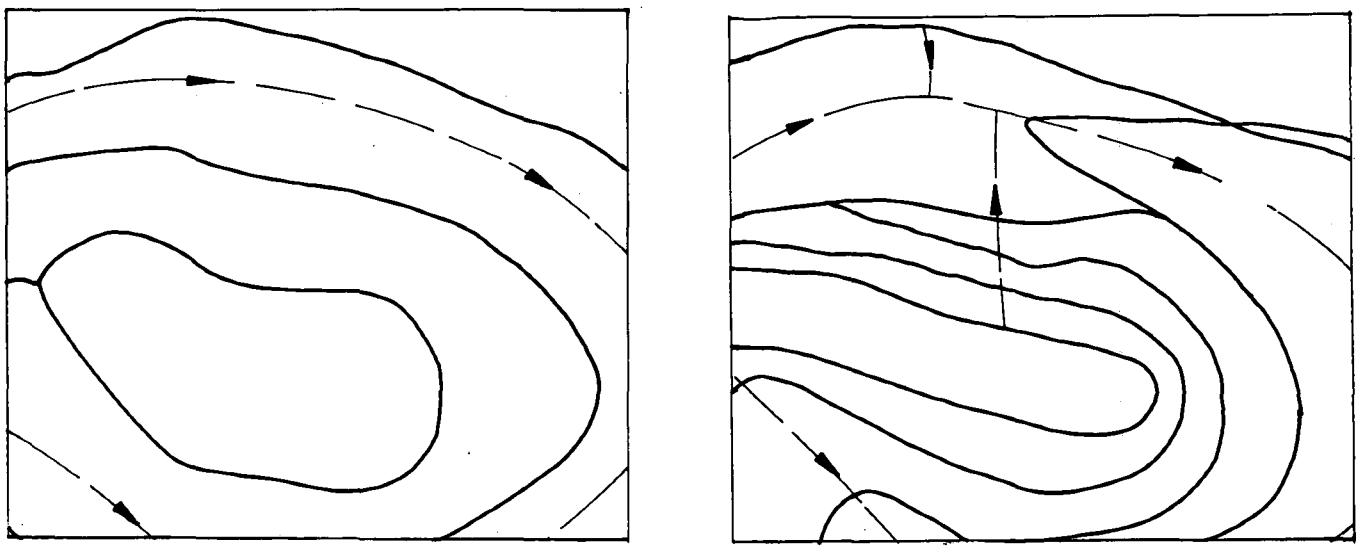
REFERENCES

1. Landrey, OP (1978). Land use on steep slopes on an Estate on the South Coast of Natal. *Proc S Afr Sug Technol Ass* 52; 125–128.
2. Whitehead, C. *et al*. *Land Use Planning for the Sugarcane Industry in South Africa.* S Afr Sug Ass Experiment Station handout.
3. Wise, C (1978) Conservation farming pays. *Proc S Afr Sug Technol Ass* 52: 129–130.

* A spill-over road is shaped so it does not carry water.
† A carry-over field is a field harvested the season before last.



A B

FIGURE 4 Comparison of Sinkwazi Estate
A– as it is and
B– as in land use plan