

ASPECTS OF STRIP CROPPING OF SUGARCANE ON THE NORTH COAST OF NATAL

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Abstract

The implementation of strip cropping or harvesting and planting sugarcane in separate panels or groups of panels on hillsides on the north coast, is discussed. Such strip cropping is an important factor in the SASA Experiment Station's nomograph, which is used to advise growers on the required conservation practices to ensure they comply with the 1983 Conservation of Agricultural Resources Act. The merits of strip cropping, with special reference to transport efficiency, harvesting and crop management, are outlined.

Introduction

Strip cropping of sugarcane is the practice of re-establishing and harvesting sugarcane in one or more panels on a hillside. It is a conservation practice which, together with other measures such as trashing, minimum tillage and the use of water carrying terraces, may be used to ensure that farm management complies with the requirements of the 1983 Conservation of Resources Act (the Act) (Anon¹). On steep slopes and areas of erodible soils such as are commonly found on the North Coast, strip cropping on hillsides is essential to keep soil loss through erosion within limits acceptable under the Act.



FIGURE 1 Strip cropping on the coast.

As early as 1957, the fields on the farm Stone Lodge were reshaped in order to facilitate strip cropping (Wise⁴). However, it was only in the mid-1970s that the early adopters of this practice in the North Coast extension area began implementing strip cropping. Since then increasing acceptance of this practice, which provides effective conservation and promotes efficient field management, has led to strip cropping being implemented on 88 of the 160 farms in the area. Under this management system only part of a hillside is re-established at any one time, which has obvious benefits in terms of soil protection. As experience was gained in strip crop farming other benefits of the system became apparent.

Reductions in the cost of cane haulage were noted and harvesting and other infield operations were made easier and more efficient.

Some of the benefits reported by growers who have practised strip cropping for some time are described, and some of the criticisms of the system are discussed.

Method

In order to implement a strip cropping system an acceptable road network has to be planned. This network should divide the area planted to sugarcane into panels that are of an acceptable width according to conservation criteria, and in addition provide access to all fields on the farm to ensure efficient crop extraction.

The SASA Experiment Station has prepared a total of 54 Land Use Plans (LUPs) for growers in the North Coast extension area and these provide, among other things, a suggested road network for the farm. Since 1987 these plans have been compiled using the SASEX nomograph (Anon²) which enables Farm Planning Technicians to calculate the vertical interval between the infield conservation terraces or roads taking into account not only the physical factors such as soil erodibility and percent land slope, but also management factors such as the use of minimum tillage, a trash blanket and strip cropping.

Where LUPs have not been prepared, growers have often sought their extension officer's advice to determine the vertical interval required between the infield terraces or roads. In the case of Tongaat-Hulett's Kearsney Estates, a 10 m vertical interval between structures was applied as this seemed to meet the needs of both conservation and crop extraction, on the particular slopes and soils of the Estates. Growers who have implemented their field layout independently of outside advice have used other criteria to determine this vertical interval and thus the width of the panels. The most significant of these criteria has been the accessibility of areas for crop extraction. On Stone Lodge for example the "contour" roads were originally planned so as to serve the three gantry points on the farm conveniently. Another yardstick that has been used, particularly on steep slopes, is the distance that is considered comfortable for a cane cutter to carry cane to make stacks as was used in parts of Marianne farm, in the Shakaskraal area.

In almost all situations however, the siting of roads is influenced by features in the topography, points of exit for infield cane transport, and even crop management considerations. On Arcadia and Emoyeni at Tinley Manor, key roads were sited to meet in the saddles between hills. With these roads as a framework the remainder of the hillsides were divided into panels, using a vertical interval determined by conservation standards at the time. In similar fashion on Sinkwazi Estate of Tongaat-Hulett's Darnall, flat hilltops and valley bottoms were first isolated into manageable units and thereafter the hillsides that remained were divided into panels (Barendse and Lonsdale³). In implementing the field layout on Mandalay, one of the topographic features used to determine the siting of roads was where noticeable changes in land slope occurred.

In order to initiate strip crop farming, growers have often chosen to mark out and often also construct the new roads through fields of existing ratoon crops. After a very large cane fire in the Umhlali area in 1982 all the fields on the farm Fairview/Greystock were redesigned at one time and managed on a panel basis the following season.



FIGURE 2 Strip cropping on an inland cane farm.

At present cane on the north coast is harvested at a very young age due to the presence of the sugarcane borer *Eldana saccharina* (which prefers older cane), and this makes it possible to redesign fields into panels within the space of two milling seasons. For example the new field layout, with spillover roads between panels of cane on Minrowley estate at Darnall, took only sixteen months to complete. In the same way structures that will eventually be water-carrying can be marked but not constructed until the panels between the structures are replanted and the waterways are stabilized.

Whereas the width of panels is determined according to conservation criteria and crop extraction requirements, the length of a panel or a group of panels that constitutes a field is decided from other criteria. At Tongaat-Hulett's Kearsney and Darnall Estates, the length of panel that corresponds to approximately the area harvested in one week is used to determine the area of a field.

On CG Smith's Hillbrow Estate a similar guideline is used but as the slopes are in places very steep and consequently panels are closely spaced, fields often comprise two or even three adjacent panels. When these multi-panel fields are re-established the old cane stools are eradicated by hand chipping and spraying with Roundup in alternate panels, so as to provide maximum soil protection. Growers who deliver smaller tonnages of cane tend to harvest cane in single panels, and it is therefore possible to create the familiar pattern of alternately harvested strips during a single season.

Such is the case on Mandalay estate where panels managed as one field extend from one boundary of the farm to the other. On other farms such as Beverley Sugar Estate the panels or strip fields are made as long as practically possible but do not extend the full length of the farm.

On this estate a field may comprise a number of strips demarcated according to changes in aspect, soil type and crop extraction routes. Cane in alternate strips is then harvested within such demarcated areas which are managed as a unit. On many farms topography often limits the length of strips and hills or amphitheatres are sometimes strip cropped in isolation.

The final step in implementing strip cropping is to arrange the new fields into a harvesting cycle. This initially necessitates the harvesting of crops at different ages and ratoon stages within the new panel boundaries and the time that this will take depends on how much of the layout the grower is prepared to implement each season. For example, on Mandalay estate the entire process took two years; on Beverley Sugar Estate the change took six years.

It will take as long as the average replant cycle on the farm to have all the cane in one field at the same ratoon stage and age but even then differences in soil type and depth may result in parts of a strip needing to be replanted more frequently than the remainder of the panel. Growers will then either demarcate a new field or groups of fields which are ecologically similar, or simply accept that the poorer area will have to be replanted more frequently but otherwise still managed as part of the strip as a whole.

Changing to a new field layout will inevitably mean sacrificing field records. At New Guelderland Sugar Estates the change to strip cropping was made over the period 1987 to 1989 and about 40 years of records were forfeited.

Irrespective of the rate of implementation of the new field layout or of the particular harvesting policy, there is always a very significant benefit to the soil resulting from strip cropping.

Results and Discussion

Harvesting

The conversion of a field layout from the old block design to panels or strips usually results in smaller working units. These usually extend between crest roads and waterways, even though the fields themselves may extend over long distances. When harvesting fields laid out in this manner cane cutters are able to complete the harvesting in individual field sub-divisions more frequently and therefore obtain more frequent reports on their performance, which is an important motivating factor.

When cane is harvested in panels a pattern of harvesting becomes evident. On Mandalay estate cane cutters cut alternate panels. They start at one farm boundary and cut until they reach the opposite farm boundary. Only then do they change to the next panel. In this way a minimum of supervision is required. There is no cutting supervisor on this farm and the cutters themselves decide upon the areas they will cut on a daily basis. Similarly operations such as fertilizer top dressing can be scheduled to follow harvesting in the same pattern.

Estimating yields of a crop grown in a long panel is difficult when the strip extends through different aspects in the topography.

Crop Extraction

The cost of infield transport on farms where strip cropping is practised will depend largely upon the main extraction network which is superimposed onto the panel layout.

This extraction network has to be well planned to ensure that road gradients are constant and the surface of the roads must be well maintained. On Waldene Estate at Shakaskraal the location of strategic extraction roads, in addition to the panel layout, has resulted in a reduction in the amount of diesel fuel used. On this farm, instead of infield haulage being mostly in an uphill direction as it was with the block layout, the panel roads make it possible for the crop to be transported on contour roads through the farm, eventually joining

a diagonal road with a gradient of 1:10. Similar results were obtained on Mandalay estate, where the construction of well-surfaced extraction routes of a constant gradient led to a significant reduction in use of diesel fuel. Roads of a constant gradient require fewer gear changes. In a particular area on Mandalay estate a total of 22 gear changes were necessary under the old layout to extract the crop. Under the new layout this has been reduced to two.

The experience on Arcadia/Emoyeni estate has been that with a strip layout, the distance from field to loading zone is no shorter than it was under a block layout, but that the route is less demanding on haulage vehicles and the in-field damage is greatly reduced. On Hillbrow, which is a large estate, an extra seven loading zones were constructed to serve the strip layout, and in order to keep the infield haulage distance to a minimum. This also eliminated the need for extra infield haulage units. Cane from some fields on this estate may be delivered to as many as three zones.

Panel roads are usually constructed either level or on a gradient not exceeding 1:100, although some roads must be constructed at steeper gradients to avoid obstacles or to join an existing extraction route.

The farms Westwood and Tweedsdale at Cranbrook are particularly steep, and crop extraction with a block field layout was extremely hazardous. With the new strip layout all loading of cane stacks on these farms is done from the panel roads, and the danger to the drivers is greatly reduced.

Making the stacks next to the panel roads rather than infield has also greatly reduced the damage to fields, which resulted when tractors and trailers were operated in wet conditions. The miller cum planter estates, who are often expected to deliver cane when wet conditions prevent private growers from doing so, find that panel roads and loading cane stacks from these roads enable them to deliver under most conditions.

On Beverley Sugar Estate the introduction of a strip layout, properly located crop extraction roads and two strategically sited zones, have resulted in two tractors and single side loaders being replaced by one tractor with a double stack trailer, and the haulage task for the day under the new layout is usually completed by noon.

The introduction of double stack trailers in some places, and particularly in steep areas, necessitates widening the roads so that corners can be negotiated.

The accessibility of fields where there are panel roads considerably reduces the need for four-wheel-drive tractors. On Tongaat-Hulett's Sprowston Estate at Kearsney for example, the haulage fleet of four front-wheel-assisted tractors has been replaced by a similar number of two-wheel-drive tractors.

On Tongaat-Hulett's Prospect Estate at Darnall the number of front-wheel assisted-tractors has been reduced from three to one. As steep hauls out of fields are eliminated when panel roads are constructed the need to have vehicles on stand-by to assist haulage units is greatly reduced.

Cane Burning

Growers who burn cane in their strip-harvested fields have experienced relatively few problems. Whereas breaks had to be cut and cleared through the old style blocks of cane to demarcate a burn, there are ready made breaks in a strip layout in the form of panel roads, crest roads and waterways.

Burning of cane is always planned and practised with caution, but such is the skill and confidence of farm staff in

carrying out this operation, that some growers leave the responsibility of burning entirely to their staff. When burning a panel of mature cane on a hillside where there are other fields of mature cane care is taken to burn when conditions are calm. Therefore burning is usually done in the early morning. Fire tankers are often brought to the field where large areas of cane are burnt such as occurs on the miller cum planter estates. Radio communication is essential between the groups lighting the fire. Growers often choose to confine a burn to one aspect of a hillside according to the direction of the wind. With a strip layout this is easily achieved by stopping the fire at a waterway. Because a fire draws uphill the cane is first ignited along the upper panel road, and allowed to burn into the panel before the main fire is ignited on the lower road. The fire is then drawn along the entire panel with the backburn on the top road always ahead.

On the farms Fairview/Greystock fire lighters are used in preference to trash bundles, which enables staff to light the fire more quickly.

Pushing cane over along the top panel before starting the back burn is not commonly practised as it retards the rate of burning. Once the cane in a panel is burnt and harvested it provides a useful fire break. Farms with a strip layout usually have valley bottom areas isolated and if these areas are harvested in winter they provide a suitable barrier to stop runaway fires.

Because there is an increased number of roads on farms where fields are laid out in panels, it is essential that farm staff are familiar with the road network so that fires can be controlled effectively. Growers in the Doornkop area take their staff supervisors and drivers on a tour of neighbouring farms each season in order to familiarize them with the roads there.

Road Network

The road network on farms with a strip layout is often extensive. The farm Arcadia at Tinley Manor, for example, which is 160 hectares in extent, has about 31 km of roads. Mandalay, which is similar in size but has steeper slopes, has 45 km of roads.

The introduction of this network both in terms of initial cost and in terms of land lost from production is given as a reason for not practising strip cropping. Despite the magnitude of the task however, growers often undertake all road construction themselves. For example on Minrowley, where the slopes are not severe, a two-wheel-drive tractor with a plough and terracer blade proved totally adequate to construct the road network. The use of hired bulldozers to construct the roads is becoming increasingly popular, not only because bulldozers can work in steep areas, but also because these machines can build a considerable length of road in a relatively short time.

The use of spillover roads as opposed to water-carrying terrace roads is becoming increasingly popular on the north coast, especially in areas where there are erodible soils and where, in the past, water-carrying terrace roads have concentrated runoff water in waterways which has caused damage. The use of spillover roads has enabled growers to avoid obstacles such as rocks without affecting the surface water management in a particular field.

Constructing roads in very steep areas results in large steep banks on the upper side of the roads. This is often seen as a disadvantage of panel roads. However, on most slopes it should be possible to reduce the bank on the upper side of

the road by grading. Cane can therefore be grown on the graded bank and hauling cane out of the field is made easier.

As roads on a strip layout follow the natural contour, this results in an increased number of stream and waterway crossings. The maintenance of these crossings may be a problem, particularly on estates that are steep, and that have erodible soils. The heavy rains during 1987 and 1988 have aggravated the situation where what were previously small crossings are now large gullies. When crossings over perennial streams are used frequently by heavy traffic, it is desirable to use pipe culverts.

Mowing panel roads to keep grasses and weeds under control, requires some tractor hours. This may be a problem during late spring and early summer when tractors are engaged in cane haulage, planting and other operations; but during the off-season the task of mowing is often seen as a means of keeping a tractor and driver occupied when there is little else to do on the farm. The problem during the period from October to January can be overcome by applying low rates of Roundup to the grass on the roads, restricting growth without killing the grass. This practice has been successfully carried out on Tongaat Hulett's Coleraine Estate and is being experimented with on many other farms on the north coast.

Management

On the north coast the infield operations of applying fertilizer and herbicides are done mainly by hand. Therefore the benefit that long lines have on the efficiency of mechanized operations is not realized. However, if care is taken to judge the amounts of fertilizer and herbicide to be used in a panel, and if the materials are placed strategically along the panel roads, the distance that operators have to carry material in order to refill is greatly reduced.

As long panels often extend through different soil types some rationalization of fertilizer application rates is necessary. If the area of different soil is significant, as occurs on Verbara estate, sub-divisions within the panel are made and are treated differently.

Panels divide a hillside into management units and it is possible, as is being done on Sinkwazi Estate, to exploit the characteristics of different varieties to suit particular soil types. The variety N12 can be grown on the drier hillsides or hilltops where soils are shallower, and a faster growing variety can be grown in the better soils in the valley. Previously, with a block layout, fields extended from hilltop to

valley bottom, resulting in the cane being harvested at various stages of maturity depending on its position on the hillside.

A significant benefit of having more roads is the ability to see more of the farm, which enables problems such as weeds, areas of poor growth and prevalence of diseases to be observed more easily. The block system does not afford this convenience unless time is taken to walk through the fields.

Conclusion

Growers regard the primary benefit of strip cropping to be the protection afforded to soil at the time of crop re-establishment. The further benefits of increased transport efficiency and easier field management are apparent but not always easily quantified. However, they remain significant enough for the more enlightened growers to accept the system as economical and the most suitable method of managing the hillsides of farms on the north coast.

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