SOME NOTES ON SOIL CONSERVATION PRACTICES AT TONGAAT

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Introduction

It has been stated on many occasions that low rainfall is the major factor limiting sugar cane growth and yields in Natal. Any practice, therefore, that will have a positive influence on the soil moisture supply must be of interest to the cane grower, particularly in these years of drought. Irrigation is the best means of overcoming the problem but for obvious reasons this is not always possible. However, conservation practices for both soil and water are both possible and practical in most instances and, even under irrigated conditions can be of great value.

This paper deals with some of the experiment results obtained on conservation at Tongaat together with a note on methods of construction and will be followed by a short slide show to illustrate the theme "conservation".

Experiment results

In August, 1967 it was decided to put down some sort of experiment to evaluate conservation, and at the time a steep field on Inyaninga Section was in the process of being prepared. This field layout is shown in Figure 1. Contour structures spaced approximately every 100 feet along a crest road were built by means of a mule-drawn hillside plough and finally shaped by hand. Halfway along their path they traversed a very steep section and converged to about 25 ft. spacings, after which they entered a "valley" and diverged to spill into a waterway. This field was on Milkwood series clay loam and showed the characteristic very shallow topsoil and numerous shaly outcrops. After the field had been completed and was planted to N:Co.376 the conservation structures were linked by an artificial waterway cut in the steepest portion of the field, which ran straight downhill to a drain in the valley bottom. This waterway was grassed to "Stenotaphrum Secundatum" (Buffalo Grass) and strongly rivetted against erosion until the grass had taken. Contours on the "valley" side of this artificial waterway were then knocked down for a distance of 100 feet and a small earth wall built around the perimeter of the experiment.

At the bottom of the unconserved plots a brick wall was built to collect runoff which was piped to a tank with a meter measuring device. The waterway separating the conserved side from the non-conserved side also had a brick dam and pipe to measure the water discharged by the structures.

(a) Water losses

On five occasions heavy showers of rain and ensuing runoff were measured at the experiment. These results are shown in Table 1 as follows:

TABLE 1
Rainfall and Runoff Results

DATE	RAINFALL (INS.)	GALLONS RUNOFF	
		CONSERVED	UNCONSERVED
20–1–68	4.59	?	*
3–2–68	0.62	2	45
3–3–68	1.29	7	79
11–5–68	1.42	39	119
11–6–68	0.22	16	93

* Meters could not cope.

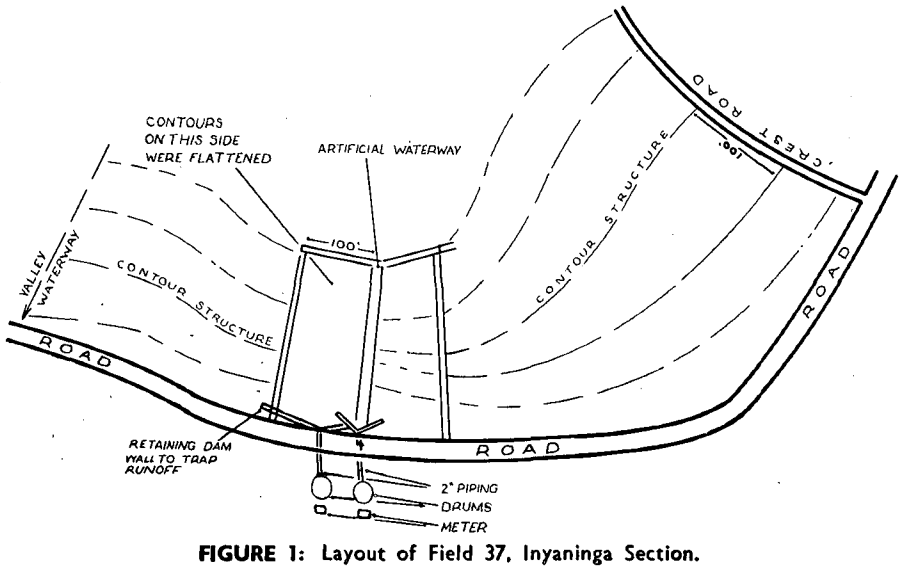

FIGURE 1: Layout of Field 37, Inyaninga Section.

Whilst in most cases the quantity of runoff water is not very large (on a per acre basis), the comparison is worthy of note.

(b) Soil losses

On two occasions there was considerable evidence of soil erosion during these rainfall showers mentioned above. It was possible on both occasions to measure the soil loss and make comparisons on a per acre basis. The results were as follows:

DATE	RAINFALL (INS.)	OVEN-DRY SOIL LOSS—LB./ACRE	
		CONSERVED	UNCONSERVED
20-1-68	4.59	999	14,062
11-5-68	1.42	Nil	642

Thus in only two storms, unconserved land lost nearly 7½ tons of soil per acre, whilst where a few contour structures had been put in the field, loss was reduced to ½ ton per acre.

The numerous small gullies and dongas formed on the unconserved slope have been inspected by many people and will be shown in a slide show to follow.

Field procedures

This practice of conservation seems to be rather in its infancy in the cane belt. The factors affecting structure design, grades, spacings, etc., are not known with any certainty and, this section is aimed at promoting discussion rather than putting across theories.

(a) Field layout design

At Tongaat the following points are given consideration in field layout:

1. *Irrigated or Dryland:* how much precipitation is there to cope with; runoff from opened spray-lines to deal with?
2. *Erodability of the Soil:* what grades to put on structures; deep recent sands not conserved; T.M.S. soils — special care in erosion control.
3. *Slope of the Field:* what spacing of contours is best; how to build structures; planning of furrows to facilitate all future mechanical operations?
4. *Drainage Problems:* are localised drainage problems likely to arise, therefore necessitating special furrow design?

(b) Construction methods

1. At Tongaat graders and ploughs have been experimented with in both structure and waterway construction. Each has special application under certain conditions but, in general, the combination is used with great success.
2. Waterways need great care in construction — care in ensuring adequate depth, levelling of the bottom, rapid rivetting for erosion — control and grassing. Several grasses have been tried and the best has been found to be Buffalo Grass (Stenotaphrum Secundatum), due to its flat growth habit — thus requiring infrequent mowing, and strong binding qualities. Other grasses tried include Kikuyu (Pennisetum Clandestinum), Kweek (Cynodon Dactylon), rivergrass.
3. Furrowing — system depends on whether drainage is likely to be a problem (master ridge plan best) or whether mechanisation is of prime importance (maximum length of line).
4. Special features — shaping of banks so that there is tractor access; leaving of wet streams with trees and vegetation; dry ditches shape to be crossed. Either bulldozers or graders or Rome-ploughs are used depending on size of job to be undertaken.
5. During the life of the crop, structures become filled with silt and soil deposits after storms. After harvesting it is field practice to remove the trash from these contours and clean once with a rear mounted grader blade. On steep land a modified hillside plough drawn by mules has been found to be successful.

(c) Observations in field

Since conservation has been practised at Tongaat it has become noticeable that:

1. Conserved fields can be cultivated sooner after rain.
2. Conserved fields show much less donga erosion after storms.
3. Streams fed by conserved fields run clear after storms.
4. There is less erosion damage in conserved irrigated fields.
5. Puddles in structures after rain are evidence of moisture conservation.

Conclusions

This note on conservation is merely intended to focus attention and draw interest to the fact that *"erosion does occur under sugar cane"*. Serious soil losses take place and must, of course, be accompanied by large losses in precipitation as runoff. The remedy is simple and lies in conservation farming, although much has still to be learned about optimum design and construction techniques.

Discussion

Dr. Thompson (in the chair): Dr. Hill's work confirms the results of an experiment at Chaka's Kraal some years ago on a Waldene series soil where run-off was compared between trashed and burnt plots. The results clearly indicated that erosion occurs under sugarcane. Over a period of six months in which 25″ of rain fell, ½″ was lost in run-off from trashed plots and 4.1″ from the burnt plots. The erosion loss was 750 pounds and 2,000 pounds of soil respectively.

Mr. Pearson: I have recently tried to use D6's to make waterways on the South Coast but they are quite unsuitable. Wheel tractors and back-mounted grader blades are more effective.

A Naardi plough followed by a grader blade is cheap and can be used on steep slopes.

I feel that more research should be devoted to soil and water conservation.

Mr. Rogers: Did Dr. Hill use the master line technique to scrub out the conservation structures?

Dr. Hill: The field had been laid out on the master line technique and was furrowed and completely planted. Then the trial was carried out.

Mr. Mann: The author has listed some criteria for field design. But I think the designer can also decide the distance apart of the structures, their length and their gradient. This is how he can vary the intensity of the conservation pattern.

All these criteria also affect other aspects apart from conservation, such as mechanisation.

Mr. Rogers: Even distribution of water has a noticeably beneficial effect on the cane.