FARM PLANNING AS THE BASIS FOR PEAK PRODUCTIVITY

by C. H. O. PEARSON

South African Sugar Association Experiment Station, Mount Edgecombe

Crop production efficiency is determined very largely by a range of management practices, many of which are interdependent and in some cases synergistic in effect. Thus, taken separately, factors such as fertilizer use, irrigation, trashing, and time of harvesting, are each capable of producing limited increases in yields. Taken together, however, and modified as appropriate, they can produce tremendous yield increases, some possibly in excess of a mere additive response.

It has been shown that by weeding cane at the right time and in the right way, yields, compared with an unweeded crop, can be increased by as much as 50 per cent. Earlier harvesting has been shown to increase yields by as much as 33 per cent, and fertilizer responses can be of the order of 10 to 20 per cent. The careful selection of varieties, the production of disease free seed, and proper attention to a range of cultural recommendations, all add to the potential yield which can be obtained economically on a cane farm. Water, it is appreciated by most growers, is a major factor limiting cane yields in many parts of Natal. Yet only on a limited number of farms have serious attempts been made to make full use of rain.

There is substantial evidence to show that for each one inch of rain effectively used by the crop, one ton of cane per acre can finally be harvested. Despite this, yields per acre on many farms are much lower than the rainfall measured on the farm suggests it should be. This apparent loss of effective water can, in many cases, be substantially and economically reduced by conservation practices. The average yield throughout the cane belt is 16.8 tons of cane per acre per annum.

This average is derived from a range of farms where yields vary from 45 tons of cane per acre per annum, down to some which produce as little as six tons per acre per annum. Rainfall, however, varies from a low level of 20 to 25 inches per annum north of Mkuzi, through 25 to 30 inches in the Heatonville area and 35 to 40 inches in the main coastal belt, to 50 to 55 inches in isolated areas extending from Mtunzini, to north of Empangeni. Some farms in these areas admittedly have specific problems, but relatively few enjoy yields related to rainfall-inferred potential.

Farm Planning

If we accept, as we should, that potential yield for rain grown cane is governed by rainfall, then farm planning can be divided into two main groups. One of these is associated with the coastal region where rainfall exceeds 40 inches per annum, while the other relates to areas where rain is less than 40 inches.

In the higher rainfall region, planning involves the provision of facilities for the safe disposal of surplus water. This entails installation of grass guarded waterways and, on steep slopes, suitable conservation structures. Proper fertilizer use and the careful selection of varieties will offer the greatest possible benefit in these areas. Furthermore, valley bottoms, demarcated by cut-off roads, should be used for crops cut on a twelve month rotation. Slopes will carry longer term crops but even relatively steep slopes or hilltops need never carry crops which have to be cut at intervals exceeding 18 months.

Where rainfall is less than 40 inches, cane farms need to be organised with water conservation as the major issue to be borne in mind. Provision should be made to carry water slowly across the slope in deep or wide structures capable of taking up to 8 to 10 cusecs at any one time. Such structures need to be built with careful appreciation of the limits imposed by soil type and the water acceptance capacity of the sub soil. They need to be capable of absorbing rain water from flash storms and ensuring its seepage into the soil and interstices in the rock below. Provision may be made, if necessary, for excessive water to be caught and held in a reservoir. But it is usually far better and more efficient to store water in the profile than in a reservoir, as it has to be removed from the latter and applied to the land, all of which entails recurrent expense.

Critical studies on the value of storing rain water in the soil profile have not been undertaken in the South African cane belt. There is, therefore, only an inference which can be drawn from work with other crops, and reference to the casual impressions of individual cane growers. Debatable as these may be, they do serve to support claims of economic benefits from water conservation. Thus, one farm in the cane belt with 465 acres under sugarcane, harvested 4,776 tons of cane in 1954. In 1966, it produced 9,902 tons and in 1967, 11,500 tons, both of these yields being from 405 acres. This increase from 10.3 and 28.4 tons per acre per annum is due in part to conservation practices adopted in the interim, a conservative estimate of the response being five tons of cane per acre per annum. The outlay on conservation works and on constructing a farm dam was R10 per acre. The yield increases in excess of five tons per acre were obtained as a result of improvements in farming practices made possible by the reorganisation of the farm.

Aids to planning

The Experiment Station provides growers, on request, with various forms of assistance in planning their farms. Firstly, they provide stereoscopic interpretations of aerial photographs of the farm itself, showing crest and drainage lines. They will advise on the location of dams, on placement of conservation structures, on the use of varieties, and on agronomic practices. The grower, however, has to implement and extend these recommendations, for he alone is aware of the vagaries of his fields, and the location of features such as seasonal spring lines. He also has to decide on issues such as the location of loading points. The grower will have to peg and arrange for construction of conservation works, although the Experiment Station does, and will, arrange training courses to explain the principles of planning, and to demonstrate pegging out and the use of dumpy and Abney levels.

Replanning a farm is less difficult than most growers anticipate. Planning must necessarily be flexible, and the grower once he has made a start will find that it becomes easier with time. Experience will also teach him to adapt the detail of his plan to suit his peculiar circumstances. The important factor is to ensure that changes are tied to a basic plan framed from an aerial photograph. The scale of this plan should be 1 : 6000, which corresponds to the scale at which farm maps have been drawn.

Redesigning one farm

The aerial photograph of Brandon Hill Farm (Pty) Ltd., taken during the S.A.S.A. aerial survey in May 1966, is shown in Fig. 1. Extending eastward from the homestead, a narrow valley bottom has been demarcated as suitable for frequent cutting. This area can undoubtedly be enlarged and the valley adjoining it, running across the farm from N.E. to S.W., can be treated in the same way.

The first overlay shows that there are four main soil types on the farm. Granites occupy the high land in the west and along the northern boundary, the rolling area in the west of the centre is occupied by schists, while to the east of the centre and on the eastern boundary there are recent red and grey sands. The top overlay shows the crest and drainage pattern. As the farm lies in the high rainfall zone receiving 50 to 55 inches of rain, the main problem will be to dispose of surplus water, and to guard the waterway with permanent grasses.

The proposed layout for this farm is shown in Fig. 2, on the adjacent page. In this, the main haulage roads are marked in red, and many of them lead to the loading zone in the south-east corner, via the district road which is marked in black. Waterways are shown as a double blue line enclosed in a dotted line. Proposed contour structures are depicted in green, and each of these is sloped gently from the ridge to the waterway at a gradient of 1 : 150. Fields, once the plan is implemented, would consist of long narrow areas suitable for strip cropping. Each of these fields would need to be planted on the master line principle to give long lines of cane ending either on a road or a waterway. Each line would be self draining and, because of the turning space available at the structure, road or waterway, they would be quite suitable for the operation of mechanical equipment.

To redesign a farm

Designs similar to those prepared for Brandon Hill farm, can be secured by any cane grower for his own farm. All he has to do is to ask the Experiment Station to secure, at his expense, an enlarged photograph of his farm. When ordering, he should provide the name and address of the farm and his Central Board, Schedule A number. The photograph will cost the grower about R10 for a 400-acre holding, and for this he will be provided with a set of photographs mounted on stiff board, together with suitable overlays. A third overlay is provided so that planning details can be added.

A grower who has ordered his map in this way will, once he has received it, be visited by his Regional Representative and a planning officer. When priorities for work and the location of essential roads have been agreed upon, the grower will, if he wishes, be assisted in his initial field work by Experiment Station personnel. The same staff will be able to advise him by telephone if he should run into any difficulty. In addition to recommendations on planning and field work, the grower will be able to ask for advice on changes in his techniques of cane growing. Eventually, he will be able to assess the productive capacity of the farm by comparison with accepted standards. By keeping simple records of labour and tractor use, he will then be able to determine not only his overall management efficiency, but the relative returns obtained from different areas of the farm.

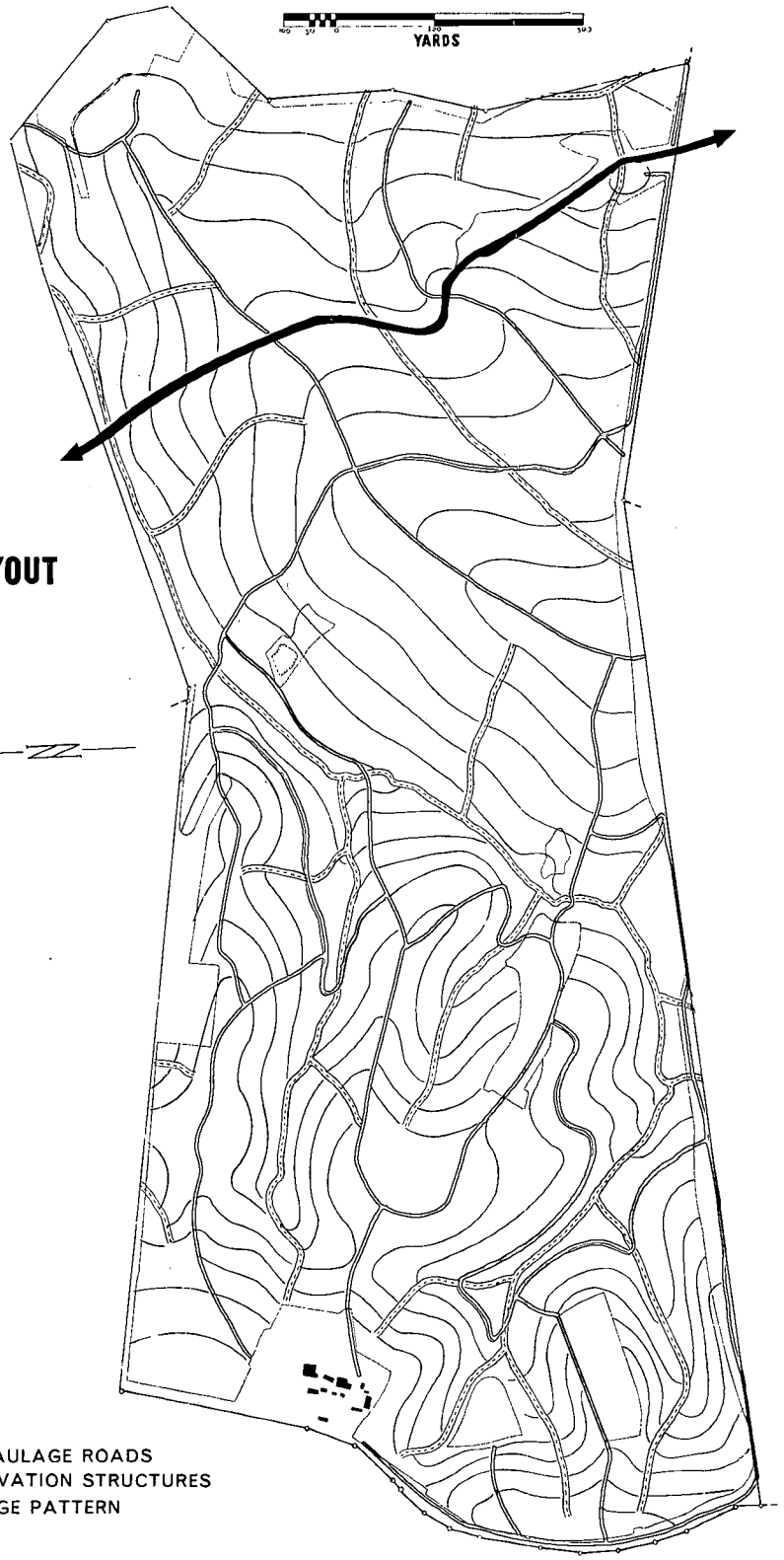
Summary

Crop production efficiency is a measure of the effectiveness of a complex set of agricultural practices which, if properly organised, can be expected to produce tremendous yield increases on the majority of farms in the cane belt. With rain grown crops, conservation of water for use by the crop is of primary importance. Indeed conservation practices are the basic requirement for farm planning.

The Experiment Station provides extensive assistance in the replanning of farms. It assists, within limits, in the execution of such plans. Advice is provided on reorganisation, cultural practices and management efficiency, and their integration to ensure achievement of maximum potential yield.

BRANDON HILL FARMS PTY LTD

Scale = ± 1:6.000



PLANNED LAYOUT

MAIN HAULAGE ROADS
CONSERVATION STRUCTURES
DRAINAGE PATTERN

Discussion

Dr. Dick (in the chair): We do not have as much rain as we would like to have in South Africa and Mr. Pearson has explained to us how to make the best use of it.

Mr. Dymond: Growers are now faced with different ways of measuring cane; so much in twelve months, so much in cane per acre, so much harvested and so much under cultivation.

Mr. Pearson: I think tons cane per acre per annum is a realistic figure.

Mr. Dymond: I am trying to stress the differences between tons cane per annum harvested or under cultivation.

Mr. Hansen: Are the various types of soils taken into account when planning of this nature is being considered?

Mr. Pearson: We concentrated more on the type of structure to be put in.

On shallow shales, with eighteen inches of top soil but with a shale that will crumble rapidly on exposure it is already interspersed with cracks and layers which will allow water to penetrate to a considerable depth.

The subsoil and rock structure absorbs water very slowly and therefore a broad-based slightly graded structure is required.

The object is to check water flowing across the slope. A knowledge of the underlying soil is essential.