

# FIELD RECORDS AS AN AID TO THE MANAGEMENT OF SUGARCANE CROPS

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## Abstract

It is likely that every practical agriculturalist keeps some form of field records although they may vary with the individual from being extremely basic to highly complex. It is unlikely however that the majority of farmers make adequate and meaningful use of these records as an aid to the management of their crops. The Field Record Processing Service (FRPS) of the SASA Experiment Station is designed to provide sugarcane growers with a computerised analysis of their basic field records presented in a standardised, tabulated and printed format. Rational interpretation of this analysis can provide valuable and usable information to the interpreter. On the other hand, without interpretation the analysis is reduced to a collection of costly statistics that are of no practical value and which can be misleading. Extracts from actual case studies illustrate the potential value of using field data as an aid to management.

## Introduction

Lack of apparent response by Umfolozi growers to their first computer analysis of field record data led to the question of whether the current presentation of results as printed columns of figures was adequate. As a trial exercise, the Extension Officer decided to do an interpretation of a selection of analyses and to provide the relevant growers with a written report elaborating on the computer printout.

The initial concept was to avoid making firm recommendations and rather to stimulate the grower's interest by demonstrating what useful information could be extracted from the data. In this way, the grower's future active participation in the use of field records as an aid to sugarcane management, could be stimulated.

In assessing the examples which follow, it should be noted that each one is pertinent only to the individual analysis being interpreted and any valid conclusions reached depend heavily on the accuracy of the raw data fed into the computer and the application of sound judgement by the interpreter.

### Grower A: Above Average Yield

#### Background

This is a progressive farmer who has kept meticulous field and irrigation records for many years and is recognized for his sound managerial skills, attention to detail and expertise in

irrigation. His average yields achieved under irrigation were nevertheless not entirely satisfactory.

#### Information required

What factors were limiting yields?

#### Method

Standard Field Records Processing Service forms were completed and analysed using field records for the past 18 years. Sucrose data were not available. All water which the crops received (irrigation and rainfall) was converted to estimated effective water. Inundation by floods in 1972, 1973, 1975 and 1977 contributed to the problems in this exercise.

#### Interpretation of analysis

The climatic yield potential was estimated to be 141 tons cane/ha/annum where 1 566 mm of effective water was required by the crop to produce 9 tons cane/100 mm effective water.

The mean yield obtained during 18 years was 99 tons cane/ha/13,4 months from 1 094 mm effective water, which represents 9,0 tons cane/100 mm effective water. The 12-month equivalent production was 89 tons from 980 mm effective water. The data for each year are shown in Table 1.

The conclusions drawn were that:

- the mean yield was 52 tons cane/ha/annum below the climatic potential of 141 tc/ha/annum
- on average, there was a shortfall of 586 mm of effective water per annum (1 566 to 980 mm)
- if current efficiency levels were maintained, the climatic yield potential could theoretically be achieved with the provision of an additional 586 mm effective irrigation/ha/annum.

#### Action

After a conference between the grower, the Extension Officer, the SASA Experiment Station irrigation advisory officer and a consultant from an irrigation firm, the entire 80 ha irrigation scheme was re-assessed. The following modifications were suggested and they have recently been implemented:

- 18 more sprinklers were added in two lateral lines
- irrigation sets were altered from two 10 hour stands/day to two 11½ hour stands/day

TABLE 1

1965 to 1982: Effective water on crop, means tons cane/ha and tons cane/100 mm effective water, all adjusted to 12-month equivalent

	Mean	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Effective water (mm)	980	1107	1037	1182	949	1013	1055	1030	817	1057	935	949	940	851	1009	956	943	997	888
Tons cane/ha	89	89	84	93	90	84	91	87	82	90	92	88	95	67	94	96	91	95	95
Tons cane/ha/100 mm	9,1	8,1	8,1	7,9	9,4	8,2	8,6	8,5	10,0	8,5	9,7	9,2	9,5	7,9	9,3	10,0	9,6	9,5	10,6
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\*F = floods

- 20-year old sprinkler line couplings were replaced
- the pump impeller was trimmed to a duty which matched motor and sprinkler systems correctly.

As a result of these changes the system capacity was improved from approximately 57 mm every 20 days to 62,3 mm every 15 days and the amount of water that could be applied per annum was increased from 1 039 to 1 516 mm. At 75% efficiency this represented an increase from 779 mm to 1 137 mm effective water. Because the system capacity would exceed the crop demand in winter and because rainfall at times during summer would make irrigation unnecessary, a total of 1 137 mm of effective irrigation water per annum would never be applied in practice. Let it be assumed that on average, only 60% of the system capacity would be used, ie 682 mm effective water per annum, to which effective rainfall can be added. The 18 year mean rainfall on the farm is 970 mm and at an assumed efficiency of 70%, this would supply 679 mm effective water. Total effective water on average, would thus be  $682 + 679 = 1\,361$  mm per annum which is sufficient to produce 122 tc/ha/annum at the present level of management; an increase of 33 tc/ha/annum.

#### *Economics*

The capital outlay of R12 000, plus any increase in operating costs, should be more than offset by the net value of an additional 2 640 tons cane per annum, the 1983/84 gross value of which is approximately R66 000 (at 12,5 sucrose percent cane and R200 per ton sucrose).

### **Grower B: Average Yield**

#### *Background*

This grower was one of the first from Umfolozi to submit five years of records to the FRPS, from an estate which includes some fields that receive supplementary irrigation.

#### *Information required*

Anything useful to improve production.

#### *Method*

Following a discussion on how to complete the data sheets, records were submitted to FRPS for analysis and the printout returned just after the 1982/83 harvest had commenced.

#### *Interpretation of analysis*

The data showed that highest production in terms of sucrose/ha/annum was obtained when the crop was harvested at 13 or 17 months of age. On average, only 11% of the crop had been cut when it was 13 months old and 7% when it was 17 months of age. The overall mean yield was 6,8 tons sucrose/ha/annum.

#### *Action*

It was suggested that the crop which received supplementary irrigation should be cut in 1982/83 at an average age of 13 months and the remainder at an average age of 17 months. The actual averages for 1982/83 were 12,3 months and 17,3 months with an overall mean of 8,8 tons sucrose/ha/annum.

In summary, the 1982/83 mean yield exceeded the 1977/81 mean yield by 2,0 tons sucrose/ha/annum but the contribution made by changing the cutting age alone cannot be quantified. The 1983/84 drought was so severe that irrigation had to be abandoned and this affected the policy for cutting age. Field records for this period have not yet been processed.

#### *Economics*

The prospect of an increase in yield of as much as 2 tons sucrose/ha/annum is sufficient financial incentive to retain the new policy for cutting age until the analysis of future records indicates anything to the contrary. The total output of the farm

increased by 563 tons sucrose/annum which has an estimated value of R112 600 at R200 per ton of sucrose.

### **Grower C: Average Yield**

#### *Background*

This holder of a large quota wished to reorganise his system of keeping field records so that it would be a better aid for management. The indications were that overall production could be improved.

#### *Information required*

Anything useful to improve production

#### *Method*

Standard FRPS field record sheets and data analysis forms were used and sufficient information was collected to submit records from 1980 to 1982.

#### *Interpretation of analysis*

A sharp decline in performance was apparent after the 7th ratoon crop and it was noted that:

- all 8th to 15th ratoon crops were NCo 310 which is a smut susceptible variety and it was growing in a smut-prone area
- on 667 ha that was cut annually from plant to the 7th ratoon crop, the mean yield was 9,6 tons sucrose/ha/annum. On 394 ha of 8th to 15th ratoon crops, the mean yield was 6,4 tons sucrose/ha/annum, a difference of 3,2 tons sucrose/ha/annum
- by keeping 8th to 15th ratoons of NCo 310, production could have been reduced by more than 1 260 tons of sucrose annually which is worth R252 000 at a value of R200 per ton of sucrose.

#### *Action*

It was recommended that all 8th to 15th ratoon fields be ploughed out as soon as possible and replanted with good quality seedcane from sources of pure, smut-resistant varieties that had been hot water treated and dipped in fungicide.

#### *Economics*

It is possible that the total cost of replanting could be recovered as a result of an improvement in production in less than two years.

### **Grower D: Below Average Yield**

#### *Background*

The grower asked the Extension Officer for his opinion on the desirability of introducing alternative crops to sugarcane and it was decided that:

- available field records would be analysed so that the history of sugarcane production on the whole farm could be studied,
- the results would be used to assess whether or not yields could be improved under rainfed conditions,
- quotations would be obtained for the implementation of an irrigation scheme, previously investigated by SASA Experiment Station staff,
- SA Cane Growers' Association Economic Liaison Service would be requested to carry out an appraisal of the situation and recommend the most viable option, ie rainfed or irrigated,
- the grower would then assess his own inclinations and managerial ability before implementing any new practice such as irrigation.

#### *Information required*

As many field records as possible.

#### *Method*

Records from 11 years (1972/73 to 1983/84) were analysed by the FRPS.

**Interpretation**

The results showed that there has been a serious decline in production from the whole farm. Although the age at which cane was harvested had been reduced, the area under cane had also been reduced and sucrose % cane had declined. The result was a 78% reduction from 1972 to 1982 in the total number of tons sucrose produced per annum (see Table 2).

**TABLE 2**

**Grower 'D' : production history for whole farm (1972 to 1982)**

Year	Hectares cut	Age of cutting	Sucrose % cane	Tons sucrose /ha/annum	Total tons sucrose
1972/73	68	23,9	12,9	5,2	700
1973/74	69	25,4	13,2	4,7	683
1974/75	60	23,2	11,7	2,9	336
1975/76	64	23,4	13,0	3,4	422
1976/77	35	30,2	10,1	1,5	126
1977/78	89	24,7	9,9	1,0	169
1978/79	44	23,6	11,4	2,6	229
1979/80	50	20,8	13,6	3,0	260
1980/81	63	17,8	12,0	2,0	189
1981/82	47	15,9	10,7	1,6	99
1982/83	42	16,8	8,6	2,5	151

The contributions of various management factors to reducing productivity have been considered; one of which is the use of fertilizers. At the recommendation of the Extension Officer, the grower took soil samples mainly from the fields to be ploughed out in 1983 and submitted them to the Fertilizer Advisory service at the SASA Experiment Station.

The results of laboratory analyses revealed that all eleven fields were deficient in phosphorus, and potassium, three were deficient in calcium and eight were deficient in zinc.

**Action**

The interpretation report has provided the grower with three options:

- (1) continue with current practices and a declining average (for 11 years) production of 244 tons sucrose,

- (2) install an irrigation scheme and obtain a realistic seasonal production of 944 tons sucrose,
- (3) use all available technology to improve yields of rainfed cane to achieve a production efficiency standard of 9 tons cane/100 mm effective water, which could result in 640 tons sucrose per season from the same gross area under cane as in option 1.

**Economics**

- To continue farming where production is declining is not a viable option.
- The implementation of an irrigation scheme has the potential to result in a four fold improvement in mean sucrose production from only 66% of the area presently under cane. It remains to be established whether or not the capital outlay of approximately R100 000 for irrigation equipment would be economically warranted.
- To improve management under rainfed conditions is an attractive alternative, as the potential improvement in sucrose production is nearly 300%.

**Conclusions**

The keeping of some form of field records is an accepted norm but their full use as a management tool is probably not. In the South African sugar industry, there are several recognised systems available to growers for analysing basic sugarcane field records. The challenge remains to interpret the analysis and to use the information as an aid to the management of the crop. The extracts from case studies used in this paper illustrate the potential that exists for improving productivity and profitability by interpreting the results of an analysis of records.

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