

A WEED EXPERIMENT AT ILLOVO

By G. D. THOMPSON

Summary

An experiment to measure the difference in sugarcane yield due to various degrees of weed control is discussed. Three varieties of sugarcane are used, and the levels of weed control are based on standard 7, 21 and 63 day intervals between weedings. The results indicate that a response of 10 tons of cane or 1.4 tons of sucrose per acre may be expected from effecting weed control equivalent to a 21 day interval as compared with a 63 day interval. This constitutes a basis for the evaluation of any system of weed control that may be proposed or practised.

Introduction

The experiment to be described in this paper was designed to constitute fairly basic research into the effects of various degrees of weed control on the development of a sugarcane crop. At the time the experiment was laid out there was very little information available to indicate how much could justifiably be spent on the control of weeds. This experiment was, therefore, planned specifically to measure the effect of weeds as such, and not to consider any of the many other variables such as techniques of weeding, types of weeds, climatic conditions, time of planting, etc., that might also affect the yield of cane.

In an earlier trial an attempt had been made to use the height of the weeds as a measure of the degree of weed control to be maintained, and the different treatments were weeded at average weed heights of three, six and twelve inches. However, these criteria proved to be rather unwieldy, since the height of the weeds within plots, and particularly within treatments, varied a great deal, and hence the control of the weeding procedures became very difficult. In this experiment, therefore, it was decided that the levels of weed control should be based entirely on standard intervals of seven, twenty-one and sixty-three days between weedings, independent of the weed growth at the time of weeding. These three treatments in very general terms, were regarded as more-than-adequate, adequate, and inadequate weed control respectively.

Design of Experiment

Since the differences in yield between the first two treatments was likely to be small, it was decided that six replications should be planted of each level of weed control, and that the effects of weeds should be tested for each of three varieties of sugarcane. The experiments was thus planned as follows:

- 3 Levels of Weed Control : A—Weed every 7 days.
 B—Weed every 21 days.
 C—Weed every 63 days.

- 3 Varieties of Sugarcane : 1—N:Co.310.
 2—N:Co.376.
 3—N:Co.382.

6 Replications.

Total Number of Plots : 54.

A split-plot randomization was employed so that each three adjacent plots, in the direction of the cane rows, represented a single level of weed control for each of the three varieties, and it was thus possible to use mule cultivation with wide breaks for turning the mules between blocks only, and not between plots as would otherwise have been necessary. The gross plot size was 1/60th acre (6 rows) and the net plot size for harvesting 1/90th acre (4 rows). The breaks between plots were 4 feet 6 inches wide, and between blocks 12 feet wide.

Procedures

The experiment was planted on 15th August, 1958, on a Dwyka soil type, and harvested on 9th August, 1960. The row spacing was 4 feet and the setts were covered with 3 inches of soil. The furrow fertilization consisted of the following:

- 800 lbs. Superphosphate,
 200 lbs. Muriate of Potash, and
 100 lbs. Ammonium Nitrate per acre

on all plots. A top-dressing followed on 9th January, 1959, as follows:

- 200lbs. Muriate of Potash, and
 200 lbs. Ammonium Nitrate per acre
 on all plots.

Very heavy rains followed the planting and hand weeding only became feasible in September. The weed control measures were as follows:

7-Day Plots: Hand weeding, row and interrow, weekly from 12th September, 1958, to 19th December, 1958.

Cultivation with mules, interrow only, from 26th December, 1958, to 20th February, 1959.

Thereafter, no further treatment, as the cane had covered in satisfactorily.

21-Day Plots: Hand weeding, row and interrow, at three-weekly intervals from 26th September, 1958 to 19th December, 1958. Hand weeding, row only, and mule cultivation, interrow only, from 9th January, 1959 to 20th February, 1959. Mule cultivation, interrow only, on 13th March, 1959.



Fig. 1

Fig. 2

Fig. 3



Fig. 4

Fig. 5

Fig. 6

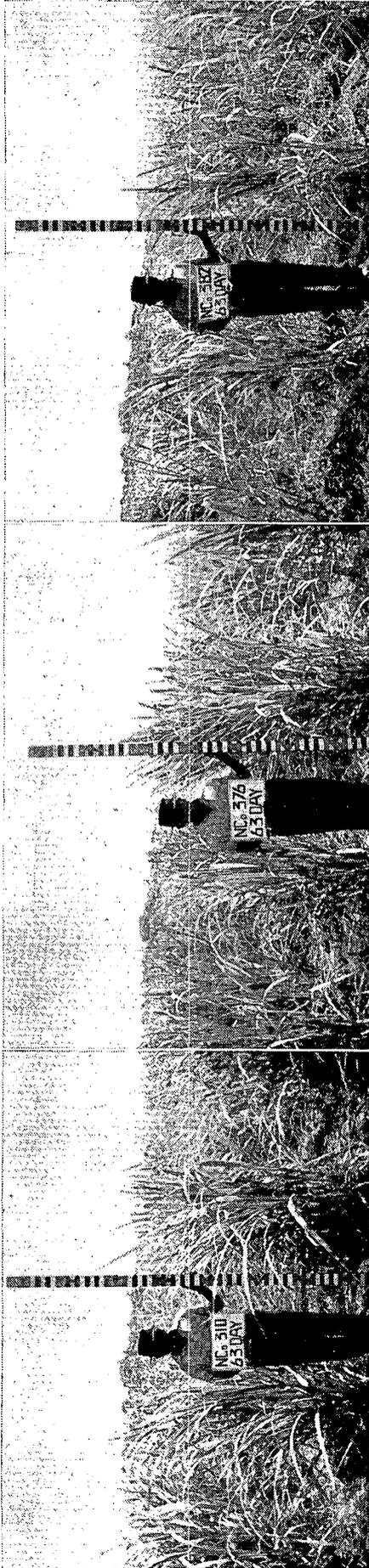


Fig. 9

Fig. 8

Fig. 7



Fig. 10

63-Day Plots: Hand weeding, row and interrow, on 7th November, 1958.

Hand weeding, row only, and mule cultivation, interrow only, on 9th January, 1959 and 13th March, 1959. Hoc weeding at 63 day intervals from 15th May, 1959 to 20th November, 1959.

The selection of weeding techniques was decided entirely as a matter of how conveniently all weeds within the plots could be removed, and at no time were the procedures regarded as being representative of any standard practice.

Results

The mean yield data follow:

Tons Cane Per Acre

	N:Co. 310	N:Co. 376	N:Co. 382	Mean
7 days	62.12	64.05	63.15	63.11
21 days	57.00	64.32	62.17	61.16
63 days	46.92	57.07	49.80	51.26
MEAN	55.34	61.81	58.37	58.51

Least significant differences:

	5% Level	1% Level
Between 2 weeding means	5.49	7.81
Between 2 variety means	3.43	4.62
Between 2 variety means at 1 level of weeding	5.94	7.99
Between 2 weeding means for 1 variety	7.32	10.15

Tons Sucrose Per Acre

Mean	N:Co. 310	N:Co. 376	N:Co. 382	Mean
7 days	10.93	10.77	9.75	10.48
21 days	10.15	10.75	9.79	10.23
63 days	8.50	9.78	8.20	8.83
MEAN	9.86	10.43	9.25	9.85

Least significant differences:

	5% Level	1% Level
Between 2 weeding means	0.96	1.36
Between 2 variety means	0.74	0.99
Between 2 variety means at 1 level of weeding	1.28	1.72
Between 2 weeding for 1 variety	1.42	1.95

Discussion of Results

The weeds in the plots weeded every seven days never developed to the stage where they could have interfered with the growth of the sugarcane at all. Those in the 21-day plots may have competed slightly with the cane for nutrients and moisture, but in the 63-day plots the weeds eventually competed very strongly with the cane for nutrients, moisture and sunlight as shown in Figure 10.

The differences in cane growth between weed treatments was most pronounced in the early stages of development, but these tended to disappear to a degree after all of the cane had covered in. Figures 1 to 9 illustrate the situation as it existed when the cane was about six months old. Sample plots of each variety and each weed treatment are shown.

The analysis of the final yield data for both tons cane and tons sucrose per acre shows that there was a highly significant difference between weeding treatments and also between varieties. Weedings at 7-day and 21-day intervals were both highly significantly better than weeding at 63 days, but there was no significant difference between the first two levels. There was no significant interaction between variety and frequency of weeding.

In general practical terms therefore, the results of this experiment indicate that an expenditure up to the value of 10 tons of cane or 1.4 tons of sucrose per acre, to maintain adequate weed control, would very likely be an economic investment. The additional harvesting and haulage costs for the higher yield of cane would naturally have to be taken into consideration. It would appear that the healthier, higher yielding cane has better ratooning qualities however, and these are being measured in the ratoon stage of this experiment which is being kept generally free of weeds.

Acknowledgments

The author wishes to thank the staff of the South African Sugar Association Experiment Station for their help in designing the experiment and analyzing the results statistically.

Mr. J. Wilson (in the Chair), said that the whole problem of keeping weeds down must be looked at entirely from the economic point of view. The necessary operations would vary from farm to farm when looked at from this angle; labour costs, terrain and the like would cause such variation. He considered therefore that there would be much divergence between growers as to the method preferred.

In reply to Mr. Brassey he said that Australian conditions were so different from those existing in South Africa that little comparison between the two countries was valid.

Dr. T. G. Cleasby outlined the method of weed control at Tongaat as being one hand weeding, followed by inter row cultivation. A second hand weeding was sometimes necessary. As far as the use of weedicides was concerned, he favoured the use

of 2-4 D as an early post emergent treatment. Many weedicides had been tried but this was the only one which was effective and economical and only, in his opinion, against broad-leaf weeds.

Mr. L. Grice said that at Natal Estates the policy was, one hand weeding followed by repeated cultivation between the rows, until the canopy was sufficient to inhibit weed growth.

Deep planting was practised and this led to a certain amount of smothering of weeds by soil turned into the cane row during cultivation.

About one third of the cane was planted during the period 15th March to 25th April. At this time of the year there was an adequate labour force assembled for the coming crushing season. The cane shoots were above the ground during the winter when there was little or no weed growth and the cane got away well when the spring came and could be cut during the following December. This meant that, from a thousand acres, thirty thousand tons of cane was available for crushing at the end of the following year.

Mr. J. L. du Toit said that Mr. Pearson had given a figure of fifteen shillings as profit per ton of cane reaped, but he considered that if one got an extra five tons per acre through adequate weeding, the profit on this five tons would be considerably in excess of the normal profit per ton of cane.

Mr. B. C. R. Tedder stated that he was not in favour of March-April planting for his farm was very hilly and such planting meant another lot of weeding in the spring with consequent moving of the soil down hill. He counted the cost of applying weedicides to the plant cane crop over the whole ten-year cycle of the life of the cane and did not debit it to the plant cane only, because the benefit the plant cane received was continued on into the ratoon crops.

Mr. I. J. P. Coignet said that the Estate on which he worked had now 5,000 acres planted to gums. The whole estate covered some 15 miles by 15 miles. The gums were affected by weedicides applied to the nearby cane and he wanted to know if there were weedicides which would not so affect the gums.

Mr. E. W. James asked if there was not a danger of weedicides having a bad effect on the soil after some years of application.

Dr. A. McMartin said that weedicides were soon decomposed in the soil, so from this point of view there should be no danger to the soil. However repeated use of these substances could lead not only to establishing a preponderance of those weeds not normally affected by them, but it had been found that in some countries where they had been used on annual crops, it was possible to obtain a population of broad-leaf weeds, which being prolific seed bearers, actually evolved weedicide-resistant strains.

Mr. W. J. G. Barnes stated that weedicides could not be used on all a grower's fields as there was a danger to other plants, such as vegetables, being affected by their use in nearby cane. However,

fundamentally the need was to keep the cane clean in its young stages and the way in which this was done was not so important as the fact that it was done.

With restriction of production less cane was being planted now so that the area to be looked after was becoming less and less.

Mr. I. J. P. Coignet said that in the last few years mosaic disease had increased on the South Coast and he suggested this might be due to weedicides acting on the parasites of the aphid which spread the disease.

He also related that one Section Manager in his area had developed a very useful tool for weeding in the cane row by cutting a chain harrow into two-foot widths.

Mr. L. Grice said this modification of the chain-harrow was used at Natal Estates.

Mr. N. C. King said that usually 2-4 D was thought of when the word weedicide was mentioned, but it must be remembered that 2-4 D was only one of a number of weedicides. The ester form of 2-4 D was volatile but there were other weedicides which could safely be used in the near proximity of a vegetable garden. The Estate mentioned by Mr. Coignet used P.C.P. which would act as an insecticide and thus might destroy the aphid responsible for spreading mosaic disease.

Dr. G. W. Shuker said that on a Rhodesian Estate where, because the cane was irrigated, extensive drains had to be constructed. These drains had to be kept clear of weeds and as mechanical means were too expensive, the use of Dfelapon, together with a wetting agent, had to be resorted to. As this weedicide acted through the leaves and not the roots and a wetting agent was used, little could get into the water and be a danger to fish life.

Mr. G. D. Thompson in reply to a query as to why cane was planted at Illovo in rows 3 feet 6 inches apart as compared with the usual 4 feet 6 inches, said that this had been found to be more economical. It gave a higher yield, and as the canopy formed earlier, less weeding was required. Also as the canes were more upright this led to the possibility of mechanical harvesting.

Mr. C. H. O. Pearson said that the use of weedicides made the weeding of water grass easier as the root systems were not so vigorous as those which had not been treated.

He considered that there had been a large increase in the amount of water grass now as compared with ten years ago. As far as plant population was concerned, it had been found that the distance between setts planted in the row had no effect on final yield per acre under dry land conditions. Under irrigation however this did not apply and the closer planting gave the better yields.

Dr. A. McMartin agreed that there had been an increase in water grass over the years. It had always been known that a variety which formed a leaf canopy early required less weeding and therefore this

property should be borne in mind by the cane breeder. It might be that the intensive cultivation of Co.281 which had once reached a proportion of about 60 per cent of the total crop, and had an upright leaf, had encouraged the spread of water grass.

Dr. T. G. Cleasby considered that much of the lack of success with weedicides was due to poor mixing and application as well as the wrong time of application.

He related the result of a test in which cane had been planted in a drum in which had been previously grown U-babe grass. This cane had remained stunted, which apparently pointed to some effect other than the use of moisture and plant food by the grass. This grass could only be satisfactorily dealt with by hand weeding and cultivation.

Dr. J. Dick said that U-Babe grass was a host of the species of eelworm which attack sugarcane. In the experiment quoted by Dr. Cleasby, stunting of cane might have been due to the effect of eelworms which had bred on the grass.

Mr. W. R. Ric-Hansen stated that a very useful instrument using tines for cultivation in the cane row had been developed on Natal Estates. When used in cane less than six inches high it was very effective and the odd stick or so of cane broken down by it was more than compensated for by the large number of weeds destroyed.

Mr. P. Hempson said that he preferred hand weeding and cultivating to the use of weedicides.

Mr. W. J. Hempson in reply to a question from the Chair, related that in a certain field where the cane was grown almost broad-cast, the yield per acre was unaffected.

Mr. C. H. O. Pearson said that the effect of the time of planting varied from South to North. While at Natal Estates, March-April planting was successful, it was not so apparently on the South Coast and he had found repeatedly that the planting of seedlings at Mtunzini was severely upset by drought during this March-April period.

Mr. J. W. Main described the use of "chunna"—a fast growing legume — grown in cane fields in India. This plant was so prolific that it completely smothered weed-growth. When the cereal had formed it was reaped by the local population and the plant was then plowed over into the cane row, smothering any any weeds there, while being a legume, the nitrogen it contained helped to off-set that required for its decomposition.

He thought this plant should be tried in South Africa because of its use in weed control and also because of the demand for it by the local Indian population. Harvesting of the cereal here would probably have to be done mechanically.