

MONOCULTURE OF SUGAR CANE

EXPERIMENTAL EVIDENCE SHOWING THAT THE TIME TAKEN IN GROWING A GREEN MANURE CROP CAN BE TURNED TO A PROFIT BY FOLLOWING CANE AFTER CANE IN A ROTATION

By C. H. O. PEARSON

The beneficial effect derived from growing a green manure of leguminous origin between crops of cane have never been proved in the cane belt of South Africa. The original recommendation to introduce this green manure crop was based on work in the temperate climates where legumes added substantially to the subsequent fertility of the soil. The practice was further supported by the fact that there were seldom any recordings showing a beneficial effect from applications of nitrogen to the subsequent plant cane crop, it being assumed that the nitrogen status of the soil had been raised by the green manure crop to a level above which further application of N showed no response in the growth of cane.

However, the green manure crop must occupy the ground for at least five months and with a bare fallow will occupy the ground for twelve months. If this practice of green manuring and/or bare fallowing is to be of any material benefit to the subsequent crops grown, it should provide gains in yield to offset the time the green manure is occupying the ground.

With this in mind a trial was laid down in October 1953 with the following treatments:

- A. Rotovate out old cane stools in September 1953, sow sunnhemp at 40 lb. per acre broadcast in October. Plough in sunnhemp in April 1954 and plant to Co.301 immediately. Plant cane to be harvested at 21 months in December 1955; first ratoon to be harvested at 24 months in December 1957.
- B. Rotovate out old cane stools in September 1953, sow sunnhemp at 40 lb. per acre broadcast in October. Plough in sunnhemp in April 1954 and leave as bare fallow till September 1954. Plant to Co.301 in September 1954. Plant cane harvest to be at 20 months in May 1956; first ratoon harvest to be at 20 months in December 1957.
- C. Rotovate out old cane stools in September 1953. Plant to Co.301 in October 1953 with 75 lb. sulphate of ammonia in the furrow and 125 lb. top-dressed.

The gross yields of the plant and first ratoon crops from all treatments to be compared.

Treatment C was given 200 lb. of sulphate of ammonia at and after planting, as experience had shown that with the rapid replanting of cane, nitrogen was necessary in the early stages of growth. Further, it was felt that no nitrogen was necessary after the green manure crops as the advocates for this practice stated that no response could be expected in the subsequent plant cane. The first ratoon crop in all three treatments receive no dressings of fertilizer but all cane had been planted with 600 lb. superphosphate per acre.

The results of the trial are given below.

Treatment	Plant Tons cane per acre	First Ratoon Tons cane per acre	Total Tons cane per acre
A.			
21-month plant . . .	33.19	37.77	70.96
24-month first ratoon			
B.			
20-month plant . . .	37.03	34.31	71.34
20-month first ratoon			
C.			
24-month plant . . .	44.40	48.19	92.58
26-month first ratoon			

Least significant difference between two means:
11.05 at 5 per cent 15.71 at 1 per cent

There is therefore no difference in yield between treatments A and B but treatment C is highly significantly better than either A or B.

To the twenty-two tons cane increase in yield for treatment C where no green manure has been used, must be added the saving in the cost of seed and an extra ploughing necessitated by green manuring. Further, there is no apparent drop in yield in the first ratoon crop when a green manure crop is not used.

It would, therefore, appear that by planting cane after cane a material gain can be achieved, which if applied to the area under green manure in the industry, would affect the total production of sugar per year.

Mr. Pearson said he had tried various tests on cane after cane, fallowing and green manuring to determine which procedure was most suitable. One difficulty has always been what to do with the land until the sugar crop was growing. Outlined in the paper was the time taken between ploughing out of the old crop, the planting of the new one, and the final crop reaped in four years.

Mr. Main asked if the author could supply any information about the practice in some other countries, e.g. in India, where the green manure crop is called Chunna. There the general practice was to plant the cane in the furrow, to plant the green manure crop between the lines, and then eventually turn the Chunna over to the cane line. Chunna was a legume which had a very high nitrogen content. He could see no reason why such a method could not be applied in this country. Another thing he would like to see would be the reduction of experimental results to a financial basis. The saving in time by cane after cane against planting a green manure crop in the ordinary way, meant an important factor in the capital value of the ground.

Mr. Pearson said that agricultural economics was a subject which would probably need another expert on the staff of the Experiment Station. He had recorded the actual increase in crop and left it to the planter himself to draw his own conclusions as to the economic side. As far as planting a green manure crop between the lines of cane was concerned, he had been discouraged by results of such practice in the past. From visible observation he found that cane so treated was not as good as the surrounding cane. This might be because sufficient moisture was not available for the two crops. It might be likened to the practice of some Indian growers here who planted maize between the cane lines, in which case one had to fertilize for two crops to get reasonable results from both.

Mr. du Toit replying to Mr. Main, said that the value of the ground did not come into the picture. The comparisons given were for different periods of cane growth but for the same period of land utilization.

Mr. Pearson said time counted from the time the last crop was cut until cutting of the first ratoon crop.

From the paper it could be seen that the first ratoon crops were cut in May, whereas the A treatment, in the case of plant cane, went through the same period.

Co.301 was the variety used, and this variety showed less differences in sucrose per cent cane at the different periods of cutting.

Mr. Sexton said that he had calculated the yield per month, by taking the total crop of cane and

dividing that by the total number of months grown. In the case of Sunn Hemp, this came to 1.5 tons per acre per month, and in treatment C, 1.85 tons per month. He asked if this experiment was carried out at the Experimental farm on a reasonably heavy soil.

Mr. Pearson replying in the affirmative, said he thought that on such a soil the Sunn Hemp crop would not break down as readily as it might in the case of sandy soil, where the need for humus was also still greater. Many people in the industry still considered that the use of a Sunn Hemp crop in a sandy soil was most desirable. He said he had had no experience as to what might happen if a sandy soil were used in this type of experiment. He had noticed that under sandy soil conditions the breakdown of trash was very much faster than in a heavier soil, and he thought that in 24 months there would be very little trash left. He thought the short period in which the ground was left following a green manure crop and before the cane crop covered it in, would still result in a rapid decomposition of organic matter.

Mr. A. C. Barnes said that under the conditions governing the experiment, although there were no figures of tons of sucrose per acre, treatment C showed 1.84 tons of cane per month. In the case of the first ratoon, the average per month was slightly different. Under the conditions of the experiment the C treatment was justified. This subject of continuous mono-culture had been argued for many years. The basic facts appeared to be that the green manure crop does a certain amount of good to the land in taking up nutrients, which, when that green manure is decomposed, becomes available to the succeeding crop. The green manure crop also supplies nitrogen and it is assumed that this is available to the succeeding crop. However, under some conditions, this nitrogen almost completely disappears before any advantage can be taken of it. The tendency seems to be to get away from green manure crops, and sugarcane being a perennial crop, actually does increase the amount of humus in the soil. This experiment was a trial, but not in a complete sense a very extensive experiment, and the result found may not be borne out in, say, coastal sand. He could quote instances where sugarcane has been grown as a mono-cultural crop for 200 years in the same land, and through the use of new varieties and good cultivation methods, the yields obtained had increased.

Dr. McMartin stated that the growing of green manure between cane rows was in general use in Mauritius some years ago. He knew that attempts had been made in this country, but in every case this led to a poor green manure crop as well as a poor cane crop. On the subject of green manures also, he had recently read a very comprehensive survey carried out by the United States Department of

Agriculture, which showed that in areas of low fertility green manures were favoured, but in regions of high fertility they were not favoured. In South Africa when green manuring became established as general practice, only Uba cane was grown which gave very poor crops. Since then the cane crops had increased and as a result the organic matter returned to the soil has increased. The application of the fertilizer has also increased, so that it might be correct to say that whereas green manuring was sound practice 30 years ago, it may not be so necessary now.

Mr. du Toit said it has been shown in the past that there was a benefit from a green manure crop, but he did not know if it was now still economic. While it would, perhaps, have been a good thing to grow a green manure crop previously, it could now be adequately substituted by fertilizers. In the old days when green manure crops were introduced, there was a difficulty of preparing the seed bed, but these difficulties have now been overcome. Furthermore, the use of nitrogen fertilizers in those days was often uneconomical because nitrogen was expensive and sugarcane cheap. Also in that period there was a surplus of sugar and land usage not at a premium. As these conditions had now changed he thought it might very well be profitable to change from the previous ideas about green manure.

Dr. Dodds related that in the early days of the sugar Experiment Station, yields were poor for various reasons, the price of cane was very low and the cost of nitrogen fertilizers prohibitive. Although the planting of a green manure crop caused a loss of time, the benefits were obvious. He said that a comparison was often made between growing of a green manure crop and leaving the ground fallow. This showed a considerable increase in yield when growing cane after green manure, as compared with bare fallowing. Even in the later ratoons this benefit was still obvious. In those days, looking at it from a financial point of view, the green manure crop did pay, though it was difficult to prove experimentally in comparison

with immediate replanting, which involved a time lag of a year in the green-manured and fallow series. Subsequent crops from the two series could not be strictly comparable because of differing weather conditions. Further, it was usually not possible to demonstrate experimentally sufficient increased yields in plant and ratoon crops to compensate for the loss of revenue from the fallowed land during a whole year, although it may have been obvious that the land had been permanently improved.

Mr. Coignet considered that one point which should not be overlooked was that green manure, besides supplying organic matter and nitrogen to the soil, also protected it from erosion during the heavy rainfall summer months.

Mr. Pearson said it was claimed that, unless a green manure crop was put in, ratoon yields decreased. It will be seen that only in treatment 'B' of the table is there a drop away in the first ratoon. The chances are that more organic matter is introduced into the soil by keeping it completely covered by a continuous cane crop than by going through the process of green manure, which leads to a restricted growth of cane in the first year. He felt that the erosion factor is answered by the fact that cane is our best soil holder and if cane could be put in quickly—cane after cane, there would be more chance of holding soil. He said that the basic thing he was trying to find out was—was it possible to build up organic matter by keeping cane as a kind of permanent pasture instead of carrying on with ordinary planting operations and leaving bare fallows. This experiment was the result of some previous ones where green manure crops and bare fallows and ploughing in trash and the like had been tried. There were certain indications of nitrogen starvation due to the ploughing of trash, or even leaving it exposed on the soil. He had a trashing and burning experiment now in progress in Chaka's Kraal and he hoped to have the results before long. He had no figures available to show if there was any increase in organic matter following trash blanketing.