SOME FIELD EXPERIMENTS HARVESTED IN 1933.

By H. H. DODDS AND P. FOWLIE.

1.—A FIELD TRIAL OF CERTAIN COIMBATORE CANES WITH UBA.

SERIES C. 1.

The probable value of the Coimbatore seedlings, more especially for extra-tropical sugar growing countries such as Natal, Louisiana, and Northern India, has been recognised for some years (cf. C. A. Barber "International Sugar Journal" for May, 1925, p. 243) and more recently has been practically demonstrated in the countries mentioned by name at least.

The experiment to be described is the first ratoon series of which the plant cane results were read at the 1932 Congress (see Proceedings for that year, page 93).

The Coimbatore varieties Co. 213, 214, 281 are compared with Uba in a soil of poor agricultural qualities. The surface soil is a shallow loam with a very stiff clay subsoil. The field is on a low lying flat and drainage is difficult; the crop is also liable to suffer severely in drought. Further details and a partial chemical analysis of the soil are given in the report on the plant cane results.

The field was originally planted in November, 1929, with six replications of each variety of 0.05 acre each.

The fertilizer applied at time of planting consisted of a mixture of 480 lbs. of superphosphate (17% water soluble P_2O_5), 120 lbs. of ammonium sulphate, and 60 lbs. of potassium chloride per acre.

The results of the plant cane harvesting are repeated below for convenient reference and showed that while Co. 214 and 213 were both inferior to Uba under the same conditions of the experiment, Co. 281 was considerably superior, yielding 26.6 per cent more sucrose per acre than the Uba, surpassing it both in yield of cane and in sucrose content and purity of juice. In fibre content of cane Co. 281 was the higher, the Uba being unusually low for that variety.

After harvesting in August, 1931, the field was cultivated in the usual way and 200 lbs. of sodium nitrate per acre applied in September; no other fertilizer was applied to the first ratoon crop.

The plant cane crop experienced considerable drought having received in all no more than 53 inches of rain during 21 months of growth. The first ratoon crop had 61.64 inches of rain over 22 months, but for the first four months there was only 4.83 inches, and 10.08 inches over the last five months before harvesting. It was therefore subjected to severe drought both in the early and final stages of growth, especially in view of the nature of the soil, as mentioned above; much of the cane was dead or dying from drought when the field was cut.

The harvesting results were:—

	Uba.	Co.281.	Co.213.	Co.214.
Tons (2,000 lbs.) millable cane per acre	24.92	32.97	26.83	17.44
Tons (2,000 lbs.) dead cane per acre	5.90	0.70	5.34	Nil
Per cent. dead cane	23.68	2.12	19.90	Nil
Tons sucrose (pol) per acre	3.277	4.817	3.424	2.283
Tons sucrose bonus for high purity according to Fahey scale	0.056	0.181	0.087	0.061
Tons sucrose per acre, including bonus	3.333	4.998	3.511	2.344
Increase or decrease in tons adjusted sucrose per acre compared with Uba	—	+1.665	+0.178	−0.989
Per cent. increase or decrease tons adjusted sucrose per acre	—	+49.95	+5.34	−29.67
Standard deviation from mean in tons sucrose per acre	0.75	0.37	0.625	0.47
Standard experimental error	0.30	0.15	0.255	0.19
Value of increase or decrease at £4.98530 per ton sucrose	—	+£8/6/0	+17/9	−£4/18/7
Sucrose per cent. cane (pol)	13.15	14.61	12 76	13.09
Bonus for purity	0.14	0.54	0.27	0.28
Adjusted sucrose per cent. cane, including bonus	13.29	15.15	13.03	13.37
Fibre per cent. cane	14.14	13.48	15.32	16.61

Juice :—	Uba.	Co.281.	Co.213.	Co.214
Brix	19.06	20.11	18.17	19.69
Sucrose	16.89	18.62	16.43	17 82
Purity	88.60	92.60	90.40	90.50
Reducing sugars per cent.	0.34	0.10	0.23	0.09
Reducing sugar ratio	2.02	0.53	1.39	0.51
Phosphate (P_2O_5) content per cent.	0.0462	0.0493	0.0552	0.0581
Potash (K_2O) content per cent.	0.1060	0.1039	0.1033	0.1143
Laboratory mill extraction	69.00	70.30	68.60	61.40

The plant cane crop results were:—

	Uba.	Co.281.	Co.213.	Co.214.
Tons cane per acre	34.11	41.03	31.66	20.79
Tons sucrose (pol) per acre...	4.721	6.019	4.090	3,177
Tons sucrose bonus or penalty for purity according to Fahey scale	−0.007	+0.016	—	+0.017
Tons sucrose per acre including bonus or penalty	4.714	6.035	4 090	3.194
Increase or decrease compared with Uba...	—	+1.321	−0.624	−1.520
Per cent. increase or decrease tons adjusted sucrose per acre...	—	+28.02	−13.24	−32.24
Standard deviation from mean of sucrose yield per acre ...	0.91	0.60	0.56	0.29
Standard experimental error	0.37	0.24	0.23	0.12
Value of increase or decrease at £4.6990 per ton sucrose ...	—	+£6/4/2	−£2/18/8	−£7/2/10
Sucrose (pol) per cent. cane	13.84	14.67	12.92	15.28
Bonus or penalty for purity	−0.02	+0.04	—	+0.08
Corrected sucrose per cent., including bonus or penalty ...	13.82	14.71	12.92	15.36
Fibre per cent. cane...	12.30	13.52	12.04	14.80
Juice :—				
Brix	20.18	20.71	18.99	21.45
Sucrose	16.73	18.47	15.80	19.18
Purity	82.90	89.20	83.20	89.40
Phosphate (P_2O_5) content per cent.	0.0300	0.0261	0.0256	0.0256
Potash (K_2O) content per cent.	0.112	0.135	0.127	0.112
Laboratory mill extraction...	68.70	76.40	73.50	66.30

Taking the two crops together we find that Co. 281 gives a combined increased revenue of £14/10/2, Co. 213 a decrease of £2/0/11 and Co. 214 a decrease of £12/1/5.

The benefit of growing Co. 281 in place of Uba under the conditions of this experiment is well demonstrated.

The range of soils and conditions in this country to which Co. 281 is well suited remains to be discovered, but it is already evident that it is a wide one. Over 400 tons of cane of this variety was supplied for planting to 217 different planters and estates last season so that it is now being widely tried with very promising results so far in the great majority of cases. The general reputation of Co. 281 in other countries is that it is particularly well suited to soils of the more sandy type, and it will probably be found that it is in sandy soils that it will be found to give the best results in this country also, whether of the wind blown beach type, or derived from Table Mountain sandstone, or alluvial.

In the experiments here described, however, while there is a moderate proportion of sand in the shallow surface soil, the sub-soil is an exceedingly stiff clay.

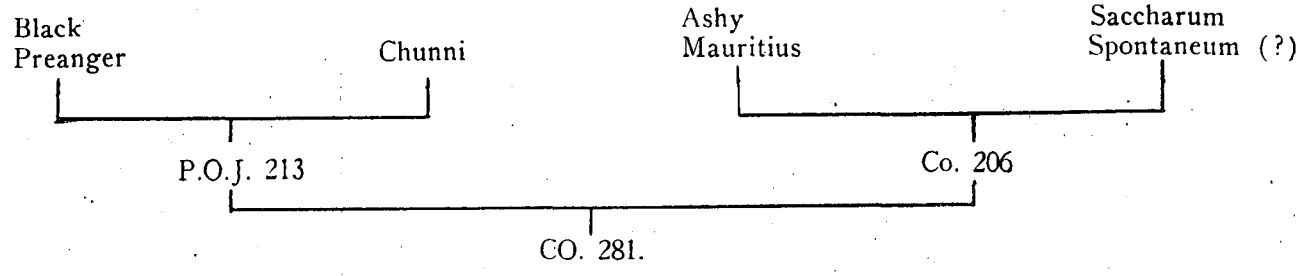
A striking feature is the resistance of Co. 281 to the very severe drought conditions prevailing during a considerable part of the experiment, a resistance much greater than that shown by the Uba control, and this, needless to say, is a very valuable quality of Co. 281 for this country.

When this experiment was first planted there was not sufficient planting material of Co. 290 available, or it would have been included in the series. In the meantime, however, a fertilizer experiment using Co. 290 cane has been planted in an adjacent field of the same kind of soil, and generally has grown in a way that compares favourably with the adjoining Uba and Co. 281.

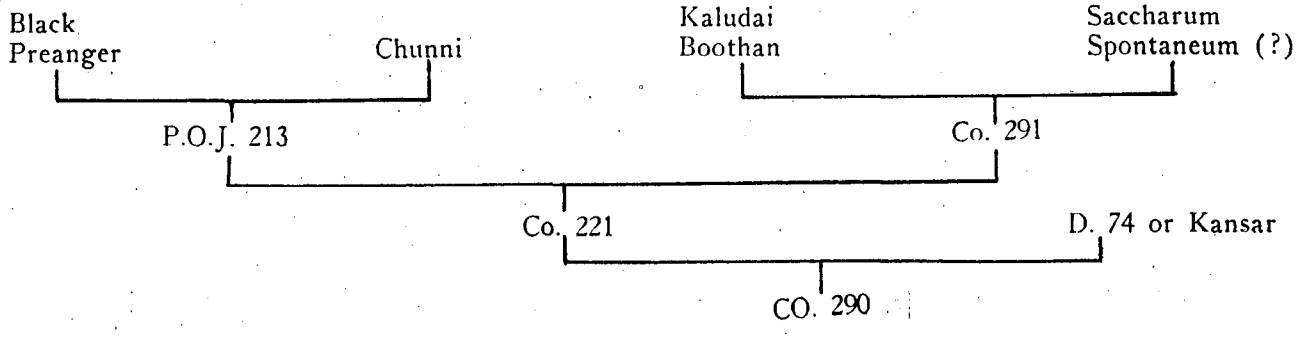
In some types of soil, however, more especially in shallow, stiff hillside soils, Co. 290 did not display a drought resistance equal to Uba under the abnormally dry conditions of the past year. Generally under experiment station conditions Co. 281 has proved slightly superior to Co. 290, but there are indications that in better soils, and especially under irrigation, Co. 290 may be the better cane of the two.

The parentage of the two canes is as follows:—

CO. 281.



CO. 290.



Co. 213 in the experiments under review has given somewhat unfavourable results, but in somewhat better soil and less droughty conditions has done much better, as for example in field trial "E" of this experiment station recorded last year (Proc. S.A.S.T.A., 1933, p. 80), when Co. 213 was only slightly inferior to C. 281 and P.O.J. 2725, and slightly superior to Co. 290, while yielding 28 per cent more sucrose per acre than the Uba controls.

C. 213 is more susceptible to mosaic disease than many of the Coimbatore varieties, although few of the earlier members excepting Co. 214 and Co. 290 have a very high degree of resistance. Co. 281 is described as only moderately resistant, though we have never had a field case of mosaic disease in Co. 281 recorded in this country.

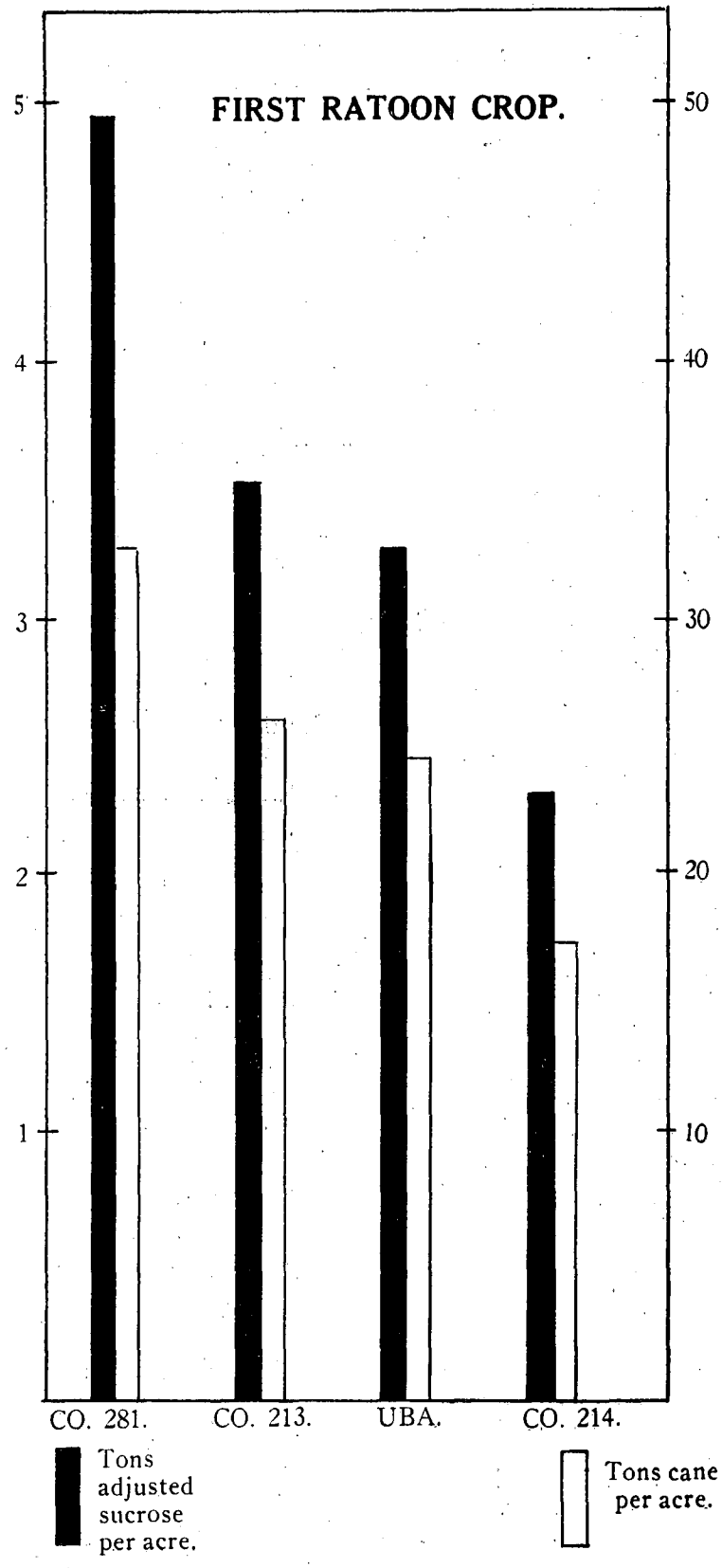
Towards streak disease Co. 281 is extremely resistant, Co. 213 and Co. 214 highly resistant, and Co. 290 moderately so.

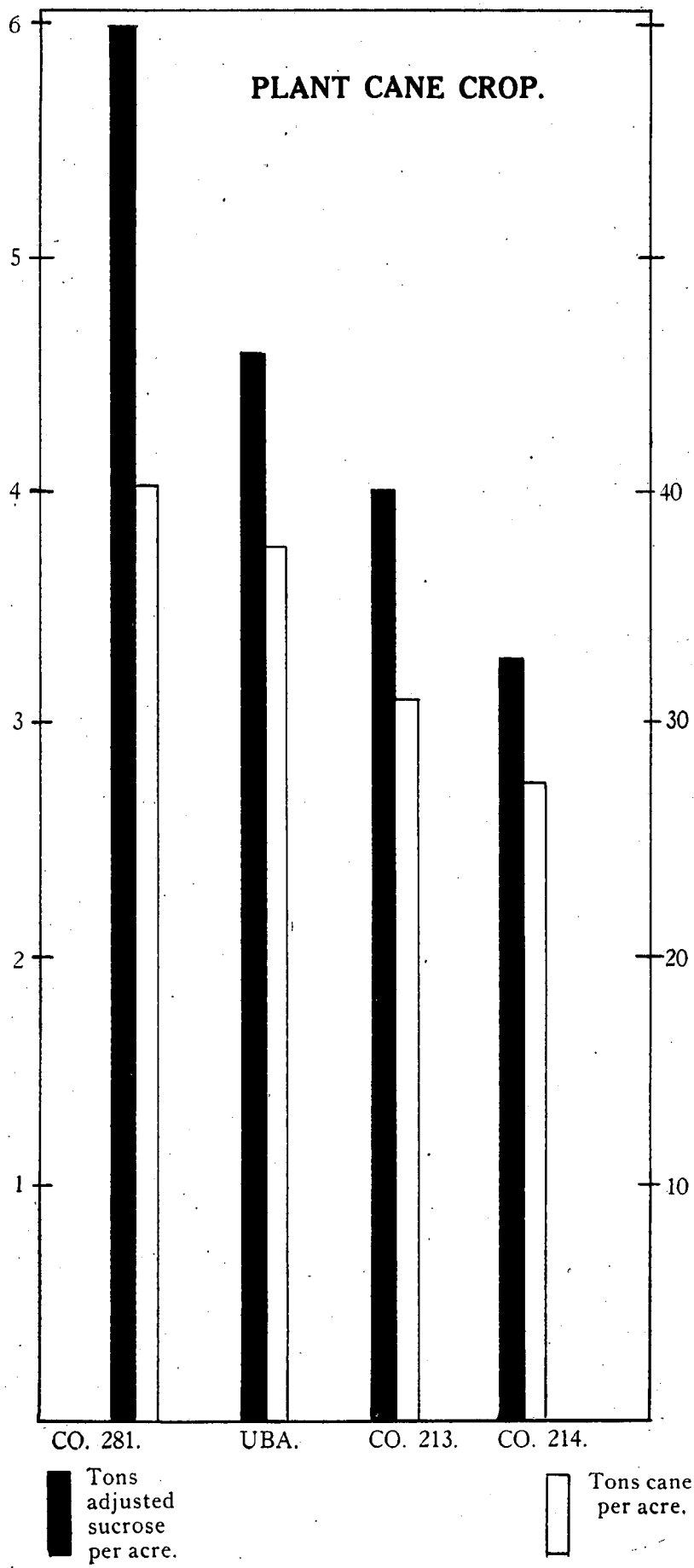
Co. 214 is a variety that has made disappointing growth, but is a very hardy variety, very resistant to drought and to most cane diseases, and is usually high or very high in sucrose. Co. 214 is high in fibre content like many of the earlier Co. canes. Co. 290, and to some extent Co. 281, are exceptions to this rule.

During the past few months the second ratoon crop has had very favourable growing weather and it is of interest to note that the relative superiority of Co. 281 appears to be well maintained.

Summary and Conclusions.

A variety trial is described (series "C" and "C. 1." of this experiment station) in which Co. 213, 214 and 281 are compared with Uba. The results of the first ratoon crop show that the superiority of Co. 281 over Uba under severe conditions of drought has increased from 28 per cent in the plant cane crop to nearly 50 per cent in the first ratoons. Co. 213 shows no significant difference from Uba as first ratoons, though considerably inferior as plant cane, and Co. 214 was definitely inferior in both crops.


FIRST RATOON CROP.
5
4
3
2
1
50
40
30
20
10
CO. 281.
CO. 213.
UBA.
CO. 214.
Tons adjusted sucrose per acre.
Tons cane per acre.


PLANT CANE CROP.
6
5
4
3
2
1
40
30
20
10
CO. 281.
UBA.
CO. 213.
CO. 214.
Tons adjusted sucrose per acre.
Tons cane per acre.

CHAIRMAN: The paper is now open for discussion.

Mr. BOOTH: In the report of the Clarification and Filtration Committee of the day before yesterday, it says "that at Incomati, Portuguese East Africa, the difficulties caused by the high wax content of the Co. varieties, more especialy Co. 290, have been largely overcome by burning the cane before cutting." Can you tell us from your observation anything about the wax content of Co. 281?

Mr. DODDS: We have very little detailed information about it. From general observation, Co. 281 appears to be somewhat high in wax. The wax coating is very conspicuous, but we have no figures yet for the actual content of wax, nor have we many particulars of the performance of this cane in the factory. We have sent small lots to Natal Estates factory, but there was not sufficient to make a proper mill test. There were no comments from the mill either for or against its milling qualities. As far as laboratory mill experience goes, it appears to be rather superior to Uba as regards ease of extraction, but with regard to the various factors involved by the wax content, we have no information at present.

Mr. BIJOUX: With regard to the composition of the Co. 281 cane, I note the reducing sugar ratio is .53, although the purity is 92.6. Do you not think that the lack of reducing sugar will be to the disadvantage of the cane, although the purity is 92.6, compared with Uba?

Mr. DODDS: Opinion in that matter, as I mentioned last year, appears to be rather divided. Some chemists prefer a cane with a low reducing sugar ratio, others seem to prefer a high one. It is difficult to say positively until these canes come to be tested in the mill. A good many of the new varieties are definitely lower in reducing sugar content in the earlier stages after harvesting. However, as pointed out in the report of the Clarification Committee, reducing sugars tend to increase more rapidly after cutting in some varieties than in Uba.

With regard to the wax content of Co. 281, I note that Mr. Beater is here, who has been doing most of the analytical work with these canes in the laboratory. He may have some observations to add.

Mr. BEATER: From my observation, it would seem that Co. 290 has a thicker coating of wax than Co. 281, and Co. 281 than Uba.

Mr. DODDS: I would like to say here that an impression seems to have got about in some parts of the country—I have heard it mentioned in Zululand—that the quality of the juice of Co. 290 might not be entirely satisfactory in the factory. We have no reason for such a conclusion at all. It is too early to say how these new canes are going to turn out in mill practice, or what the quality of the juices will be. But as far as present experience goes, there is no reason to suppose that there will be any difficulty with Co. 290 juice. I may say that Co. 290 has been grown extensively on the Incomati Estate in Portuguese East Africa, under conditions not very dissimilar to some of ours, with entirely satisfactory results.

Mr. BIJOUX: Referring to experience at Incomati, could you tell us what degree of exhaustion they attained in molasses?

Mr. DODDS: I have not the information here, and doubt whether we have it at all. We have information of the yields, however, and the yield of sucrose per acre was at least doubled where Co. 290 replaced Uba. I would like to call your attention again to the greatly increased returns in yield and revenue attained by substituting certain selected variety canes for Uba, an increase of £6 to £8, or even more, per acre per crop—which could be even greater in more productive soils. In your presidential address, sir, you commented on the difficulty in assessing the cash value of research. Here is one direction in which it can be done; there are many thousands of acres in this country where the new variety canes selected, propagated and distributed from the Experiment Station could show an equal gain.

The President then asked Mr. Dodds to read his remaining papers, viz:

(1) "The effect of Streak Disease on the yield of Uba Cane," (2) "An experiment in the Cultivation of Uba Cane."

Before reading the latter paper, Mr. Dodds said: The report I have just read to you on streak disease was hardly justified as a paper from any new results of material importance to be recorded. The main reason for writing it was to form a text to preach a little sermon on the control of streak disease, as we see it. But in the experiment to be described—one that has not been published before—we have very interesting and positive figures, as well as significant conclusions to be drawn.

2.—THE EFFECT OF STREAK DISEASE ON THE YIELD OF UBA CANE.

(Part II.)

A paper on this subject was given by us at the 1932 Conference in which the effect of streak disease was traced in the plant cane and first ratoon crops of a field of Uba cane, planted with alternate plots of streaked and streak-free setts respectively.

There were four replications of each series, of approximately 0. 526 acre each, and each plot contained the same number of stools. This was attained by planting in holes four feet apart in each direction, and placing originally three setts in each hole, so as to make reasonably certain of the germination of at least one sett. Where more than one germinated, excess shoots were removed, leaving one in each hole. Each sett comprised three internodes, the outer buds of each being previously removed, so that each was a single eye sett likely to germinate vigorously.

The present paper describes results from the third (and last) crop of this experiment in which the previous conclusions are confirmed, although the difference between the two series is somewhat less, as was to be expected, if only because of the gradual spread of the disease by secondary infection into the originally healthy plots.

The second ratoon crop was harvested on the 23rd and 24th May, 1933, with the following results:—

	Originally streak-free cane	Originally streaked cane
Tons cane per acre	33.47	30.81
Sucrose (pol) per cent cane	13.31	13.69
Tons sucrose per acre	4.577	4.360
Purity of juice	91.0	91.6
Bonus on Fahey scale for high purity	0.4	0.46
Sucrose adjusted for above bonus	13.71	14.15
Tons adjusted sucrose per acre	4.589	4.360
Fibre per cent cane	15.52	15.37
Percentage ratio of adjusted sucrose per acre	100.00	95.00
Standard deviation from mean in sucrose yield per acre	0.44	0.275
Standard experimental error	0.22	0.135

Having in view the comparatively large experimental error the small difference now recorded between the two series cannot be regarded as statistically significant. As in earlier cuttings, the average composition of the cane from the two series of plots showed no significant differences.

The yield of cane in tons per acre over the three crops is as follows:—

	Originally streak-free cane	Originally streaked cane	Per cent reduction in yield from streaked cane
Plant cane crop harvested July, 1929	44.78	39.75	11.24
First ratoons harvested June, 1931	36.49	32.72	10.33
Second ratoons harvested May, 1933	33.47	30.81	7.95

The percentage of secondary infection at the time of the last cutting is not known, but the stools growing up after the first ratoon cutting were then 70 per cent infected in the originally healthy plots.

The spread of streak disease into the originally healthy cane makes it very difficult to measure the loss caused by the disease, but in any case the benefit of planting only streak-free material is evident. Even if the cane becomes streaked there appears to be an advantage gained from a healthy germination, and any time that elapses before secondary infection takes place is all to the good.

The rapid spread of streak disease from the diseased plots into the originally healthy ones shows how the disease can become widespread in a few years, unless efforts are made to control it by selecting streak-free cane for planting, and by rogueing out infected stools. This has happened on a large scale in several important areas of the sugar belt within recent years. Districts that were relatively free from streak disease ten years ago, such as portions of the Eshowe and Chaka's Kraal areas are now largely infected owing to lack of effective control on many of the plantations concerned.

On the other hand, in the Inanda division, where more trouble has been taken on estates both large and small to control streak disease by selection and rogueing, the cane fields are still relatively free from streak disease.

Once an area becomes widely infected with streak disease, it imposes a severe handicap on the growing of Uba cane in that area, and eradication of the disease seems impracticable once it has passed a certain stage, as long as Uba is cultivated.

In these areas Uba should be replaced by resistant varieties such as most of those released in recent years for commercial planting. Co. 281 is very highly resistant to streak disease, as is P.O.J. 2878, and apparently P.O.J. 2714 and 2727. Co. 290 and P.O.J. 2725 are evidently somewhat less resistant,

but sufficiently so to make them suitable for replacing Uba in streak-infected areas where conditions are otherwise favourable for these varieties.

CH. 64/21 appears to be even more susceptible than Uba to streak disease in some districts where streak disease is rife, and is appreciably less tolerant than Uba to the disease. This is shown in experiments recently harvested at the experiment station in which the loss in weight of the plant cane crop due to streak disease was no less than 29 per cent with CH. 64/21, compared with 10 or 12 per cent in the case of Uba.

For this reason the planting of CH. 64/21 is no longer encouraged, although it is a cane that has uniformly demonstrated superiority over its Uba parent when compared in field trials.

The effect of streak disease on the yield of other varieties of cane remains to be determined, and streak-diseased material of Co. 290 and P.O.J. 2725 is being accumulated for this purpose.

3.—AN EXPERIMENT IN THE CULTIVATION OF UBA CANE.

The experiment to be described forms an attempt to assess the value of weeding and of cultivation of the sugar cane crop.

The field was ploughed out of second ratoons on July 15th, 1931.

It was treated with 500 lbs. per acre of raw rock phosphate and sown with buckwheat on August 13th, 1931. There was very little rain for that and the following two months, but a light crop of buckwheat grew and was ploughed in on October 9th. The field was then harrowed, furrowed out, and planted on October 26th with Uba cane in the ordinary way in rows 5 feet apart. A mixture of 600 lbs. superphosphate, 150 lbs. ammonium sulphate and 75 lbs. of potassium chloride per acre was applied in the furrows before planting.

Four plots of approximately 0.0565 acre each were hand-weeded and cultivated with light scarifier drawn by a single mule, according to the standard practice of the experiment station.

Another four similar plots were hand-weeded only, the cultivation being omitted.

A third series of four similar plots was hand-weeded once only, on November 27th, and thereafter was neglected.

Further hand-weeding was done in the first two series on January 1st, February 13th, and April 2nd, 1932. The cultivated plots were cultivated on January 13th, January 26th, February 22nd, March 7th and March 31st, 1932.

The rainfall over the 20 months of the crop was 59.82ins. For the six months previous to harvesting the total rainfall was only 10.61ins.

The cane was harvested on 10th July, 1933, with the following results:—

	Cultivated & handweeded.	Handweeded only.	Neglected.
Tons of 2,000 lbs. cane per acre	29.79	27.90	15.96
Sucrose (pol) per cent. cane	14.91	14.84	14.29
Purity of juice	91.10	91.50	90.20
Bonus for high purity according to Fahey scale	0.41	0.45	0.24
Sucrose per cent. cane adjusted for purity bonus	15.12	15.29	14.53
Tons adjusted sucrose per acre	4.504	4.266	2.319
Percentage ratio to standard	100.00	94.72	51.49
Value of adjusted sucrose per acre at £4.92091 per ton	£22/3/3	£20/19/10	£11/8/3
Fibre per cent. cane	14.89	15.06	14.86
Standard deviation from mean in sucrose per acre	0.311	0.157	0.0350
Standard experimental error	0.156	0.078	0.0175

The loss in value of the neglected cane is very evident, amounting to nearly one half.

On the actual figures obtained there is a small margin in favour of the cultivated and hand-weeded cane over the hand-weeded only; but on taking the experimental error into account, the difference cannot be regarded as very significant, and as far as this experiment is concerned the case for cultivation must be regarded as not definitely proven.

Planters in general are of course aware of the necessity of thoroughly weeding of cane fields, but it is probably not generally realised that gross neglect of weeding may result in the loss of half of the crop.

The injurious effects of weeds on a crop may be due to many causes, some of them less obvious than simple competition for moisture, plant-foods, root-space, and light; they may, for example, serve as host-plants for diseases and injurious insects. Under our conditions, however, where supply of moisture is usually the limiting factor in sugar cane production it is probable that the principal harm they do is in robbing the cane of moisture, particularly in times of drought.

The effect on the soil in the experiment under review has not yet been studied, but Call and Sewell, in Kansas (Jour. Amer. Soc. Agron., Vol. 10, pp. 35-44) showed that the loss in moisture from a field in summer was 6.65ins. where weeds were not removed, compared with 2.50ins. from a bare surface, 2.39ins. from a 3in. mulch and 1.19ins. from a 6in. mulch. Further, there was a heavy loss in nitrates from the unweeded portions and substantial gains in nitrate by nitrification in the rest.

It has been claimed that practically the only benefit to be derived from cultivation is the destruction of weeds. Other experiments, however, show that the cultivation of crops is also beneficial in other ways (see Hutcheson & Wolfe "Production of Field Crops," New York, 1924, p. 113).

In this country where we are subject to periodical severe droughts, thorough cultivation of the soil with consequent formation of a soil mulch can hardly fail to be beneficial. Besides conservation of moisture, the supply of air to the roots of the plant is an important consideration, affected by cultivation.

But as pointed out by Russell ("Farm Soil and Its Improvement," London, 1923, p. 10), the main function of cultivation lies in its use for regulating water supply. By cultivation the farmer can more quickly get rid of an excess of moisture, or, on the other hand, can spread a scant supply over a long period. This art is of the greatest importance to the Natal sugar planter, whose rainfall is so uncertain and irregularly distributed and liable to such extremes of deficiency and excess.

Experiment Station,
South African Sugar Association,
Mount Edgecombe,
Natal.
March, 1934.

CHAIRMAN: The papers are now open for discussion.

Mr. PALAIRET: I am sure we are all very, very grateful to the Rev. Mr. Dodds for his sermon! I think "sermon" is the right word, because after hearing the paper the congregation cannot answer back.

Mr. DODDS: An important distinction is that they are at liberty to do so, if they wish.

Mr. BOOTH: There is one question I should like to ask in connection with the cultivation experiment —what was the type of soil?

Mr. DODDS: It occurred to me afterwards that that was an omission from the paper. Mr. Palairet, at the Congress last year, was good enough to say that we never omitted any material data from our papers, but I am afraid that is not always quite true. The soil I should describe as a medium loam, of moderate depth. Mr. Fowlie is perhaps better qualified to answer the question from the intimate knowledge of the soil only to be gained from actual field work. He might perhaps add his comment.

Mr. FOWLIE: Mr. Dodds has described the soil correctly. It is like most of the rest of the Experiment Station soil. It has got clay underneath, but perhaps not quite so near the surface as it is in some other parts of our fields. Studying that field during different kinds of weather, I have noticed that its drainage is not particularly good, so I would infer that even although the depth is moderate, there must be enough clay in the soil itself to make it a not particularly free-draining soil.

CHAIRMAN: I think Mr. Dodds should have carried the neglected field experiment further and found out how long it takes to wipe a field out. Some places I have noticed, if you leave the weeds long enough, it is all weeds and no cane. I think it would be interesting to know how long it takes.

Mr. DODDS: Another experiment which might have been included in the series, as a visitor suggested, was a series of plots weeded when the boss was looking on, and others when he was not.

CHAIRMAN: I am very sorry that there has not been a better discussion on these papers. As I have said before Mr. Dodds' papers always seem to get it in the neck. He always comes on last, and everybody seems to get tired towards the end, and they all go home. Mr. Dodds' papers are always, I think, neglected. I think in future we will have to try and bring Mr. Dodds on in a more important place. After all is said and done, the agricultural side of the industry is the most backward. The factory work is not so bad. I think the agricultural side has a tremendous lot of leeway to make up. We are getting 25 tons of cane to the acre; Hawaii is getting 125. We have got to make up 100 tons somewhere. I would like to thank Mr.

Dodds for his papers, and will you please signify your approval in the usual manner. (Applause.)

Mr. MURPHY: I do not think it would make any real material difference whether Mr. Dodds' papers were read first or last. His papers are jolly well written, and the ground he covers in his papers leaves us precious little to discuss. I do not think really there is much scope except for one or two odd questions.

Mr. PALAIRET: I support that. There is really nothing to be said. Mr. Dodds has already said it.

Mr. Camden-Smith now took the Chair, and called upon Dr. Hedley to read the Report of the Boilers and Boiler Practice Committee.

Dr. Hedley read the Report.