

ABSTRACT OF PAPERS

TWENTY-FIFTH ANNUAL SUMMARY OF CHEMICAL LABORATORY REPORTS

By H. H. DODDS and J. L. DU TOIT.

Although the average rainfall for 1949, 43.35 inches, was above normal, the cane crop was adversely affected by the deficient rainfall in 1948 and an abnormally dry winter season during 1949.

During the 1949-50 season 4,929,580 short tons of cane were crushed to make 561,122 tons of sugar with a ratio of cane to sugar of 8.79.

The average sucrose of the cane was 13.52 per cent. with a peak of 14.45 per cent. in September. The fibre content was exceptionally high and averaged 16.19 per cent. The mixed juice purity, 86.22 compared favourably with the average over the past 10 years.

Co.281 formed 47.3 per cent of the crop and Co.301 41.9 per cent. Co.331 and N:Co.310 have increased to 4.2 and 2.6 per cent. respectively.

The average extraction for the season was 92.94 per cent. and the reduced extraction 94.78. Boiling house recovery was high at 89.68 and the overall recovery 83.35 per cent.

Of the 18 factories reporting, Tongaat Sugar Co. had the highest crushing rate, 159.25 tons of cane per hour. There were two other factories crushing more than 100 tons per hour and two factories had a crushing rate of less than 30 tons per hour.

The average yield of cane per acre for the 1948-49 season was 26.80 tons and the Inanda district led, as usual in Natal, with 31.58 tons of cane per acre.

SOME NOTES ON THE PRINCIPLES OF OUR MANUFACTURING PROCESSES

By K. DOUWES-DEKKER.

As a first example of a deviation from the normal manufacturing sequence—clarification, concentration, crystallization—the mid-sap carbonatation process is described. In this process, which was developed and put into practice in Java, the partly clarified raw juice is concentrated to 40-45° brix and subsequently more thoroughly clarified by the double carbonatation process. Next the juice is concentrated to syrup. By this method, based on the principle that at a higher concentration more non-sugars are removed per unit weight of brix, with about two-thirds of the amount of lime usually required for the carbonatation of mixed juice, a higher rise in purity and a corresponding increase in recovery was attained.

Next the Bach process is mentioned as an example of the combination of two chemical purifications and the centrifugal separation of syrup and molasses, as an example of the addition of a physical purification to the normal (chemical) clarification. Although a considerable amount of precipitated non-sugars can be removed from syrup by centrifugal separation, a still greater amount is likely to precipitate during the subsequent crystallization process. Therefore, in order to improve the properties of the last boiling,

and to facilitate the separation of sucrose crystals and final molasses, centrifugal separation of second molasses is more effective and easier to apply than separation of syrup.

The principle of high-density clarification is also applied with superior results in the refinery. In this case, however, good use is made as well of purification by recrystallization. Since the usual juice clarification methods give rise to a limited increase of the purity of the juices, and since the purity of the crystals is closely related to the purity of the mother liquor, it is unlikely that without recrystallization the purity level of first class refined sugar can be attained.

Finally, the preference for continuous manufacturing processes is discussed. Continuous subsiders are mentioned among the best known examples of this type of apparatus, and attention is drawn to the rotary filters, which, although continuous, are in some respects unsatisfactory.

One of the best studied clarification processes is the de Haan carbonatation. The evolution of continuous tanks, allowing strict adherence to the requirements of this process, is discussed.

SOME NOTES ON THE FUNCTIONING OF SULPHUR TOWERS

By P. J. LAUBSCHER.

This paper is a report of the tests done on sulphur towers generally used in sugar mills for absorbing sulphur dioxide in limed mixed juice, by passing the latter down the towers countercurrently to the stream of gases from sulphur burners.

The design of the towers and the methods of operating them at three factories are described.

Efficiencies of the sulphur towers was determined

by a gas analysis method and pH values of juice from the towers was recorded. The efficiency of sulphur dioxide absorption was found to be high, averages being 94 per cent., 99.8 per cent. and 99.9 per cent., for the three towers worked on, but fluctuations from the optimum pH of sulphured juice aimed at are high, varying between 4 and 9, 6 and 11, and 5.9 and 7.2. Such fluctuations are undesirable for good work.

OLIVER-CAMPBELL BAGACILLO

By L. F. CHIAZZARI.

Certain shortcomings of the Oliver-Campbell filter have long been realised. Among the most common are:—

- (1) Poor mud retention,
- (2) Turbid filtrates,
- (3) Introduction of new impurities and, concomitant with all these,
- (4) Undesirable recirculation.

With this in mind, laboratory tests were conducted on the lixiviating of the bagacillo filter medium generally used, and it was found that two digestions of 15 minutes duration each in an abundance of water limed to a pH of about 9, with a final digesting in pure water, greatly improved the quality. In fact

the treated bagacillo became a filtering aid rather than just a filtering medium.

Samples of scum were then mixed with treated and untreated bagacillo to average factory proportions, filtered, and the filtrates analysed for purity and colour. It was found that a higher purity and a greatly improved clarity of juice were obtained from the treated bagacillo as compared with that from the untreated material. The average of 15 analyses showed an improvement of 0.8° in purity and 18.0 in light absorption, with maximums of 1.76 and 28.0 respectively. The removal of colour and turbidity was very apparent and a clear, sparkling juice frequently obtained.

A PROGRESS REPORT ON SOME CLARIFICATION PROBLEMS OF NATAL CANE JUICES

By G. C. DYMOND.

The author shows that the addition of small quantities of sodium carbonate to cold raw cane juices results in a decrease in hardness and in lime salts.

Further, a new clarification process is described, in which the juice is sulphited to 3.2 pH in the clod. A precipitate settles out which contains high per-

centages of cane wax, silica, and other non-sugars. Experiments are in progress to deal with this refractory precipitate. The liquid decanted off is neutralised with lime, heated and settled, when a second precipitate is obtained. This acid pre-clarification process, it is stated, results in valuable wax recovery, with beneficial effects in sugar manufacture.

SOME INDUSTRIAL APPLICATIONS OF ELECTRONICS

By A. F. McCULLOCH.

This paper is of a descriptive form and is concerned with the applications of electronic techniques in the industrial field.

In the opening part of the paper, the author gives an elementary description of the most common types of electronic components such as thermionic and gas-filled diodes and triodes, photo-electrical cells and cathode ray tubes. The detecting, amplifying, rectifying and other characteristics are illustrated.

The second part of the paper is devoted to a description of the methods of utilising these charac-

teristics in a number of typical circuits which have been applied to industrial control and measurement problems such as continuous dimension gauging, control of liquid levels, temperature, moisture content and electrical motor performance, turbidity measurement, chemical analysis by polarographic methods, the protection of machinery against tramp metals and the automatic control of machine tools.

Mention is made of the precautions needed where high input impedance occurs, such as in the pH meter, to ensure that reliable measurements are obtained.

NITROGEN AND DRAINAGE

By O. W. M. PEARCE.

A brief review of the processes which make nitrogen available to plants is made, together with some of the factors which influence these processes.

The application of large amounts of nitrate nitrogen in a commercial fertilizer is often uneconomical, as this form is readily leached out of the soil by heavy rains.

While organic matter should be conserved, ploughing into the soil sugarcane trash with a carbon:nitrogen ratio of 80 to 90:1 may result in the following plant cane crop suffering from nitrogen starvation for a considerable time. In some soils, relatively rich in organic matter, it might be advantageous to burn off the trash, and, after a short fallow, add nitrogen by application of a commercial fertilizer.

Legumes, through the action of symbiotic nitrogen-fixing bacteria, may add to the soil as much as 200 lbs. of nitrogen per acre, provided the land is well prepared to allow their root systems to be adequately

supplied with air. The use of leguminous green manure crops for certain conditions is advised.

Drainage is all-important, as poorly drained soils are usually deficient in nitrogen because of the action of anærobic denitrifying bacteria present in the oxygen-deficient environment. Various types of drains are used in the South African sugarcane fields and their advantages and disadvantages are listed.

The author gives reasons for preferring the French drain, even though it is more expensive to construct than the other types. The materials used for this type of drain in the cane fields are brushwood, stones or bamboos, sealed by an overlay of trash with a final covering of 2½ feet of earth.

The use of French drains in a certain area resulted in an estimated yield of 35 to 50 tons of plant cane per acre, compared with the previous plant cane crop of 10 to 15 tons per acre when this area was served by shallow surface drains.

GROWTH RATE METHODS FOR DETERMINING FERTILIZER REQUIREMENTS

By J. L. DU TOIT.

The total height of each of 30 to 40 cane stools was determined, the measurement repeated after a month and the stools arranged in blocks according to the determined growth rates. The necessary treatments, e.g. O, N, P, K and NPK, properly randomised and replicated, were then applied and the growth increments resulting from these treatments determined after a further month and statistically analysed.

About 30 experiments were carried out and, in general, there was good agreement between the

rapid technique and field experiments. Apparent contradictions could be explained after further investigations.

Leaf analyses proved instructive. Certain correlations found between nitrogen per cent. leaf, as well as nitrogen/phosphate ratio of the leaf and nitrogen responses are given.

The tests entail a considerable amount of work, but are considered useful in research and the results can be applied directly in the field.

CO-ORDINATION IN SOIL CONSERVATION

By J. F. TWINCH (Soil Conservation Officer, A. E. & C. I. Ltd.)

Planned agriculture is the co-ordination of all aspects of soil conservation into a sound farming programme. Soil conservation, as a general term, embodies the protection of (1) our soils from wash, from exhaustion and from incorrect use; (2) our veld from overstocking, unscrupulous burning and from being ploughed up and generally mismanaged; (3) our forest areas from abuse and fire; and (4) our watersheds and natural storage areas from any form of exploitation.

These aspects, considered as a co-ordinated whole, give the farm plan—a farming programme based and managed on correct land use. Correct land use is the basis of stable agriculture, and this concept of

farm planning aims at the prevention of the damage caused by incorrect land use.

The initial essential in farm planning is the classification of the land and the subsequent use of the land in accordance with its capabilities.

The use of aerial photographs in farm planning still remains an insufficiently used asset. Farms can be accurately and quickly mapped from aerial photographs and, besides this, the farm can be carefully studied, eroded areas isolated, veld types differentiated, and stock and water facilities investigated. This is merely a fraction of the information that the photographs provide for both the farmer and the planner.

A THIRD SERIES OF INSECTICIDE TESTS AGAINST THE ELEGANT GRASSHOPPER

By J. DICK.

An account is given of tests with a number of insecticides against the elegant grasshopper, *Zonocerus elegans*.

The effect of exposure to the atmosphere for one or two months, on Bexadust (a powder containing 5 per cent. benzene hexachloride, and at least 0.5 per cent. of the gamma isomer), and another powder stated by the makers to contain 2 per cent. of the gamma isomer, was investigated. Although exposure slowed down the action of Bexadust, the final kill produced by powder exposed for one or two months was as high as that produced by fresh material. With the other powder, exposure not only slowed down the action but considerably reduced the final kill. Even fresh samples of this powder were not as effective as Bexadust.

A rough estimate of the total benzene hexachloride in the two powders suggests that the powder stated to contain 2 per cent. of the gamma isomer does not actually contain this amount.

Some information is given on the inert carriers used in the preparation of these powders.

In an experiment in which the toxicity of Aldet (a powder containing 5 per cent. DDT and 2.5 per cent. technical benzene hexachloride) and Thiophos dust (a powder containing 1 per cent. parathion) was compared with that of Bexadust, all these insecticides killed 100 per cent. of the hoppers, Thiophos being the most rapid in action, with Aldet intermediate between Thiophos and Bexadust.

INVESTIGATIONS ON SUGARCANE BREEDING IN NATAL DURING 1949

By P. G. C. BRETT.

Further work on the effect of different factors upon sugarcane pollen fertility had indicated that the usual male sterility of tassels under Natal conditions is due to one factor only—low temperature. By subjecting canes to warm conditions before flowering, pollen fertility was increased in nine varieties, all except the variety N:Co.291 having some tassels with good dehiscence. Dehiscence in the variety Co.421 was of particular interest, as this variety is reported to be male sterile under the tropical conditions of the cane-breeding station at Coimbatore.

The effect of warm conditions was also found to hasten the time of emergence of the tassel and, even in the case of the variety Co.290, to enable this emergence—which does not normally occur in the field—to take place.

The importance of low temperature in producing these effects in the field suggests that this factor may also be responsible for the relatively small amount of flowering in Natal and for the manner in which it is distributed; it is sparser at the higher altitudes inland, but within a particular area tends to be more

profuse on the upper part of hillsides than in the valleys below.

It appears that a severe drought may not only prevent the initiation of flowering, but if this has already occurred, may even produce a reversion to vegetative growth, resulting in the condition known as "bunch top".

Partly because of the relatively large amount of

flowering, and partly because of the good results obtained in increasing pollen fertility, seedling raising during the last season proved very successful.

From 29 different crosses more than 37,000 seedlings were raised, and 13,000 were planted in the field. About two-thirds of these came from crosses in which the fertility of the male parents had been increased by artificial treatment.

FURTHER DEVELOPMENTS IN CHEMICAL WEED-KILLERS

By A. McMARTIN.

In a paper given to this Association the previous year, the opinion was expressed that the use of selective weed-killers of the hormone type would be restricted by the presence of resistant weeds in large enough numbers to create another weed problem; this, in Natal sugarcane fields, would be the case where large numbers of grasses were present and chemical control was attempted with weed-killers which suppressed only broad-leaved weeds.

Trials have now been carried out with 2,4-D. mixed in fortified oils, as recommended by Crofts and Emanuelli in Porto Rico, by means of which a greater control of all weeds in cane fields, including grasses, has been attained. The mixture used has been—

4 gallons oil of high aromatic content,
2 lbs. pentachlorophenol,
2 lbs. Stanvac wetter.

This has been made into an emulsion with 96 gallons of water, and used at that rate per acre, with 2,4-D. added to supply either 1 lb. or 2 lbs. per acre.

This is used as either a pre-emergent or post-emergent spray; in the latter method some spotting of the cane leaves has occurred, but no permanent damage has been done.

Trials have shown that the complete mixture of oil spray plus 2,4-D. gives better results than either alone. Pre-emergent spraying also promises to be of more value than post-emergent spraying.

Although all spraying has been done at the rate of 100 gallons per acre, it is realised that the bulk of the water can be considerably reduced, and experiments are to be carried out with the same mixture used at the rate of 10 gallons per acre.