

ABSTRACT OF PAPERS

TWENTY-THIRD ANNUAL SUMMARY OF CHEMICAL LABORATORY REPORTS

South African Sugar Factories, Season 1948-49.

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

Although the average rainfall for 1948, 35.25 inches, was again below the average and there was a second winter drought, the crop was not very seriously affected.

The mean screen temperature, 69.0°, was slightly above normal.

The 1948-49 sugarcane crop totalled 5,216,144 tons, and the amount of sugar made, 607,845 short tons, has only been surpassed once; that was in the 1944-45 season, when it was 614,157 tons.

The average sucrose per cent. cane was 13.89, which is considerably above the average, and the peak was reached as usual during September. The fibre content of the crop, 15.90 per cent., was one of the highest on record, and the purity of the mixed juice, 85.92, was close to the average for the preceding ten years, but reached a peak abnormally early in June.

Co.281 still forms the bulk of the crop and constituted 56.9 per cent. of the cane milled, but this variety is now on the decrease and Co.301 (36.1 per cent.) and Co.331 (2.5 per cent.) are on the increase. A small quantity, 0.07 per cent., N:Co.310 was milled for the first time. Uba and Co.290 now only constitute 0.72 and 0.98 per cent. of the total crop,

while the P.O.J. varieties have also dropped to 2.7 per cent.

The average extraction for the season was 93.32 per cent. and the boiling-house recovery 89.14, giving an overall recovery of 83.19, which is not quite so high as it was last year. The ratio of cane to sugar was 8.58.

Of the 18 factories reporting, the highest crushing rate was 159.33 tons per hour by Maidstone factory, which is a South African record. This factory also had a record output of sugar, having produced 84,925 tons of sugar from 704,743 tons of cane. There were two other factories crushing more than 100 tons per hour, and three averaged less than 30 tons per hour.

The estimated world production of sugar for the 1948-49 crop of over 32,000,000 long tons is a record. The estimated Cuban crop of nearly 5,500,000 tons would again be the highest for any country.

The average yield of cane per acre for the 1947-48 South African crop was 24.47 tons. Being mainly a two-year crop, the yield was still affected by the severe droughts of 1946. There is evidence that the yield for the 1948-49 season will prove to have been considerably larger.

SOME REMARKS ON THE EXHAUSTIBILITY OF FINAL MOLASSES, ON THE WINTER RATIO, AND ON THE DETERMINATION OF THE COLOUR OF WHITE SUGAR.

By K. DOUWES-DEKKER.

Exhaustibility of Final Molasses.

The author explains that as a quick and reliable method of judging the exhaustion of final molasses has not yet been found, and one has to be content with the comparison of the purity with certain standards, these standards should be such that the influence of factors which cannot be altered at will should be eliminated. Thus the influence of the composition of the non-sucrose should be eliminated, and the joint effect of the equipment of the factory, the working method prescribed and the accuracy with which this method is followed, should be taken into account.

From analytical figures of a large number of Javan molasses the author constructed an equation to calculate the "reasonable" purity of a final molasses. The comparison of the actual purity with this calculated "reasonable" purity can lead to important conclusions.

The principle of a new experimental method is explained. This method is based upon the axiom that a final molasses at the moment of being spun off should be neither under- nor oversaturated. It has been demonstrated that for every molasses the minimum purity for a certain viscosity can be found by means of the saturascope and a simple viscosimeter like the "Hoeppler."

Winter Formula and Winter Ratio.

The overall recovery and boiling-house recovery were a definite improvement over older calculations expressing the performance of a sugar factory. Even these calculations, however, do not make allowance for the purity of the raw material, nor do they express adequately the crystallized sucrose in the final sugar. The Winter formula predicts the amount of crystal recoverable, while the Winter ratio, comparing the amount of crystal actually made with that predicted, is a simple figure for judging the performance of a factory.

Colour of White Sugar.

For judging the quality of a sugar, the author

points out that colour is an important criterion, and therefore the sugar chemist should be able to determine colour by a simple method and express it in reliable and reproducible figures. The determination of the "extinction," for a predetermined wavelength, of a standardised solution of a sugar has been of value in the past, but small differences in the appearance of white sugars are not adequately expressed by the "extinction." A far better method is the determination of the reflection curve of the crystals. From this curve the monochromatic specification of the colour can be easily calculated, and it is possible to express this by a single figure for the remission value which directly gives the whiteness of the sample.

REPORT OF THE TRASH INVESTIGATION COMMITTEE.

An increase in the amount of trash, tops and other extraneous matter adhering to cane delivered to South African sugar factories led to the appointment of a Committee to collect information on the subject.

The Committee's report is a record of data gathered during the 1948-49 season. This shows that a cane crop standing in a field consists of an average of about 8 per cent. of dry leaves (trash), and 15 per cent. of top and green leaves.

Laboratory mill tests show that 5 to 14 per cent. of dry trash and tops crushed with cane may increase

the fibre content up to 9 per cent. on cane, lower the purity of the extracted juice, and decrease the Java Ratio by as much as 10 degrees.

A large-scale factory test further showed a loss of 1.2 per cent. in sucrose extracted per cent. sucrose in cane, and a decrease in crushing rate of over 30 per cent. was shown when the cane milled was accompanied by 10 per cent. of trash.

With the present cane-testing system, growers sending in trashy cane gain considerably at the expense of those sending in clean cane.

SUMMARY OF EXPERIMENTS CONDUCTED WITH A CANE SAMPLING MACHINE.

By G. S. MOBERLY.

The report deals with certain experiments carried out to test a mechanical method of sampling cane on the mill carrier, the sample being in the form of shreds removed from the cane as it travels up the carrier, by means of a circular saw.

Mechanical difficulties experienced in the earlier stages of the experiment were successfully overcome, but the results obtained did not give satisfactory

comparisons with the total sucrose in the cane as determined by accepted standard procedure. Parallel sampling by the method under consideration gave inconsistent results.

The author considers that the machine would have to be radically redesigned before satisfactory results can be expected.

TRIANGLE SUGAR ESTATES.

By K. B. SINCLAIR.

The Triangle Sugar Estate is described. This 91,000-acre estate is situated in the Sabie Valley area at approximately 1,300 feet above sea-level, and temperatures rise as high as 111°F. in the shade in November and December, falling to 26°F. in June and July. Rainfall at 18 to 20 inches per annum is not of much value to the sugarcane crop because of its poor distribution.

Irrigation is necessary, the water being sufficient for 2,500 acres. A plan of the general lay-out of a field with its irrigation system is shown.

Harvesting takes place from June to December, plant cane being 14 months, and ratoons 11 to 12 months, old. Under normal field conditions, but with only 7 acre-feet of water applied, plant cane up to 14 months' old yielded 40 tons per acre for Co.281,

44 tons per acre for Co.290, and 60 tons per acre for P.O.J. 2878 and P.O.J.2725. An individual field of third ratoon Co.281 gave 32.4 tons per acre. Average crusher juice samples showed 20.6° brix, and 86.9° purity.

The factory milling plant is comprised of 12 rollers, each 24 by 48 inches, and a 22 by 46-inch Krajewski crusher. It is planned to reach a crushing rate of 25 tons of cane per hour.

The three main varieties cultivated were Co.281,

Co.290 and Co.301 until they became very badly infected with smut disease. This was particularly bad in Co.301, a variety otherwise of particular promise, and 422 acres of a total of 689 acres had to be discarded as a result. The P.O.J. varieties have proved highly resistant to the disease and are now planted extensively, while from the South African Sugar Association's Experiment Station some 40 other varieties have been obtained, and are now on trial. Rogueing-out of diseased plants is normal practice with all varieties which become infected.

THE MECHANISATION OF AGRICULTURE AS APPLIED TO SUGARCANE CULTIVATION.

By. W. L. FIELDING.

The history of the progress of mechanisation in agriculture generally is described, and the difficulties of producing equipments for sugarcane agriculture, due to the bulky nature of the crop, are stressed.

The sugar industry in South Africa is now experiencing the initial stages of labour shortage, an economic phenomenon which has been experienced in the cane sugar industries of many countries which for long depended on the employment of cheap and plentiful labour. The position is by no means acute, but is likely to become so if development of non-food producing industries continues. The investigation of mechanisation problems in the Hawaiian sugar industry is given as an example of planning, and the early work of a Mechanisation Sub-Committee of the South African Sugar Association is described. Under Natal conditions it is thought that conserving the trash in the field is worth while (as opposed to burning before cutting), because the resulting mat acts as a soil and moisture conservation device, suppresses weed growth and ultimately contributes to the maintenance of soil organic matter. A survey has shown that about 61 per cent. of planters conserve trash, 17 per cent. partly burn and partly conserve trash, and 22 per cent. always burn. The suitability of mechanical equipment for land preparation and cane cutting is discussed in relation to the trash question. The relationship between trash, inorganic manurial application and green

manuring figures prominently in the discussion.

As the labour situation is not acute, mechanical handling (loading) rather than cutting has received priority attention. A mechanical cutter, suitable for use on Natal terrain, is likely to prove difficult of development and expensive. Such a machine is a subject for discussion rather than practical development at present.

The achievements to date are, pre-eminently, widespread use of mechanical rather than animal traction, the manufacture of cane-planting machines in Natal, the development of mechanical devices for the rapid destruction of weeds in plant cane and the development and manufacture in Natal of a self-loading cane trailer. Labour shortages are often seasonal, being generally more acute in September-December, when native labourers return to their reserves to plant their own crops. The development of machines which reduce labour requirements during this season of overlapping operations (planting, weed eradication in young plant-cane and harvesting) is a distinct and useful achievement. A rough estimate is an overall saving in labour unit requirements of 60 per cent. in planting, 30 per cent. in harvesting, and 80 per cent. in mechanical weed eradication on farms using the equipments described, efficiently. Improved efficiency in sugarcane agriculture through greater timeliness of operations will also be considerable.

A SYSTEM FOR THE MECHANISATION OF CANE HARVESTING.

By ANGUS MACLEAN.

Mechanisation in any sphere of industry necessitates the simplification of the process to the minimum, and where large quantities are to be handled bulk must receive special attention. Established hand methods must often be ruthlessly abandoned

if a machine is to handle the job, and the harvesting and handling of cane is a sphere in which such an approach is necessary.

By cutting the cane into short lengths (6 inches to 18 inches) the tops and leaves are severed from

the cane, making their separation a comparatively simple matter as the nature of these is such that on these being projected, separate trajectories are followed by each.

Harvesting Machine. The machine envisaged cuts the cane into short lengths, the separation of the cut cane, leaves and tops being accomplished simply by a form of winnowing and the short cane left standing is dealt with by an adjustable cutter. These parts, together with the separated cane, are raised in an elevator and discharged into a detachable trailer, or lorry and trailer running parallel with the machine. This machine would be capable of handling 350 tons cane per day, with larger or smaller units easily designed.

Transport. An arrangement similar to the Brooks cane lugger, if operated with one or two trailers, offers a simple and effective system of cane transport, which has its own power-operated hoist. The

detachable bodies can be arranged with a hinged end and are self-discharging when this end is held and the other end raised by the boom. Existing narrow-gauge cane trucks are easily modified to suit the transport of cut canes by using a wire basket with a hinged side for mechanical tipping at the cane carrier.

Loading at Siding. This is a problem in Natal that cannot be easily overcome with cane in its uncut length, but with the proposed system an elevator two feet wide could handle more than one ton per minute. This whole unit, mounted on a turntable and driven by an engine of small horsepower, would be able to discharge the canes evenly over the whole standard railway truck.

Conclusion. The problem of effectively using machines for harvesting and handling of cane cannot be solved unless it is treated as a whole and not separated into several departments for individual solution.

THE CORRECT USE OF IMPLEMENTS ON THE CANE FARM.

By W. L. FIELDING and R. M. HALL.

No sound development of mechanised agriculture is possible unless the farmer learns the correct use of implements. Experiences at the South African Sugar Association's Experimental Farm at Chakas Kraal with a reversible or one-way plough and a cane planting machine are given as examples of the careful study of implements, leading to their efficient use.

The reversible plough is particularly useful in the Natal sugarcane belt because much of the terrain is hilly. With a one-way implement, contour ploughing is possible without the time loss and extra expense entailed in running light when a fixed plough is used on the face of a hill. The exact setting of an adjustable stop which controls the angle of entry of discs is vital to success; the discs must be kept sharp, especially when ploughing in a trash mat; the near track or wheel of the tractor must be run in the open furrow in order to obtain the correct line of draft; it is an advantage to use wheel weights (240 lbs.) when using the Ransome's "Magic" No. 5, bringing the total weight of the plough to 1,490 lbs. A 35-h.p. Caterpillar diesel was used for traction.

The adaptation of a "Don" planting machine, imported from Australia at a cost of £49, from animal to tractor traction is described. Although mechanical feeding of cane sets into the delivery

shute has now been perfected in Natal, the machine described was successfully hand-fed following patient tuition of the native operators. An experiment is described in which a study is being made of the effects, on cane growth and yield, of furrows of varying depth and width. Obviously the smaller the furrow the lighter the draft, the greater the economy, and the easier the operation of rapid interline cultivation of plant cane by a fast-moving wheel tractor, becomes. Due regard is, of course, given to the question of soil conservation in the early stages of growth, as controlled by contour furrowing. Among the advantages of planting machines are timeliness of operation (planting can be carried out swiftly in the most favourable season); the furrow is opened and closed in one operation, thus conserving moisture and assisting germination; a saving in labour units of 60 per cent.

There are now over one hundred and fifty of these machines, manufactured in Natal, at work in the cane belt.

Study of these two machines has been amply repaid, and it is pointed out that development and improvement must continue and that there will be constant need for experiment, modification and education in agro-mechanics.

MECHANICAL LOADING OF CANE IN NATAL AND ZULULAND.

By B. H. ABRAHAMSON.

The mechanical loaders developed in other countries for handling sugarcane are not suitable for South African conditions, owing chiefly to the topography of the cane fields.

The main requirements of a suitable loader for local conditions are :—(a) ability to be used with different types of transport, (b) suitability for use on hillsides, and (c) reasonable price to suit small growers.

Particular types of loader developed or used in South Africa are the Thomas loader, the P. & H. loader, the Hyster crane, the Castagnos grab loader, and the van der Watt self-loading trailer. The advantages and disadvantages of each are given and their use described.

The van der Watt self-loading trailer, invented and developed in Zululand, is particularly favoured, and a detailed account of its operation is given.

CHEMICAL WEED-KILLERS.

By A. McMARTIN.

The principal hormone weed-killers in use at present are methoxone and 2.4.D, of which latter four formulations are available—the acid itself, the sodium and ammonium salts, the ester formulations, and amine formulations. The first is insoluble in water, but suitable for dusting; the second is soluble in large amounts of water, and hence used for dilute sprays; the third can be used as concentrated sprays; while the fourth is mainly used for woody plants.

The amount to use of any formulation should be based upon 1 lb. of active ingredient per acre for susceptible species, used as a spray, and twice that amount if used as a dust, increasing the dose according to the resistance of the species. Dilute sprays can be used in 100 gallons of water per acre, concentrated sprays in 10 gallons of water per acre.

Weeds vary in the ease with which they are killed, and much depends upon the stage of development of the weed, but on the whole the best time to apply is in the young seedling stage. Sugarcane has not been affected in any of our experiments.

The use of these chemical weed-killers in our cane fields is complicated by the presence of resistant grass species among our weeds, which have been found in field trials to ultimately occupy the ground formerly occupied by a mixture of species, resistant and susceptible. The use of these selective weed-killers must therefore be viewed with caution, but a development which might alter the situation is the mixture of these hormones with contact sprays of the oil type, which kill the grass species also.

THE DISTRIBUTION OF TEMPERATURES ALONG THE COAST OF NATAL AND ZULULAND.

By B. E. BEATER.

This paper deals with the distribution of mean temperatures, temperature records from fifteen points in the South African sugar industry being summarised both monthly and annually.

The writer shows that the mean annual temperature for the sugar belt is 69.7°F., with a maximum

of 75.8° in February and a minimum of 62.0° in July.

General temperature figures are supplemented by meteorological data at the Experiment Station at Mount Edgecombe.

A map tracing the distribution of temperatures is also presented.

THE ARTIFICIAL STIMULATION OF PRECIPITATION.

By J. A. KING.

The condensation of water vapour on hygroscopic nuclei to form the water droplets of clouds and the Bergeron-Findeisen theory of rain formation are described. This theory postulates the co-existence of ice and water particles as a requirement for rain-drop development, and an account is given of research conducted in the laboratory of the General Electric Company which has made it possible to

create large numbers of nuclei for ice crystal formation in supercooled clouds, as an artificial means of fulfilling this requirement of the Bergeron-Findeisen theory. Langmuir's chain reaction theory of rain-drop formation in clouds at temperatures above freezing is described, and the paper concludes with a resume of the practical results of some of the experiments which have been carried out.

FURTHER REPORT ON SUGARCANE BREEDING IN SOUTH AFRICA.

By P. G. C. BRETT.

Attempts to overcome the difficulty that few sugarcane varieties in Natal produce much viable pollen have been made in three ways. (1) A marked increase in the pollen fertility of several varieties was obtained by subjecting cut canes that were going to flower to artificial conditions. The increased fertility was probably due to preventing the minimum temperatures from falling too low. Increase in day-length appeared to be without effect; increase in humidity, while perhaps of value in keeping the cut canes in better condition, did not appear essential. (2) a preliminary attempt has been made to use pollen introduced from Mauritius for crossing.

Only one seedling germinated, and this is believed to have arisen by parthenogenesis. (3) a number of varieties which have proved useful males in other countries have been introduced, in the hope that they will retain their fertility here. In addition, selections for pollen fertility are being made amongst seedlings raised in this country.

The technique of crossing in use at present is based upon the Hawaiian system. In 1947 only about 230 seedlings were germinated and 54 planted in the field; in 1948 the numbers were about 7,000 and 3,000 respectively.

SOME FURTHER INSECTICIDE TESTS AGAINST THE ELEGANT GRASSHOPPER.

By J. DICK.

A further series of laboratory experiments is described, in which a number of insecticides were tested for control of *Zonocerus elegans*.

Bexadust, a powder containing 0.5 per cent. of the gamma isomer of benzene hexachloride, killed almost all the hoppers in four separate tests.

A dust, stated to contain 2 per cent. of the gamma isomer, gave inconsistent results and was not as effective as Bexadust.

A D.D.T. emulsion, diluted to 2.7 per cent. in water, killed almost 90 per cent. of the hoppers, but was somewhat slower in taking effect than benzene hexachloride.

Common salt, both as a water solution and as a dust, showed some insecticidal effect. The solution and the dust caused mortalities of 40 and 25 per cent. respectively.

THE EFFECT OF BENZENE HEXACHLORIDE AND DDT DUSTS ON THE GERMINATION OF SUGARCANE.

By J. DICK.

Experiments were carried out to discover whether D.D.T. and benzene hexachloride would have any adverse effect on the germination of sugarcane. Tests on N:Co.310 and Co.281 showed that the total germination was not affected by a 2.5 per cent.

D.D.T. powder, nor by a dust containing 0.5 per cent. gamma benzene hexachloride. The D.D.T. powder appeared to have a slight retarding effect on N:Co.310, but this was not noticed for Co.281.

NOTES ON SUGARCANE AGRICULTURE FOR BEGINNERS.

By C. D. SHERRARD.

The present practices followed in South Africa in the planting of sugarcane, the ploughing-out of old roots and the replanting of fields are summarised.

Recommendations are made for fallowing, for the growing of green manures, for the making of furrows and for planting. Planting should start in August and seed cane be preferably selected from one-year-old cane, but the tops of two-year-old cane can be used with success. Single-stick planting of short setts, pre-treated with a fungicidal dip such as "Aretan," is desirable.

Fertilizer recommendations are : 800 lbs. of super-phosphate per acre, applied in the furrow at planting, with a top-dressing of 400 lbs. of ammonium sulphate (or its equivalent) when the cane is growing. Certain Government standardised mixtures of fertilizers are recommended when "straight" fertilizers are not obtainable.

Methods of cultivating to eliminate weeds are described for plant cane; while for ratoons, it has been found that, except on wet low-lying areas, the leaving of a blanket of trash without lining it into rows is sound practice and inhibits weed growth.

Cutting starts in May and ends in December usually, the highest sucrose figures being obtained in September. Burning before cutting is no longer extensively employed, for trashing greatly reduces

weeding costs and increases crop yields. Most hillside cane is cut when 20 to 24 months old, but the cutting of year-old cane is becoming popular.

The suitability of the different varieties for various conditions, together with their other qualities, is listed. Co.281 is most widely grown, and thrives on well-drained loams to clay loams. Co.301, next most widely grown variety, does well on coastal wind-blown sands and is suitable for year-old cutting. Co.331 is now being grown successfully in the higher altitude areas and in some poorly-drained areas on the coast.

N:Co.310 is rapidly taking the place of Co.281 and is probably one of the highest sucrose canes yet released. Co.290 has gone largely out of cultivation because of its susceptibility to red rot and doubtful ratooning qualities.

P.O.J.2725 and 2878 are of real value to growers on alluvial flats, where, with N:Co.310, they will probably form most of the crop.

Of the three newly-released varieties, N:Co.349 is an upright grower with little canopy, but yields well on a wide range of soils. N:Co.291 lodges badly at two years old on good soil, but grows rapidly and sheds most of its trash at an early stage. It is a low sucrose cane when cut off the peak period. N:Co.339 yields well on good loams to clay loams and produces an excellent canopy.

SUGARCANE YIELDS AS INFLUENCED BY CROP DEVELOPMENT.

By A. McMARTIN.

The phenomenon exhibited by plant life known as regeneration, i.e. the production of missing organisms from incomplete plant parts, such as the formation of roots and shoots on cuttings, does not occur in a haphazard manner but exhibits an orderly manner in development. This is particularly the case with regard to the position on a cutting from which new organs are developed, and in the sequence of this development. Although in a sugarcane cutting no true regeneration of tissue occurs, marked polarity is exhibited in that the portion originally nearer the apex of the stalk acts as a shoot pole, and the other end a root pole, resulting in a quicker shoot development at the former, and a quicker root development at the latter end. The first developing bud may exert an inhibiting influence on the other buds, but this inhibition may be overcome by planting the

setts with the buds facing sidewise in contrast to one row of buds facing up and the other facing down. The former method also leads to a more uniform shoot-root development from the young shoots.

Under field conditions in Natal the above factors are of secondary importance, however, in determining the nature of germination obtained, when compared with the effect of unfavourable soil (particularly moisture) and disease. Very frequently the number of buds that grow is only about 26 per cent. of those planted; the end buds of a cutting often fail to grow, leaving only one or two to germinate in a three- or four-budded sett, and frequently only one of these develops. The best insurance against germination failure in Natal has been found in the disinfection of setts prior to planting.

The effect of leaving trash on the sett is to slow down the rate of germination, but to cause a development of more nodes underground on the young shoot, leading to greater tiller development.

The influence of germination on tillering and ultimate yield depends very largely on subsequent growing conditions.

An increase in the shoot population of a field of young cane may lead to increased yield if this can

be maintained till cutting time, but usually during the dry winter months considerable mortality among shoots occurs, and densely populated fields lose more than those supporting fewer stalks, so that in the second season the crops even up, and at harvest no difference is found between those that were dense and those that were thin in numbers when young. More important than a dense crop of young shoots is an even one—a thin even stand is better than one dense in parts with large gaps.