

REPORT ON AGRICULTURAL PRACTICE IN THE SOUTH AFRICAN SUGAR INDUSTRY

By H. H. DODDS, M.Sc., A.I.C.

In order to arrive, if possible, at an outline of representative practice in as far as it may be said to exist in the cane sugar industry of South Africa, a questionnaire was compiled and sent out to 100 representative estates, distributed over the sugar-growing areas.

Copy of the questionnaire is appended.

Thirty-three answers were received, which is an unusually good response in the light of experience with earlier inquiries of this nature.

Sugar cane has been grown in Natal, the only sugar growing province of South Africa, since 1850, but for many years the industry was on a very small scale and the output was never much over 40,000 tons until the year 1909, when for about ten years it fluctuated between 80,000 and 115,000 tons. Since 1918, however, the increase of production has been rapid and for the year 1930/31 was over 390,000 tons.

Agricultural practice has never become standardised to any great extent and varies widely in different districts and even in neighbouring plantations. Until recent years little or no organised agricultural experiment has been carried on to determine the best procedure for any given locality. The local conditions themselves vary enormously both with regard to soil, rainfall, labour supply, etc., and in any case wide differences in practice are to be expected.

About 28 per cent. of the cane is grown by the manufacturing companies who own the sugar factories, the remaining being grown by about 600 individual planters. The average area under cane of the latter is about 700 acres, ranging from under 300 to over 1,600 acres.

Most of the estates are on gently rolling hills; many contain a considerable proportion of flat land, but few are entirely on the flats and these are generally confined to certain large alluvial areas near the mouths of the larger Zululand rivers, especially the Umfolozi and Umhlatuzi rivers.

Zululand is no longer a separate political entity, having been annexed to Natal in 1897, but for many purposes it is convenient to retain the name for the area of the province north of the Tugela river. This part of the country now produces about 36 per cent. of the total output of sugar.

Soils.

All types of soil are represented, sandy loams predominating.

With few exceptions they are fairly well watered by numerous coastal streams, although the rainfall, with an annual average of about 40 ins., is of course deficient for sugar cane.

The soils in the older part of Natal are on the whole somewhat heavier and, with certain exceptions, less well watered than those of Zululand.

Although clay to medium loams predominate in this lower part of the coast, there are considerable areas of sandy soils derived from a formation known as Table Mountain sandstone, also wind-blown beach sands.

Preparation of New Lands for Planting.

Of recent years there has been a rapid development of new areas brought under cane from virgin soils originally covered either with dense scrub and undergrowth known as East Coast bush, or further inland with what is known as thornbush veld, which contains much fewer trees and less underbrush, with coarse grass predominating.

Within the last year or two this new development has, of course, received a heavy check from the economic conditions prevailing in the sugar industry generally.

The land is usually stumped and cleared by hand, the larger logs being usually removed for firewood or timber, and the brushwood, etc., being burned *in situ*. Sometimes this labour is done by taskwork, from 30 to 60 trees according to size being felled per day per unit of labour. In the thornbush veld the grass is burned after removal of the trees.

The alluvial flats which have been mentioned are mainly covered with reeds and papyrus grass in their original condition; these are cut, allowed to dry, and burned.

In very few cases is the practice followed, common in certain other countries, of leaving tree-stumps *in situ* and planting the cane in holes. One large estate uses steam engine tackle for stumping, but this is usually done by hand, in some cases with the aid of some mechanical device; in a few cases, in the older parts of Natal, no clearing of virgin lands has been done during the tenancy of the present occupier.

Ploughing.—Many types of ploughs are used in breaking-up new land, roughly one-half being disc ploughs, the proportion being 60 per cent. in Zululand and 45 per cent. in the rest of Natal.

The number of ploughings is universally two or three, and the depth of the furrow ranges from 4 inches to 10 inches at the first ploughing, and 6 inches to 12 inches in subsequent ploughings.

Harrowing.—In harrowing, the plain disc type of machine is almost universally preferred in the preparation of new land; sometimes, however, later harrowings are done by a spike harrow. The number of harrowings usually coincides with the number of ploughings, except in some cases where one or two extra harrowings are done at intervals.

While some planters harrow as soon as possible after ploughing, others allow considerable intervals to elapse, no doubt varying according to the weather and other conditions.

A common practice is to allow an interval of two or three months before harrowing after the first ploughing, but to harrow as soon as possible after later ploughings.

The total time taken for preparation of new land varies widely, ranging from three months or less in easily prepared sandy soils to twelve months in heavier land carrying a dense growth of bush.

Preparation of Old Cane Lands.

The total number of cane crops grown before replanting varies very considerably, from three, comprising one plant cane crop and two ratoons, in the case of lighter soils, up to nine or ten ratoons exceptionally in alluvial flats; the average number of ratoon crops, however, is from three to four.

Before ploughing out old cane lands the trash lying on the ground is sometimes burnt, but on the whole, especially in the older cane lands, the trash is ploughed into the soil. Disc ploughs are commonly used for this purpose, but by no means exclusively. A three-furrow disc outfit is commonly used where the trash has been burnt, but where there is a thick coating of trash to be buried single-furrow Australian disc ploughs with 28-inch disc are often used. There does not appear to be a multi-furrow disc plough that will do this work effectively. Heavy mouldboard ploughs for one or two furrows are occasionally used in sandy soils. Usually there is no special means of dealing with old cane stools, which are generally found to decay fairly readily and eventually pulverise and are ploughed in. In a few cases, however, they are raked into the furrows and broken by hand, or carried away to be used as fuel.

The number of ploughings given varies from one to five, two or three being the most usual number.

It is apparently becoming the general practice in recent years to allow the land to fallow for a season before planting again with cane, more usually with green manuring during the fallow.

The crops mainly preferred for green manuring are buckwheat, cowpeas, and Mauritius or black velvet beans (*Stizolobium aterrimum*). Commonly a succession of green manure crops is grown, sowing buckwheat in the dry and cool, early and late seasons, and legumes during the rainy summer months. Some planters find that it is better to fertilize green manure crops either with a phosphatic fertilizer such as superphosphate or raw rock phosphate, or sometimes a complete fertilizer is used. Filter cake is sometimes applied with the green manure crop.

Disc harrows are universally preferred for harrowing old cane lands, occasionally followed by spike harrows; in one or two cases spike harrows are used exclusively. The number of harrowings generally corresponds with the number of ploughings, but occasionally an extra one is given, especially after the last ploughing.

In cases where no fallowing is done the normal interval of time between the first ploughing out of the old cane land and replanting with cane ranges from three to six months.

Furrowing or Ridging of Land.

The average distance between the furrows is almost exclusively $4\frac{1}{2}$ feet or 5 feet, and is more in only few

cases in rich alluvial soils, where it may be up to 6 feet. A few planters take the trouble to mark the distance accurately by chain or other means, but in most cases the distance is estimated by eye after the first furrow or two has been accurately measured. The depth of the furrow varies, greatly depending on the character of the soil and on the type of outfit used for the work. The range is from 6 inches upward. The type of plough used for this work is a heavy double mouldboard.

Use of Fertilizers, etc.

Comparatively few estates practice liming; the benefits from liming are not always assured, and much experimental work needs to be done on the use and application of lime in representative soils.

Filter cake is largely used, usually in quantities of about 10 tons per acre, but up to 25 tons per acre or even more are sometimes applied. Its use, however, is largely governed by convenience of transport of this bulky material from the factory to any given field.

Stable manure is applied as far as obtainable, but in view of the relatively small livestock population in the sugar belt, supplies are nearly everywhere very scanty.

The use of molasses as a fertilizer is reported only on two estates, where the results are stated to be remarkably good.

The use of commercial fertilizers is general.

In many cases only the phosphatic fertilizer, which practically all South African soils most urgently need, is supplied, in the form of superphosphate or otherwise, but in the majority of cases a mixed or complete fertilizer is used. Sometimes the planter has a mixture made up to his own specification, which would appear to be the most economical method in the present state of the fertilizer market, provided the planter knows approximately at least what his soil requires. There are, however, also widely used various proprietary brands of mixed fertilizers, of which no single one appears to predominate. The quantity of fertilizer supplied per acre ranges from 400 lbs. to 800 lbs., with an average of about 600 lbs.

Most planters also fertilize the ratoon crops, although one or two state that they have had negative results from this. Usually superphosphate only is used for this, but in some cases nitrogen or potash is applied, or both, the usual dressing mentioned being from 200 lbs. to 500 lbs. per acre.

Methods of Planting Cane.

Most planters prefer twelve months' old cane for planting, either plant or first ratoon; some, however, prefer more mature stock from 18 to 24 months old. One or two estates make a practice of using the upper part of the mature cane for planting purposes, the rest of the stick being sent to the mill.

It is evident that the selection of planting material in many cases is not very stringent; the common practice is to select a good stand of cane as a whole and use it wholly. Most planters, however, discard the weaker sticks, and many take the wise precaution of planting streak-free cane only. Only a few planters mention the condition of the buds as a criterion in selecting cane for planting.

The cane, with only one or two exceptions, is left untrashed and is cut into lengths usually from 9 to 15 inches. In a few cases longer sticks are left, up to 2 or 3 feet. Usually the whole cane is used for planting, and it is but seldom tops only are used, as mentioned above.

The single continuous line is the general procedure in planting, sometimes with an overlap; a few planters use a double line, especially when planting late in the season. The depth of soil covering the sett also shows very wide variation, depending partly no doubt on the kind of soil, but partly also on the personal choice of the planter. It varies from as little as 1 inch up to 6 inches, and is most often covered by hand, although frequently done mechanically.

The rolling of cane by machine after planting is nowhere practised in this country as far as the compiler is aware, and only one planter specifically mentioned the tramping of the earth on the plant by the labourer after covering, which is a small precaution that should not be omitted.

The best months for planting are generally stated to be from September to November, although many planters remark that circumstances may make it necessary to plant earlier or later than this optimum period.

In some parts of Zululand delayed planting is done as late as February to April, but in most districts the rainfall would not admit of this being successful. It is of interest to note that one or two planters state that with the use of mechanical traction they can get all their planting done when they wish, instead of being compelled to carry over to the less favourable months for planting, which was the case when animal transport was used.

Treatment of Blanks.—Many planters state that with the proper preparation of the soil and selection of plant material, there are few if any failures to germinate; others consider that it is uneconomical to replace blanks whether they are few or many, unless for some reason they may be so numerous as to make it advisable to replant the field. Usually, however, the practice is to fill in with new setts as soon as possible after the misses are evident, sometimes using an extra dose of fertilizer to hasten forward new plants. Other planters do not fill in misses until some months have elapsed, and a few in such cases supply with complete stools grown in a headland or elsewhere specially for this purpose and transplanted.

Cultivation of Plant Cane.

An increasing practice, especially in dry seasons, is to use drag harrows over the field shortly after planting; this practice is described in detail by H. L. Garland in the Proceedings of the South African Sugar Technologists' Association for 1931. This is considered to ensure the covering of the cane and maintain a good tilth and reduce weeds at a minimum cost; the harrow may be a light one, drawn by one mule and covering about four acres a day, or a thirty-foot harrow drawn by a tractor capable of doing nine acres per hour; the latter is somewhat more costly per acre, but of course is much more expeditious and gives more uniform results. The damage that may be done to young shoots

is considered negligible when compared with the advantage of the practice.

Most planters, however, still confine mechanical cultivation to the middles, and weed only by hand in the actual cane lines. Some planters run a light plough between the lines preparatory to further cultivation, but the majority, in the case of plant cane at least, use only light shallow multiple-tined single-row cultivators. A few planters rely on hand weeding only, without mechanical cultivation. The usual number of hand weedings ranges from two to six, no doubt varying according to soils and weather conditions.

Mechanical cultivation on most estates is carried out practically continuously until the leaf canopy is formed. The number of cultivations reported varies from three to twelve.

Mules are used almost exclusively for this work; in one or two instances, however, motor traction is used in addition, two rows being cultivated simultaneously in a few cases. It is claimed that the practice of harrowing as outlined above reduces the amount of subsequent work necessary, so that only one hand weeding and about four mechanical cultivations will be required.

Rogueing of Cane for Streak Disease.

This has been attempted by many planters, but has been found impracticable where secondary infection is frequent, as is the case over the greater portion of the sugar belt; on a few estates in the central North Coast area (Inanda district), where secondary infection is relatively infrequent, rogueing is found practicable, but is best reduced to a minimum even in such areas by the careful selection of the cane used for planting.

Harvesting of the Cane.

The age of cane at harvesting is almost universally 20 to 24 months in the case of plant cane and ratoons. Only in a few estates in moist alluvial soils, or where irrigation is practised, can the time of the crop be reduced to 12 to 15 months, including only one growing season, and even in such cases one planter notes that stronger ratoon plants are obtained if a full two seasons' growth is permitted, although it may be practicable to cut after one season.

The practice of burning the standing cane before harvesting is a general one in certain districts, notably over the whole of Zululand. In the rest of Natal we find that the practice is not generally followed, except apparently in a portion of the Umhlali—Chaka's Kraal area. It is noted that in the Inanda district, where the soils are shallower and for various reasons less able to withstand the drain on the organic content involved in the practice of burning, the burning of cane is not practised at all.

The deep rich soils characteristic of most of the Zululand area have more reserves of organic matter, which makes the burning of cane practicable for the present at least; and as pointed out recently by H. P. Agee, of Hawaii, provided it is possible to maintain big crops, it may be permitted to continue burning indefinitely without seriously affecting the fertility of the soil; this, however, is a somewhat dangerous doctrine in a country such as ours, having deficient rainfall, and low organic content already in many soils.

The harvesting of the cane is done almost entirely by taskwork, a usual daily task being from 2 to 3 tons of cane per day cut and loaded on the truck or waggon, in the case of cane that has been burnt before harvesting; where the cane has to be trashed by hand when cutting, the task varies from 1 to 1½ tons of cane per day cut and loaded. The total number of labour units employed in harvesting 100 tons of cane naturally varies considerably, according to circumstances, and ranges from 40 to 100 or more.

The most common procedure is to load on to waggons which are drawn by oxen or mules to the nearest railway station or siding, and loaded on to S.A.R. (Government Railways). Many estates, however, have portable tramlines connecting either with the S.A.R. or the light railway owned by the milling company; a few planters use motor lorries in place of waggons, and one planter uses the type of loading derrick which is common in Louisiana, and thereby reduces the gang necessary to load a railway truck to about one-third.

The harvesting season almost universally begins in May or June, and continues to November or December or even into January. It is, however, generally recognised that the best quality of cane and highest yields of sugar per acre are attained in the months of July or August to October.

Cultivation of Ratoons.

On those plantations where the cane is burnt before harvesting, the debris on the fields, consisting mainly of cane tops, is raked usually into every fifth to seventh row. The exposed middles are then opened up first with a light plough, generally to a depth of 4 to 6 inches, and then cultivated as with plant cane by light tined or disc cultivators. Where the cane has been hand trashed and not burnt, the cane trash and tops lying in the field are usually raked into alternate rows and the exposed rows cultivated as described above, the covered rows being left with the double covering of trash. In a few cases the trash is raked back from the covered rows, which are then cultivated in their turn, but more usually only the alternate rows first uncovered are cultivated. In some instances the trash is left undisturbed except for hand treatment of the weeds that force their way through the trash blanket.

Irrigation.

Very little irrigation is as yet practised in Natal, and only six estates report any.

The only ones of any considerable extent are those of Natal Estates, Ltd., 2,000 acres, and Tongaat Sugar Co., Ltd., 500 acres; in both of these open furrows are used. The Tongaat Sugar Co. irrigate in the furrow in the case of young plants, and between the lines in twelve months plant and all ratoons. The standard number of irrigations is 12 of 3 inches each, and the cane is usually harvested after the normal two years' growth. Messrs. Natal Estates have a main irrigation furrow of 1 in 1,000 grade and irrigate their fields with channels at 50-foot intervals; they ordinarily give 15 to 20 applications of 2 or 3 inches each, and usually harvest their irrigated cane within 12 to 15 months after planting. They find that in this way a crop can be grown

in one season such as would ordinarily take two years to grow without irrigation.

Mr. W. W. Jex, of Stanger, has a small 50-acre irrigation outfit which is described in the Proceedings of the South African Sugar Technologists' Association for 1931. A feature of this is the use of a spray method of irrigation; applications of 3 inches per month are made during the growing season in two equal portions per month, and the cane is usually harvested every 15 months on the low-lying lands and every 20 to 24 months on the hillsides.

Labour.

Plantation labour is of two main types—South African aboriginals (native) and East Indian, the latter usually being the descendants of Indians originally brought into the country under indenture. The native labour by far predominates, being exclusively used in Zululand and in the majority in the rest of Natal.

The native labour may be engaged from among those located in the neighbourhood of the estates employing them, dwelling either as tenants of European landowners, or in locations set apart by Government for the occupation of natives; or they may be recruited from tribes who live at some distance from the more highly cultivated parts of the country.

In matters affecting field labour, more than anything else, we find marked differences in opinions between different planters; thus some prefer the local native, others consider the labourer whose home is at a distance the more reliable.

Natives, with only one or two exceptions, are paid for every thirty days actual work; in one or two cases pay for Sunday is granted, provided the preceding week has been unbroken. Indians, as a rule, are paid at a fixed rate per calendar month.

The labour forces employed on the estates vary very considerably and usually show wide seasonal fluctuations, double or more being employed during the height of the harvesting season.

The number of acres recorded under cane for each unit of labour employed ranges from 5 to 12 during the harvesting season, and from 9 to 21 during the rest of the year.

Many kinds of work are paid for on the task system, but the only kind which is unanimously conceded to be suited to this system is the cutting and loading of cane. Some planters task practically all their work, either individually or to a gang as a whole; others do not approve of the task system, except for harvesting of cane as stated. The consensus of opinion, however, appears to be that task labour is not advisable where working with animals is concerned, for the obvious reason that under task conditions such animals are less likely to be carefully handled.

Many planters consider also that the planting of cane is an unsuitable subject for task labour. The individual tasks allotted for various kinds of work naturally vary enormously. The task for harvesting and loading cane has already been mentioned; that for weeding ranges from 500 to 2,000 yards, depending no doubt on the kind of soil and intervals at which the fields are weeded.

The task for ploughing also varies greatly from 1,000 to 3,000 yards, as do the tasks for planting cane or for

raking trash into alternate lines where this is practised. Very few planters practise any system of bonus except in a few cases in harvesting, or in one instance for ploughing over-time, at night time, by moonlight.

Means of Draught and Transport.

Oxen are used very generally in Zululand, in fact exclusively in some plantations where there is still sufficient land available for grazing purposes, which is considered to be essential for oxen.

Mules, even in Zululand, however, are generally preferred for such work as cultivation. In a few plantations motor traction is used for hauling cane and for ploughing. Further south, grazing land becomes less and less available and the use of mules becomes more general, and many estates use mule transport exclusively, while others have a few spans of oxen or motor tractors and retain them for such work as ploughing and hauling of cane.

The rations fed to oxen generally consist almost exclusively of cane tops during the harvesting season and grazing only during the remainder of the year. In a few cases this is supplemented by crushed maize or bran.

Mules are generally fed on crushed maize, varying from 4 to 10 lbs. per day, together with grass or cane tops.

Most of the larger estates and some of the individual planters form a balanced ration by supplementing maize with oil cake, lucerne or the like, but this appears to be the exception rather than the rule; and although some planters state that their mules look well on an exclusive diet of maize and cane tops, there can be little doubt that they would gain in energy and working life of the animal if a more complete diet was given. Treacle (molasses) is used on many estates, but not nearly sufficient use is made of this valuable and economical article of diet.

General Layout of Estate.

The size of field preferred varies very greatly from 10 to 40 or 50 acres in the smaller estates, up to 70 or 100 acres in some of the larger ones.

No very definite preference is indicated regarding the length of line, some estates state that they prefer the lines as long as possible, and most appear to prefer from 400 to 500 yards. On a few estates, especially in the more hilly districts, the cane rows are contoured, but the more usual practice is to plant the cane in straight lines at right angles to the general direction of the slope, if any.

Fire Breaks.—The usual width of fire break varies from 15 to 30 feet; commonly, but by no means generally, a double space is left between adjoining

estates. The fire breaks are usually kept cleaned by ploughing and weeding, or maintained as farm roads. In only a few cases are they used for growing vegetable crops or the like or for growing seeds for green manure crops. In a few cases the fire breaks, where not otherwise required, are placed at the disposal of the labourers for growing vegetables and the like to supplement their rations. One or two estates plant trees in their fire breaks to help to prevent soil erosion.

Cane Varieties other than Uba.

Since for the last few years previous to 1931 the commercial cultivation of varieties other than Uba has been prohibited, there is very little opinion to be expressed regarding other varieties.

Some of the older established estates report that the thick cane varieties formerly in cultivation such as Green Natal (Light Preanger) and Louzier (Otaheite) failed not necessarily because they were overcome by disease, but rather because they ratooned poorly, and in resistance to drought could not compare with Uba.

Natal Estates, Ltd., mention that D.1135 ratooned well and compared favourably with Uba even without irrigation, but was subject to mosaic disease.

The varieties released from the Experiment Station for commercial planting during 1931 are well spoken of in many cases, especially P.O.J. 2725, which has resisted drought remarkably well and where conditions are at all favourable has made excellent growth. Only one planter mentions the early flowering of P.O.J. 2725, which is of course a serious defect of this variety in more tropical climates.

P.O.J. 2878 is also well spoken of, especially where it has been irrigated.

There are few or no comments as yet on the more recently released varieties, Co. 290, P.O.J. 2714 and P.O.J. 2727, but they are generally regarded as promising, especially the Co. 290.

CH. 64/21 compares favourably with Uba, but is found to be even more susceptible to streak disease.

Conclusion.

The foregoing brief outline of sugar cane agriculture as practised in South Africa may be not without interest as showing the methods that have been evolved under rather unusual climatic and soil conditions for sugar cane.

Experiment Station,
South African Sugar Association,
Mount Edgecombe,
Natal,
South Africa.

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