

SUGARCANE GROWING IN NATAL

FIELD METHODS AND PRACTICES IN OPERATION IN 1953

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In 1949 a paper by C. D. Sherrard was read at the Technologists Congress under the title "Sugarcane Agriculture for Beginners". It is now five years since this paper was compiled and the industry has adopted certain modifications in its general field practice during this period. A survey of the practices today in the fields, and a study of the progress made during the five years, will not be without its advantages.

Some point in the growth of the cane must be taken for a start of such descriptive analysis and the most convenient is when the land is under an old ratoon crop of cane.

Preparation of Field.

It is the usual practice to cut the fields, due for ploughing out, as soon as the mills open in May. This is more pronounced in the higher altitudes. The field, having been cut during late May, June and early July and the trash blanketed, is left until the first spring rains. It is often only possible to plough after rain has softened the ground and this is certainly the case where the last crop of cane has been burnt standing. It is not the case to the same extent where the trash is left, as the underlying soil is generally moister due to the trash mulch. A wetting of the trash by rain will consolidate this extremely tough material, thus helping when ploughing operations are started.

Even under the most favourable conditions of rain the trash and old stools of cane are not easy to plough completely with one ploughing. It has been the practice for some time to plough the old cane field with disc ploughs; simply bringing up enough soil to harrow and enable a green manure to be sown and germinate. This first ploughing, as a result, often has a ragged, untidy appearance and no alarm should be felt if the field takes on such an appearance.

The period of growth of the green manure will allow sufficient time for trash and cane root to soften and rot, so that when the green manure is ploughed in, about March of the next year, it is possible to make a clear, good ploughing.

Crop Change Over.

Reference has already been made to green manure crops and this practice is extensively carried out using sunnhemp or velvet beans for the purpose.

Sunnhemp, which is sown usually at the rate of 30 to 40 lbs. of seed per acre in December, and velvet beans at the rate of 80 lbs. per acre, grow during the rainy summer period very rapidly and are at their maximum growth about March of the following year. Beans are preferable for earlier sowings, during October and early November, whilst sunnhemp sown in December gives a very rapid cover. January sowings of sunnhemp seem to be preferable if seed is to be collected but despite the high price of sunnhemp seed, the practice of saving seed is not general in Natal, due to the unreliability of the sett and the damage caused by insects and fungus diseases.

Whilst sunnhemp invariably is sown broadcast for a green manure, velvet beans are sometimes drilled in so that the land can be scuffled between the rows until the beans, which are slow to start vigorous growth, have made a complete cover.

It has always been thought that a legume crop would improve the soil and enrich it with nitrogen. This theory has never been proved in the cane belt and, in fact, evidence is being collected which shows that no manurial advantage is gained by the subsequent cane crop. This is more pronounced where the more orthodox method of planting cane in August to December is in practice. The green manure having been ploughed in in March, the field is left as a bare fallow for 5 to 9 months and under the high midday temperatures experienced on the coast, even in winter, most of the organic matter and some of the chemicals would appear to be lost through oxidation and bacterial action. The only apparent advantages to be gained by green manuring are: (1) The better tilth created by the ploughing in of vegetable matter; (2) The control of certain insect pests by the period when no cane host is in the soil.

It is felt that, by suitable mechanical methods, a similar tilth might be produced to that created by green manuring, and, if any manurial advantage is gained by the practice, such gains could be rectified more expediently by the use of suitable chemical fertilizers.

Research work is progressing along the line of eliminating, where possible, the need for a green manure, but at the moment, because of insufficient evidence to support any alternative method, the

practice of green manuring between crops must of necessity be maintained to allow the old cane roots and trash to rot and to create the seed bed condition necessary for planting.

It may be born in mind that it is considered best at all times to keep the soil under some sort of cover. Under present conditions and planting of cane in March, two to three weeks after ploughing in the green manure would seem the best time to take advantage of whatever manurial residues there may be attributed to a green manure.

To try to eliminate any period of bare fallow certain planters have been attempting to follow the sunnhemp or velvet bean crop with another crop to fill the period March to September. Lupins have been tried with variable success and it would appear that considerably more research work will need to be carried out on this crop before any degree of certainty of a satisfactory stand can be guaranteed.

Whereas with sunnhemp and velvet beans no bacterial inoculant to start the formation of nitrogen fixing bacterial nodules on the roots is necessary in the coast soils of Natal, such inoculants are very necessary in the case of lupins. The bacteria associated with lupins is of a specific nature for this crop and the method of inoculating the seed needs care, as exposure to light for only a short period is damaging to the life of the bacteria. Lupins seem to be extremely susceptible to attack by eel worm which is present in most of the soils of the cane belt and it has been noted that better results are obtained in the growth of lupins when a sunnhemp crop, which plant has a repellent effect on eel worm, is grown directly prior to lupins being sown.

Time of Planting.

Planting can be carried out when a suitable depth of soil has been prepared as a seed bed and when this soil contains sufficient moisture to allow germination. This set of conditions usually occurs after the first rains in August or September and again in March. It is considered that the period January and February is not too good for planting, as the open furrow into which the seed material is placed rapidly dries out on the surface and the setts are thus placed in a hot dry medium. At this time of year any cane that germinates makes too much soft growth before the dry winter period sets in and cannot withstand this subsequent drought so well as the smaller, tougher plant that results from a March, April planting. Winter planting during June and July often has dry conditions to contend with in the early stages of growth, but where overhead irrigation is applicable, or the occasional winter rain occurs, winter planting is possible despite the cooler conditions.

It has been found by experimentation and in practice that if cane receives a really good start

there is little difficulty in maintaining good ratoon crops, but where the cane receives a bad start little can be done to effect a substantial recovery in the ratoon crops.

Mention must be made of the planting machine when dealing with the time of planting because if dry conditions are experienced when it is desirable to plant, the opening and immediate shutting action of the furrow by the planting machine and the resultant placing of the sett in moist soil conditions considerably helps the germination of the cane. These conditions cannot be achieved by hand planting.

In the higher areas of 2,000 ft. above sea level the period of planting is restricted. It is considered that October is the optimum time for planting, with little latitude into September and November.

Planting.

Having decided on the time to plant and having prepared a good seed bed the actual operation starts with the process of marking and then furrowing out. Unless the slope of the field is extremely moderate it is advisable to mark the contour of a similar level and to correspond the lines of cane to these contours. As the gradients become steeper, greater care must be taken in marking out the lines of cane and it is as well to allow a slight slope in one or other direction so that rain water does not accumulate in the line, break through the ridge and thereby start soil erosion. If the slope of 1 in 250-300 is introduced, the water from each furrow can be led away down the slope at a road or other hardened drain.

Where irrigation by furrow methods is contemplated the lines must conform with the requirements of the supply of water.

The slope and conformation of the field having been accounted for, the land is opened up for planting by a ridging body drawing a furrow 6 to 8 inches below the level surface of the soil and at intervals 4 ft. 6 in. apart. Any fertilizer required is spread along the bottom of the furrow, the cane sett is then put in position and covered to a depth of 2 inches. It is advantageous to firm the sett in and not enough attention is paid to this process of firming the sett. Air must be reduced to the minimum in the immediate vicinity of the sett to prevent drying out and the moisture in the soil should be brought into close proximity with the sett to encourage germination.

Spacing between Rows and Seed Rate.

It is the general practice to plant in rows 4 ft. 6 in. apart. This standard distance may be varied according to the fertility of the soil and the type of cane being planted. In rich flat soil, with a

vigorous variety, the rows may be placed 6 ft. apart, but where the soil is poor and the variety upright in growth habit then the inter row may be reduced to 4 ft.

The setts, if prepared before planting, may be placed either as two setts lying alongside one another or with a space between the ends. It was thought that a greater number of sticks per acre were produced when two lines of setts were placed in the furrow. It has been shown by experimental evidence that the same weight of cane is produced from a continuous line of setts as from a line where setts were placed with 3 ft. between their ends. Counts of sticks in this experiment show that the greater the number of sticks resulting from the continuous planted row were, individually, of a far smaller size than those in the wider spacing treatments. It is the practice generally that, when planting a good germinating variety, a gap of 9 to 12 inches is left between sett ends. Where, however, the germination is not so free, the practice is to place setts slightly overlapping. The amount of cane required to plant an acre when setts are placed double is 4 tons. By spacing 12 inches between sett ends this quantity is reduced to 1½ to 2 tons per acre. It can be appreciated that when large areas are to be planted a considerable saving in seed material can be effected with the spaced planting.

In connection with space planting, an operation carried out after the germination of the sett may be mentioned here. It has always been the practice to "supply" the area planted with fresh setts wherever germination has failed. It used to be considered necessary to carry out this process wherever a hoe could be inserted between the growing shoots of cane. Because of the uniform yields recorded from the wider spacings in experimental plots it has been established that no gap in the line of cane under 3 ft. in length need be "supplied".

Selection of Seed Material and Its Preparation for Planting.

Seed material consists of the stick of cane cut into suitable lengths and in such a condition that the buds, occurring at each node, are plump, vigorous and likely to germinate quickly.

To obtain the buds in the best condition young cane is selected. By experimental trial it has been found that the recently produced top of 2 year old cane is equally as good for seed material as cane 12 months old. This fact is important during drought conditions when the growth of cane up to 12 months old is small, as it is possible to use the tops of cane being sent for crushing as seed material.

It is more convenient, however, to use the longer sticks of 12 months old cane and so plant cane or

first ratoon cane is usually used. This cane is cut at ground level and to obtain the speediest germination the trash should be removed and the stick then cut into 15 to 18 inch lengths. The length of 15 to 18 inches is taken so as to ensure that there are at least 3 buds or eyes on each sett. It has been found that where the three bud sett is used the two end buds can be damaged by insect or fungus attack whilst the centre eye germinates satisfactorily.

To prevent the attacks of one fungus disease, pineapple disease, which attacks the setts placed in the ground by entering the cut ends, it is usual to dip the whole sett in a water soluble organic mercurial fungicide. Various proprietary brands of the fungicide are on the market and the solution is made up by mixing one ounce of the powder in a gallon of water. It is useful to bear in mind that a match box full of the powder is roughly one ounce.

If conditions are extremely favourable for germination, namely the soil being nicely moist and the temperatures on the high side, the older method of planting may be adopted. This consists of leaving the trash on the stick, laying the whole stick in the furrow and then cutting it across at suitable intervals. This method speeds up the planting process but retards the appearance of the shoot above ground and in any but the optimum planting conditions exposes the sett to undue risk of attack by insect or fungus. The retarded appearance of the shoot above ground leads to expensive weeding at a later date.

Weeding of Plant Cane.

The eradication of weeds has, due to the practice of trash blanketing the fields, been reduced to those occurring in the plant cane only. By the correct management of the available labour and suitable use of mechanical and horse drawn implements, these weeds should be dealt with as soon as they appear through the surface.

As little hand weeding as possible should be resorted to. The young cane first shows through the surface in the bottom of the planting furrow. In this stage the weeds in the row can be kept in check by the use of a small, very light, semi-circular spiked harrow fitted with a guiding handle and drawn by a mule. It is the object at this stage to preserve the form of the furrow until the cane is somewhat larger.

When the cane is 12 to 18 inches high, a light scuffle can be taken down the ridges to drag out the weed growth from the inter-row that may not, until this stage, have been touched, and to fill in the furrow. By repeated scufflings the furrow is filled in entirely and weed growth is either smothered by

the filling in process or pulled out by the tines of the scuffles. Generally one hand weeding at least is necessary in the row of cane and it is felt that with the judicious use of an ornone weed killer the optimum conditions might be achieved when only one hand weeding is required before the cane can furnish sufficient canopy to check any further weed growth.

Cane, once it has germinated and formed its first leaves, is extremely tough and will withstand a considerable degree of rough handling. In some cases the early cultivations are carried out effectively by drawing sets of zigzag harrow or chain harrows over the row and inter-row.

As previously mentioned cane, given a good start, will ratoon satisfactorily and any check such as might be given by competition with weeds in the early stages of the plant cane crop may have a considerable effect on the whole crop. The old saying that the right time to weed is before weeds are visible is especially applicable to the plant cane crop. It is, however, very difficult to compete with the rapid growth of weeds during the wet summer period. This is especially the case in the higher areas where plant cane does not come away as quickly as in the lower areas on the coast.

Harvesting and Trashing.

Harvesting of the cane of necessity corresponds with the opening of the mills. This usually takes place in late May, though in some years, because of economic or supply reasons, an earlier start is made. Cane reaches its maximum sucrose during the period September—October, rising from a low start at the beginning of the season and dropping again after the peak towards the end of the season, about the time of the change of year.

It is usual to start the May cutting by cutting the old ratoon crops that are due to be ploughed out the same year. It has been found that crops cut for ratooning during the period late May to mid July do not come away as well as those cut at a later date. If the season starts before late May then it is preferable to start cutting a ratooning for the late May, mid July period. It is thought, by some that this failure to ratoon during the colder periods of the year is connected with soil fertility and although the fertility has a great bearing on the ratooning qualities of a crop, the temperature factor has an over-riding effect as can be seen from the ratoon of June cut crops in the higher altitudes. These, even as first ratoon, are often a complete failure following early July cutting when conditions are cold.

Cutting takes place in most of the Natal belt after 22 to 24 months growth. Certain areas, notably the flats near river mouths where the

water table is high in a rich alluvial soil, can produce high yields in 12 months, but the sucrose content of the cane is low compared with the slower grown hillside cane prevalent in the cane belt. Another short period crop is cut in some areas by selecting the cane Co.301 which can give satisfactory yields in 14—18 months of growth.

At cutting it is nearly a universal practice now to strip the dead leaves, "trash", and cut the tops off the stick of cane and let this crop residue lie as a blanket over the field. In cases where the soil is inclined to be damp it is advisable to part the trash over the line of cane except in the warmest periods of the season, so that the ratooning cane may receive the drying and warming action of the sun.

The layer of trash left after each cutting has to a great extent changed the whole of the farming methods practiced in the cane belt. The extensive weeding of the ratoon cane, which at one time occupied a large labour force for a considerable period of the year, has now been reduced to the attention necessary on plant cane only. The mulch created by the layer of trash is all too evident by inspecting the soil directly underneath. When areas of bare ground are dust dry, areas under trash alongside are moist and friable. These constant dampish soil conditions must have an effect on the growing cane and on the uptake of plant food and fertilizer by the cane.

It has been observed that when trash is carried in to a plant cane crop, the roots will travel freely in the surface soil under the trash layer where they appear as comparatively thickish vigorous feeder roots. The cane growing in ground without a trash layer has roots of a tough, wiry nature which instead of travelling through the surface soil take a downward course, penetrating the subsoil. As it is the surface layers of the soil rather than the subsoil that can be most easily affected and altered by cultivation and the additions of fertilizers, it is preferable to keep as many feeder roots as possible in this area. Trash, itself of vegetable origin, will on rotting produce organic matter or humus and this material acts as a sponge absorbing and holding not only water but plant foods as supplied through fertilizers, both of which are given up to the growing plant as they are required.

It is not unreasonable to suppose, after considering the above facts relating to the practice of trashing, that fertilizer policies relating to cane that has been burnt standing, and thereby removing the bulk of the trash, have little or no relation to the fertilizer requirements of a crop that from the plant cane harvest onwards is under a constant blanket of trash

Trash management has been under experimental scrutiny for some years and it has been found that

although beneficial responses to trashing may not be recorded after the first crop of trash has been applied, namely at the first ratoon harvest, benefits can usually be recorded at the second ratoon harvest. Increases of up to 10 tons per acre have been recorded in third ratoons in favour of trashing against burning, but it has also been found that on ploughing out the crop after the third ratoon, green manuring, bare fallowing, and then replanting to cane all the advantages gained by trashing had been lost to the new plant cane crop. It would seem that until some new method of changing crops is arrived at no lasting residual can be expected from the trash treatment. Experimental work on this problem is at present in hand but as yet no conclusions are ready for publication.

Fertilizer Practice.

Since the Experiment Station was started in 1925 a considerable volume of work has been carried out on this subject by members of the Experiment Station staff and other workers in the cane belt. Throughout the proceedings of the S.A. Sugar Technologists, papers are to be found relating to phosphate, nitrogen and potash dressings and the methods of application. Early on it was established that, as is the case in most of the soils of South Africa, phosphates were deficient and that cane in the first instance gave the greatest responses when treated with phosphatic fertilizers. Because of the small amount of movement of phosphates in the soil it was established that the best method of applying phosphates was through an initial dressing given at the time of planting in the furrow. Little or no effect from this type of fertilizer was ever recorded when it was applied as a top dressing to ratooning cane until the trash blanket practice was introduced. It seems that if phosphatic fertilizer is broadcast over a layer of trash, probably in the presence of adequate supplies of nitrogenous fertilizer, there is likely to be a recorded increase due to the phosphates from the second ratoon crop onwards. In the case of virgin soil it will be safer to assume that a dressing of from 600 to 800 lbs. of superphosphate will be required. In the older cane lands, where dressings of phosphatic fertilizers and perhaps filter cake, a by-product of the sugar mill that has a high phosphatic content, have been applied in fair quantities for a number of years, a phosphatic build up may have been established and in this case somewhat lower furrow dressing may be resorted to. As the crop of cane occupies the ground for a period of from 6 to 8 years the residual effect of an initial furrow dressing of 250 lbs. on a rich soil and 800 lbs. of superphosphate on a poor soil cannot be expected to last over and above the plant and first ratoon crops. It would, therefore, be advisable to consider the incorporation of some phosphates in the top dressings given to the

second ratoon crop. The determination of the state of the soil and the fertilizer requirements of the crop can to a degree be arrived at by the chemical analysis of soil and growing leaf and to help the cane planter a service has been inaugurated with this object in view. Particulars of this service can be obtained on application to the Experiment Station, Mount Edgecombe.

The need for nitrogenous fertilizers is most marked in ratooning cane where dressings of 300 lbs. of sulphate of ammonia should, if possible, be applied to each ratoon crop. The uptake of nitrogenous fertilizers is to a large extent dependent on the amount of moisture available to the cane and in this respect higher dressings should be given when irrigation is practiced and when the rainfall is above average, and must be applied to obtain a quick breakdown of trash and the best effects to be gained from the trash blanket treatment.

No mention so far has been made of the use of nitrogenous fertilizer on the plant cane crop. It has been considered unnecessary to apply nitrogen to the cane after ploughing in a green manure crop. The amount of nitrogen accumulated by a leguminous crop in 6 to 7 months of growth is hardly likely to affect a cane crop planted 5 to 6 months after the green manure has been ploughed in. If the effect is to be felt the cane should be planted within a few weeks of the green manure being turned in and this is only possible with March planting, when no nitrogen seems to be needed in the form of fertilizer.

Where the long twelve months fallow has been adopted or new ground is broken up, it has been noticed that planters using one of the standard mixed fertilizers as a furrow dressing have obtained extremely satisfactory plant cane crops. The small quantity of nitrogen applied when using a mixture seems to give the young plant cane a needed help that sees it through the rest of its growing period. From this it would appear that a dressing of 100 lbs. of sulphate of ammonia should be added to the phosphatic dressing applied in the furrow and mentioned earlier. The last main plant food, potash, has until a few years ago appeared to have been adequately supplied by the soils of the coastal belt. Whether it is that the constant drain of this chemical from the cane fields in the removal of molasses for industrial purposes is beginning to make itself felt or for some other reason, the fact remains that in certain areas and on certain soil types deficiencies in potash are now occurring. Resort to the Fertilizer Advisory Service is recommended to determine the type of dressing of this material to apply to any given crop. No spectacular increases in yield should be looked for from dressings of potash unless the level of potash in the soil has dropped so low that growth cannot

be maintained. In this case, large "shock" dressings of 300 to 350 lbs. muriate of potash will have to be applied and followed up by dressings of 100 to 150 lbs. on all subsequent ratoon crops. It is seldom that such drastic treatment is necessary, but it is wise to ensure against such circumstances occurring by giving small dressings as and when advised to do so.

Although many of the soils of the cane belt are extremely acid in nature, sugar cane is a plant that can tolerate a wide range of acid conditions. Experimental evidence has never shown any beneficial gains from applications of lime in the field. In the higher areas it has been a fairly common practice to use dressings of Karroo manure in conjunction with a dressing of lime as a manure at planting time. There is no experimental evidence to support this practice.

Irrigation.

A limited area of the cane belt of Natal is at present under irrigation and it is unlikely that more than one-third of the existing area under cane could ever be brought under irrigation. The reasons for this are: (1) Much of the land is of too steep a gradient; (2) The main sources of water, the rivers, are in too deeply eroded valleys and the cost of raising the water to the cane fields would be excessive; and (3) There is insufficient water in the rivers throughout the year. The conservation of water in sufficient quantities to allow for more than one-third of the area to be supplied would have to be undertaken on an industrial or national basis, but despite these drawbacks considerable advantages can be gained by supplying water to the cane wherever possible. The insurance against drought and the possibility of growing cane on land in regions where the rainfall is too low to support growth by itself, were the main reasons for the biggest irrigation project that is operating today, the Natal Estates scheme, being originally laid down.

It is undoubtedly possible to substantially increase the yields of cane by applying extra water over and above the natural rainfall. It would appear that to certain limits adequate rainfalls during the normal summer period help to keep the cane growing rapidly. It seems that the addition of water during the winter period can maintain growth despite the lower temperatures which operate at this time of year.

These indications come from some preliminary research investigations which also tend to show that the spray methods of applying water are superior to the furrow method of irrigation.

Further researches into these problems are necessary before any satisfactory conclusions can be arrived at.

Choice of Variety.

Co.301.—On all really sandy soils, and particularly the coastal wind-blown sand, Co.301 seems to have been undoubtedly one of the best varieties. On many other heavier soils this variety will also yield well but has a tendency to "lodge", which makes cutting and loading difficult; it is better, then, on the more fertile soils to cut this variety yearly or between the age of 12 and 18 months. It is easy to cut, being soft and yet brittle, and many sticks snap off at ground level during the cutting process. Co.301 forms a complete canopy at an early stage, which saves much weeding in plant cane and ratoons.

It has been found to be very susceptible to "smut" and for this reason in certain areas may be replaced by N:Co.334. It is doubtful if any other variety will yield quite as well as Co.301 does on the sandy soils.

Co.331.—This variety has found a place in the industry where others are not at their best. It has done well at high altitudes and growers in Eshowe, Entumeni, Doornkop and Powerscourt areas favour it in preference to others. It is also doing well in low-lying, poorly-drained spots typical of a large area around Ginginlovu. To a certain extent Co.331 is also being grown on the better class sands which were previously under Co.301.

Co.331 is a vigorous grower, giving a high yield of cane per acre with rather a low sucrose if cut early or late in the season, but mid-season gives reasonable returns. It has an upright habit lacking the canopy, but it is rather tough to cut, and cutters will often complain about this when cutting it for the first time.

It is susceptible to pineapple disease, which is a disease affecting the cane sett, and bad germination with this variety is usually due to this. Setts should always be treated with a fungicide before planting, as this is a fairly sure control.

In years of deficient rainfall this variety often has many dead or half-dead sticks in a stool, particularly when left over as a two-year-old crop.

N: Co.310.—This variety is doing very well on the better class sandy loams and clay loams and alluvial river flats. On the red-brown coastal sands it also appears to give a good yield but is rather slower growing than C.301, and there is some doubt whether it will be suitable for one-year-old cutting on these soils.

N:Co.310 has given the highest sucrose of any cane yet released and has a good growth habit, forming an excellent canopy similar to Co.301. It is soft to cut but the sticks seem to be more solid

and denser than other varieties, and it is easy to underestimate yields.

This variety appears to be an extremely good germinator and it should give some of the highest yields of sugar per acre of any of the released varieties.

This cane is most suited to rich, well watered soils. On the poorer dryer soils the yield of the ratoons tends to drop off rather rapidly.

Co.290.—This variety is not widely grown now, since it has been found to be very susceptible to red rot, and under unfavourable conditions is not a good ratooner.

It is, however, a very good yielder as a plant cane crop, and will also ratoon well if cut yearly and preferably during the summer months. This is an important point, because many of the ratooning failures have been caused by cutting in May, June and July.

With Co.290, then, do not cut until the end of August or later, and the crop should not be older than, say, 18 months.

Treated in this way this variety will give excellent yields on the better class sandy soils and on the well-drained heavier soils. It will not stand a tendency to water-logging.

Red rot has only become epidemic in the mist belt—that is, at altitudes of over 1,500 feet—so there seems no real reason why Co.290 should not be a very useful variety in many other places. It is reasonably resistant to smut, and may prove to be a substitute for Co.301 on the reddish coastal sand.

It is a fast grower, forming a good canopy at an early stage, and it is easy to cut and load.

Canes Recently Released or Due for Release in 1953.

N:Co.339.—is a variety giving heavy tonnage, whose sucrose is medium to good, usually slightly higher than Co.301. In variety trials it has shown itself to be adaptable to a wide range of soil conditions. It is also slow and difficult to germinate and should be given the best possible conditions at planting.

This cane stools well and maintains its ratoons well.

N:Co.293.—in the high altitude districts has shown considerable promise, doing well in the Eshowe and Braemar districts and proving itself best in a variety trial at Eshowe. It has a sucrose content comparable with Co.301 and gives satisfactory tons cane per acre yield. Its canopy is satisfactory and it resists red rot. Cases of mosaic have been found.

For low coastal areas it cannot be recommended as under coastal conditions it flowers excessively even when young and it has been noticed that its ratoons are poor in the lower areas.

It might, under damp or irrigated conditions, be grown near the coast for annual cutting.

N: Co.334.—This cane has a stiff upright habit of growth of cane with a fair to good canopy which in drought conditions tends to close upwards into the line of cane. It has a sucrose content slightly higher than Co.301. The cane does well in sand and is not to be discounted in many other types of soil. Growth is often slow in the first year, but the stand in the second year is uniform and the cane is not given to lodging. The cane is resistant to attack by smut and mosaic. The variety is not immune to smut but is the most resistant of the varieties which have been recently released; only a few cases of mosaic have been recorded.

N:Co.292.—This cane is a useful cane which may prove itself as an alternative variety in planters, cropping programmes. It gives a useful though not outstanding yield in tons cane per acre and sucrose content is slightly below that of Co.301. It does not seem prone to any disease though cases of mosaic and smut have been found. Canopy is fair and although the leaf yellows under drought conditions, recovery is very rapid when rain has fallen.

Conclusion.

It is intended with this paper to start a series that may, as the years proceed and practice in the cane belt is modified or changed, report these at the Congress. In this way it may be possible to create an interest in the field operations which, after all, are the vital factors in the industry, for without efficient field management, not only would the mills lack their raw materials, but it is surely in the fields that any profit or loss in the whole business of sugar manufacture has its origin.

Thanks must be recorded to Mr. C. D. Sherrard for the use made of his paper of 1949, which has up to now been extensively used and it is a certainty that many planters have sought advice from its pages in the last five years.

Experiment Station,
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Mr. Dymond said that he could not recall a previous Congress at which the standard of papers presented was as high as during the present Congress. Papers on engineering, chemical and other subjects had been excellent and the standard of agricultural papers presented on the agricultural subjects had come equally up to the standard set by the other

papers. He said that discussion on all four papers would take place simultaneously so that those present could ask questions covering all the papers presented at the agricultural session.

Mr. Dymond, of Doornkop, said that Mr. Pearson had not mentioned what should be done with the last crop as far as trash was concerned. He asked whether Mr. Pearson recommended burning the trash.

Mr. Pearson said that as far as was known at present the idea was to plough in the trash and get some cover onto the ground as quickly as possible. He referred to the new method of planting by parting trash over the cane, rotavating, moving the trash and then rotavating in the inter-row and planting there. Another treatment they had tried was to remove the trash, plough out the cane and replace the trash. That trash had now been ploughed in and he expected to find a complete nitrogen starvation.

Mr. Farquharson said both Mr. Jex and Mr. Pearson had mentioned rotary hoes. He had heard that these machines broke down the soil structure by pulverising it and thereby destroyed its fertility. Was this correct?

Mr. Jex said the rotavator was possibly one of the most potentially dangerous instruments put into farmers' hands. It was also one of the most potentially useful. It depended entirely on the way it was used. It did have a definite use in that it shortened the time within which fields could be replanted. Much had still to be done by way of experiment on this subject. The rotavator if used in conjunction with chisels or sub-soilers for creating a seed bed in the top 5—6 in. of the soil was a remarkably useful instrument. If correctly used in the preparation of cane lands a rotavator could not harm the soil. Rotary hoes were considered dangerous for continuous cultivation. Where cane was kept under trash for 8 to 10 years experience suggested that the soil character changed and the texture became more friable. Organic matter accumulated so that when the cane was ploughed out you had a friable soil and not the hard pan which you might get under different conditions. But where soil developed a hard pan through bad agriculture, it was unwise to rely on a rotary hoe to restore tilth—it could, temporarily, but this tilth was misleading if proper agriculture was not adopted. In his view, however, it could, and probably would, replace the plough.

Mr. de Lisle mentioned the lapse of time between the ploughing in of the green crop and replanting of cane. During this period the land was exposed to the elements; his practice was to use velvet beans for a green crop, then rotovate the beans roughly when they were in pod and let them lie. The beans

grew again and gave cover until planting time, when they were ploughed in.

Mr. Pearson said he was grateful for this information as they were still looking for means for keeping the ground under cover the whole time.

Mr. Palairt said he felt the point made by Mr. Jex required elaboration. If organic matter were mixed in by the rotovator there was an improvement in the structure of the soil, which more than overcame the harm done by the use of a rotovator on hard soil. He referred to Mr. Pearson's reference to small irrigation schemes and the use of irrigation in winter. His experience was that with a small irrigation scheme he had water just when he wanted it, and with proper management there need not be any need for water in winter. He thought those planters who had no water during winter should not be deterred from adopting a small irrigation scheme.

Mr. Garland said that if Natal Estates did not have water for irrigating some of its lands the cane would die. The principal advantage of the water was, in his view, during the winter months.

Mr. Pearson said that experiments in irrigating were still somewhat in their infancy. At Chaka's Kraal, however, they had applied 20 in. more than average rainfall during winter months and had got a crop of up to 50 tons per acre in 13 months. Water during winter often added to increased tonnage and was more beneficial than water applied in summer.

Dr. Dodds said it was most heartening to see that three of the papers presented were written by growers. This was another excellent indication of the co-operation given by the farming community which was further attested to by the large attendance. He referred to the help that had always been given to the Experiment Station by Natal Estates.

Mr. Barnes said that the subjects raised were of deep interest, especially when compared with practices in other countries. The presence of drains in the fields did not prevent the use of machines. Mechanical cultivation was practised with the cambered bed system of the West Indies. Tractor haulage of cane was used, the trailers being loaded in the field. Temporary bridges, readily moved from place to place, and the filling of drains by trash at certain points, enabled tractors and carts to move in and out. In Louisiana the bed and furrow method was no deterrent to mechanical reaping and haulage. It should not be assumed that mechanical haulage was impossible where open drains existed. Tile drains were excellent. They should be laid in accordance with a definite plan, and their positions must be accurately known.

Mr. Barnes expressed the view that reaping should to some extent be considered as a cultural

operation when a ratoon crop was to follow. With trash blanketing there was a possibility that the cane might be cut too high instead of at or just under the ground surface. If stubble was left it might be necessary to use stubble shavers to ensure a good ratoon crop, as was the case in Tanganyika and elsewhere.

Mr. Starling asked whether Mr. Pearson could explain Mr. Wise's reference to applications of less than 20 tons per acre of compost having a depressing effect.

Mr. Pearson referred to the work of Russell who had used radioactive carbon with compost and had followed this through with geiger counters. It was found that the bacteria population grown on the farmyard manure of 5 to 10 tons per acre very quickly absorbed the manure applied and were left in a starving state, so returning to the nitrogen originally in the soil. The net effect was to deplete the soil of its inherent nitrogen content. The conclusion drawn was that small quantities of compost left the soil in a worse state than previously.

Mr. Adams said that in his knowledge many planters used less than 20 tons of filter cake per acre. Was it really proved that to put 10 tons of filter cake per acre was a definite waste? He asked whether excessive application of filter cake might damage the crop.

Mr. Pearson said that the proportion of water to solid in filter cake was less than in manure. The amount of organic matter going in was lower than for farmyard manure. At Chaka's Kraal huge quantities of filter cake had been piled on the soil before the Experiment Station took over. They could, therefore, get no phosphate reaction, but there was also no evidence to show that excess application of filter cake had any bad effect on the soil.

Dr. Dodds said that as far as he knew where carbonation filter cake was used in large quantity it was liable to have some slight deleterious effect on the soil possibly because the minor elements had been completely precipitated by the excess of lime. The optimum figures that he knew of were 8 tons of dried material and between 16 to 20 tons of wet material per acre. This applied chiefly to the sulphitation filter cake.

Mr. Jex said that he would not like to accept Mr. Wise's statement without further knowledge, as otherwise it might do great harm. He felt that anything added to the soil must benefit it and the more that could be put in the sooner would an adequate state of fertility be reached. In his experience, where he had applied less than 10 tons per acre of filter cake the result was possibly small, but it was nonetheless there. Twenty tons per acre undoubtedly was more advantageous, but he

felt they could not discount the effect of applying very much smaller tonnages continuously throughout the year.

Mr. Garland said he had had years of experience with filter cake and he could see no harm in applying 20 tons and more per acre. There was a tendency to burning in dry conditions, but in good conditions this application resulted in wonderful crops.

Mr. Patrick Murray said that all bagasse was burned in boilers. The bagasse came from the fields. Had any experiment been conducted in the returning of bagasse to the fields?

Mr. Steward referred to Mr. Wise's paper and the suggestion that planting could be done in unusual months. At Kearsney a very big expansion programme was initiated and from 1948 onwards, for over three years, they had planted in every month throughout every year. There was no effect on the final crop. Although cane planted in winter did not germinate as well or as quickly as cane planted in spring, when all the canes were a year old there was no material difference in the stand. This suggested a solution to the question of what to do with lands between March and August. He said they should be planted; provided the soil was sufficiently moist he felt that planting at any time was quite safe. Planting machines undoubtedly helped in this respect.

As a result of experience they used D mixtures at planting. They did not know exactly why, but it undoubtedly gave the best results. He suggested that planters should consider mixing their own fertiliser as he felt this would, in the end, be cheaper. He believed very strongly in the use of green manuring; his company always used sunnhemp; or velvet bean on long-fallow lands and beneficial results had been proved.

Mr. Dymond, replying to Mr. Murray, said that bagasse had not been used in the field for obvious reasons. He referred to Dr. Rapson's reference to bagasse used in paper making. This was far more valuable than it would be if the bagasse were returned to the field. Several references had been made to filter cake, but little had been done either to enrich filter cake or to dewax it. Professor Owen had shown that dewaxed filter cake had a very much more beneficial result on fields. It had been said that if filter cake were applied to the soils in great quantities over a period of years the wax might have a deleterious effect on the soils.

Mr. Pearson said he was grateful for Mr. Steward's remarks on mixtures. He, too, had observed that planting with D or F mixtures appeared to give better results than planting with straight supers. Tests were being carried out to try to find out why this was so. He felt that nitrogen applied in small quantities in the furrow was beneficial to the young

cane, but this still had to be proved. He criticised the combination of N. P. and K. in the mixtures put out by the Government in relation to the Sugar Industry and expressed the view that they were not adequate for sugar cane agriculture. Trials showed there had been great difficulty in getting response to phosphate in top dressing, and he felt that the amount of phosphate in mixtures was too high and farmers had to pay for the phosphate to get the nitrogen onto their crops.

Mr. Jex referred to the question of ploughing in the final trash. The basis of the question was the possible effect on the soil. Practice seemed to bear out that trash on top of the soil was advantageous. The demand for nitrogen was at the bottom of the trash layer. By ploughing in the trash the soil was virtually made to eat the whole substance of trash and nitrogen and the soil might be said to suffer from indigestion. A great deal more research had to be done to determine how the trash should be dealt with. Nowhere in nature would they find any such device as a plough to turn the organic matter into the soil. He felt that if there were any doubt then nature should be followed. Where he had disregarded nature and ploughed trash into the ground in the absence of nitrogen, he had actually immobilised his ground for long periods at a time. If trash were accumulated over one crop for 8 to 10 years you would have on the soil a layer of humus. The organic content of the soil would have been improved to a marked extent, and thereafter it would be possible to concentrate on the mechanical aspect of providing a good seed bed. The final trash could either be carried off or burned off, but carrying or bulldozing it off were not found satisfactory, because soil was compacted by treading, and experiments carried out so far indicated that burning off the final trash might be the best method provided the under layer was damp when burned off. He asked that this should not be confused with burning of cane every year. In this case the trash was burnt only once in 10 or so years, and immediately afterwards the work of preparing a seed bed was begun. There was no chance then for a hard surface to be formed. It was possible that burning the final trash might be advisable, but far more experimentation had to be done.

Mr. Almond said an experiment on the lines outlined by Mr. Jex had been put down and was being carried out. They would be able to compare such points as turning in the last crop of trash, carting it away and burning off the last crop of trash.

Mr. Jex asked what the nitrogen treatment of the field was.

Mr. Almond agreed with Mr. Jex that a great increase in yield per acre was possible, but thought progress should be more rapid. Planters should

be more alive to the value of the Experiment Station and more willing to accept their advice which was based on results of field trials. An example of delayed progress was the case of trash blanketing which has only recently been accepted as a sound agricultural practice but was first suggested by the Experiment Station in 1935.

Mr. de Villiers asked Mr. Garland how many tons of filter cake were usually applied per acre.

Mr. Garland replied that approximately 20 tons per acre were applied every time the fields were ploughed out.

Mr. de Villiers pointed out the very high content of calcium carbonate of carbonation cakes and asked if deficiencies in minor elements had not been observed on Natal Estates, with particular reference to iron and manganese.

Mr. Rault replied that he did not think this subject had been investigated in Natal.

Mr. de Villiers said that a case of iron deficiency on cane had been found at Triangle owing to too much calcium carbonate in the subsoil under shallow soil.

Mr. Palaret said that Mr. Jex had substantially justified a practice he was working. He used trash blanketing on all ratoons, but where a field was to be ploughed out he carted the cane whole to the siding where he topped and trashed it and made compost. This fulfilled most economically the two points made by Mr. Jex; the trash was removed with no tamping of the soil.

Mr. Dymond said that the question raised by Mr. de Villiers was of the utmost importance. He felt the effect of the continuous application of calcium carbonate should be investigated by the Experiment Station.

Mr. Garland said he was very surprised to hear Mr. Jex suggesting that the last crop of trash should be burned. He was against this practice. He added that he was also in favour of green manuring. He felt there was no need for D mixtures if green manuring was followed. He went on to say that Mr. Steward had raised an important point. Natal Estates was, he thought, the first company to follow the principle of winter planting. One third of the area was now done in March and in April. He did not agree that planting should be done throughout the year. January and February and March and June were, in his view, very bad months for planting.

Mr. Steward said he did not advocate planting all the year round as a general practice; he just wanted to point out that if, for various reasons, planting was necessary it could be carried out at any time, provided there was sufficient moisture in the soil.

Mr. Jex said he had been taken to task by Mr. Garland for speaking a little heresy, but sometimes he liked heresy. He took his cue from nature in which fires were not unknown; it might not be a bad thing to have an occasional fire. A fire every year was of course a bad thing and he could never advocate it. But after 8 to 10 years of covering the soil, he was still not convinced that a final burning might not be advantageous. He questioned whether a green manure crop would be necessary after continued trash blanketing. It would certainly be better to grow a green crop when soil conditions were not right, but where the soil was built up and in good condition it might be as good, and more economical, to grow another crop of cane rather than put in green manure crops—and to get the nitrogen out of a bag!

Mr. Pearson thanked those who had taken part in the discussion, particularly from the planters' point of view. It had been most advantageous to the Experiment Station staff. He was also extremely grateful to the three gentlemen who had contributed papers for the discussion. It was not always possible to set out in writing what could be said in discussion. He felt that the interchange of opinion between the Experiment Station staff and the farmers themselves was a very good thing.

Mr. Dymond expressed the meeting's thanks to the Experiment Station staff for making the Station available and providing the entertainment. He thanked all those who were present and who had contributed their part to the discussion, which he felt was of an extremely high standard. Mr.

Dymond said that shortly eleven members of the Industry would be going overseas to the International Congress in the British West Indies. He hoped that when they came back it might be possible to have one or two days either in Durban or at the Experiment Station in which these delegates could pass on their impressions and their opinions gathered at the Congress.

He referred also to the fact that it was hoped that up to six world experts would be invited to South Africa to meet growers and millers and exchange information. This followed on the Association's decision to invite Mr. de Sornay from Mauritius in the previous year and the system of inviting guest speakers to the meetings of Council. Out of these talks had come such valuable papers as those presented by Mr. Jex and Mr. Hogarth. The Association was aiming at improving continually the standard of papers and the level of information disseminated throughout the Industry. He felt that the Congress had been in every way an outstanding success.

Mr. Rault commented on the remarkably friendly spirit of co-operation between millers and planters. He felt that the Technologists' Association had a great deal to do with this. Mr. Dymond in particular was very alive to the need for this co-operation and had done a very great deal to foster it. He, Mr. Dymond, had conducted the meetings during the past four days with the utmost efficiency and good humour and he asked that a most hearty vote of thanks be accorded to Mr. Dymond.