SUGARCANE AGRICULTURE FOR BEGINNERS

By C. D. SHERRARD.

During the last two to three years, due to lifting of cane quotas and increased demand for sugar, there are many who have bought farms in the sugar belt with the intention of growing cane if their conditions are in any way suited to this crop. It is from these intending growers that so many inquiries are received at the Experiment Station about the elements of cane farming.

In this paper it is hoped to give a brief outline of the routine agricultural practices on the sugarcane farm, which may be of help to the beginner.

Preparation of Field.

Old ratoon fields are usually ploughed-out soon after cutting in May, June or July, given one or two disc harrowings, and then left until time to sow the green manure cover crop some time between September and December.

When under a blanket of trash the ploughing-out of old cane roots is not easy and it is almost impossible to effect a really good first ploughing. However, using a disc plough and keeping the disc sharp, even though all the trash is not buried it is possible to turn up sufficient soil, which after several discings will give a seed bed good enough for the sunn hemp or velvet beans. Once under the cover of a green manure crop the trash soon rots down, and when it is time to plough in the cover crop most of the trash will have disappeared, making the second ploughing much easier.

When breaking virgin land under natural grass, sward and bush, it would be advisable to let this land lie for twelve months after ploughing, so that the old grass will have time to rot down.

The practice of short fallowing—that is, ploughing-out old ratoons and replanting the land the same year, is not recommended, there being no time for the old roots and trash to rot down and it is impossible to work the land into a good tilth for replanting in the time available.

Green Manuring.

A twelve-months' fallow with a green manure cover crop should be the aim of all planters. The cover crop, either sunn hemp or velvet beans, should be planted from the beginning of December up till mid-January to obtain the maximum yield of green manure. Planted earlier than December, sunn hemp tends to flower before it is fully grown, resulting in a poor growth; and after January a poor crop may result.

Sunn hemp can be broadcast by hand at the rate of 50/60 lbs. per acre, and velvet beans if broadcast at about 80 lbs. per acre. These can also be sown in lines about 3 feet apart, placing the seed 1 foot to 18 inches apart in the line, and then interline cultivation will control weed growth, which should result in a better green manure crop and a cleaner field at cane planting time. This method would save bean seed, only about 30/40 lbs. per acre being necessary. Both these crops can be ploughed-in when in full flower about four months after planting. Some find difficulty in ploughing-in velvet beans, and use a heavy disc harrow over the cover which chops up the bean haulm and makes the turning-in easier.

After ploughing-in of the green manure cover crop the field can be given a disc harrowing and then left bare through the winter months, and following the first rains in August or September another harrowing and, if necessary, another ploughing can be done. By this time the field should be in a good tilth for planting.

No very definite figures are yet available showing actual increase in tons of cane per acre due to fallowing and green manuring, and some may argue that the loss of twelve months while the land is out of cane will never be made up in extra cane yield. This may or may not be true, and experiments now being carried out should give definite figures in three or four years hence. However, there is much evidence coming from those planters and estates who have been adopting the long-fallow system, that an all-round improvement in yield from their fields has resulted.

Those who consider that the twelve months fallow system reduces their tonnage might in many cases be able to cut the crop following the long fallow at one year old. In this way the loss in tonnage, if any, would be reduced by half.

Immediate benefits from the long fallow are, then :—

(1) Twelve months in which to rid the field of old cane stools and to allow all trash to decompose.

(2) The ploughing-in of a green manure legume adds organic matter and improves texture of the soil. This is particularly noticeable when preparing a field for planting which has been long-fallowed. A good tilth will be obtained and furrowing-out becomes easier, a point which is important when using planting and covering machines.

(3) Legumes have the power of fixing atmospheric nitrogen and storing it in the root nodules, which is returned to the soil on ploughing-in and should supply at least sufficient nitrogen for the following plant cane crop.

(4) The application of a mixture of rock phosphate and superphosphate, broadcast before sowing the green manure, has been advocated, so that the maximum yield of green material is obtained, and at the same time the phosphate taken up in this way will be returned to the soil in an organic form when the crop is ploughed in.

Note.—A good crop of sunn hemp or velvet beans should yield about 10 tons or more of green material per acre.

In a chapter on manuring of sugarcane, Dodds[1] states: "Rock phosphate or a mixture of rock and superphosphate may be applied with advantage to the green manure plant, up to 600 lbs. per morgen, thus lessening the requirements of the following cane crop."

Time of Planting.

Planting usually starts after the first rains in late August or September and continues on to the end of December. Planting on into January and February is not recommended, as fields planted in these months appear to "hang fire" and not stool out. Some contend that cane planted in March and April will germinate well and stand through the winter months and be ready to cut as a 16- or 18-months-old crop. There is little to recommend "out of season" planting, however, and except for a few isolated areas it would seem best to aim at planting early, even before the first rains, provided setts are treated with a suitable fungicide, but not later than the end of December.

Preparation of Land.

It is very important to have the fields for planting well prepared and in a good tilth. This facilitates furrowing-out and covering, it being an advantage to pack the soil firmly round the setts to exclude air spaces and the danger of the sett drying out. A good tilth then greatly enhances the chances of good germination and is particularly necessary to assure success with mechanical covering or planting machines. The absence of "clods" in the field after ploughing also makes weeding of plant cane a much easier job, particularly so now that light cultivators are being used actually in the cane lines, and light harrows over the whole field.

Furrowing-out.

Lines are usually spaced 4 feet 6 inches apart, but in the higher altitude areas where growth is not so vigorous 4-foot spacing is a common practice. On the other hand, on the fertile hillsides and alluvial river flats, where cane stools vigorously, 5-foot spacing is often used. Canes of upright habit are often planted more closely than those of spreading habit.

Furrows are drawn out with a cane ridger, either animal or tractor-drawn, to a depth of 9 or 10 inches. That is, the cane sett placed in the bottom of the furrow will be about 9 inches from normal soil surface. From the top of the ridge thrown up to the bottom of the furrow however, will be about double this distance, which tends to give the impression of greater depth. Tractor-drawn ridgers will furrow-out deeper and can be adjusted to various depths, and the planting machines in use to-day tend towards rather shallower planting than has been the custom in the past.

Machine planting is becoming increasingly popular and is a great saving in labour and has the advantage of placing the sett in moist soil and covering it immediately. The use of the "Don" type with the straight narrow mouldboards, which plants to a depth of about 8 inches, leaving the planted field almost level, is a "break away" from the orthodox planting method. Experiments are now being conducted to ascertain whether cane planted in this way will yield and ratoon as well as when planted by the old method.

Whatever the depth of furrow is, the sett should only have a light covering of about 2 inches of soil or less, which should be well packed down. Hence most covering and planting machines are fitted with rollers, and when covering by hand natives should be taught to walk forward rather than backwards and so tread the soil as it is hoed over the cane sett. Some soils tend to pack of their own accord and need no further consolidating after planting.

The general opinion throughout the sugar belt is that deep planting is essential to ensure that plant cane will not suffer from drought and that the ratoons will come away well. The depth of planting is, however, really limited by the thickness of the top soil, so on shallow, shaley soils it would be unwise to plant so deep that the cane would be rooting into the subsoil. Again, on badly drained, low-lying situations where there is a danger of water-logging, care should be taken not to place the sett so deep that germination might be retarded. On the other hand, the coastal sandy soils are often furrowed out to a depth of 12 inches or more, to prevent drying out before the cane sett is established. No hard and fast rule, then, can be lald down as to planting depth, and this must be left to the discretion of the planter to suit his own conditions.

Choice of Seed Cane.

The ideal seed cane is thought to be plant cane of about one year old, well grown and having had no checks. This should give setts with even joints and well developed, succulent buds. The top two feet or so of two-year-old cane is also sometimes used, and there is no evidence to show that this material is inferior to plant cane. The selection of seed cane is important, because poor material may germinate

badly, resulting in gappy stands; and from a point of view of reducing the spread of mosaic and smut, healthy cane only should be picked for planting.

Rate of Seeding.

Seed cane is cut into lengths of from 15 to 18 inches, giving a three- or four-budded sett. The usual rate of seeding is about a stick and a half. That is, each sett is placed in the bottom of the furrow and is overlapped by half the length of the next sett. At a line spacing of 4½ feet, this planting method will require about 2 to 2½ tons of seed cane per acre. Under poor conditions some prefer double-stick planting, but this is rather a waste of seed cane. Single continuous stick planting is sufficient when the land has been well prepared and planting is done after rain.

Sett Treatment.

Dipping the ends of the setts in a suitable fungicide preserves the sett when planting under very dry conditions. Aretan is generally used, at the rate of one ounce per gallon of water; or a useful measure in the field is a match-box full per gallon of water. Removing the trash from the setts before planting reduces the quantity of fungicidal dip required, but is a laborious process with cut cane and can be done much quicker in standing seed cane. So it is better to strip seed cane and then convey to the field for planting. Trashed setts will probably germinate quicker than those with trash left on; on the other hand, where trash is left on there is less danger of the sett drying out, and there is some evidence to show that these setts will eventually send up more shoots than stripped setts. If a fungicide is not used when planting by hand, then the quickest way is to place whole sticks in the furrow with the trash on, and cut up into setts as they lie in the furrow.

Manuring of Plant Cane.

The results from a number of experiments over a period of many years shows that a dressing of from 600 to 800 lbs. of superphosphate per acre in the furrow at planting time can be considered a sound practice. Responses to this dressing will vary according to the soil type and locality, and, of course, according to the previous treatment of the land in question. This dressing is usually applied by hand along the bottom of the furrow. When using a fertilizer machine or planting machine with fertilizer attachment it is drilled in a band immediately below the sett, or in two bands on either side of the sett.

If straight superphosphate is unobtainable, then a mixture of all three fertilizers, nitrogen, phosphate and perhaps potash is used; but this practice is not recommended, firstly because of the high price of mixtures compared with straight fertilizer, and secondly because the nitrogen and potash in the mixture is far better applied as a top-dressing after the cane is established. Should a mixture be used in the furrow at planting time, then one with a *high* phosphate and *low* nitrogen content should be chosen.

If only a limited quantity of superphosphate is available, then a 50/50 rock phosphate and superphosphate mixture might be used. Other manures like kraal manure, Karroo manure and filter cake are also valuable, either in the furrow or broadcast and ploughed-in before planting. Quantities per acre are really limited by the amounts of these manures available and cost of cartage, etc., but as much as 12 tons of filter cake per acre in the furrow have been tried here without harm to sett germination, and growers report from the Eshowe area that this quantity of Karroo manure has been applied with success at planting time. Only on the alluvial river flats of Umfolozi and Umhlatuzi can one entirely dispense with fertilizer at planting time.

Weeding Plant Cane.

It should be the aim of all planters to do as little hand weeding as possible, as this is a slow and expensive job requiring large gangs of labour, but rather to keep weeds in check with light cultivators and harrows, etc. It is essential to tackle the fields at an early stage before the weeds are too big to be destroyed in this way, and before they can affect the young cane plants.

There are two methods of keeping plant cane fields clean with mechanical weeding.

(1) By using a very light, straight-tined cultivator or spring-tined cultivator along the cane lines before and as the cane is coming through. If the implement is a light one, then very few setts will be disturbed and all small germinating weeds will be killed. This operation must be done when the weeds are just germinating and at frequent intervals, so that weeds are never allowed to become established. The interline can be cultivated with the ordinary cane scarifier after the cane is through and well established.

Cultivations along the line can continue until the cane is at least 6 inches high, and little or no damage is done to the cane shoots, particularly on a hot day, when the shoots bend under the cultivator without breaking off. Less shoots are broken off if the cultivators travel along each line in the one direction, not returning in the opposite way as this tends to break the shoots.

(2) By using a light drag harrow or chain harrow. The drag harrow for this purpose should not weigh more than about 30 lbs. per section and should be in three sections, not joined together, only hitched to the drawbar. In this way the harrow can be drawn along in the same direction as the run of the furrows.

Harrowing should start a week or ten days after planting, or as soon as any weeds appear, and should continue until the cane shoots are at least 6 or 8 inches

high. Very few shoots will be broken off if this is done in the direction of the furrows, and the harrow sections are not joined together. This must be repeated at frequent intervals, never allowing weeds to become established. Quite an appreciable amount of filling-in of furrows will occur, which will delay the appearance of cane shoots, but apart from this the method described is a very rapid way of control.

There are many in the indusrry to-day who are against this way of weed control, as they say the filling-in of furrows or deep covering which occurs when harrowing before the cane is through is a serious setback. However, plant cane fields have been treated on the Experiment Station in this way for the past three seasons, and very good stands of cane have resulted requiring only one or two light hand-weedings in the line from time of planting until a good canopy is formed.

This method of harrowing would not be a wise practice for those who favour very deep planting, because too much filling-in would occur and the cane might fail to come through this deep covering. This again might be the case in the high altitude areas where growth is much slower, and everything should be done to encourage rapid germination.

In an article to the "Sugar Journal," Jex[2] says: "We have in the past grown accustomed to seeing a weed before we decide to dig it out, but it is absolutely important with mechanical weeding to kill the weed just before, or within a day or two after it germinates."

The chain harrow is a help in keeping down many of the weeds germinating in the interline, but it is necessary to use a suitable cultivator along the cane line as well. The chain harrow is much lighter than the drag harrow and for this reason is not quite so effective. Many planters favour it, however, in preference to the heavier harrow.

Scarifying to keep down weeds should continue between the lines of plant cane until the cane has closed in sufficiently to check weed growth of its own accord. From then onwards very little weeding is necessary under good growing conditions.

In the cooler high altitude areas weeds are a much greater problem as the cane grows slower, taking longer to cover in than at the coast, and weeding operations must continue to a later stage.

Weeds, if allowed to become established, can seriously setback a field of plant cane or ratoons, and planters should try and prevent weeds at any time getting so big that they compete with the cane for soil moisture and plant-foods, and particularly in the early stages of cane growth.

Top-dressing Plant Cane.

It is considered unnecessary to apply top-dressings of nitrogen to plant cane on fields which have been under a green manure legume like sunn hemp.

To fields of plant cane which have not had this treatment a dressing of inorganic nitrogen in the form of sulphate of ammonia or nitrate of soda, when the cane is about 18 inches high, is a recognised practice. At present these fertilizers are almost unobtainable or only on the market in very limited quantities at a high price, so that quantities per acre are limited by these factors.

In pre-war days the practice was to apply sulphate of ammonia 21 per cent. N at 400 lbs. per acre, or nitrate of soda 16 per cent. N at 500 lbs. per acre.

These inorganic fertilizers can be sprinkled along the side of the cane row or just broadcast along the interline, and need not be worked into the soil as they are soluble and soon wash in with the first rains. Ammonium nitrate 35 per cent. N is also a useful fertilizer for top-dressing and occasionally appears on the market.

If no form of straight nitrogen is available, then plant cane might be top-dressed with mixture "G" or mixture "H" as these are high in nitrogen content. Mixture "H" contains 8 per cent. N and 10 per cent. phosphate as P_2O_5 and "G" contains 6 per cent. N, 10 per cent. P_2O_5 and 3 per cent. potash as K_2O.

Although it is wasteful to apply so much phosphate in the mixture as a top-dressing, in all probability it is not entirely lost but will eventually be worked into the soil and be of use to the next crop. A dressing of 500 lbs. to the acre of mixture "H" costing £3 16s. 0d. would supply the same amount of nitrogen as would 200 lbs. per acre of sulphate of ammonia costing about £2 10s. 0d. Obviously straight nitrogen should be used when obtainable.

Fertilizers should be bought taking into consideration the price of the unit of the fertilizing ingredient for which they are required. This can easily be arrived at in the case of straight fertilizer by dividing the price per ton by the percentage of either N, P_2O_5 or K_2O.

For example, given the choice of nitrate of soda 16 per cent. N at £21 per ton and ammonium nitrate 35 per cent. N at £35 per ton, the planter would be wise to choose the ammonium nitrate, as taken on their unit values nitrate of soda works out at 26s. and ammonium nitrate 20s. per unit. As well as being cheaper, this is a more concentrated form and less would be necessary and railage costs lower.

The unit value of mixed fertilizers can be calculated in the same way, but account must be taken of all three fertilizing ingredients, nitrogen, phosphate and potash, if the mixture is stated to contain these.

Other manure which might be used to supply nitrogen to plant cane is Karroo manure, containing 1 to 2 per cent. N, or hoof and norn mixture about 3 per cent. N, or any other organic form of nitrogen

which is available. Although these organic forms are slower acting than the inorganic and much larger quantities must be applied to supply the equivalent amount of N, good results are being obtained in some areas. In the Eshowe district planters report big increases in yields from 5 tons of Karroo manure per acre applied as a top-dressing. It would seem that in these high altitude areas the organic form of nitrogen may give better results than the inorganic sulphate of ammonia or nitrate of soda, though no definite figures are yet available to show this is the case.

Cutting.

Cutting usually starts late in May or early June and continues on until the end of December or early January. Sucroses are low at the beginning and at the end of the season and reach a peak during the month of September.

Ratoon fields and fields due to be ploughed-out are usually cut first, and plant cane fields left till later in the season, requiring a longer period to ripen up.

The variety Co.331 tends to be a late ripener and wherever possible should be cut later than the other varieties, or low sucrose will result.

Burning v. Trashing.

Although the practice of burning cane before cutting appears to be dying out to quite an extent, there are many who still adhere to this practice on the grounds that it is labour-saving, and burnt fields, they say, ratoon better than do trashed fields.

When considering the labour question, it should be remembered that even though burnt cane can be cut considerably quicker than unburnt, the succeeding ratoons under a blanket of trash require far less weeding than do the burnt fields, and no cultivation. Also the appearance of ratooning burnt fields can be misleading, as invariably these come away quickly with vigorous stooling, but this lead over trashed fields is not maintained and final yield will show a fall off on burnt areas which tends to become accentuated on ratoon crops.

In connection with this question, it might be interesting to give some yield figures for a trashing versus burning experiment at this station which went to third ratoon. It was planted in 1939 and was eventually ploughed-out in 1947.

	Tons cane per acre.	Sucrose per cent. cane.	Tons sucrose per acre.
Plant cane crop, 1941—			
Burnt	39.78	15.58	6.20
Trashed	42.18	15.18	6.40
First ratoon crop, 1943—			
Burnt	52.83	12.28	6.49
Trashed	61.13	12.47	7.62
Second ratoon crop, 1945—			
Burnt	40.26	13.69	5.51
Trashed	49.16	13.63	6.70
Third ratoon crop, 1947—			
Burnt	28.10	13.92	3.91
Trashed	41.42	13.83	5.74

These differences proved to be statistically significant.

It must be noted here that in the plant cane crop, before any burning or trashing had taken place, there was a difference of 2.40 tons of cane in favour of the trashed plots. Also the burnt plots had all remnants which were left after the burn removed and put into division lines, and it was noticed that these lines always grew more vigorously than the lines of the actual plot harvested. Taking these two points into account, however, there is still a very big fall off in yield from plant cane to third ratoon on the burnt areas, which was not the case with the trashed areas. Another interesting point which came to light in this experiment was the increased benefit from fertilizer on the trashed plots over the burnt in the third ratoon crop.

No fertilizer.	Tons cane.	Complete fertilizer.	Tons cane.
Burnt	27.54	Burnt	28.58
Trashed	38.38	Trashed...	43.62

This experiment is being continued over another crop cycle with exactly the same treatments occupying the same areas, so that the cumulative effects of trashing and burning can be studied. After ploughing-out the old crop in 1947 the field was put under velvet beans, which were eventually ploughed under and the plots were replanted in October, 1948. Further yield figures will be obtained in 1950.

Cutting Age.

Most of the hillside cane is cut when 20 to 24 months old, and cane should not be left over into the third year's growth. On alluvial river flats where growth is rapid much of the cane is cut when 12 to 18 months old, and this is also becoming a common practice on many hillside farms too.

The variety Co.301 is particularly suitable for 12- or 15-month-old cutting on the more fertile soil types, as this variety when left over to the second year often "lodges" and becomes a tangled mass very difficult to cut and load at harvesting time.

The sucrose of one-year-old cane at the peak of the season is generally as high as two-year-old, but very early and very late in the season will probably be lower. If possible, then, year-old cane should be cut in September and October.

The advantages of year-old cane is that it has not lodged and is straight and so is easy to cut and load, giving good weights on trucks, etc. This is quite an important point these days, when native labour is scarce. Some may argue, however, that there is double handling required cutting every year, when the cane could be taken off with one handling every second year. This is the case, though by cutting every year there is undoubtedly a gain in tonnage per acre, which somewhat compensates for extra handling required.

Loading.

Loading is a laborious and tiring job, far more so than cutting, and for this reason efforts are being made to develop mechanical means of handling and loading cane after it has been cut. The South African Sugar Association Mechanisation Committee are experimenting with several different types of machines which are giving very promising results, and should any of these types prove really successful, then a great deal of labour troubles at harvesting time will have been overcome.

When loading by hand in the field it is considered that a carry of about 70 yards is the maximum, and if cane has to be carried further than this the labour soon tires.

Many forms of transport are used in this industry, the large estates using mostly tramline trucks varying from two to as much as 10-ton capacity. Other means of transport are ox wagons, lorries, or tractors and trailers, the latter method becoming more popular in recent years.

Cane is generally loaded across the body of the vehicle if it is going to a railway siding for re-loading on to S.A.R. trucks; but if going direct to the factory then it is loaded lengthwise with the body of the vehicle and is lifted off by crane on arrival at the factory.

Treatment of Ratoons.

On burnt fields, cultivation will have to start soon after cutting. The interlines are usually pony ploughed and then scarified at intervals to keep down weeds. The "Uba" type of cultivator is used throughout this industry, drawn by one mule, but since efforts are being made to mechanise and speed up all operations many cultivator attachments for tractors are now procurable and do the job of weeding ratoon and plant cane much more rapidly.

On trashed fields, the trash is either moved into alternate interlines and the cleared lines ploughed and scarified, or the trash is left untouched in a blanket. In either case there is far less cultivation and weeding required than on the burnt fields.

The practice of leaving the trash as a blanket is one which is becoming more popular in the industry and there are many points in favour of it.

1. There is no cultivation required and very little hand weeding.
2. As a general rule the lining of trash into alternate inter-rows gives no increase in yield over the trash blanket method, and there is quite a lot of labour involved in moving the trash and cultivating the cleared row.
3. Having the soil covered with trash appears to conserve moisture and maintain a moist, crumbly tilth from which ratooning cane derives particular benefit in periods of drought.

In some parts of the industry there are those who believe in moving the trash twice and cultivating each interline, but there is little to recommend this practice as it has been found on other crops the only benefit from cultivation is the destruction of weeds. Further, it would seem impossible by mechanical means to produce a better tilth than that which exists immediately under a trash blanket.

However, there are many localities where it may be unwise to leave a trash blanket, such as low-lying spots which tend to become water-logged, being badly drained, and in some of the colder high altitude areas where ratooning is normally slow. Under these circumstances the trash could be lifted into alternate rows or just relieved over the line of cane to allow the shoots to come through easily.

It is almost as important to keep weeds in check in ratoon fields as it is in plant cane, and where the trash has been burnt or lined cultivations between the lines should continue until a good canopy has been formed which prevents further weed growth. Where a trash blanket is left, weedings where necessary must be done by hand, but few weeds should come through provided there is a thick blanket. Where crops of 20 tons per acre and less are customary it is doubtful whether there will be sufficient trash to prevent weed growth, and under these circumstances it would be wise to line the trash and scarify the interline.

Top-dressing Ratoons.

In a number of experiments conducted over a wide range of soil types, it has been impossible to establish a definite benefit from phosphatic top-dressings to ratoon crops, whether applied in a deep furrow along the interline or broadcast on the surface of the soil and worked in. The practice of applying superphosphate to ratoons, then, is of doubtful value and there is no object in moving trash so that super can be worked in.

An interesting experiment harvested at this station during the 1945-46 season will help to demonstrate that under normal hillside conditions in periods of deficient rainfall the leaving of a trash blanket is a benefit. Also the ploughing-in of 350 lbs. of superphosphate per acre in the cleared interline gave no increase in yield and was apparently a wasted operation.

	Tons cane.
Trash blanket with 350 lbs. ammonium sulphate broadcast on trash	24.23
Trash lined, 350 lbs. ammonium sulphate, 350 lbs. superphosphate ploughed-in along cleared interline	19.98

This difference proved to be statistically significant.

The rainfall for twelve months growth of this crop was only 24.17 inches, and probably the droughty

conditions rather enhanced the benefit from the trash blanket.

Unfortunately, the results from the two methods of application of sulphate of ammonia cannot be determined here, as there was no control without sulphate of ammonia. However, one would seem justified in assuming that the method of broadcasting on top of the trash was no less effective than that applied in a pony plough furrow.

Nitrogen in the form of ammonium sulphate or nitrate of soda has proved to be definitely beneficial just broadcast on top of the trash or sprinkled along the side of the cane row. Dressings at the same rate as given for plant cane, and applied a month to three months after cutting, preferably during the growing season when rain can be expected, is a sound practice.

Mixtures "G" and "H" may again be used on ratoons as for plant cane, when straight nitrogen is unobtainable.

There are many growers in the industry who find it hard to believe that any fertilizer can be of use to the cane when broadcast on top of trash and not actually put into the soil. It has been proved, however, quite definitely that soluble inorganic fertilizers like ammonium sulphate, nitrate of soda and both forms of potash, i.e. potassium chloride and sulphate, will be readily washed through the trash with light rain and be immediately available to the cane crop.

Choice of Varieties.

Co.301. On all really sandy soils, and particularly the coastal wind-blown sands, Co.301 is undoubtedly the best variety. 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 is being replaced by Co.331. It is doubtful if Co.331 or any other variety will yield quite as well as Co.301 does on the sandy soils.

Co.281. This variety is grown throughout the industry on all soil types and can be counted on to give reasonably good yields under most conditions. It does not thrive on sandy soils and in poorly drained areas. It is proably the only variety in cultivation which will give a fair yield on shallow, shaley soils. It has given the best yields on the red-brown heavy loams and dark loams typical of the soils in the Empangeni area where so much Co.281 is grown. It has also formed a large proportion of the crop on the alluvial river flats of Umfolozi.

This variety has the disadvantage of an upright habit of growth, forming little or no canopy, so should not be chosen for the high altitude areas where weeds are such a problem. It is not quite so easy to cut and load as Co.301, being hard and fibrous. Co.281 is not as popular as it used to be and yields appear to be falling off, and many planters are replacing it with Co.301, Co.331 and N:Co.310. It appears to be the most susceptible of the released varieties to mosaic disease.

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 Gingindhlovu. 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 Co.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 only during the 1948-49 planting season have some failures been reported. It should give the highest yield of sugar per acre of all the released varieties, and there is every indication of it replacing most of the Co.281 now being grown.

There are only a few areas in the sugar belt where it has not thrived, and these include some of the poor

sandy soils in the high altitude areas and on shaley soils. It shows signs of being as good a ratooner as Co.301 or Co.281.

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 can 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 waterlogging.

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.

P.O.J.2725 and 2878. These two varieties are only grown in any quantity on the alluvial river flats of Umfolozi, or under irrigation. They require plenty of heat and water to produce a good crop, and there are few situations other than the flats where they will thrive.

P.O.J. 2725 and P.O.J. 2878 are both high-sucrose canes. 2725 gives the better plant cane crop, but 2878 seems to ratoon slightly better and is straight and usually not lodged, a rather important point on the flats where heavy yields are obtained. With N:Co.310, these two P.O.J. varieties will probably form the greater part of the crop of irrigated and river flat areas.

There are three other released varieties, Uba, P.O.J.2714 and P.O.J.2727, that are practically out of cultivation to-day or only found in isolated spots. The two P.O.J. varieties are not as good yielders as the other two mentioned and are not worth planting now. Uba was put out of cultivation because it was susceptible to streak disease, and it will probably become just as infected if it were again planted on a large scale.

New releases. Three new varieties, the release of which has now been gazetted, are described below.

N:Co.349, 291 and 339 were selected from the same batch of seedlings as was N:Co.310 and have the same parentage. They are not quite so high in sucrose as N:Co.310, and in the many variety trials where they have been tried out with N:Co.310 the latter has out-yielded them in most instances in tons sugar per acre, though seldom to a significant extent. There are, however, several areas in the industry where one or other of these three may find a place, and it is always wise to have a selection of varieties on the farm in case of sudden outbreaks of disease in any one.

N:Co.349. This variety has yielded consistently well on practically all soils found in the sugar belt, and it is difficult to state at this stage in its development that it is any better on one than on another. On the reddish coastal sand in two trials it has equalled Co.301 in plant cane and first ratoons, and on a sandy loam in Eshowe was equal to N:Co.310. At the Experiment Station on a heavy loam it again was as good as N:Co.310 in yield of sugar per acre over two crops, and in all cases it has out-yielded Co.281 by a big margin. Although slightly lower in sucrose per cent. cane than N:Co.310, it makes up for this in a slightly higher yield of cane per acre.

It germinates very well, is a straight cane which does not easily lodge, making it good for cutting and loading. The sticks, like N:Co.310, seem very solid and heavy, and loaders cannot lift such bulky bundles as they do with Co.281. It has one rather big drawback, in that it is a very upright grower, forming no canopy, and in areas where weeds are a big problem planters may find it uneconomical from this point of view. With a habit like this closer line planting may be advisable, and trials are now being carried out to determine the optimum spacing for canes with and without a canopy.

N:Co.349 should be kept in mind as another substitute for Co.301 if it proves to be less susceptible to smut.

N:Co.291. N:Co.291 has yielded well on the sandy loams to clay loams at the coast, but shows some signs of not ratooning well on the coastal sands. It is a fast-growing cane giving a heavy yield of cane per acre, with rather a low sucrose similar to Co.331. With Co.331 on a sandy loam at Entumeni it out-yielded N:Co.310, Co.301 and Co.281, and for this altitude (about 2,000 feet), where growth is normally slow, N:Co.291 may prove a useful variety.

On the more fertile soils at the coast it grows fast and lodges at an early stage, and for this reason should be cut before it is two years old. It has a peculiar way of lodging—instead of all the canes falling in one direction, sticks fall outwards from the centre of the stool and it becomes even more tangled and difficult to harvest than other lodged varieties. Because of this fault and its low sucrose this variety should be tried out with caution, and only an acre or so planted at first, so that planters can see for

themselves whether it will suit their own particular conditions. It has the advantate of being partially self-trashing and even at a year old most of the trash has fallen, a big help at cutting time. It forms a fairly good canopy as young plant cane, and is not as upright a grower as Co.331.

N:Co.339. Probably the heaviest yielding cane yet produced, but so far the only yield figures available are from trials done at the Experiment Station here on the one type of soil, which is a medium to heavy loam. Figures will be available during the 1949 cutting season giving yields on other soil types.

It has a very good canopy, quite as complete as Co.301, and its sucrose, though not as high as N:Co.310, should equal that of Co.301. It has the disadvantage of being a rather poor germinator. This cane will not be distributed to growers until the 1950-51 season, as only very small stocks are available at present.

Conclusion.

It is not intended in this paper to say how the routine operation on the sugarcane farm should be carried out, but rather to discuss the pros and cons of the many practices which are adopted throughout the sugar belt, with a view to helping the planter decide what is best for his own conditions.

Green manuring, the management of trash and the weeding of plant cane fields has been discussed in some detail, as these are subjects about which opinions differ greatly. Also, many inquiries are made as to the suitability of certain varieties to a particular type of soil or situation, and it is intended here to give some indication of the characteristics of the released varieties.

Acknowledgment.

I wish to acknowledge the work of the Agricultural Department of the Experiment Station, particularly Mr. Almond, for having made much of this information available.

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Experiment Station,
South African Sugar Association,
Mount Edgecombe.
March, 1949.

The PRESIDENT said that this paper had filled a long-standing need, and while written primarily for beginners, contained much of interest to the old-established planter.

The author had pointed out that straight fertilizer was preferable to mixed fertilizers, and he had shown, for example, that application of a mixture costing £3 16s. 0d. might well have been replaced by ammonium sulphate at a cost of £2 10s. 0d. Mixing charges were very high.

He was not sure that straight fertilizers were always better, and he thought there were cases where a mixed fertilizer was essential. We might say that potash was not often required, however. The paper stated that we had had no real response to phosphatic top-dressings, but at a previous Congress some planters maintained that they had had excellent results from this practice. Certain growth measurement had been carried out in which individual stools had been fertilized, necessarily with top-dressings. In one case where it was known that there was a response to superphosphate applied at planting, the growth measurement test showed no response to either superphosphate or nitrogen top-dressings, but the two together showed a response. It was therefore suspected that the soil at that stage was short of both nitrogen and phosphate. After the crop was cut, the whole field was top-dressed with nitrogen, and the growth measurement test then confirmed that suspicion, for a response was now shown to phosphate in any form or combination. He therefore thought that it was possible to get a response to phosphatic top-dressings under certain conditions, and, on the other hand, a response might not be obtained from straight fertilizers if there were more than one serious limiting factor.

The author had indicated the value of organic nitrogen at high altitudes. In many countries where cane was cut at about 14 months old, application of nitrogen was associated with decrease in sucrose content. Here we had had only a few such cases, probably because of the long ripening period with our two-year-old crop. It might be that organic nitrogen might have an effect on sucrose content as it was slow acting, and not like the inorganic form which had an immediate effect and did not persist in the soil until harvest time.

The paper was very valuable in summarising details of the new varieties, particularly the three varieties which had been released this year, and also N:Co.310, about which we still did not know everything. He was not quite sure that it was correct to say that N:Co.310 had given the highest sucrose of any cane yet released. He would not himself qualify it as really higher than the P.O.J. canes, but it certainly was in the same grade. With regard to N:Co.349 and N:Co.291, Mr. Sherrard had pointed out that N:Co.349 was generally a high-sucrose cane and N:Co.291 often low. From tests this season it would appear that N:Co.349 had the advantage of having high sucrose quite early in the year, and high sucrose quite late in the year. N:Co.291, however, was much more sensitive to the time of cutting, and cut early in the year certainly had a very low sucrose, while towards the end of the year the

sucrose was reasonably good. Although very many tests were done, these were all from one particular field, and he thought they should ge repeated on other fields, because it would be very useful if we could establish that N:Co.349 had a very even curve while N:Co.291 had a very sharp one. The information so far obtained would appear to bear out that N:Co.349 might be a very good cane for cutting at all times of the year.

He referred to the table on page 124. In that experiment he thought the investigators had gone further than the planter would, in that all the tops were removed from the burnt plots, and thus there was a loss of a considerable amount of plant food. As a consequence some of the burnt plots became very poor and were found to be deficient in potash. A response to potash applications had been obtained on these plots. The division lines, into which the tops had been thrown, yielded outstandingly better than even the trashed plots. This experiment had also started with a bias in favour of the hand-trashed plots, for in the plant cane crop, when no difference could be ascribed to treatment, the plots which were trashed yielded better than the burnt plots. Further, weed control was more difficult in the burnt plots where there was no blanket of trash to keep down the weeds, so that unless there was more cultivation in these burnt plots, it was rather difficult to ascribe all the difference as being due to the trashing alone.

Mr. FIELDING said that one of the chief breeding problems was to find a variety to replace Co.301 on the coastal sand, and he would like to ask whether Co.290 was actually resistant to smut, and how long it would take to find out the degree of resistance which would be exhibited by N:Co.349.

Referring to the President's remarks about the burning versus trash experiment, he said that he was not here when the work was done and it might be that the figures were not quite accurate. Still, that did not destroy the general conclusion, and, as he had stated, there were now eight complex experiments growing, which should, in the course of a few years, yield very concrete evidence as to whether it was really worth while trashing. It was very important to thrash the matter out thoroughly.

Dr. MCMARTIN said that we had now, as far as he knew, no Co.290 growing, at any rate in any quantity in the areas affected by smut, and we had no information derived from local experience in regard to the susceptibility of Co.290. The only information we had was learned from neighbouring territories—Rhodesia and East Africa. In Portuguese East Africa, at Incomati, where Co.301 suffered very badly from smut, Co.290 was much more resistant. Though smut was found in Co.290 in Rhodesia, this variety was more resistant than Co.301, and it could be considered as a possible substitute for Co.301 in these sandy areas. How long it would be before we could tell the susceptibility of N:Co.349, he would not like to guess, but thought it would be a few years.

Dr. BATES said that in Rhodesia Co.290 showed a fair amount of smut but nothing like the same order as Co.301, and it had occurred in Co.290 in some fields which had been heavily contaminated previously by smut-infected Co.301. N:Co.349 had only recently become infected after being exposed to contamination for nearly fifteen months. It was still very early ,however, to attempt to assess the relative susceptibility of the new varieties and he was still undecided, after two years' study, whether Co.290 or Co.281 was the more susceptible.

Dr. DODDS pointed out that rotting trash, buried near cane, would certainly delay growth under certain conditions, because the bacteria decaying the trash took up nitrogen. This only afterwards became available.

One problem of the Experiment Station was that, for the last two or three years, numerous letters had been received from planters and prospective planters, asking for full information by letter or pamphlet of the whole business of sugar-growing from beginning to end. That was not very easy to give in a letter, and unfortunately no pamphlets dealing adequately with the subject had been available until now. He realised that a good many of the matters raised were debateable. People have had their own experiences and formed their own opinions, depending on the conditions under which they worked, but he felt that the paper could be relied on as standard practice. All at the Experiment Station had had a good look through it and discussed it. The only point he was still not satisfied about—and he would like to know the opinion of those present—was as to the quantity of cane used for planting.

The author stated : "The usual rate of seeding is about a stick and a half." No doubt that was the usual practice, but he could not help thinking that it was too much. There were some existing experiments in which cane had been spaced out, leaving a pretty wide gap of various sizes in different parts of the field. This experiment was due to harvest some time this coming season and would give some interesting information, under Experiment Station conditions. He thought that under good conditions of planting (and nobody should plant unless conditions were reasonably good), single-stick planting should be enough, and even this might be found too much.

Mr. DRUMMOND enquired if the action of wind caused much loss of fertilizer when used as a top-dressing on trash.

Mr. SHERRARD replied that while some superphosphate might be lost, this would not apply to sulphate of ammonia or nitrate of soda.

Mr. WALLER said that this year he had used a Ferguson tractor with a spring-tine cultivator in a 14-acre block of cane. He found that the three centre lines, treated on both sides with the cultivator, were green, those treated on one side were also green, while those which had a blanket of trash were a sickly yellow. The soil had never been waterlogged. Leaving a trash blanket saved him many pounds in weeding costs, however.

The PRESIDENT enquired if any experiments had been carried out to test the effect of green manures on the availability of rock phosphate.

Dr. DODDS related that, a long time ago, experiments had been done in the Empangeni district. These seemed to indicate that rock phosphate became more available under certain conditions, and in the rich Empangeni soil did not take very long. Those basaltic soils were better in that respect than those in some other districts, and he thought more experiments should be laid down to test this point in different types of soil.

Dr. DICK drew attention to the army worm which hid under the blanket of trash. He had had several letters from growers who had been worried by it. Where trash covered the ground, whole fields of young ratoons had been nearly defoliated, but the insect had no permanent effect and the cane recovered completely after the insect disappeared. It disappeared as a result of the action of a parasite which was a kind of fly, and also through a number of fungus diseases.

Mr. SINCLAIR stated that in Rhodesia they had a good blanket of trash and they had a lot of insects, and he asked if it were best to kill the insects.

Dr. DICK thought it not advisable to use an insecticide, as this might destroy the parasite and do more harm than good. D.D.T. could be used against the insect, but this was more effective against the parasitic flies than against lepidoptera. In any case, the insect disappeared very rapidly, and after a few months no deleterious effect could be observed.