NOTE ON PRELIMINARY RESULTS OF GREEN MANURING EXPERIMENTS.

(By V. C. SCHWIKKARD, Field Manager, Natal Sugar Experiment Station, Mt. Edgecombe.)

The following paper entitled "NOTES ON PRELIMINARY RESULTS OF GREEN MANURING" was read by Mr. V. C. Schwikkard, Field Manager at the Experiment Station—

Mr. Schwikkard: "Before beginning my paper there is just one point I would like to stress. Mr. Williams in his address, among many other interesting things told us of the harmful effect resulting from an excess of organic matter in the soil. Needless to say we cordially agree with him, but we go further and say that as far as the sugar belt is concerned we do not think that there is any danger whatsoever of that stage ever being reached; the tendency is all the other way. Our soils are very deficient in organic matter and it is not likely that our soils will suffer from an excess of organic matter, not at any rate in our time.

The subject of Green Manuring would appear to be a "hardy annual" at the meetings of our Sugar Congress but the essential importance of maintaining an adequate supply of humus in the soil warrants the repetition given to the subject. No matter how well supplied a soil may be in the major plant food elements, phosphorus, potash and nitrogen, if the land is deficient in organic matter or humus poor crops will result and unless steps are taken to remedy this deficiency each ensuing crop will be even poorer.

Humus may be introduced to the soil in two ways, viz.: by means of liberal dressings of farmyard manure or by green manuring. The former method is the best but unfortunately, as we all know, supplies of farmyard manure are very limited in the sugar belt. On the other hand the fact has been established that green manuring is the most economical and effective substitute.

Green manuring is not a practice confined to modern times, it was known over two thousand years ago and surely a practice which has survived twenty centuries of trial is proof of its value.

As has been shown, the object of green manuring is the introduction of humus into the soil. It now follows to explain the functions and effect of this humus in the soil. Sand will hold only one-quarter of its weight of water and clay from a half to three-quarters of its weight of water while humus will hold double its weight of water. Hence it follows that a soil which is well charged with humus is capable of retaining much greater quantities of water than other soils without piddling or becoming waterlogged. Then again this soil with its improved water retaining properties due to the organic matter will remain moist for a far longer period in times of drought—a fact worthy of consideration when our periodical droughts and their effect on the growing cane, are taken into account. Humus renders heavy soils more friable and easier to work while it gives more substance to sandy and light soils and increases their water-holding capacities. The decaying vegetable matter promotes the growth of beneficial bacteria and also feeds it, resulting in the presence of countless micro-organisms which are so necessary to the physical well being of the soil, and also takes a part in rendering the mineral plant foods into an available form so that they can be taken up more readily by the fine root hairs of the plant.

It is perhaps not out of place here to recall the concluding words of Mr. Edelman's address to you last year—"That the success of any farming depends on no factor more than the maintenance of the fertility of the soil and without humus you can never maintain soil fertility."

We are able this year to give you a little more practical information regarding various green manure crops as a result of experiments begun since our last Congress. Some of these experiments you will see this afternoon.

As we know the past season has been one of the worst on record—our rainfall has been less than half the average or normal summer precipitation. This has seriously militated against the success of experiments laid down this season. It speaks well for those crops which have not only survived but flourished under the severe conditions which prevailed
and at the same time does not finally condemn those crops which have failed or partially failed.

A fair number of different crops including legumes and non-legumes are under trial. Under the legumes the following varieties have given the best results as regards growth and hardiness:—Velvet bean, cow pea, mung bean and sunn hemp, while under non-legumes we have buckwheat, rape and niger oil. These crops have given encouraging results and we feel that we can safely recommend them as suitable for green manuring purpose and they have this advantage that at least one or another of them may be sown during eight or nine months of the year.

Before discussing the abovementioned crops in detail a few words on the preparation of land for a green manure crop will not be out of place. At least one thorough ploughing is essential followed by harrowing with both spike and disc harrows. It is assumed that the land is old cane land containing innumerable tough cane roots, for the disintegration of these roots a spike harrow will be found to be the most suitable implement to use. The disc harrow slices the heavy clods and has the effect of a shallow ploughing and mulching of the surface soil which will give the desired seed bed.

The preparation of a good seed bed is important. If the soil is acid, that is deficient in lime, give it the required dressing of lime, by broadcasting, immediately after ploughing so that it can be worked into the soil by the harrows.

A green manure crop will appreciate a dressing of fertiliser in the same way as any other crop. By fertilising, a better crop will be obtained which means a greater quantity of green matter for ploughing under giving additional humus in the soil. When a crop is ploughed under there is returned to the soil in toto all the mineral plant foods taken by that crop from the soil plus humus represented by the mass of green matter turned in and in the case of a leguminous crop, a quantity of nitrogen. All these, including the fertiliser applied to the green manure crop, become available for the ensuing crop whether it be cane or any other crop. Thus the advantage of fertilising the green manure crop is obvious. Not only does the fertiliser stimulate the growth and increase the yield of the green crop but when the latter is turned under the fertiliser becomes available for the following crop and is not lost.

We may now return to the crops previously mentioned:—

The velvet bean is a plant of trailing habit though bush varieties are also known. So far it appears to be the best of the legumes and under normal conditions is immune or resistant to most diseases and free of insect pests. There are quite a number of different varieties the best known of which are the Florida and white Stingless, the latter is a variety first found to be grown by the natives of Rhodesia, where it has ousted all others. You will have the opportunity this afternoon of seeing a plot of the former and also a plot of the Black Mauritius type. The Florida variety has been found to suffer from a form of leaf-rust, a fact which is borne out by the condition of the plot at the Experiment Station while the adjacent plot of Black Mauritius bean is healthy and vigorous. Steps will be taken to obtain seed of other varieties for further trials. Seed is sown at the rate of from 50 to 60 lbs. per acre depending on the size of the seed, and harrowed in with a disc harrow. Sowings may be made from October to January. Velvet beans yield a heavy crop of green matter which may be ploughed under about four months after sowing. It will be observed that velvet beans require a slightly longer growing period than other crops under review but this is compensated for by the higher yields obtained while it is highly drought resistant.

Cow peas have proved to be a very good green manuring crop. Both trailing and bush varieties occur. While the crop stands drought well it is more liable to disease and insect pests than velvet beans. A pest which frequently attacks cow peas is the eel worm or root-knot. Certain varieties including the Brabham and Iron, both bush varieties, are considered to be immune against this disease. Cow peas are better suited to the lighter soils and require lime. The bush or erect varieties give better results when sown in drills which permits of their cultivation as they do not cover the ground as rapidly as the trailing varieties and in consequence are likely to be choked by weeds when broadcasted. When sown in drills seed is sown at the rate of about 20 lbs per acre and when broadcasted at the rate of 30 lbs per acre. Ploughing under of the crop may be done from three to three and one-half months after sowing the best time for which is during the months of November, December and January.

Mung pea is a bushy plant of erect habit and similarly to other plants of the bush type flourishes better when sown in drills and kept clear of weeds in the early stages, though very fair results have been obtained when broadcasted. Unfortunately this crop has proved rather susceptible to eel worm and leaf rust in certain localities. Mung pea planted in January of this year at the Experiment Station has withstood the drought very well and flourishes where most other crops have failed and
has so far remained free of eel worm. It is possible that this pest is much less active in the heavier soils. Seed is sown in drills at the rate of 12 lbs. per acre and broadcasted at the rate of 25 lbs. per acre and should be ready for ploughing under in about three and one-half months. From mid-October to January is the best time for sowing.

Sunn Hemp was first introduced to Natal by Messrs. African Explosives and Industries Ltd., of Umbogintwini about two years ago, with excellent results. It has since been tried in many parts of the coast with equal success so that we have no hesitation in its recommendation. Its chief merit lies in the fact of its hardiness and rapid growth. In sunn hemp we have the quickest growing legume, it may be ploughed under within six to eight weeks of sowing by which time it will have attained a height of from 2½ to 3 feet and presents no difficulty to the plough. If allowed to continue growing it will reach a height of from 6 to 8 feet but it is inadvisable to delay ploughing in after the crop is three feet high. Due to its rapidity of growth and hardiness it serves as an excellent catch crop and may be sown anytime from August to the end of March. Seed is sown broadcast at the rate of from 45 to 50 lbs. per acre. At present Rhodesia is the only local source of supply and planters would be well advised to grow their own seed in order to obtain acclimatised seed for their own use and possibly also supply the demand which is bound to arise. For seed purposes it is best sown in drills two feet apart and spaced about 12 inches in the row and should be sown about November so as to ensure a growing period of from six to seven months.

Turning now to the non-legumes we come first to buckwheat, a crop which has proved excellent in its way even under severe weather conditions. It has proved itself one of our most reliable crops. Like sunn hemp it is most hardy and a rapid grower and is thus another excellent catch crop. Ploughing in can be done within six to eight weeks of sowing. When sown at the rate of 35 lbs. per acre it soon forms a dense covering over the ground to the exclusion of all weeds. Maximum growth is not reached until the first seeds have ripened and fallen to the ground. Under favourable conditions, when the crop is allowed to ripen and seed freely, a second self-sown crop is obtained after ploughing in. While naturally better yields are obtained when sown during the warmer summer months, satisfactory results have been secured from sowings made as early as August and as late as April.

So far rape is the only crop which seems to offer any solution to the problem of securing a winter green manure crop. It is best suited to the heavier soils where it may be sown at the rate of 7 or 8 lbs. per acre. A small plot at the Experiment Station sown early in February is making very satisfactory progress and has not been attacked by caterpillars to which it is somewhat liable. Seed sown in February and March may be ploughed under in May and June respectively.

Niger oil.—Two plots were laid down to this crop this season and in spite of drought and intense heat has made excellent growth and is most promising as a green manure crop, attaining a height of nearly three feet in two months. It is best ploughed in at the flowering stage, about 2½ months after sowing. The seed being very fine and light it requires a well prepared seed bed and should be broadcasted at the rate of 10 lbs. per acre and harrowed with a disc harrow. The two plots referred to were sown in January and February of this year and probably under our conditions sowings may be made from November to February.

Other crops which are under trial are gram (chick pea), lupins, white mustard, soya beans, sunflower, hubam clover, field peas (Black Eyed Susan) and pigeon pea (Dhal). The results obtained from lupins are not encouraging while soya beans have not been a success. Three varieties of the latter were tried. Hubam clover like Mellilotus Indicus has also been a failure and white mustard was destroyed by caterpillars. Sunflower has grown very well but its merits as a green manure crop by itself is yet to be proved, but sown in conjunction with a trailing crop such as velvet beans is excellent. Gram and pigeon pea are both very slow growing plants and their value as green manure crops on sugar plantations is yet to be ascertained. Whilst field peas may grow satisfactorily and serve a useful purpose as a late autumn crop, the high cost of seed will no doubt militate against their extensive use.

Most green manure crops do not offer great difficulty in ploughing in. As a general guide the following method is recommended. In the early morning the stems of the plants are crisp and brittle, when in this condition a disc harrow will cut and lay over the crop which will facilitate the work of the plough. In some cases it may be necessary to follow the harrow with a Cambridge roller. A disc plough due to the cutting nature of the disc is the most suitable implement to use for turning the crop into the soil, but if not available a mouldboard plough with
disc coultier attachment will serve the purpose. When laying down a crop preparatory to ploughing it is advisable to lay down daily only as much as the plough can cope with, and repeating the operation progressively. Some crops of course may be ploughed in without previous treatment.

A thorough harrowing immediately after the crop has been ploughed in, is essential in order to conserve as much moisture as possible to assist in the more rapid decomposition of the crop turned in and finally a period of at least three weeks, preferably longer, is desirable before planting the land to cane.

Field of Buckwheat grown for green manuring at Central Sugar Experiment Station, Mount Edgecombe, 5 weeks after sowing.

**DISCUSSION ON THE NOTE ON PRELIMINARY RESULTS OF GREEN MANURING EXPERIMENTS.**

Mr. Rapson: In agreeing with what Mr. Schwikkard has said I would like to give a few of my experiences with regard to securing seed for field purposes and planting. Many years ago I bought a bag of Velvet Beans and planted them. The result was not as satisfactory as I anticipated. I collected as much of the seed from that as I could and the following year repeated the operation on the same land, and the result was so great and the difference so marked, that one could hardly conceive it being the same crop. I had the same experience with regard to Sunn Hemp. The seed from Rhodesia, which I put in, only gave a maximum growth in the first year of 3 feet. By taking the seed and replanting the next year the maximum growth was about 8 feet. If in the first year you don't get the satisfaction and results you anticipated don't be disheartened, but try it again the following year and you will be well compensated. The cost of seed is a great item and if the planter will only leave a small portion of the field and collect the seed for planting the next year he will be well repaid for it.

Mr. Patrick: I would have liked Mr. Schwikkard to have touched on the question of the saving of fertiliser due to green manuring. That is an important item. With all your leguminous green manuring you are getting an enormous addition of nitrogen, and the average planter who is putting in a made-up fertiliser is paying heavily for nitrogen which is not necessary to put in such a case. To my idea if you have spent a considerable amount of time in putting humus and nitrogen into the ground it seems ridiculous to put more of it into the ground in the form of cane fertiliser. When you put it in in the form of green manuring probably all you have to add is a small percentage of potash, if any, and above all you have to add the phosphate constituent which is almost entirely lacking in most South African soils. The saving you get in green manuring is quite an important point quite apart from the addition of humus to the ground.

Mr. Schwikkard: In the case of a non-leguminous crop there is returned to the soil only those mineral plant foods which it has taken out of the soil. They
are returned to the soil in a more available form. In the case of a legume there is returned an additional supply of nitrogen. Now with regard to the application of nitrogen to our soils, from experiments made at Winkle Spruit it was ascertained that in that particular soil it was uneconomical to apply nitrogen in the form of a commercial fertilizer. In some cases negative results were obtained and in same cases the slightly increased gains did not compensate for the nitrogen applied artificially. That is one of the questions which we have under trial at the Experiment Station to determine whether the application of nitrogen is necessary or not. Of course at this stage we are quite unable to state definitely whether it is so.

Mr. Patrick: I take it that in theory, when you put a great amount of nitrogen into the soil which it previously did not have, we may assume that it is not necessary to put it in in the form of fertilizer also.

Mr. Schwikkard: The term “fertiliser” covers quite a lot. We all know our soils are very deficient in phosphates. A green manuring crop merely returns to the soil what was in it before. It does not give you any additional fertiliser, but it improve the fertility of the soil—except in the case of legumes which contain nitrogen. So in the case of a green manuring crop it is still essential to apply nitrogen if your soil requires it.

Mr. Patrick: I admit you have to add humus, but I stick to my point that if you have given the soil a given amount of nitrogen from leguminous plants there is no necessity to put more in in the form of fertilizer. There is another point. Legumes very often do not give very good results on certain soils and I believe in many cases it is advisable to inoculate your soils. Can you tell on analysis of a soil whether your legumes will yield the required amount of nitrogen, and whether you ought to inoculate the soil?

Mr. Schwikkard: I think that is a question for a chemist to answer and I would ask Mr. Dodds to reply to that.

Mr. Rapson: I think Mr. Patrick’s question were answered at the last Conference. It was pointed out that the cost of 1% of nitrogen in a fertiliser was about £1. If you added 4% of nitrogen you would have the equivalent of £4 of nitrogen in the form of fertiliser. By applying a green manuring crop it would give you 100 lbs. of nitrogen per acre. It would then be clear to anyone that you would have an excess of nitrogen in your soils and it would be quite unnecessary to add this extra amount in the form of a chemical fertiliser.

Mr. Dodds: With regard to the inoculation of soil for legume seeds by cultures of the organisms which are believed to be necessary, I have always felt some doubt as to whether this was an economical proposition. Cultures of these germs can be found on the market and they are not very expensive, but I have had no personal experience of them. It would always seem to me that it is simoler and the effects more assured if you were to obtain some soil from a field which had been growing the same crop, in the event of any ascertained deficiency of the organisms. As far as I know that deficiency can only be ascertained by trial; it would be impossible to ascertain it by chemical analysis.

“it is not a chemical question at all; bacteriological examination may or may not show it, of that I am rather doubtful. After all comparatively little is yet known by bacteriologists as to the precise nature of these nitrogen fixing bacilli. Usually the weeds that are indigenous in this country are largely of a leguminous character and one would not suppose under ordinary conditions that the soil would be lacking in the necessary bacteria. However, all this is a matter more or less of speculation so far as I am concerned and like so many other subjects it is one for experiment.

With regard to the subject of green manuring, I am somewhat of a fanatic on this question. In fact I understand that I have been referred to occasionally as “Buckwheat Dodds.” (Laughter). I certainly do think that the restoration of humus to your soil is the most important question in front of the sugar agriculturist to-day because it is the most fundamental one. It is no use trying to grow improved varieties and so on unless the soil to begin with is in a condition to give you good results. (Hear, hear). The most fundamental question is the fertility of the soil. I have pointed out repeatedly that so many of our fields have been progressively exhausted, and that is why we are faced with decreased yields.

As regards the fertilisation of green manuring crops, it is, as has been pointed out in the paper, an excellent practice to fertilise your green manuring crop with phosphates, because one is safe in assuming that almost any soil is deficient in phosphates; certainly more than 90% of the soils that have been analysed by the Dept. of Agriculture show a striking deficiency of potassium on analysis, but I stick to my point, that if you have given the soil a given amount of nitrogen from experiments...

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do harm in other countries, where it does so by delaying maturity, but I don't think that would be the case here. The cheapest and best way to apply nitrogen, I believe, is in the form of a green manure crop. If you can't get a leguminous crop to grow successfully I don't think that you get much poorer results by growing a non-leguminous crop, because our soils seem to me to possess unusually rapid powers of nitrification. I have examined analyses of a great many soils at Cedara and Umbogintwini, and it is remarkable how the proportion of nitrogen bears a constant ratio to the total quantity of organic matter present, showing that rapid nitrification had taken place replacing largely the nitrogen which had been withdrawn from the soil by the crop. This is a matter for experiment and study from several standpoints. We have begun some field experiments to obtain information on this point at Mount Edgemere and at our sub-stations. Up to the present the only apparent gain we have obtained from any nitrogenous fertiliser is where it has been applied in the form of a guano, and in that case I am inclined to suspect that the advantage is due to the organic matter rather than to the nitrogen. However, I prefer not to express any more definite opinion until we have some experimental results.

Mr. Townsend: I should like to ask a question which can be answered by Mr. Dodds or Mr. Schwickward. Is it advisable in any case to grow green manuring fertiliser without the application of manure, taking into consideration the low fertility value of our soils at present? I mean does it pay you to put in these green crops without a fertiliser, and if so what proportion is necessary to give you a reasonable return? Also, is it the intention of the Experiment Farm to be able to state to the farmers the most suitable green manure which they could use in their own particular district. We have the coast lands which are of a very sandy nature, we have the intermediate belt which is of a clay substance, and the veldt which is of decomposed granite formation. Probably you will find that different varieties of green manures are required for these different soils. I would like to know if experiments have been made in these soils and whether it is possible to indicate the most valuable seed to apply in each case. Mr. Dodds mentioned the natural growth which one finds along the coast. I would specially refer to a weed which the natives call "ditembiya," which gives a yellow flower and is a very prolific grower. If sown it will cover the ground entirely with a healthy vigorous growth which reaches to a height of three feet when seeding, but can be ploughed in very readily at say two feet, and I would like to know if the value of this has been tested as a green manure. I understand from farmers who cultivate for mealties that where this plant grows and is ploughed in very good results have been obtained. I was wondering if it was of any value as a green manure.

Mr. Schwickard: Replying to the first question as to whether it is profitable to fertilise a green manure crop or not, our reply is: most certainly it is profitable. The idea of growing a green manure crop is to introduce additional humus into the soil. Therefore, if you can supplement that additional humus by getting a bigger crop to plough in you have so much to your benefit and the fertiliser will do it. It is obvious that it is profitable to fertilise a green manure crop. Further, when that crop is ploughed in, the fertiliser applied to it is not lost, as Mr. Dodds reminded you just now. It is available for the following crop in a better form.

With regard to fertilisers, we would recommend in the first place phosphates in some form or another. We are carrying out quantitative experiments at the Station to determine what is the most profitable quantity and form to apply. Our experiments are not as yet by any means definite, but we are of opinion that a dressing of 500 lbs. super-phosphate or its equivalent in other forms of the phosphate would give very fair results.

Mr. Dent: Am I to understand that if you fertilise the green manure crop it is unnecessary to fertilise again when you plant the cane?

Mr. Schwickard: It is unnecessary to fertilise the following crop, provided you have applied sufficient fertiliser in the first instance when sowing your green manure crop.

Mr. Rapson: I found that I got a very satisfactory result by putting on a top dressing of 300 lbs. of superphosphate when sowing buckwheat. Mr. Townsend's soil is very similar to my own and if he was putting in a crop for humus a dressing of 300 lbs. of superphosphate would be worth while. One factor which has not been brought forward is the balance of plant food in the fields. If you get an abundance of nitrogen in your soil, assuming say 200 lbs. to the acre, and you have an abundance of potash, but lacking in phosphates your plant will only respond to the minimum quantity of its necessary plant food, so it is necessary for you in all cases to balance your potash phosphates and nitrogen and you plant will then thrive thoroughly. That is a very important factor to be considered by all planters. It is useless to put in an abundance of nitrogen and not have the other two balance proportionately.

Mr. Dodds: I would like to endorse Mr. Rapson's remarks with reference to the advisability of fertilising green manure crops, especially with phosphates, both in order to preserve the balance of the plant food in the soil and to improve your yield of green manure crop as well as the following cane crop. Our present practice at the Experiment Station which may, however, have to be modified in the light of further experience is to give a fairly heavy dressing of ground rock phosphate with the planting of the green manure crop. We are applying a minimum of 500 up to 900 lbs. of finely ground rock phosphate per acre, which is broadcast at the time that the seed is sown. The advantage of selecting rock phosphate is that it is a very cheap form of phosphate and therefore the farmer can apply it in larger quantities without too great a strain on his purse, and it becomes gradually made available in the soil, especially through the agency of the green manure plant itself. And there is some evidence to show, as representatives of Kynocks' will tell you,
that buckwheat is particularly effective in that respect for adapting insoluble phosphate to its own use and thereby making it available for a succeeding crop.

There is another advantage of rock phosphate in this connection which it is well to point out. A great many of our soils are in need of lime, and lime is somewhat of an expensive proposition, and in a great many places in this country it has been found in the case of soils which do require it that the result is not economical owing to the high cost of liming. Now if you use rock phosphate it seems to me from a chemical point of view that if the phosphate has been used by the plant, the calcium can only remain in the soil as calcium carbonate and you get the eventual benefit of correcting acidity in the soil by the calcium derived from the rock phosphate, and so you get the advantage of a dressing of lime from the rock phosphate as well as the phosphoric acid. That is a theory which was first suggested to me by Mr. Blewett of African Explosives & Industries Limited, Umbogintwini, and so far as I can see, it appears to be quite sound. At all events our experiments will help to throw light on this also. So it seems to me at present that we should fertilise our green manure crops fairly heavily with rock phosphate. Whether a further application of phosphates to the succeeding crop is necessary or desirable is doubtful. Theoretically it ought not to be, but you have to remember that for a green manuring crop the fertilizer is broadcast and consequently is not in a locally concentrated form anywhere in the soil. We find the benefit of applying a fertilizer in the rows at time of planting is that you get a local concentration of fertilizer round the plant, which gives it a good start; and a healthy start means very much as you have seen in the case of Streak disease. Even where you have fertilized the soil heavily some months beforehand it may still pay to put in a small dressing of some soluble fertilizer in the furrows with the cane when planting to give it a healthy start and so enable it to make the best use of the fertility of the soil.

Mr. Brunette: I would like to know what is meant by the reference to laying down a green crop prior to ploughing in.

Mr. Schwikkard: With reference to the term laying down before ploughing in, a number of green crops are very difficult to plough in as they stand, and the term "laying down" is simply the running over of these crops with a disc harrow for the purpose of slashing and cutting them up to prevent the clogging of the plough, and that can effectively be done by means of a disc harrow.

Mr. Patrick: Before we leave this paper may I digress slightly and make a few remarks about the Experiment Station. The planters have representatives on the Station Committee to look after their interests, but it is not always fair to leave the whole thing to their representatives to go and see what is being done; then probably they will be in a position to criticise a little more justly and constructively when they see what is being done and the difficulties that have to be overcome. It is the duty of every member to go and visit the station and not leave it out just because there are one or two representatives on the committee. (Hear, hear).

Chairman: On behalf of the Congress I must thank Mr. Schwikkard for his paper which was full of valuable information. Every progressive farmer to-day is going in for green manuring; you see it almost in every plantation. (Hear, hear). The practice is becoming almost general and planters will find if they want any information, as Mr. Patrick rightly pointed out, they can get all the information they want by consulting the Experiment Station staff and seeing their experiments. The experiments are not only confined to the Station at Mount Edgecombe, but there are co-operative experimental plots through the whole of the sugar belt both on the North and South Coast.

The Congress adjourned at 1 p.m. for lunch.
At 2.15 p.m. a visit was made to the Association's Experiment Station at Mount Edgecombe. A large char-a-banc was available for conveyance of members, whilst many who had their own cars assisted by taking passengers with them.

**GUIDE TO FIELD EXPERIMENTS AT MOUNT EDGECOMBE EXPERIMENT STATION.**

**Fertilizer Experiments:**
These will be found on blocks B2 on the right of the road leading to the experiment station from the main road, C.1 on the same side of the road, but beyond the tramline, crossing it at right angles, and D.1 on the opposite side of the road to C.1. These areas were divided into 105 sections of 1/16th of an acre each, comprising 8 cane rows 5 feet apart and 68 feet long, divided from each other in one direction by a 7ft. headland, and in the other direction by a 5ft. boundary cane row which is not included in the experiment. Each section is numbered, those without fertilizer treatment being also marked with a "C" (control) label.

There are 33 sections without fertilizer comprising 24 controls and 9 sections discarded because of the presence of antheaps or other apparent irregularities in the soil. The 72 fertilized sections have been treated with 26 different fertilizer combinations in triplicate or duplicate, which are intended to throw light on the most profitable form of fertilizer for this type of soil. The soil is a clay loam which is shown by chemical analysis to be very deficient in phosphorus, slightly deficient in potassium and organic matter and of very slight acidity and lime requirement.

The cane was planted on December 20 and 21, 1925, and was planted single row only. All fertilizers were applied in the furrow two days before planting, with the exception of the soluble nitrogenous fertilizers, sodium nitrate and ammonium sulphate, which were applied as a side dressing on March 5, 1926. There was a record drought immediately after planting, but the canes have germinated and developed well, if somewhat slowly. Very few misses occurred and these were filled with transplants of the same age taken from reserve sections planted for this purpose.
There is little of special interest yet to record; a marked difference is noticeable between those sections receiving fertilizer and the controls, and the special benefit of phosphorus is already evident. Soluble phosphate in the form of superphosphate or ammonium phosphate so far gives the best results, as was found to be the case also in the initial stages of the experiments at the field stations, but at the latter the insoluble forms of phosphate, e.g., rock phosphate and basic slag, were found to overtake the others eventually.

Green Manure Experiments:

At plot C.3 beyond the fertilizer experiments on the right side of the road, a number of plants have been tested for their suitability as green manure crops. This area was divided into 20 sections of 1/40th acre each and fertilized with a mixture of ground Egyptian rock phosphate and potassium sulphate in the proportion of 900lbs. of the former and 60lbs. of the latter per acre. They were sowed to a range of 20 different plants on February 3.

Under the dry conditions prevailing buckwheat was by far the most rapid in development and luxuriance in growth until more rains came. Niger Oil plant has also done well, as have velvet beans, and more recently, cowpeas, rape, mung peas, sunflower and sunn hemp. Soy beans (Hollybrook Early, Southern and Tar Heel Black) were relative failures, as were gram (both white and brown) and blue lupins. Yellow lupin and rye failed to germinate at all, while mustard was entirely eaten off by caterpillars. The three latter sections were consequently sown to buckwheat, field pea (Black Eyed Susan), and pigeon pea (dhal) on March 19.

Some green manure crops were also tried on somewhat larger areas on sections A.1 which were sowed on January 26, but the prejudicial effects of drought were not more noticeable here than at C.3 and with the exception of buckwheat and Niger oil plant very little success was recorded.

Imported Cane Varieties:

At C.5 is a small section where a few rows of the following varieties were planted on March 11 together with Uba cane for comparison:

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<th>Variety</th>
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</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>Toledo</td>
</tr>
<tr>
<td>3</td>
<td>Kassoer</td>
</tr>
<tr>
<td>4</td>
<td>Oshima</td>
</tr>
<tr>
<td>5</td>
<td>Kina'</td>
</tr>
<tr>
<td>6 (part of)</td>
<td>Kavangire</td>
</tr>
<tr>
<td>7 &amp; 6 (part)</td>
<td>Uba</td>
</tr>
</tbody>
</table>

These were recently released from the quarantine greenhouse being all immune to Mosaic disease and represent with one or two exceptions the pick of the known Mosaic immune varieties. They were received from the U.S. Department of Agriculture, Washington, in July, 1925, through the kindness of Dr. E. W. Brandes. It is proposed to make some quantitative tests of one or two of the more promising varieties introduced from Queensland recently by Natal Estates, Ltd., on plot A.2.

This area which was under cane until the latter part of December last, has been once ploughed and treated with 900lbs. per acre of rock phosphate and 60lbs. per acre of potassium sulphate; it is now being allowed to fallow before ploughing again and cultivation of a green manure crop before replanting to cane varieties (D.1135 and others) next season.

Streak Disease Experiments:

These are practically a repetition of the experiments initiated by Mr. Storey, at Umbogintwini, which are being repeated in a district where secondary infection (by means of insect carrier) is less frequent. This series was also very adversely affected at the outset by drought.

Eight similar sections of 1/16th acre each in area have been planted with twelve months old plant cane drawn from the same field; these were planted with entirely Streak diseased and entirely Streak free setts in alternate sections.

Experimental Error:

At C.2 an area of nearly one acre has been fertilized, planted and generally treated as uniformly as possible with the object of determining the extent of the unavoidable differences in yield per acre that may be expected from various portions of it. Already the misses consequent on the drought have led to evident irregularities, the result of which it is intended to trace.

Soil Exhaustion:

At B.1 two sections have been marked off and planted with cane, one of which it is intended to grow continuously without fertilizer, and the other will be treated at regular interval with mineral fertilizer, but no organic matter. The yields of cane from both sections are expected to give interesting results in the future.

The afternoon was spent in inspecting the various plots covering the experiments as described above.

Considerable interest was taken in a small isolated section in which there were a few young plants of the recently imported varieties of cane which had been released from the Quarantine Greenhouse. Mr. Dodds and Mr. Schwikkard had a busy time of it explaining the nature of the various experiments and answering the numerous questions which were asked by planters who were keenly interested in all that was being done.

After completing the inspection tea and refreshments were provided which proved very welcome.

Mr. Dodds then gave a short address as follows—“It gives me great pleasure to welcome such a large and appreciative gathering at this the first Field Day of the Experiment Station. Although there is com-
The Congress resumed at 10 a.m.

Chairman: In regard to co-operative buying, I think it would be a step in the right direction. Anything in co-operative buying in this industry is always a step in the right direction. The Government are preaching it, the heads of Departments are preaching it, we are getting leaflets on it, periodicals on it, and the newspapers are preaching it. Everybody is preaching co-operation in this country and I think there is much to be said for it in many directions especially in regard to the purchase of commodities for the sugar industry. I may say that the principle of it has caught on with certain sections of this industry and I understand that they are doing very well. They have set up certain machinery and the planters are getting very great benefits indeed from their scheme of co-operative buying. I understand the merchants will allow any concern for this purpose which is brought into being something like 1% on most things and 2½% on certain other things. I think that the purchase of material on wholesale terms is also quite possible. So that the system of co-operative buying and establishing a bureau or some sort of central house for co-operative buying for the whole of the industry is quite within the range of possibility, seeing that we have already established organisations which can be added to. They have all the necessary machinery set in motion for this sort of thing. I now invite discussion on this very interesting subject.

Mr. Patrick: The position is this: A certain section of the cane planters have their organisation going to-day. You don’t want to complicate it by a series of other organisations. It seems to me the idea would be to enlarge the scope of that particular organisation, which at present exists, so as to cope with the requirements of any planter. It is very simple. We are all agreed on the principle, we have the organisation, merely enlarge it.

Capt. Greig: I agree entirely with what Mr. Patrick has said. The organisation we have is acting very well. I personally entirely agree with the principle, but I think it would be a pity to disturb our little scheme which we have at present. If a bigger scheme came about whereby the smaller scheme could be absorbed, well and good, but to-day we are doing very much better than we did before.