

## SOME PLANTERS' PROBLEMS

P. FOWLIE.

The problems of the cane grower fall naturally into two groups; those which are best dealt with collectively by planters' organisations and those which the individual ought to decide for himself. It is with the latter class of problems that this paper mainly concerns itself.

### Labour.

By far the heaviest outlay on a cane farm is the labour bill so anything calculated to improve the efficiency of the labourer is well worth consideration.

Different men have their own ideas as to the best ways of engaging and managing labour units and it is not proposed to discuss these things here but in a great many cases a little more attention to the feeding and housing of labourers would be a very profitable investment and the following points are offered for consideration.

### Feeding of Labourers.

There is a tale told of an old lady whose language was more forcible than polite. She was advising a young woman about to be married how to manage her husband so as to keep him willing and able for all the duties good husbands are supposed to undertake. After sundry words of wisdom she wound up with "And, my Dear, be sure you always feed the brute well." This advice is well worth taking to heart with regard to our farm labourers. Their staple diet is mealie meal and probably will be for a long time to come, but it does not form an ideal diet without additions. Mealie meal is essentially a starchy food and its feeding value for both men and animals is much improved by an admixture of some food containing a higher percentage of proteins or flesh forming substances. The usual weekly meat ration is some help in this direction, but an allowance of beans or cowpeas further improves the balance of the ration.

Then medical men stress the point that a mealie meal ration is very deficient in certain necessary vitamins, and tell us that many of the ills our labourers suffer from could be prevented if they ate a more varied diet including such things as green vegetables, fruit and milk. On the cane farm one wonders how far sugar cane itself goes to supply the need. Undoubtedly the craving for green vegetable matter has something to do with

the average native's fondness for chewing cane. On some sugar farms patches of beans, mealies, sweet potatoes, and other things are planted to provide a change of diet for the labourers. Planters who do this say it pays them very well as it not only makes for contentment and efficiency but for much better health and fewer days lost owing to sickness. Of course the addition of sugar to the ration is always much appreciated. It is really a cheap food when its high digestibility is considered. Besides cane planters ought to give a sugar ration if only to advertise their own product.

### Housing.

Considerable improvement has been effected in the housing provided for labourers on many farms and estates during recent years but much could still be done in this direction. Here again the main considerations are to house the labourers under healthy and comfortable conditions.

Houses intended to be permanent ought to be constructed so as to leave no cracks or other shelters to harbour vermin. They ought to have no permanent fixtures. All beds and receptacles for clothes, etc., ought to be movable to allow for thorough cleaning out periodically. Frequent spraying, and if necessary, fumigation ought to be practiced. Applications of strong lime wash in which some disinfectant has been mixed assist greatly. No fires ought to be allowed in sleeping quarters unless proper fire places and chimneys are provided and generally speaking these are not necessary on the Natal Coast if clothes can be dried in the kitchen or a room having a fireplace. Ventilation is very necessary but rather difficult owing to the usual habits of the native who likes to stuff up all openings. The best place for ventilation openings is at the apex of the roof. If such openings are covered by mosquito gauze it will tend to prevent them being stuffed up as well as keep out mosquitoes and other insects.

### Implements and Labour-Saving Devices.

The implements and equipment for the cane farm ought to be chosen to suit the soil and contour of the fields etc. What is very good on one farm may not be at all suitable on another where conditions are different. Much depends upon whether oxen, mules, tractors, or a combination of all three are to be used for draught purposes. There is of

course the individual planter's ideas to be taken into consideration as to how he wishes to have his work done. The great thing is to buy only the equipment which is really necessary and so to keep the outlay down to the lowest level consistent with efficiency. How often does one see discarded implements lying about which have done very little work because they were found to be unsatisfactory.

To get the best possible service from implements, wagons, and machinery, constant attention is necessary. Small repairs made in time, proper lubrication of all wearing parts, and seeing frequently that all loose nuts are tightened up will often prevent serious breakdowns which not only are expensive to repair but may cause loss and inconvenience through stoppage.

Storage under cover when not in use and painting once a year also do a great deal to preserve implements, etc.

#### Fertilizers.

The fertilizer problem is perhaps the most puzzling of all to most farmers.

Not so very long ago many planters in South Africa did not use any fertilizer, but gradually it has become evident that the use of fertilizers is highly profitable on nearly all our cane soils. Now what the planter wants to know is "What is the best fertilizer to use" and "How much ought I to apply." Very often the planter puts these questions to the fertilizer salesman. The usual reply he gets to the first question is "Our special fertilizer." To the second the answer is more varied as the salesman is likely to consider how much his client is likely to be willing to purchase and he does not wish to risk spoiling a sale by suggesting a

dressing not in keeping with his client's purse, etc. It is a great mistake to apply to the fertilizer salesman for advice on these matters. His business is to sell fertilizers and it is to his interest financially to sell the proprietary brands which leave the largest profit for his firm and the biggest commission to himself. He frequently contrives to give his clients the impression that his firm's "Special Cane Fertilizer" is compounded from some secret formula having such special virtue that it is worth anything up to £2 per ton more than its analysis would indicate as compared with other fertilizers obtainable.

There does not seem to be any evidence to support this idea that any Special Compound fertilizer can have a value due to the secret of its composition. Agricultural chemists and scientific agriculturalists in all countries value fertilizers on their analysis and our own government recognises this standard by making it necessary for all fertilizer sellers to state on their invoices the minimum analysis they guarantee of all fertilizers sold.

It is important that all compound fertilizers should be thoroughly mixed and in good condition for sowing but otherwise it does not seem to matter at all how the mixing is done.

Taking analysis as the criterion it is easy to show that the planter can save money by buying his fertilizers unmixed instead of buying "Cane Specials."

The usual "Cane Special" is what is known as a complete fertilizer. Those of different firms vary more or less from each other in analysis and in the ingredients from which they are made up. The following example is not exactly the same as any brand on the market known to the writer but it approximates fairly closely to several well known brands both in analysis and price.

#### Example of a Special Cane Fertilizer.

Phosphoric Oxide			Nitrogen	Potash
Soluble in water.	Soluble in Citric acid.	Total		
10%	11%	12%	3%	6%

Cash Price = £5 17s. 6d. per ton of 2,000 lbs.

To make up the equivalent of one ton of this the farmer could purchase the following:—

1,050 lbs. 19.1% Super at £3 1s. 3d. per ton	£1 12s. 6d.
300 lbs. Sulphate of Ammonia at £8 4s. 3d. per ton	£1 4s. 3d.
200 lbs. Muriate of Potash at £10 2s. 0d. per ton	£1 0s. 3d.
Total	<u>£3 17s. 0d.</u>

It will be noticed that this does not add up to a ton so there is less material to handle and a saving in railage. A dressing of 725lbs. per acre of this mixture will give the same amount of fertilizing material as 1,000 lbs. of the imaginary "Special" mentioned above and the cost per acre will be under £2 instead of nearly £3 for the "Special." The home mixing of fertilizers can be done for 2/6 per ton or even less.

The next question is whether a mixture of approximately this composition is the best to use. So far as present evidence goes such a mixture is suitable for average dryland conditions, but there is no certainty that it is the best. Further investigation may bring to light information which will cause us to alter our fertilizer policy.

In other sugar growing countries where large quantities of fertilizers are used the modern tendency is to reduce the amount of mixed fertilizers purchased and to endeavour to apply the various simple fertilizers, either singly, or mixed in varying quantities, to suit varying soil and climatic conditions. To determine the most profitable applications of the several fertilizer ingredients various tests are used. Trial plots with various fertilizers and combinations in the field give the most positive information regarding the response to applications of each ingredient in varying amounts, but this takes a long time. Within comparatively recent times tests of the amounts of available plant foods in the soil by rapid methods of analysis are being undertaken in ever increasing numbers and the analysis of cane juices are also being used as an indication whether the fields on which the cane was grown are well supplied with the various ingredients or not. In Hawaii where many of these tests have been carried out some estates are modifying their fertilizer practice on the information thus obtained particularly with regard to the amounts of phosphates and potash to be supplied.

In this country we have practically always been able to show a very profitable response to dressings of 600 to 800 lbs. of superphosphate per acre, or corresponding quantities of other phosphatic fertilizers applied in the furrow at planting time, but the results from applications of nitrogen and potash at the same time have been conflicting hence the comparatively small amount of these ingredients usually included in cane mixtures. In other cane countries nitrogen is usually considered the most important fertilizer requirement and in this country many fields of our plant cane and practically all our ratoons show by their colour that they are poorly supplied with this ingredient. It is easy to see the change in colour brought about by an application of nitrogenous fertilizer.

Bearing this in mind it seems strange that so often the response to applications of nitrogenous

fertilizers has been disappointing. The usual reason advanced is that our periods of drought nullify the good effects of the nitrogenous dressing because cane which had made quick growth feels the drought more than slower grown cane. This may sometimes happen, but it seems probable that we have not given our nitrogenous fertilizers a proper chance. It has been the practice to give the whole application either in the furrow at planting time or to give the nitrogenous fertilizers all in one dressing soon after the cane is up.

In Hawaii, where large amounts of nitrogen are found profitable, even on rather dry plantations without irrigation, it has become common practice to give up to 5 or 6 dressings during the growth of a two year crop and it seems at least possible that we might find larger applications of nitrogenous fertilizers profitable than have been used in the past if we applied them at the same short intervals. At least it is worth trying.

With regard to potash, the position is somewhat different. It is found that certain soils are well supplied with this ingredient and show little response to further additions of it in fertilizer whilst other soils require considerable amounts. We have comparatively little information about the behaviour of our cane soils in this respect but generally speaking our heavy red and black soils are much better supplied with potash than our light sandy soils and potash ought probably to be increased in our fertilizer applications to the latter. It does not appear to make much difference whether it is applied at planting time or a month or two afterwards except that it may injure the germination of the seed cane if more than our usual very small amount is applied at planting time.

It would appear to be a good plan to give the phosphates only, in the furrow and the nitrogen and potash later, after the cane is up. The Hawaiian plan on some estates is to give the first application as soon as the cane begins to stool out and further applications later, and on others a small portion of the nitrogen and potash is given in the planting furrow with the phosphates.

These remarks apply in the first instance to the plant cane crop, but the fertilization of ratoons has also to be considered. It has not been customary for us to repeat the same dressing to our ratoons that we have given to the plant cane crop but there is a growing opinion in sugar countries that ratoons need fertilizing just as much as plant cane.

With this question of the fertilizing of ratoons is bound up the further one of the life of the ratoons. In this country it has been customary to take a plant crop and two or three ratoons and then plough out and re-establish. On some of our rich patches of alluvial soil there are fields which have given

ten or more ratoons without seriously dropping in yield. It seems quite possible that by heavy applications of suitable fertilizers the yield of cane from ratoons could be maintained at a profitable level for a larger number of crops than is the case at present. If this could be done part of the present heavy cost of replanting would be saved.

In applying fertilizer to ratoons it seems to be important that ploughing between the lines ought to be done as soon as possible after cutting. The phosphatic fertilizer is best applied in the plough furrows alongside the cane and covered by the cultivator. The nitrogen and potash may be applied at the same time or as a top dressing later. If heavy or even moderate dressings of these fertilizers are given it seems very desirable that they should be applied in several doses at intervals of six weeks or two months during the best growing season. This applies particularly in the case of nitrogenous fertilizers.

This paper has grown to a greater length than the writer intended and there are still things he would have liked to include but space will not permit. If the somewhat sketchy suggestions put forward serve to focus attention on some of these problems and raise discussion about them the writer will consider his work has not been in vain.

South African Sugar Association,  
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Mr. WATSON: Before speaking to the main topic, I would like to make one small criticism, if Mr. Fowlie will pardon me, of his remarks on housing, that is, very briefly, that roof ventilation and fumigation cannot go together. If a planter, or anyone considering building new barracks, or advising in the structure of them, where the plantation depends on fumigation for mosquito and malarial control, they cannot introduce roof ventilation unless of a very expensive type.

This paper, which the author has presented under, I think, a rather modest title — "Some Planter's Problems" — is, in effect, a rather interesting and well thought out note of the general problem of soil fertility which concerns the sugar cane growing industry. Take the first paragraph, where the author deals with the part played in planters' fertilizer policy by the fertilizer salesman. I have been for long rather amazed at the lack of knowledge shown by planters in general on the basic principles of fertilizer purchase and valuation. There is another aspect of the part played by the fertilizer salesman, and that is the so-called experiment. I

know of one experiment—no doubt there are others—on the North Coast, where five or six plots are planted out to the same quantity of different proprietary brands of fertilizer. The analysis of each of these brands approximates so closely to the general average analysis of the lot, that it is quite evident that no significant result of any kind can be obtained from that little experiment, leaving aside the fact that there was only one plot of each treatment. Well, that planter no doubt put down the experiment full of hope, and two things are going to happen. First of all, just by chance, one of the brands of fertilizer may respond, due to soil variation, and the man will select that brand for future work, and the brand being expensive, it is so much the worse for him. Later, when his expectations are not fulfilled, he will be discouraged on the subject of experimentation. I think that is very unfortunate, because I think the time will come sooner or later, when planters will do more than co-operate, they will be encouraged to put down their own simple experiments with some reference to the modern trend of ideas in the essentials of field trials. These two points, I think, are so important that more publicity, and more information should be disseminated amongst planters on the general principles of fertilizer purchase and valuation, coupled with a warning against waste of time in laying down experiments that cannot possibly produce anything. The South African Cane Cane Grower's Association has recently, on a number of occasions, made very close contact with planters on the subject of locust control, and through that propaganda helped planters very much. I don't know whether it is in order to suggest that the South African Cane Grower's Association could co-operate in spreading abroad more knowledge about the principles of fertilizer purchase.

With regard to the remainder of the paper, I think it is a matter of regret that the time limit has forced the author to condense drastically so many very interesting vital points. This, as far as I know, is the first document from the Experiment Station source into which one may read anything in the way of a challenge to the hitherto dominant position of phosphates in our fertilizer policies, where phosphate has occupied an almost unchallenged position as a panacea of all soil ills in this country. As such, I think it should be warmly welcomed, for the evidence supporting the exclusive use of phosphates is, to say the least of it, slender, and indications, shall we say, of the possible advantageous use of other plant foods are not entirely absent.

With regard to ratoons, the author mentions the fertilisation of ratoons in Hawaii and in other countries. Well, in the two countries that everybody regards as supreme in agricultural research—Java and Hawaii—Java takes no ratoons and, there-

fore, cannot help us to answer the question. In Hawaii, a reference to the literature will show that the ratoons are fertilized, in many cases, as extensively, and perhaps in some cases, more extensively, quantitatively, than plant cane. In Australia, we find ratoons fertilized. In this country, some planters and some small producers of cane are already fertilizing their ratoons to the same extent that they fertilize their plant cane. In view of this, in view of the well known fact of increased consumption, in view of the colour of our ratoons, as Mr. Fowlie points out, I cannot see but that it must be a harder job to make out a case for refraining from fertilizing ratoons than to make out a case for giving them fertilizer.

Mr. ARDINGTON: I would like to thank Mr. Fowlie for his able paper. I think he will agree with me that there is nothing very startlingly new in it, but it is a very valuable thing indeed to have the position reviewed like that all in one paper, so that you can consider it as one.

As regards his reference to housing and feeding, I agree with him most heartily. We want to improve these two points, and I think in that respect we are moving in the right direction, a little slowly, perhaps, but that may be the best way to do it. The Public Health Department are a worrying lot of people at present, but as long as they are not too unreasonable and push us gently, I think it is a very good thing.

The fertilizer question is a very, very interesting and critical one indeed, and I have been extremely interested to hear what Mr. Fowlie has to say. I always carried out fertilizer experiments myself, I am still doing so, but I am bound to admit I have always been extremely despondent about them. I have come to the definite conclusion that fertilizer experiments, to be really valuable, want to be carried out by somebody who can give all his time to the job. A working farmer, who is occupied with a hundred different jobs all his life, cannot give the particular attention to detail and to the considering of records that is necessary to give these experiments any real value whatever. That is where the value of the Experiment Station comes in.

I have heard these remarks about the fertilization of ratoons, which is a thing that has interested me ever since I heard about sugar. I fertilized ratoons myself, but I have never had one of my fertilized experiments which gave me profit. I believe something has been done at the Experiment Station. They cannot give us anything very satisfactory about the fertilizing of ratoons; in my opinion all the more reason for persevering with this job. I am not competent. I want them to tackle this job seriously, systematically, and over a long period, so that in time they will be able to tell us something conclusive about it. As far as I am aware, they are not able to tell us anything conclusive about

it up to the present. The question of applications of nitrogen and potash is another thing that wants dealing with systematically and over a period of years. That is one of the things I have done myself. I have used Chilean nitrate, sulphate of ammonia, and that sort of thing. I have done it in one dressing, in several dressings, and dressings over a long period. The result has been disappointing. I am satisfied that somebody more competent than I ought to take on the job.

Mr. LINTNER: First of all I should like to mention a subject here that I would gladly comment on, but a subject that I am not very competent to comment on. It struck me as very valuable, the admirable way Mr. Fowlie dealt with the improved feeding of the labourers. Recently, the South African Association for the Advancement of Science considered the question. Apart from dozens of varieties of the curious looking plants that grow wild in South Africa, and the suggestion that lucerne should be fed raw to the natives, very little suggestion was made for improving their food, and it seems to me that looking at the problem from a practical point of view, such as Mr. Fowlie does, helps matters forward much more readily than suggestions such as those which were forthcoming at that recent Congress.

Secondly, I would heartily endorse this idea of the lack of knowledge which the average planter displays when purchasing his fertilizer. It is a great stumbling-block when one goes on to the various farms along the sugar belt and elsewhere in the country, in fact it is generally the case that in spite of continuous propaganda on the part of the Department of Agriculture, as well as private institutions, that there are very few planters who even know how to calculate out the percentage value of the different ingredients in a fertilizer when it is put before them, and really it is only a matter of getting into touch with the bodies I have mentioned, their own experiment stations and extension officers, who are always prepared to travel great distances to supply any information that they may require, and also periodical visits to the School of Agriculture are more than necessary and too often overlooked.

There is another point here which Mr. Fowlie mentions. I think I understand what he means, although I think it requires slight qualification, and that is the use of rapid methods of testing available plant foods in the soil. There are several methods, and those in use up to now I do not think are very reliable. There are some forthcoming of some use in other countries being studied here at the moment, which apparently may give very good results indeed, but until such time as we are positive of the results obtainable by these new methods, I think it is advisable to take care not to jump to conclusions afforded by the results of some rapid methods used.

Regarding what Mr. Fowlie says about the application of potassium, I find that it is not always the case that one should apply this ingredient in several dressings, in fact, with a heavier dressing than it is usual to apply, on very heavy, dull red, clayey soil out at Kearsney I got an enormous increase of yield. When that dressing was split into several, however, no effect was observable between applying it in small dressings as against a large dressing initially, and I do not think there is any particular danger, at the moment, in applying very much heavier dressings of that particular ingredient in the furrow and planting cane on top of it, because, actually, I think that one can mix the soil with the fertilizer and avoid any possible injurious effects on following germination. In fact, I think that quantities of potassium have never been applied to the soil in this country that could possibly cause any harmful effects to germination. And secondly, regarding the application of fertilizers in general to soils of varying analysis, soil analysis, as such, does not reveal a very great deal, and it is usual to suspect that a soil which is very high in any given ingredient should require less of it in fertilizer. But on the other hand, you have instances where there is nothing short of soil hunger, and that is the case in your very heavy soils, which are already rich in an ingredient. You have to apply far more to that soil to get an effect than you would to a correspondingly lighter soil with a lower content of that ingredient, that you cannot actually generalise between light and heavy soil, because of this particular absorption that might take place.

Mr PALAIRET: I would like to make a few comments on Mr. Fowlie's remarks. The first thing I would like to comment on is what Mr. Fowlie says about the feeding of labour. We have recently had this new Sugar Agreement, which, of course, was designed—one part of it—to restrict the production of the other man. Planters have suddenly come to realise that that also restricts their own production, and I think they will have to consider how they will use the released land. Now we have here a very definite indication of a highly profitable use of that released land. Personally, I have for some time been using my fire breaks for sweet potatoes, and have found an improved ration, with a very definite reduction in cost. Beans come under the same heading, and I do think that the use of these two crops, with variations of the ration, and an undoubted improvement in the ration, are now rendered even more easy to do than they were before.

On housing, comment has been made on the question of ventilation in the room. We have got two aspects there, first, that it is undoubtedly a better ventilation from many points of view. But against that you have got two points, first, the Health Department discourage it, in this sense, that you have got to get your plans specially passed if your

ventilation is other than their standard; and secondly, you have got the point Mr. Watson put up about fumigation.

Now no comment has been made about Mr. Fowlie's remarks on implements. I have felt for some time that in no one implement that we have got at present have we got really the correct thing. We are using, as we have to owing to mass production, methods and implements which are designed for other use in farming, and which we must use until we can get together and get implements of ploughing more rationally arranged. We do not really know what is available; we do not know what has been tested, we do not know what has been proved. At previous Congresses, efforts have been made—six or seven years ago—to ascertain data from planters on this subject, with results which, though promising at the moment, never got anywhere.

Mr. DODDS: Mr. Chairman, I would like to have emphasised practically every point that Mr. Fowlie has made, but time will not permit, and I must content myself with giving his paper my blessing and general recommendation to all planters of everything that it contains. However, there are one or two points that I must deal with more specifically, especially in view of remarks that have been made by previous speakers.

One of the most important things in Mr. Fowlie's paper is his comment on mixed fertilizers. We have stated from the Experiment Station more than once that the practice of buying mixed fertilizers is not to be recommended, for at least two reasons. One is that you do not get best value for money in an ordinary proprietary brand of mixed fertilizer. As Mr. Fowlie said, there is more margin of profit and commission on mixed fertilizer; and calculation of the unit values of any one of them on the market will show that it is considerably more expensive to buy fertilizers in that form than it would be to buy the ingredients separately, with a reasonable charge for mixing. That is one objection.

Another is that although you can, of course, regulate your applications of mixed fertilizer, you cannot regulate the proportions of different ingredients that you apply, you can only apply them in the proportions in which they are originally supplied; and there is increasing evidence to show that the three main ingredients of a complete fertilizer—phosphates, potash and nitrogen—are not necessarily best, all supplied at the same time. We are only at the beginning of information on this matter, which I hope we will have more positively within a few months' time.

These are the two main reasons—and there are probably others—why one should not buy mixed fertilizers, as the average planter is always recommended to do by the average salesman.

As Mr. Watson, Mr. Ardington and Mr. Palairé all pointed out, fertilizer experiments are not quite so simple as they may seem at first sight. In fact at first sight, one might say that nothing could be simpler. All you have to do is to have two patches of soil—it does not matter about size or shape, as long as you know the area. You treat them in two different ways and compare the yields per acre of cane and of sucrose that you get from each of them. But, unfortunately, it is not nearly as simple as all that. The reason is that nobody can find two pieces of soil that will give the same result even if they are treated as closely alike as possible. You will always find what we call “experimental errors,” which does not mean errors on the part of the experimenter, but unavoidable differences due to the depth and texture and composition of the soil. We have come to the conclusion that to do a field experiment on any subject that is to give you a quantitative result, you must have not less than six replications of each different treatment. So that practically puts it out of reach of the small planter to my mind, and an experiment, to be of any value, can only be undertaken by large estates or by planters who, for some reason or other, are in a position to go in for this detailed work. Not only is any field experiment fairly complex, even if the object is comparatively simple, but the results require most careful interpretation, in which mistakes are very apt to be made, and years of work are necessary before any conclusions may be arrived at with any degree of certainty. Still, something has been accomplished, although in the field of fertilizer experiment we have not got on nearly as far as we should have liked, or nearly as far, for example, as in the relative values of cane varieties for given soils.

But we know, for example, that phosphates are deficient in nearly all local soils originally, and are a first necessity for adequate fertilization of any soil. There is evidence to show that once a heavy phosphate application has been given, it is not necessary to go on giving very heavy phosphate applications after you have supplied the initial deficiency of the soil. In many of our experiments we have found, under the conditions of the experiment, that we had response to phosphorus, and phosphorus only. That is partly because in such experiments the soil was well supplied, for the time being, with the other elements, or, may be, in some cases the other elements were not supplied in the best form or the best way. Apparently it does not matter very much how you supply your phosphate, within certain limits, the soil or the plant can use it anyhow, but show a little discrimination in the way in which it will accept potash or nitrogen. There are cases, however, in which we have shown a very definite and profitable response to potash. These are mainly in sandy soils, or soils that have long been under cane.

As regards nitrogen, organic nitrogen, in the form of whale guano for example, has shown a profitable response in practically every case in which we have experimented with it, but we are loth to extend the use of whale guano and similar material, because, of the high cost, and the insufficient supply for the demands of the planter. We feel it is necessary to find some way of utilising inorganic matter which is cheap and can be supplied by the world's market *ad. lib.* There is some evidence to show that ways and means may be devised of getting useful results from mineral nitrogen, by applying it at the right time and in the right away. Mr. Palairé and others mentioned that soils rich in organic matter and soils well supplied with moisture may respond to mineral nitrogen where other soils do not. That may be due to the chemical reactions of the humus in some way, but may be due to one and the same cause, that is to say, the moisture content, because we all know that humus conserves a large proportion of moisture in the soil.

As regards ratoon fertilization, I am convinced, personally, on general principles, and on the experience of large estates, and the experience of the Sugar Industry all over the world, that fertilizing ratoons is profitable and necessary, but I cannot yet point to any positive results from our own work. I think we shall have some before very long, but I cannot say we have any at present. As Mr. Ardington and others pointed out, there is a good deal of lack of knowledge, on the part of planters, on fertilizer matters. We are always willing to enter into correspondence, and already have a large correspondence with planters who write to us for information about fertilizers; this service is one of the principal ones for which the Station exists. Some of these letters have been modified into a sort of general circular and have been sent to all planters.

There is just one more matter before I close. It has been pointed out by another speaker that within a few years' time most planters will have land to spare to use profitably if they can find any such use for it. Mr. Fowlie did not mention in his paper, some work that we have done quite recently, and which is not yet at a stage on which we can report. We have been growing a crop of velvet beans at the Station, and have succeeded in gathering and stacking a considerable amount of hay. This is very well liked by the mules, and it opens up a prospect of usefulness for our fields, in which we may be able to supply, not only food for labourers, but for transport animals or other livestock as well.

Mr. WATSON: I had hoped at the beginning of this debate, that the debate would end on a note of encouragement to planters who wished to carry out experiments. Instead, I find myself in the position of regretting that so much has been said

to discourage them. In actual fact a simple experiment of six replications and four treatments can be got into a very small area of less than 1½ acres. If you have 1/20-acre plots, it is true that it takes a little bit of time and careful work to put the experiment down initially and to apply the fertilizer. Apart from that, until the harvesting of the experiment, there is not very much to do to it, except to see that it is not damaged by mules, and so on, and that is pretty easy with ordinary care. I am sure that that will repay planters. Mr. Palairt says in principle it must be admitted that the soil of a particular farm can only be suited on that farm, and not elsewhere. An experiment laid down at Darnall, say, is not of much value at Umfolozi or Umzinto. With regard to the interpretation of these results, it is quite true that great care and knowledge is required. I myself hope to have the co-operation of the many experts here today, with our experiments at Tongaat.

Mr. FOWLIE: I think those who have spoken on this matter have exhausted most of the points for and against each other. I would like to mention just one or two things. I quite appreciate, I think it was Mr. Lintner's remark, that these modern methods of soil-testing require to be taken carefully. I think certainly they do. I think certainly that some of the things that have been done in this country already by certain people going round and professing to tell farmers the requirements of the soil by doing a few tests with some bottles and things are probably not of much value at all. But this problem seems to have

reached a further, and rather more accurate stage, shall I say, in Hawaii during the last few years, and Hawaiian Experiment Stations and Hawaiian service of expert agricultural chemists have devised methods of their own that, I understand from overseas reports, are a distinct improvement on any of the older methods, which they think are sufficiently reliable to give them indications which are good enough to go on in fertilizing their fields. And if that is so, and we can get these methods handled by somebody that we can rely on, I think that those methods, within a comparatively short time, may be adopted and found very useful in this country. But at the same time, I quite realise that Mr. Lintner was right in saying, as a sort of note of warning, that we ought to be careful about these methods, especially when put into the hands of inexperienced persons. Now I do not think I will try to reply to all the criticisms, as most of the things that have been brought up have been dealt with and answered by those present. I would just like to say that I feel very gratified that there has been so much discussion on the various ideas that I brought forward in rather a sketchy way. I would like to thank you all very much who have taken part in this discussion for the very nice things you have said about the paper.

The PRESIDENT: In spite of the humble title of this paper, as mentioned by Mr. Watson, the reading of the paper has resulted in a very eloquent and interesting debate. I will ask you all to join me in a vote of thanks to Mr. Fowlie for his paper.

(Applause):