Soil and Health Library

Soil Fertility -- The Farm's Capital

By Sir Bernard Greenwell, Bt.

Journal of the Farmers' Club Part 1, February 1939

Address to a Meeting of The Farmers' Club held at the Royal Empire Society, Craven Street, W.C.2, on Monday, 30th January, 1939.

With Discussion following by:

Sir Albert Howard

Dr G.T. Wrench

I HAVE been asked to read a paper on the "Waste Products of the Farm and the Town," but I think a better title is "Soil Fertility -- The Farm's Capital."

The subject should be considered primarily from a national point of view, as if the nation deals wisely with it the fortune of the farmer will follow in its train. I call it a national problem because, in the first place, we have lost many millions of pounds of interest owing to the default of countries such as Mexico, China, Russia, Germany, Austria, Central Europe, Brazil and other South American States, and this deficiency must be made good. At the moment some of it has been made good by the price of gold which comes from mines owned by British subjects, in fact, gold must be considered more as a commodity to-day than a medium of exchange, for it is mined from holes in the ground in Africa and Australia and taken to America and buried in another hole there. The amount of sterling we receive for this gold may decrease and then the question will arise as to how we are going to balance the excess of imports over exports. One way in which this can be done is to produce more of our food in this country, for though we can manufacture more goods to sell abroad, if the foreigner will not buy these goods we must concentrate on. agricultural products to enable us to cut down our imports.

Only a few days ago it was published that the Exchange Equalisation Fund had lost 150 million pounds' worth of gold to America since last May, I see by this morning's newspaper that no less than £15,000,000 went out last week, and it makes one wonder whether this question of exports and imports is much more pressing than one at first thought.

If prices of agricultural products improved we would soon see the production of the farm largely increased. The Government created the Wheat Deficiency Payment, with the result that the acreage under wheat has grown from 1,200,000 to 1,800,000, a sure proof that the farmer can play his part if lie is assured an adequate return.

Now, one asks oneself, is this country capable of producing, say, another £100,000,000 of agricultural produce ? That, gentlemen, is the problem I want to put before you to-night. If this is to be done the fertility of the second-rate land will have to be greatly improved, and a lot of derelict land brought back into cultivation, but this cannot be done unless the farmer gets a proper return on all the products of his farm.

Taking stock of the country and its agricultural industry, we start with one of the best climates in the world, but if our land is not in a proper state of fertility we do not

get the benefit of this climate. Secondly, we have a class of men who are second to none in the art of cultivation. Thirdly, the produce of the farm is consumed very near to the point of production. Fourthly, we have tools to-day which our forefathers never dreamt of; I refer primarily to the tractor, new tools for harrowing and subsoiling, not to mention the possible practical use of the combine harvester, the gyrotiller and the grass drier. In fact, in spite of the increase in the cost of labour, it is possible to-day to marl land with 25 tons to the acre at a cost of £2 5s. 6d. per acre, plus 10s. for spreading. Further, we have materials in the country which to-day are being wasted and which, if put to proper use, would largely increase the fertility of our land.

Let us first of all review the position of the agriculturist. As I have said before, the Government has helped him in the production of wheat and he has increased his acreage by 50 per cent., although the amount of land under this crop is still a million acres less that it was some years ago.

Pigs are now on a basis which ought to repay the farmer, provided he houses and feeds them properly.

I take it the dairy farmer has not been doing too badly as the number of cows has been increasing of late years, and although there has been a slight decrease in the amount of milk produced owing to the dry summer and the high cost of feeding stuffs, this will probably increase again. Anyhow, because the ratio between the liquid milk and processed milk is widening, deductions from the Pool price for processed milk are smaller.

On the other hand, although sugar beet is probably responsible for very much better cultivation of the land it is doubtful whether the majority of farmers have made any profit on this crop during the last two years at least, and they must have lost very heavily this year not only owing to the small tonnage of the sugar beet itself but the lowness of the sugar content. Incidentally, the growing of sugar beet has reduced our imports 600,000 tons of sugar; nevertheless, the amount of sugar carried in ships is actually greater owing to the importation of raw sugar and the re-export of refined sugar.

Our fatting stock has largely decreased and the farmer is losing money on fattening bullocks and sheep, also on poultry production owing to severe competition by the importation of these products not only from our Colonies but from countries which buy from us only a very small proportion of manufactured goods in exchange, and it is this side of the industry which furnishes the land with its humus and, therefore, its fertility.

The question now arises, is there any way in which this fertility can be built up again with waste products from the farm or the town?

Taking our grassland first, probably more can be done by proper mechanical treatment followed by intensive stocking than by artificial manuring. Some people are suggesting that we should plough up a lot of our second-rate pasture land and resow it, but this I have found is very speculative as the cost is in the neighbourhood of £3 to £5 an acre and the results are bound to be uncertain. By cleaning out ditches, reopening drains and by mole draining, however, a lot can be done. I have also found

that by using a Ransome mole plough or subsoiler of the wheel type, pulled through the land at a depth of 12 in. to 14 in. 4 ft. apart, one can produce much better grass, and this is proved by the greatest expert of all -- the animal. In a field which was partly subsoiled we found that this subsoiled part was grazed hard by the cattle, and the part that was not treated in this way was only lightly picked over. The cost of this is about 2s. 6d. per acre without overheads and lost time. We reckon £1 a day for a 40-h.p. tractor, including labour, depreciation, etc., and a tractor will do 9 to 10 acres a day subsoiling at 4 ft. intervals.

One must not confuse the action of subsoiling with mole draining. The subsoiling breaks up the subsoil so that the water table is slightly lower and allows the water to penetrate into the soil and be retained there. It drains the top few inches so that the plant is not standing in water but at the same time forms a reservoir to hold the water for when it is required. On a sloping field the water will move slowly to its lowest point, whereas mole draining takes away the water and only partially retains it in the ground surrounding the mole. It is advisable to pull the mole plough along the headland to the lowest part of the field into the subsoil cuts to take off the superfluous water at the lower end of the field.

I am told that the reason this operation is so very successful is because the subsoiler lifts and shatters the soil so that the oxygen in the air starts the decay of the old turf roots underneath. It also lets tile water down and the shattered soil forms a reservoir from which the plant above can draw its supply. Thus humus is formed from the decayed vegetable matter and animal wastes and this in turn brings bacterial action and nitrification, and the manufacture of plant food. The grasses and leguminous plants (clovers, lucerne, and so forth) are able to root much deeper, earthworms increase because there is the material there which they can consume, but most important of all -- and this is a point which we are only just realising -- the presence of humus in the soil enables other fungi to invade the roots of grasses and clovers and set up the mycorrhizal association: a method of direct manuring which up to the present has been unrecognised. Finally, conditions for the fixation of nitrogen from the air are established.

I have just mentioned the earthworm. I am afraid very few of us realise what a good friend this little fellow is to the farmer, and if we can only increase the population of the earthworm in the soil he will do a lot of our deep cultivation for us and aerate the soil gratis. Where we manured our grassland with artificials, we found the worms disappeared, but the following year a compost was applied made from town rubbish mixed with dung, and immediately the worm casts reappeared. It is a known fact that the nomad tribes in Central Africa always pitched their camp on ground covered with worm casts as they found that this was the best grazing.

I have not come across many writings on the earthworm since Charles Darwin's noted work, but I am certain that the fertility of the soil is bound up with organics which are a great encouragement to the worm. There is very little doubt that he is a scavenger and if he disappears you will find his place taken by leather jackets and other insects detrimental to the crops.

Coming to the arable land, the corn crops take much out of the soil which has to be replaced. A fallow is one way of replacing some of the fertility of the soil and making

it clean. Moses laid down that the land should be fallowed once in seven years, but in this country and in South America we often make a fallow once in three or four years. To get the full benefit, however, of the soil and our climate I do not think that this is enough or economical, the land must have the addition of some organic dressing which if applied in sufficient quantities the fallow can be dispensed with.

Now when a farmer goes out of his farm, the incoming tenant has to pay a proportion of the cost of the cake, manures, etc., which have been used on the farm, as tenant right, it being held that the land, or the fertility of the soil, is richer by these purchases and that the farmer has not yet reaped the benefit of them. But we as a nation buy in the neighbourhood of 350 million pounds' worth of foodstuffs each year but the country gets no "tenant right " for this as practically nothing is returned to the soil. It is from the waste products of this material that we should build up the fertility of our land. I see that Mr. Wallis, Secretary for Agriculture in America, says that the farmer pours fertility year after year into the cities, which in turn pour it out down the sewers into the rivers and ocean.

To-day the rubbish from the towns is wasted, it is either burnt in destructors or sent out to sea, at other times it goes to make up low places alongside rivers, or is dumped in old quarries, but thank goodness we have an example of how this rubbish can be used to advantage. I refer to the Borough of Southwark. This borough collects its refuse and after taking out tins, bottles, etc., it is crushed to quite a fine material in hammer mills and has been sold to the farmer for years at the rate of 20,000 tons per year. I get this delivered to me at 2s. per ton at one station within 20 miles of London and 2s. 6d. five or six miles further out. I have only had two years' experience of this myself but from the results I have seen that we can multiply our dung by four and get crops as good as if the land had been manured with pure dung. I can, however, give you a better "chapter and verse" from a tenant of mine who has been using this crushed material for the past 20 years. His farm is about 230 acres on a light chalk soil, he milks 80 to 100 cows and grows on his arable land practically all vegetables. He uses this rubbish for the most part neat, but in his cow yards he puts one part rubbish to three parts cow dung which he says makes a much better substance for applying to the soil than cow dung neat, as it helps to break it up.

I was discussing this question with our local veterinary surgeon and asked him how he found the cows on this particular farm and he told me that it was a very clean herd indeed. He added that where he attended a farm in Hertfordshire some years ago the bailiff sold off all the cow manure and there was no end to the trouble he had owing to this organic substance not being returned to the soil. I expect, however, similar examples can be found all over the country, and one of the objects of this paper is to stress the necessity of the application of organic substances in order to get clean crops, healthy stock and, finally, healthy human beings. The organic substances are those which take up the moisture and hold it in the soil for the good of the plant. It also contains the food for the plant, but of the two the role of holding the moisture is probably the most important as if you have not the moisture the plant is unable to make use of the food.

There is another product of the farm which in most cases is wasted, and that is the liquid manure. The town waste would be a very fine medium of absorbing this and getting it distributed on the farm in a not too concentrated form. I cannot help thinking

that without a medium like town rubbish this liquid has been applied to the soil in a much too concentrated form with the result that crops have been laid and vegetables have rotted. This liquid is not humus but is the food of the fungi which make humus from vegetable wastes.

Now this town rubbish contains about 42 per cent. of organic matter which, as I have said before, is lacking in the soil. Artificial manures do not help to produce humus, they may increase the crop at the time and leave behind in the first place a bigger root system which is organic, but in the long run they leach out the humus from the soil. For instance, the use of superphosphate has, I understand, had very detrimental effects in New Zealand and it is beginning to show the same effects in South Africa. This humus is the house in which the surplus water is stored to be given back to the plant in dry periods, and, further, I think the art of cultivation is to get the humus to a depth in the soil where the moisture does not evaporate, which cannot be done without proper subsoiling.

If the plant receives a check it is immediately liable to any disease, with the result that the crop is not so good for human or animal consumption, and I believe before long it will be proved that the higher the fertility of the soil the more nutritious will be the food produced from it, eventually resulting in a more healthy nation.

If we who are using these waste products of the town are right in our estimation of their value, then the Government, if it wishes to see a more prosperous countryside, must see that these waste products are made available to the farmer at a reasonable price. There is another kind of town refuse which is being made to-day. The West Kent Drainage Board are drying out the digested sewage sludge. This has saved them considerable expense. The dried cake is sold to a Frenchman for export to France at 25s. a ton. Surely, if the French can afford to buy this waste, it ought to be worth more to us in this country.

I saw it stated that the rubbish of our towns is estimated at 13 million tons a year which at 10 tons to the acre would increase our wheat acreage by 50 per cent. on a four-course rotation, manuring once in the four years. In a memorandum dealing with Public Cleansing issued by the Ministry of Health in September last year, returns were made from 376 local authorities and the cost of the collection and disposal of refuse in 1936-37 was 17s. 1d. per ton, and the weight per person was 1.7 lbs. per day. In the case of Southwark, which has been mentioned, I see by the return that their cost of collection is 14s. 7d. per ton and the disposal 7s., but I understand by their method of crushing and selling the product they reduced their overall costs by 3s. per ton. Luckily we have controlled tips all over the country which are available and which most of the corporations are only too pleased to get rid of.

The Government has introduced a Fertility Act under which it pays half the cost of putting calcium on the land and 25 per cent. of the cost of slag, but this is only a half measure, as without the proper complement of humus or organic substances being returned to the soil the fertility is only being released and not built up. This fertility is not only the farmers' capital but ultimately the capital of the nation.

Nor must one forget that practically the whole of the riches of the world come from the land, either above or below, and partly from the sea ; the land yields food, gold,

coal, oil, etc., and, therefore, is the basis of all wealth. The manufacture of materials is only secondary, and, therefore, it is still true that when once a nation's agriculture goes that nation goes down the hill.

Final1y, I would like to remind you that whatever profits are made on the farm, they are returned within a very few days to the town, and surely the farmer is a better client to the townsman than the foreigner!

To-day Mussolini is bringing land into cultivation and seems to be following the precedent of Sully in the reign of Henry IV and Colbert in the reign of Louis XIV. Both these statesmen brought back prosperity to France by restoring its agriculture. It strikes me that it would be better if the whole world started mucking its fields instead of muck-raking over other people's affairs.

To recapitulate:

1. The land of the country ought to produce very much more to make up for our unfavourable balance of trade.
2. The greater the fertility of the soil the less the effect of dry periods on the crops.
3. The application of the waste products of the town over and above those of the farm, and the subsoiling of the grassland are complementary to the Fertility Scheme of the Government.
4. A fertile soil means healthy crops, healthy animals and, last but not least, healthy human beings.

Discussion

Sir Albert Howard, C.I.E.

It gives me particular pleasure to move a vote of thanks to Sir Bernard Greenwell for a very timely and a very important paper. As you all know, Sir Bernard is a man of affairs as well as a successful breeder of livestock and the farmer of many thousands of acres of land. In Suffolk he has carried through during the last five years or so a fine piece of development work, the transformation of what was a derelict estate into well farmed land. Such transformations will soon have to be effected all over the country. He is therefore well qualified to present a comprehensive picture of our affairs, and to indicate the part which home agriculture must play in the national economy if Great Britain is to make both ends meet and stop living on her capital.

This country can only grow more food if more capital, in the shape of humus, is put into the soil. This capital can only do its full work when the land is properly farmed. Humus will then pay regular dividends in the form of high quality produce, which in the years to come will be recognised as the foundation of our public health system. The last three lines of this paper, "A fertile soil means healthy crops, healthy animals and, last but not least, healthy human beings," should be adopted as the motto of the Ministries of Agriculture and Health. Every Parliamentary candidate, of whatever party, for our agricultural constituencies should be required to subscribe to it, to incorporate it in his election address, and to promise to do his utmost to get it welded

into the fabric of the permanent legislation of this country. In that way the agricultural community will have a real agricultural party in the House of Commons. In advancing this principle and in getting it accepted and acted upon, the farmers will soon establish their true position in the State, and this will result in markets, prices and a square deal for the land. The future of farming must not be allowed to degenerate into abuse of the Minister of Agriculture and into a wrangle about markets and prices; the whole subject must be lifted on to a higher plane -- the health and wellbeing of the nation. To attain this end, a slogan which will appeal to every thinking person is essential, and Sir Bernard has supplied it. It applies not only to this country but to the Empire as a whole.

The obvious place to begin in restoring soil fertility in this country is on grassland -- leys, pastures and meadows -- because the restitution of the manurial rights of the soil depends on applying more muck and much better muck. To produce this we must have more animals. Sir Bernard has told us how to improve the grass on heavy land by removing the factor which is holding up the formation of humus from the old turf and the urine and dung of the stock -- lack of air. When I first read this paper, a number of ideas came to my mind. I saw clearly the real reason why some pastures on the farm on which I was brought up would fatten a bullock and why the fields alongside would only keep a bullock alive or make a fat beast start slimming. These differences must be bound up with soil aeration and the natural formation of humus under the turf. A fattening pasture must be one which will make first class humus; a slimming pasture is one in which some factor like poor soil aeration is interfering with humus manufacture. Subsoiling grass on heavy land starts the formation of humus, which will go on so long as the aeration of the surface soil is maintained and the water can drain away. The pioneer in humus manufacture on grassland in this country was Mr. Hosier. He had to deal with poverty-stricken downland pasture where the limiting factor in the making of humus was not soil aeration but urine. He applied this substance economically by means of his bail system; humus was formed; an earthworm population appeared and set to work; the grasses and clovers improved; the livestock soon acquired bloom and became healthy. His success depends on large quantities of freshly-made high quality humus. He had the wit to make his soil grow its own manure in the form of microbial tissue, which on the death of the fungi and bacteria helps to form the complex material we call humus. I want everybody in this room to realise that humus is a thing that has to be grown on the farm and grown properly, and that just as much care and attention must be devoted to growing humus as is now given to raising crops and livestock. If we neglect the growing of humus and its maintenance, the soil will first deteriorate and finally go on strike -- this has happened on a large scale in many countries already. Much of the land of this country is well on the downward path through want of humus.

Subsoiling grassland should not, of course, be confined to pastures. It should be tried out on meadowland in the early autumn when the aftermath has been grazed, when the fields have thereby received a good dressing of urine and dung, and the soil is warm enough for the fungi and bacteria to make humus. Subsoiling might also do good in prolonging the life of a temporary ley.

An interesting question arises in connection with subsoiling pastures. Will it make basic slag unnecessary? If we examine the turf and subsoil of a pasture which responds to slag, we find humus has been formed and an earthworm population

established. The slag appears to affect the clovers and grasses indirectly; it neutralises acidity, starts humus manufacture, earthworms appear and the clovers and grasses improve. It is quite easy to see if subsoiling is a cheap substitute for slag or not. A pasture on heavy soil should be subsoiled to set up the full production of humus. Half the field should be slagged. The livestock will then prove the value of the test. If they concentrate on the slagged half, then the slag is doing good; if they show no preference for the slagged half but graze the field equally, the slag is superfluous. Subsoiling may therefore turn out to be a cheaper method of producing the results now obtained by the use of slag.

I am glad to see that Sir Bernard is making use of at least one of the groups of experts to be found on every farm, and I wish more use were made of animals as an indispensable research agency. It is curious that such animals as cows and pigs have never been consulted with regard to our modern cowhouses and piggeries and their cold, damp, uncomfortable cement floors, and their other expensive and useless fittings. Had this been done, large sums of money would have been saved and much unnecessary misery avoided. If the Milk Board were to set up a few experimental cowhouses for, say, ten cows, which were large enough for twenty, the one-half of each house with a cement floor and the modern apparatus for tying up, and the other half with plenty of bedding on a floor of beaten chalk or earth and provided with the old-fashioned chains so that the animals can lie down in comfort, I am sure the cows would avoid the concreted half, which is quite unsuitable for animals with cloven hoofs.

There is a brief reference in the paper to the mycorrhizal association in grasses and clovers. This is a very important matter, and its realisation is perhaps one of the greatest advances in agricultural science in the last fifty years. During 1938 I had occasion to have examined the roots of the grasses and clovers of some of the most noted meadows and pastures in Europe. Both the grasses and clovers, which were remarkably healthy, were heavily infected with fungous growths, and these growths are being rapidly digested by the roots. Here we have a direct channel of nutrition between the humus in the soil and the roots of the plant by means of fungi which are digested just where proteid food rich in nitrogen and phosphorus is needed. The roots of a plant act very like the stomach of an animal, and agricultural science has completely lost sight of this important section of the nitrogen cycle and of one of the ways a plant feeds. The mycorrhizal association occurs in most, if not all, of our crops -- cereals, fruit trees, grasses and clovers, hops, strawberries, vines, bulbs, and so forth, and it at once explains why farmyard manure gives better results than artificials. Good old-fashioned muck helps the mycorrhizal association; artificials do not, and cannot. I consider that the failure to recognise this mycorrhizal association in British farming is one of the many consequences of the N.P.K. mentality which for a hundred years has cast a withering blight on the progress of agriculture. Everyone has been thinking in terms of plant nutrients and has forgotten to study Nature's marvellous machinery by which the soil and the plant come into gear. Had this been done fifty years ago, we should have heard far less of artificial manure and much more of humus and of muck. The small plots of Rothamsted would have been unnecessary.

I am particularly interested in the town waste question, and I should like to enlarge a little on what was said in the paper. A large-scale trial of humus made from hop bine, hop string, crushed refuse from Southwark and all the miscellaneous wastes of the

garden has been carried out at Bodiam in Sussex on the large hop garden of Messrs. Arthur Guinness, and the results have been satisfactory in every respect. I have never seen finer or healthier Fuggles than those grown on humus at Bodiam last year. The manager of this garden, Mr. L. P. Haynes, has worked out comparative figures of cost between N.P.K. applied as humus or as artificials, and there is a very considerable saving when humus is used. The demand for crushed wastes has now exceeded the supply, and the depot at Southwark has been oversold for some time, with the result that a new source of supply is now required for Kent.

Perhaps a word of explanation is needed about the value of these pulverised wastes. They furnish a part of the food of the fungi and bacteria which make humus; the rest comes from the farmyard manure. The two things supplement one another: the town wastes furnish something lacking, in muck; muck furnishes something wanting in town wastes. A mixture of three volumes of town wastes and one of muck is ideal, and the result, as Sir Bernard says, is to increase the volume of the finished humus several times.

At the moment, by far the most important source of unused humus in this country is the controlled tip. There are scores of these tips in the neighbourhood of our towns and cities in which the dustbin refuse has been covered with a layer of soil or ashes and allowed to ferment, and in a year or two humus is formed. There are millions of tons of this humus now lying idle, and all that is needed is to screen it and put it on the land. The space left can be used for dumping more refuse. I have tried this material in a greenhouse and had it tested by expert horticulturists and the results are very satisfactory. There is no reason why large scale trials on every sort of land cannot be set in motion during 1939.

I hope these brief remarks will do a little to convince everybody present that Sir Bernard has not only solved some important problems but has acted as a true agricultural catalyst, and I am sure his paper will lead to many new developments. I therefore have great pleasure in formally moving a hearty vote of thanks to Sir Bernard Greenwell for his paper.

Dr. G. T. Wrench, M.D., B.S. (Lond.)

I am grateful for the opportunity of taking part in this discussion. From the days when I was a student at Guy's, it has always been puzzling to me why there is so much disease. Later on, when I got a small local reputation as a research worker, I asked whether I could research the healthiest people I could find. I felt convinced that we should never get to the root of the problem of why there is so much disease if we continuously studied end-products, namely, diseases themselves, and never studied the condition in which there is no disease. Putting in for those research posts, I made my subject, "What is health?" and sought to study the healthiest people I could find, but I got no response. I was asked to go on to cancer research, and so on. Eventually I became a general practitioner in India, and I have devoted the past three years to trying to settle this question as to what is disease, but more particularly, what is health.

Actually that question as to what is health has been answered by Sir Bernard Greenwell in precisely the same words as I should answer it: "A fertile soil means healthy crops, healthy animals, and, last but not least, healthy human beings."

I studied a very healthy people in North-West India. They were people who had practically no disease among their crops, no disease among their animals, and no disease among themselves. It may be thought that one cannot be so certain about people in the North-West of India, but that is the report of all the friends who have sent me information about them. The reason for the absence of disease among them is that they stand in a unique position in agriculture. Sir Bernard Greenwell remarked what very fine farmers we have in this country, but with all due reserve, I maintain that neither in doctoring nor in farming are we so perfect as we think we are. (Laughter.) One of the chief things which these people in North-West India do is to use the rule of return. Everything that takes life from their soil, after use, is composted and put back into the soil, nothing is allowed to go waste. The children who wander about get praise, not for bringing home flowers, but for bringing back dung found on the hills. Everything that takes life from the soil is put back to the soil, and that distinguishes them from other peoples in neighbouring valleys, who are not so healthy. Their kind of agriculture follows a remarkably long tradition.

Now I feel positive that the question, which I asked myself as a student, "What is health?" can be answered now. Health means whole. There is no separate human health, no separate animal health, no separate vegetable health, no separate soil health. There is one whole, and it starts with the soil. ("Hear, hear.") I have come from Maidenhead to-day. I there saw for the first time in a municipality a little bit of what my Hunza people are doing. I saw sewage-sludge and household refuse in a large compost heap, it was steaming when turned over. I saw within that steaming compost something that one sees completed in Hunza. I saw far less rheumatism -- in Hunza there is no rheumatism -- far fewer or no colds, far less or no cancer, and I realised that the health of the peoples of Europe and of the world lies not so much in the palm of the doctor but in that of the agriculturist.

Coming from India, this question appears to me so vital that there is nothing I would not do to impress this definition of it upon authority, but it is difficult sometimes to get to headquarters. We have a new Minister of Agriculture who is a farmer. I am a doctor and therefore have not the same access, but if this Club has influence in getting people to put the results of research and study before him, I beg that I should be allowed to put the results of my experience before the Minister of Agriculture.