

THE PRACTICE AND PRINCIPLES OF GREEN MANURING.

(Paper by C. EDELMAN, Agricultural Experimentalist, Cedara.)

Mr. C. Edelman, Agricultural Experimentalist, Cedara Agricultural College, then addressed the members as follows:

With regard to papers on green manuring, it has been suggested that I should give the fundamental principles of green manuring while Mr. Dodds goes into the matter more deeply. Therefore I don't think I will keep you very long. Green manuring as we know is one of the means of conveying humus or organic matter to the soil. We know humus to be the decayed vegetable or animal matter. To put it very plainly we may say this: that green manuring is really a substitute for kraal manuring. We know from experience that kraal manure proves beneficial on practically every kind of soil, but we also, unfortunately, know that the supply does not nearly equal the demand. That being the case we have to find another crop or another manure to serve the same purpose as kraal manure, and we try to find that in what is known as green manuring. In other words we try to grow a crop in the soil to plough it in to replace the organic matter which is annually lost from the soil.

If we only study the soil for a moment, if we only study its composition, we find that it contains humus, mineral matter, living organisms, and water. In order that we can get the best out of the soil we have those four things present. As soon as one is absent it is like a chain with a missing link; there is absolutely no connection. Of course we are rather viewing things this year under what may be termed magnified spyglasses. With so much rain every sugar cane crop looks to be thriving and you can hardly tell the bad from the good.

The purpose of my paper is to try and drive home the importance of a good organic matter supply to the soil when the conditions are totally against growing crops. Now if we only study the functions of humus then do we really realise what it performs in the soil. I read this out to you at your last Congress and I wish to read it out to you again. It is entitled "The Sad Thing about Organic Matter or Humus."

I don't mean that humus is all that is necessary for the soil—far from it. But in order even to get the best out of artificial fertilisers it is necessary to have a good humus supply. If we consider the functions we know that humus is the main source of nitrogen in the soil and as soon as the nitrogen is deficient you cannot expect to get a healthy growth of sugar cane or other crops. Nitrogen is responsible for the vegetative part of the plant, so that a soil deficient in nitrogen means a soil that

cannot grow anything but a very very weak crop. We know this also, that several soils do not require nitrogen, but we don't know that several soils do not require humus. It is on account of this kraal manure, or green manure or humus that food is supplied for the micro-organisms, and if the food is there the organisms do the rest; they convert it into nitrogen and once in that form the plant can take it over very readily indeed. We also know that humus or organic matter improves a light, sandy soil by making that more retentive for moisture and most probably for fertiliser. With regard to heavy clay soils we know it tends to make that more loose or friable.

An experiment was conducted with organic matter in a clay soil as follows: a certain portion of clay soil had extracted from it its organic matter content and then the soil was allowed to freeze and thaw again. Once the organic matter was out of the soil, in spite of the fact that it was allowed to freeze and thaw, it remained one hard mass, but as soon as the humus was replaced that same soil was again allowed to freeze and thaw, and on thawing it broke down into a fine mass. So it will be seen that it can improve the extreme soil and also the other extreme, the light soil and the heavy clay. It has a binding effect in the case of a light soil and in the case of a clay soil it makes it more open.

We all know the majority of clay soils are too tight and if we can get some substance to make them open and easier for cultivation then we are working on the right lines. Not only that but we know that our richest soils are very often situated in the vleis, but they need drainage and other things. I really would be more happy lecturing to a lot of maize farmers because I have done more work with maize. At the same time it is very gratifying to note, as you all heard yesterday, that it is thanks to the maize that Mr. Storey has been able to find out so much about the Streak disease in sugar cane (hear, hear). So perhaps I shall feel more at home with you to-day.

As I pointed out at the commencement I am just giving you the fundamental principles, and the fundamental principles are the same for all crops. What I want to make clear is this: that soils no doubt need artificial fertilisers and not fillers; you all know that by now (laughter). I am a great believer in fertilisers provided you use the right ones. But there comes a time when your organic matter becomes exhausted. Take for example the medium types of soil, medium to heavy. There comes a time when that organic matter becomes exhausted and

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work as you will you can never get a fine tilth. I can see the roller followed by the disc harrow followed by the ordinary harrow, and followed again by the roller, disc and harrow, only to bury the lumps and bring them up again. If you fail in that respect I think that the soil really needs organic matter or humus. Of course we know that green manuring supplies a certain amount of plant food other than nitrogen, but really that is taken as of little account. The particular thing about a soil is its physical condition and once you lose the humus you have lost the physical condition.

I overheard a conversation on the question of whether green manuring paid or not. I believe they have about 1,200 acres of green manuring at Natal Estates. If you want to know if green manuring pays I think you had better ask Mr. Campbell. You see how very important it is to maintain the organic matter in the soil. You know that when your land is ploughed up the first time you expect good crops for a year or two. Why is that? Because it is rich in humus. But as time goes on that humus is burnt out we might say, and your soil becomes poor. Well the idea is not to let that humus get burnt out or wasted but to maintain it year in and year out. You will see therefore that from every point of view you cannot go wrong by using humus for the land. There may come a day when someone will be able to supply it to farmers in the same way as artificial fertilisers are supplied to-day.

Now what is the first step towards soil improvement to-day? If we consider the fairly heavy clays we know that they most probably need drainage. If we consider most of the sugar lands we know they are somewhat on the light side. The first step towards improvement is the addition of humus. If you have some other ways of applying humus to the soil we don't say go in for green manuring. We know that unless mixed farming is practised and stock are kept, and you have not a good supply of kraal manure and cannot buy it very readily, you are apt to sell your fertility of the land or give it away. In future when you sell sugar cane or mealies ask them to pay you also for the fertiliser that you sell; don't give it away for nothing as has been done in the past.

Study the moisture content of the different soils or the holding capacity of the different soils for moisture. We find that with the sandy soil 100 lbs. of sand will hold about 25 lbs. of water, a heavy clay between 50 and 75 lbs. and when we come to the humus or vegetable soil we find it holds double its own weight of water. Think what has happened in the past. Of course, as I have said, this year we are seeing everything at its best. But it is in a dry year that we want to see these things and not in a year such as this. We know perfectly well, as Mr. Blewett told us yesterday, that in a dry season the

fertiliser will have an effect on the seed and so on. We want to find something that can be used in a dry year that does not prove detrimental either to the soil or the welfare of the crop.

We cannot have too much of humus in the soil say for sugar cane. There are cases where you can overdo the humus business and have too much, but I don't think you will ever get to that stage in the near future or as long as we live. Again if you consider your alluvial soils, your soils which don't need fertilising; you can probably get 15 bags of mealies to the acre without fertiliser. To what is that richness due? Largely to this organic matter or humus. The humus is the peacemaker of the soil. Without that the bacteria and even the water and all the other plant foods are at loggerheads with each other and can't get on until "Mr. Humus" comes stepping in to such an extent that it is buried with the soil. We know then from every possible point of view that humus proves beneficial for the land. As far as I can make out you have undoubtedly got a green manure crop for the summer months. We have got very fine crops of Mauritius Bean—a species of the Velvet Bean—and other green manure crops, and we also saw yesterday a very tall growing crop known as Sunn Hemp. Of course we know that Sunn Hemp should be ploughed in when it was half that height or even less.

Seeing a green manuring crop growing to about six or eight feet reminds me of one of the shows held in Scotland. At a Show there were some very large beetroot. There was one huge beetroot weighing about 30 to 40 lbs. The judge came along and put a first prize ticket on that. The old Scot came along and said "It may be very good, but where are you going to get a pot to put it in?" Well it is the same with that green manure crop when it gets about 6 feet high, I don't see where you are going to get a plough to plough it in. We know there are two types of green manuring crops, the legumes and the non-legumes. These will be dealt with better by Mr. Dodds I think.

There is one thing I would like to say. If you intend practising winter green manuring I think it will be necessary to grow the seed first in the area to acclimatise the seed. We know that winter crops do best in the cooler climates. For instance one of the worst green manuring crops we saw yesterday was that of Rape. That does not thrive in a climate such as this unless it is planted towards the end of March and the soil has plenty of moisture. In our experience we found a crop of that sort does better with medium to heavy soils and not on sandy soils. I also saw rye which was not looking too good. If you have to bring on a winter green manuring crop the first step in that direction is the growing of the seed first because unless you get acclimatised seed on your farm you never can rely on good results.

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You will see therefore that we have these different types of crop. We have the long growing crop and the crop that matures in a very short while, but I still think we might improve on getting a suitable winter crop provided we can get suitable seed.

There is another paragraph I would like to read out to you in regard to the nitrogen supply of the soil. We know at present it does not affect South African conditions in general but this is an extract from an American Bulletin:—

“Except on those soils which still have a large proportion of unexhausted nitrogen left, the nitrogen problem is a most important soil fertility problem before the farmer. . . . Legumes and green manures are needed in larger degrees . . .”

You will see we are ever facing problems and trying to solve these different problems. I have tried to show you briefly the importance of organic matter or green manuring in the soil. In conclusion I would like to add this: As a means of restoring the humus content of the soil, as a means of lessening soil erosion, and as a means of getting the best value out of the artificial fertilisers, green manuring may help you to gain the goal. In other words, I would like to say that the success of any farming depends on no factor more than the maintenance of the soil fertility and without humus you can never maintain the soil fertility. (Loud applause).

The Chairman on behalf of the members expressed their appreciation of Mr. Edelman's address.

GREEN MANURING FOR SUGAR CANE.

(Paper by H. H. DODDS, Director of Experiment Station, Natal.)

It is evident that the main agricultural problem in nearly all the older sugar growing countries is the progressive exhaustion of the organic matter, or so-called humus, in the soil, and many parts of Natal also appear to have reached this stage. Records of soil analyses and comparative yields of cane in the early days are lacking, but I believe that many old colonists will agree with me when I suggest that the soil in Natal, like the old grey mare in the song “ain't what it used to be, twenty long years ago.” However that may be, there is no doubt that the records of soil analyses from different parts of the province show that in the older sugar growing districts and even in many of the new ones there is now a marked deficiency of organic matter in the soil.

Insufficient attention has been given to this essential factor in the past. On the more scientifically conducted estates commercial fertilizers have been systematically applied for years, together with sugar house waste products rich in the required lime, so that the soils in these cases are not usually conspicuously lacking in other plant food ingredients in an available form, but in nearly every case they are deficient in humus. On very few estates has any attention been paid to the cultivation of green manure crops as a source of humus, and that only within the last two or three years. This deficiency in organic matter is still more marked in other parts of the province where cultivation has been less intensive and where the practice of burning the trash from the cane has been systematically followed.

To restore and maintain the fertility of the soil I believe it will be necessary to institute the practice of green manuring as an essential part of our system of agriculture. Unfortunately it has not

been to anyone's direct pecuniary benefit to any considerable extent, except to the planter himself, that green manure crops should be grown, hence the vigorous and effective propaganda which has been devoted to the sale of some other of his raw materials has hitherto been lacking in this instance.

In the sugar growing districts of Louisiana the exhaustion of the fertility of the soil after long continued heavy cropping reached an acute stage a few years ago. The yield of cane per acre has steadily fallen during the past few years from 18 tons per acre per annum in 1921 to 7 tons in 1924.

Several causes are contributory to this decline including mosaic disease, various insect pests and unfavourable seasons, but in the opinion of those who are in the best position to judge the principal cause is the decrease of permanent fertility. Some years ago second and third ratoon crops were commonly grown, now one ratoon crop is the most that will give satisfactory returns and even this usually shows a marked decline in yield compared with the plant cane.

The rotation which came into general use was two years of cane comprising plant and first ratoon crops, followed by a rotation crop of maize, the residues (stalks, etc.) of which were ploughed in as early as possible and succeeded by a green manure crop of cowpeas which was ploughed in before planting cane for the following season. This practice certainly postponed the day of reckoning for a time, but it soon became evident that the progress of soil exhaustion had only been checked and not stopped even though commercial fertilizers were extensively used.

Looked at from the point of view of the nitrogen balance which is a convenient rough method of estimating the fertility of the soil arithmetically,