A PRELIMINARY NOTE ON THE INCREASE OF AVAILABLE PHOSPHATE IN ROCK PHOSPHATE BY COMPOSTING

By G. C. DYMOND.

Past experiments have indicated that the composting process increases the availability of P_2O_5 in general, but the results have been complicated by the use of filter cake with its naturally high percentage of available P_2O_5.

During the past two years further experiments have been carried out with the co-operation of H. Krumm, A.R.I.C., chief chemist of African Metals Corporation Ltd., the producers of Langfos rock phosphate.

The analysis of this rock phosphate is as follows:

	Per cent.
P_2O_5 total	17.1
P_2O_5 (soluble in 2 per cent. citric acid)	7.0
Ratio	40.9
CaO total	25.8
Lime as $CaCo_3$	2.5
Iron oxide as Fe_2O_3	2.8
Aluminium oxide as Al_2O_3	1.2
Fluorine...	1.95
Insolubles	49.2
Moisture...	1.4

In the first series the finely crushed Langfos was layered between the coverings of organic materials, which included filter press cake and other ordinary activating media. Temperature variations occurred, presumably due to irregular layering of the phosphate. The results were as follows:

	1	2	3	4
Total P_2O_5 per cent.	2.16	2.13	2.30	2.21
2 per cent. citric soluble P_2O_5 per cent.	1.90	1.70	1.80	1.80
Ratio	88.0	79.8	78.2	81.5

Now as the ratio of total to citric soluble phosphate in Langfos is only 40.9 per cent., the increases in the above experiments might be due, wholly or in part, to the unknown quantities of filter press cake used.

In order to clear up this point another series of experiments was carried out. All materials were weighed and no filter cake was used. The amount of Langfos used ranged from 8 per cent. to 22 per cent. by weight and was well distributed throughout the mass. No temperature variations were recorded.

The results were as follows:

Original raw materials.	*Control.*	1	2	3
Total P_2O_5 per cent.	1.12	2.48	3.64	4.63
2 per cent. citric soluble P_2O_5 per cent.	.80	1.36	1.84	2.25
Ratio	71.4	54.8	50.5	48.6
Same after Composting.				
Total P_2O_5 per cent.	0.69	3.02	3.58	4.70
2 per cent. citric soluble P_2O_5 per cent.	0.51	2.24	2.77	3.27
Ratio	73.9	74.2	77.4	69.6
Increased availability	2.5	19.4	26.9	21.0

This work is being continued and a further series of experiments is being carried out to determine the maximum amount of Langfos which can effectively be treated in this manner.

The agricultural value of this process is important, for not only is the availability appreciably increased, but the resulting phosphate, surrounded as it is by large quantities of organic matter, will be less susceptible to fixation in the soil. Further, the composting of city wastes has been criticised on the grounds that the bulky material produced is low in unit values and therefore costly and uneconomic from a long transport angle.

Enrichment with rock phosphate should satisfy the only criticism against the extended recovery and use of the vast stores of fertility that are being wasted in the garbage dumps and sewage systems of our towns and villages.

Mr. Bechard described his experiences with the use of phosphate, with which he had concentrated in his fields for several years. Without a laboratory he could not know for certain what the results had been except that his fertiliser costs had been lowered and he was not disappointed with the results. He used a considerable amount of Langfos; he made about 400 tons of compost a year to which he added about 20 tons of Langfos with very good results.

Mr. du Toit said the paper showed how dangerous it was to draw conclusions. In the first series of experiments the ratio of available to total phosphate was increased from forty to double that figure, but the addition of filter cake might have been responsible for this increase. Mr. Dymond had, however, carried his experiments further and not used filter

cake, yet after his second experiment it was still somewhat difficult to say just how much of the Langfos became available. He felt Mr. Dymond should state what other materials were used, with their weights and analyses. It had been shown that organic matter to a certain extent prevented the fixation of available phosphate which would, of course, also happen if superphosphate were mixed with the compost.

Mr. Dymond, in reply to Mr. du Toit, said the materials used were dried grass, cane trash, mule and cattle manure, lime, molasses and Langfos. All materials were weighed. Filter cake was used in two of the series and this had somewhat complicated part of the results owing to the high availability of the P_2O_5 present. Further experiments were being carried out to finalise these points and he hoped to have another paper prepared during the course of the year.

Mr. Lewis asked whether anyone could indicate the value of filter cake as a fertiliser.

Mr. Bechard said if he could apply twelve tons per acre of filter cake he would dispense with all other fertilisers. He had applied six to twelve tons of filter cake in an experiment and the result was cane which must have given about seventy tons per acre.

Mr. du Toit said that on a dry basis most of the Oliver Campbell type of filter cake would probably contain about two per cent. available phosphate. The unit value of phosphate was slightly over 10/- but the rock : super mixture came to about 8/6. He described the method on which the amount of available phosphate was calculated. He thought filter cake might contain from $\frac{1}{2}$ to $\frac{3}{4}$ per cent. of nitrogen; apart from these ingredients and a little potash, filter cake was rich in organic matter, calcium and magnesium and contained the minor elements which might all be of some value. He thought if filter cake could be bought at 18/- a ton it would be an excellent buy.

Mr. Galbraith asked what the effect was in mixing boiler ash with filter cake.

Mr. Dymond, who said he agreed with Mr. du Toit's contention, replied to Mr. Galbraith that he thought the mixture had no value as the potash present was in the form of an insoluble potash glass. It was not worth the trouble of mixing or carting.

Mr. Lewis asked whether Mr. Dymond considered filter cake a source of extra elements.

Mr. Dymond replied that he did. The subject was part of his particular pet theory—the utilisation of city and human wastes. The only valid argument put up against their use was that the product was bulky and low in unit values and therefore costly to transport. The answer was enrichment through rock phosphates.

To illustrate what he meant he read a short extract from a paper he hoped to present shortly:

"On the average a human being excretes 0.31 lbs. of faeces and 3 lbs. of urine every day. He also causes the accumulation of 2 lbs. of litter or garbage. The evaluation of these waste products determines our individual contribution to the earth's fund of fertility and, in the mass, our value to the land we live on and the country we call our own. In agricultural terms or unit values of N.P.K.—nitrogen, phosphorus and potassium—we are worth £1.634 per person per annum. To this may well be added the physical and bio-chemical values of organic matter and the essential benefits of trace elements. Add to these the abattoir and trade wastes and we can accept the simple minimum value of £2 per person per year. After three score years and ten, we should have given back to Mother Earth in gratitude £140 worth of potential fertility.

"Not much, but when we consider our white population in South Africa of two and a half millions, the figure mounts to £5,000,000 per annum. Add to this the somewhat lower values of our natives and then speculate in terms of world populations and the figures become astronomical. The world produces and largely destroys some five thousand million pounds worth of human wastes every year."

The importance of enrichment with rock phosphate could now be visualised.