A NOTE ON THE ANALYSES OF COMPOSITE SAMPLES OF FILTER-CAKE FROM SOUTH AFRICAN SUGAR FACTORIES

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Abstract

A table is presented showing the amounts of plant food available in filter-cake samples collected in September, 1971 from the 22 South African and Swaziland sugar factories. The average mineral contents of N, P and K have been converted to equivalent fertilizer and monetary values.

Introduction

This paper is similar to one presented last year (Alexander 1971[1]). The main difference lies in the fact that on this occasion the samples are more representative. During the 1970 crushing season two samples of filter-cake were taken from each of the 20 sugar factories operating in South Africa, and also from the two factories in Swaziland. These two sets of samples were collected four months apart, and the results gave an indication of the amounts of available nutrients to be found in locally produced filter-cake. It was suggested that an average of two catch samples was not sufficient to account for the normal variations in nutrient concentration which would occur in individual factories. In an attempt to eliminate this shortcoming it was decided to seek the co-operation of all mill managers in obtaining composite samples. These were to be collected in the middle of the crushing season. As a result, each factory submitted a composite sample comprising several subsamples taken every day, throughout the period of a week towards the end of September, 1971.

Sample handling

As soon as the samples were received at the Experiment Station they were re-dried, ground, and stored prior to analysis. In discussions following the presentation of the previous paper, interest had been expressed in carbon:nitrogen ratios, and the iron and silicon contents of the filter-cake. Hence C:N ratios and percentages of Fe and Si have been included in the analytical results presented in Table I.

Sample variability and comparisons

Although the figures quoted for any particular factory are not necessarily identical with the annual mean for that factory, they are almost certainly much nearer to the mean than the results previously quoted for the 1970 season.

Comparing 1970 data with those for 1971, it can be seen that whilst N and P are higher in 1971, Ca and Mn decrease, whilst K, Mg, Zn and Cu are approximately the same. For individual mills it might be added that low N values at ML FX and RN in 1970 might have been fortuitous, but at UC the low value may be real. For P, low total and available values seem to be real at FX and AK. Ca seems to have been consistently high at MH, UR, PG and JB. The singularly low Zn at UC in 1970 has increased in 1971 to a figure more in line with those for other mills.

Monetary value

South African filter-cake produced in the middle of the 1971/72 season contained, on average, 1,93% N, 0,91% available P, and 0,20% available K. Thus one ton of the dry material contained the equivalent of 42,0 kg of urea, 46,4 kg of double supers and 4,0 kg of muriate of potash. At today's prices (1972), these ingredients are worth R3,32, R3,09, and 20 cents respectively, or R6,61 per ton of dry filter-cake. The high moisture content normally present in the material (often between 50 and 75%) reduces the monetary value to less than half that shown for the dry cake.

As in the past, no allowance has been made in this calculation for the fact that only a portion of the nitrogen becomes available to the cane crop. In practice, therefore the value of nitrogen in filter-cake is well below that shown. Nitrogen availability in organic residues is closely dependent on the C:N ratio of the material. Harmsen and Kolenbrander (1965[3]) state: "The C/N ratio of the decomposing material must be below 20 to 25 (corresponding to about 1,5 to 2,0% N) for an appreciable net mineralization of nitrogen. The reimmobilization of mineralized nitrogen during the decomposition of substances with a C/N ratio above the critical value of 20 to 25 might bring about a depletion of the available nitrogen, and thereby induce the well known effect of nitrogen deficiency when such substances are added to the soil". In this case, filter-cake with an average C:N ratio of 19,5:1 would be marginally on the right side of the critical value, and should therefore begin to mineralize nitrogen slowly when incorporated in the soil. The mineralization rate would be greatly speeded up by composting the material before use. An anonymous report (1943[2]) quotes the effect of composting Hawaiian filter-cake as reducing the C:N ratio from 23,7:1 to 11,5:1. The resulting compost was found to be an excellent fertilizing medium, whereas fresh or partly decomposed cake was not. A complicating factor is that fresh filter-cake appears to have a greater nematicidal effect than the decomposed product, at least under South African conditions.

TABLE I

Filter-cake survey, September, 1971
(Oven-dry basis)

Factory	C%	N%	C/N	Tot. P%	Avail P%	Tot K%	Avail K%	Ca %	Mg %	Cu ppm	Zn ppm	Mn ppm	Fe % ppm	Tot. Si%
1 ML	33,9	1,72	19,7	1,25	1,20	0,43	0,35	1,60	0,49	59	90	940	1,62	3,4
2 MH	38,1	2,25	16,9	1,55	1,50	0,22	0,14	2,55	0,74	60	113	630	0,24	3,7
3 UR	32,9	1,71	19,2	1,35	1,25	0,31	0,17	2,45	0,47	109	113	1100	2,02	6,9
4 PG	39,7	2,01	19,8	1,10	1,00	0,26	0,20	2,05	0,49	33	42	720	0,36	2,7
5 UF	38,0	2,09	18,2	1,00	0,95	0,39	0,22	1,40	0,37	50	76	700	0,42	6,3
6 EM	34,6	1,66	20,8	1,00	0,90	0,33	0,17	1,70	0,61	35	38	760	0,82	7,4
7 FX	34,9	1,62	21,5	0,52	0,46	0,50	0,21	0,80	0,33	25	28	340	0,21	6,2
8 EN	36,3	2,02	17,8	1,15	1,10	0,26	0,19	1,85	0,37	66	50	620	0,14	5,6
9 AK	38,5	1,57	24,5	0,58	0,48	0,24	0,18	0,70	0,25	26	30	370	0,17	4,9
10 DK	40,4	2,47	16,4	0,66	0,52	0,26	0,19	0,80	0,29	42	34	550	0,31	3,5
11 DL	40,9	1,79	22,8	0,72	0,62	0,24	0,15	0,80	0,28	39	34	280	0,28	4,3
12 GD	40,1	2,38	16,8	1,35	1,20	0,26	0,18	1,95	0,50	60	118	960	0,31	3,5
13 GH	39,1	1,60	24,4	0,70	0,60	0,46	0,37	0,90	0,29	26	42	400	0,13	4,1
14 MV	38,3	2,22	17,3	1,25	1,15	0,24	0,13	1,80	0,46	21	142	880	0,25	4,0
15 JB	32,8	1,79	18,3	1,05	0,97	0,35	0,20	2,25	0,24	40	38	700	0,04	5,6
16 UC	21,6	1,32	16,4	0,80	0,70	0,26	0,18	1,30	0,17	50	32	815	0,10	7,1
17 TS	40,1	1,87	21,4	0,90	0,75	0,28	0,20	1,20	0,40	38	32	730	0,16	3,8
18 ME	39,7	2,01	19,8	1,15	1,05	0,24	0,15	1,70	0,42	43	60	630	0,44	2,8
19 IL	37,7	2,65	14,2	1,30	1,12	0,24	0,16	1,20	0,49	40	56	980	0,36	3,2
20 RN	38,5	1,88	20,5	1,30	1,15	0,35	0,22	2,05	0,50	26	66	560	0,25	3,4
21 SZ	39,1	1,84	21,3	0,90	0,71	0,22	0,18	1,20	0,41	96	41	560	0,34	2,0
22 UK	40,6	1,96	20,7	0,76	0,60	0,20	0,15	1,00	0,42	29	40	750	0,12	1,5
Av. 1971	37,1	1,93	19,5	1,02	0,91	0,30	0,20	1,51	0,41	46	60	681	0,27*	4,4
Av. 1970	—	1,69	—	0,90	0,72	0,27	0,19	1,84	0,37	52	69	898	—	—

* Excluding the results for Malelane and Ubombo Ranches. (Both samples were re-digested, and re-analysed for iron, with similar results.)

Filter-cake contains small but significant amounts of calcium, magnesium, and sulphur, together with silicon and the trace elements. It would be extremely difficult to place a monetary value on these various elements, even collectively. They are, of course, of no benefit at all to a grower whose soil is already well-supplied with them.

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