

SOIL REJUVENATION WITH CRUSHED BASALT IN MAURITIUS

Part I—Consistent results of world-wide interests

By O. D'HOTMAN DE VILLIERS

IT is now 25 years since the writer, from the classical studies of N. CRAIG and P. HALAIS on the soils of Mauritius at the Sugar Cane Research Station as well as from his own work on the soils of Highlands S.E. and annexes carried out at the same Institution, concluded that the extremely impoverished free soils of the superhumid regions of the island, which were giving comparatively mediocre responses to liberal doses of N.P.K., could be rejuvenated by application of adequate quantities of crushed basalt, the mother rock from which almost all the soils of the colony are derived. Full theoretical exposition was first published in the local *Revue Agricole*, 1937, 16, 89-92.

The first open field experiments with crushed basalt laid out on approved statistical lines (two trials consisting each of two 4 × 4 Latin Squares) were planted in 1938 at Hermitage (Belle Rive) where the annual rainfall is about 135 inches so that the soil there is the totally leached out, acid residuum composed mainly of hydrous oxides of iron, aluminium and titanium, with comparatively very little silica.

The results of all these carefully conducted trials, with doses of basalt from 10 to 90 tons per acre, were fully given and discussed in two papers^{1, 2} reviewed at some length by Dr. MARTIN-LEAKE in the *International Sugar Journal*^{3, 4}. It is therefore merely necessary to recall that crushed basalt conclusively proved its capacity for very significantly increasing cane yields of POJ 100, M 27/16 and M 134/32 under heavy or under normal fertilization with N.P.K. In other words, the response of the basalted soil to chemical fertilization, using the current salts together with phosphatic guano, had been very significantly increased. In addition, the writer obtained a significantly positive effect of increasing doses of crushed basalt on juice quality in several instances and this, it can be stated today, was strikingly corroborated by a six-year experiment in large pots with POJ 2878 and Co. 301.

In view of all the consistent evidence accumulated during 11 years from pot and open field experiments and from laboratory studies, and seeing that breaking and crushing basaltic rocks on the spot to a powder of suitable fineness could be done cheaply, assuming very large quantities are crushed, the author, in 1947, induced Dr. HARRY EVANS, Ph.D., of the Research Station, to lay out new experiments for checking purposes. "A 3 × 2 × 2 factorial experiment was laid out at Hermitage consisting of 3 levels of basalt dust, viz.: none, 91 and 182 tons per acre in all combinations with normal estate fertilization and twice

the normal estate fertilization and with the varieties M 134/32 and M 63/39⁵."

EVANS and the writer left the Colony but S. M. FEILLAFÉ, also of the Station, took over the matter and, every year, published in the Annual Reports the results of another carefully conducted field trial, and the figures for five crops are condensed in the Report for 1952⁶.

	tons per acre		
Crushed basalt	0	91	182
Plant cane	31.9	33.6	36.3
1st Ratoon	26.7	29.8	32.6
2nd ,,	32.4	34.2	37.3
3rd ,,	33.0	36.2	38.1
4th ,,	33.7	38.4	41.4
Total for five crops	157.7	172.2	185.7

Thus, a statistically highly significant gain of 28 tons of cane was obtained over five crops as a result of an application of 182 tons of crushed basalt on two cane varieties. It should be pointed out that the fertilization, on the average, was well above normal and, in addition, at planting, the notable quantities of filter-press cake, farmyard manure, final molasses and ashes applied must have substantially masked the effect of basalt, at least for the first one or two crops. This was pointed out by FEILLAFÉ.

Anyway, the notably greater response of the basalted soil to the fertilizers applied, predicted by the writer since 1937, is once more very evident. And FEILLAFÉ, who was able to follow such a correctly laid out trial for five successive years, stated that it was reasonable to suppose that still more infertile soils would give even more "spectacular" results, and that it could be inferred from the trend of the figures that a response to basalt could safely be expected for many more years to come.

Subsequently the Research Station passed from Government to the Planters, and is now the independent Mauritius Sugar Industry Research Institute under the able direction of Dr. P. O. WIEHE, C.B.E., D.Sc.

In 1955 the Institution laid out a new field experiment at Rose Belle (Cascade) for measuring the

¹ *Rev. Agric. (Mauritius)*, 1947, 26, 160-175.

² *ibid.*, 1949, 28, 124-134.

³ *I.S.J.*, 1948, 50, 90-91.

⁴ *ibid.*, 1950, 52, 117-118.

⁵ *18th Ann. Rpt. Mauritius Sugar Cane Research Sta.*, 1947, 42-48.

⁶ *23rd Ann. Rpt. Mauritius Sugar Cane Research Sta.*, 1952, 19-20.

effect of four levels of crushed basalt, viz: none, 45, 90 and 180 tons per acre, once again under heavy fertilization and, furthermore, with the variety B 3337 which, like POJ 100 used by the writer in his very first Latin Squares, is adapted to poor soils. Here are the results⁷, unpublished figures for 3rd Ratoon being added by the writer:

	tons per acre			
Crushed basalt	0	45	90	180
Plant cane	15.5	23.1	27.9	31.1
1st Ratoon	39.2	44.8	47.1	49.6
2nd Ratoon	32.7	36.9	37.9	36.5
3rd Ratoon	37.3	39.7	41.2	44.0
Total gain in four crops		19.8	29.4	36.5

The writer could not desire more powerful experimental evidence of his thesis and predictions. For plant cane ("virgins") the increase in yields due to 180 tons per acre crushed basalt reaches the 100% mark. Such a demonstration, as well as all the other statistically significant results accumulated during the past two decades, are not only of the highest interest to agricultural science, but they evidently are of practical value, especially on a small island where a rapidly growing population is causing the gravest concern to the authorities. Whether the effect of basalt in the soil is physical or chemical or both, would be rather immaterial to the economist to whom the substantial gains in yield, repeatedly obtained for years, is all that really counts; provided the preparation, transport and application of the rock dust are not prohibitively expensive.

Such is the consistency in uniformity of the results obtained with different levels of fertilizer applications in four different first grade field trials distributed in space and time, with five different varieties of cane, that it can safely be estimated that about 150 tons per acre crushed basalt of the degree of fineness used should, on the impoverished soils in question, give an additional 3/4 tons of sugar per acre per year, on the average, for a long series of annual cane crops.

There are, at present, more than 20,000 acres under cane on the senile yellow soils in the super-humid regions of Mauritius, which practically never suffer from drought. Furthermore, even larger areas (Crown lands) could be opened up not only for extension of cane cultivation, but also for growing many other food stuffs so greatly needed in the serious demographic conditions of the Colony.

To begin with, early in 1936, tomato plants were very successfully grown in pure crushed basalt exclusively fertilized with nitrogen. Soon afterwards was started a series of pot and open field experiments with oats, millets, soya beans all exclusively fertilized with nitrogen. Without exception, the results were very conclusive. Soya beans, on small plots to which about 150 tons per acre of crushed basalt were applied, gave an increase in yield as high as 427% for a first crop.

H. EVANS⁵ in pots with Hermitage soil and basalt under fertilization with nitrogen grew oats with highly significant results. S. M. FEILLAFÉ⁸ also used oats to demonstrate that basalt was effective in the

senile yellow soil but not in the rather rich soils under lesser rainfall; nitrogen and phosphorus being supplied to each and every pot.

In Germany, it can be recalled, pine seedlings on very poor soils treated with 70 tons per acre of basalt waste gave, after 23 years, 4-5 times greater volume of timber than on untreated plots, as revealed by R. ALBERT⁹. H. H. HILF¹⁰ calls basalt sand the "enduring fertilizer" which is readily yet sufficiently slowly weathered so that when scattered in large quantities (about 1 cm thick) over unproductive sand soils, it improves their fertility, deciduous trees being helped more than conifers. More recently, A. NĚMEC¹¹ of Czechoslovakia also obtained, in the space of two years, with spruce trees, striking results from large doses of crushed basalt on degraded forest lands.

Incidentally, it was the wish and advice of a Sub-Committee of the Society of Chemists in 1948 in Mauritius, that silvicultural experiments on a suitable scale should be carried out in the Colony.

In conclusion, in addition to sugar cane it is seen that forest trees and food stuffs can also strikingly benefit from large doses of crushed basalt on poor soils. It seems, therefore, that it is now up to public and/or private enterprise to examine the economic possibilities of a question which should arouse renewed interest in the agricultural world.

AGRICULTURAL ABSTRACTS

Inoculation of sugar cane plants with mosaic virus using the airbrush. J. BIRD. *J. Agric.* (Univ. Puerto Rico), 1961, 45, 1-7.—The "airbrush" devised by LINDNER and KIRKPATRICK¹³ is found to be a more efficient tool than the Matz pin in securing infection.

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Further studies on transmission of the causal agent of chlorotic streak. J. BIRD. *J. Agric.* (Univ. Puerto Rico), 1961, 45, 8-18.—Healthy sugar cane grown in conjunction with diseased cane or Napier grass in white quartz sand, became diseased. The causal agent appears to be identical for both plants.

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Progress report on cultivation practices at Central Aguirre Sugar Co. W. BARNES. *Sugar J.* (La.), 1961, 22, (8), 19-22.—The major development described is a combined mould-board plough and subsoiler used for sugar cane banking. It makes possible the deep placement of N.

⁷ *Mauritius Sugar Ind. Research Inst. Ann. Rpt.*, 1958, 81.

⁸ *21st Ann. Rpt. Mauritius Sugar Cane Research Sta.*, 1950, 27.

⁹ *Forstarchiv*, 1936, 13, 158-162.

¹⁰ *ibid.*, 1937, 13, 113-116; 1938, 14, 93-102.

¹¹ *Soils & Fertilizers* (Imp. Bureau Soil Science); 1948, (1629), 341; 1950, (1940), 312.

¹² *Rev. Agric.* (Mauritius), 1948, 27, 155-162.

¹³ *Phytopath.*, 1959, 49, 507.