

ORGANIC MANURES IN MAURITIUS.

By G. C. DYMOND.

For more than 100 years, the production and return of organic residues has been a tradition and a basic principle of agriculture in Mauritius. There is little doubt that this age-old practice has played an important part in maintaining that general level of fertility, so noticeable in the heavily cropped cane lands of this tropical island 1,500 miles from Durban.

Before dealing with this specific subject, I should like to give you a few descriptive notes on this 720 square miles of land in the Tropic of Capricorn.

Mauritius has a mixed population of about 410,000. Out of a total acreage of 460,800, there are 143,497 under sugarcane; for sugar constitutes 97 per cent. of the potential wealth of the island. I say "potential," because the value of their primary product has varied from an extreme high of over £90 per ton, to an extreme low of under £5.

The conditions of sugarcane agriculture and sugar manufacture differ considerably from those existing in Natal and Zululand, due primarily to peculiarities of soil, climate and rainfall.

The soil is of volcanic origin, its rocks consisting almost entirely of basalt and its varieties trap, trachyte, lava, etc. The rocky nature of some of their cane fields is something that has to be seen to be believed. In consequence, the use of mechanical implements is restricted.

An incredible amount of labour is expended in collecting the stones and rocks, and packing them into walls, which separate every second cane row. These ramparts are moved every five or six years, when the cane is replanted in fresh holes between the remaining rocks. The resulting aspect of the cane fields, before they become covered over, is something that must be unique in the history of sugar production.

The rainfall, though usually abundant, is unevenly distributed, as it ranges from 50 inches per annum in the coastal areas to 175 inches and over up country. The soil is porous, and despite the good rainfall irrigation is extensively practised.

The principal canes being grown to-day are BH.10/12 and a Mauritian seedling M.134/32, which is a cross between P.O.J.2878 and D.109.

In the north of the island, planting takes place between May and June, while in the cooler uplands (about 1,800 feet) it is done between September and December. Five ratoons are the general limit and the cane is harvested each year, when it is 12 to 16 months old. The standing cane in each field is hand-trashed once and often twice before cutting, the trash being placed in alternate cane lines. This old-established custom costs from four shillings to six shillings per acre. This practice, it is said, prevents the growth of aerial roots and side shoots behind the dead leaf sheaths common in humid climates. It also assists the cutters in reaping and sending only clean cane to the mills, an important condition not observed in this country.

The average yield of cane per acre per year is about 22 tons. This figure is, however, affected by low yielding native areas, as on well controlled estates yields up to 50 tons are obtained.

The price paid for cane varies from 11/- to 13/- per ton, from which the planter normally makes 3/- profit.

Sugar production during the last three years was:—

	1938.	1939.	1940.
Total quantity produced (short tons)	353,441	229,460 (drought)	347,600
Local consumption	13,717	12,822	Not yet ascertained
Export (98.6° pol.)	339,724	216,638	do.

There are 36 sugar factories operating at present in Mauritius. Owing to the short crushing season (about ninety days) a great deal more care is paid to the agricultural side than is the case in Natal. Thus planting is always done during the most favourable period and from selected material. The top portion of the cane only is used and this is soaked for ten days in lime water prior to planting.

COMPOST MANURES.

It can be truly said that "compost manures" form the basis of all manurial treatment of the plant cane crop in Mauritius.

Two main types of this material are recognised, "fumier," which is made from cane trash, grass and weeds, rotted with cattle droppings, and "saccharogene," which is a mixture of filter cake, molasses, ashes and bagasse, with a variable quantity of coral sand.

With regard to the former, fumier varies considerably in its quality. Thus Indian smallholders with one or two oxen, produce what is called "long manure," a compost in which the original materials are low in plant food and only partially rotted, owing to exposure to heavy rain without catchment facilities.

At some of the estates the manufacture of both fumier and saccharogene is a highly developed business. At Benares, for example, 1,500 tons of compost are made under cover each year. This requires the carting in single ox-carts of 750 tons of trash and weeds, and involves the use of 11,905 labour days per year. At an average labour cost of 55 cents per day, the labour bill amounts to approximately £500. Costs are carefully kept, the total cost per ton working out at 6/6. The number of cattle required to produce this 1,500 tons is 140, or roughly 11 tons of compost per head. All of these animals are kept specifically for this purpose and live their lives as manurial machines in specially constructed stables.

At Mon Tresor, 5,000 tons of compost are made from 300 cattle and 500 sheep and goats. The costs here were approximately the same as at Benares.

The trash used at these estates is from cane which is to be replanted; all other canes are stripped and the trash banked between the cane rows. Weeds and grass, such as the variety called "chindent" or "dogs teeth," on account of its tenacity, are all collected from the brakes and roadside and laboriously brought to the composting site. In Natal cane cleaning devices, such as have been developed in Hawaii, would provide all the trash required for any compost programme.

In most cases the compost is made in large rectangular blocks above the level of the ground. Concrete ditches surround these sites and various devices are used for the return of drainage. In all cases I saw, there appeared a lack of aeration, while the mass was kept too wet. Another method consists of a deep covered excavation adjacent to the stables, where the cattle are fed and gradually raise themselves to ground level, by alternate layers of trash and their own excreta.

The following is the composition of fumier and goat manure, as recorded by N. Craig Bulletin No. 11.

	Fumier.			
	Moisture.	Nitrogen.	P ₂ O ₅ .	K ₂ O.
Average	64.8	0.75	0.28	0.44
Extreme low	32.0	0.25	traces	0.03
Extreme high	83.0	1.62	0.89	1.16
Number of tests	61	61	15	15
Average of previous tests, Bulletin 14	58.8	0.71	0.24	0.22

	Goat Manure.	
	Moisture.	Nitrogen.
Number of tests 7	45.4	1.32
Extremes	17—67	0.75—1.90

Saccharogene is a variable mixture of filter cake, molasses, ashes, bagasse and coral sand. At Medine, the dunder from the distillery is heavily limed in concrete tanks and allowed to settle. The supernatant liquid is run into the irrigation water and the sludge added to the saccharogene beds.

It is stated that differences in the composition of this material are not only due to varying factory processes of clarification, but also by "differences in the cane supply." So varietal canes

grown under identical conditions show varying quantities of P_2O_5 in the juice. Thus:—

	Grms. P_2O_5 in 100 ml. Juice.
White Tanna	0.025
R.P.8	0.015
R.P.73	0.006

BH.10/12 is stated to contain very much less P_2O_5 than White Tanna. It is regrettable that similar investigations started by the Clarification Committee in this country some years ago were not continued.

In regard to molasses, V. Olivier, Sans Souci, found a distinct relationship between the potash content and the rainfall—the potash increasing as the rainfall decreased. This is an interesting point that might be investigated in this country.

The average analysis of saccharogene is:—

Water.	Nitrogen.	P_2O_5 .	K_2O .
39.0	0.98	2.87	1.64

Composting is laborious, costly and primitive. Artificial is very costly, simple of application, and a gamble. The effect of the first is long-term, the effects of the latter are to be found in a million conflicting reports. It is probable, in my opinion, that they would not be so conflicting if their use were based, as in Mauritius, on a basic policy of organic composted manures.

One of the reasons against the more popular development of composting, is the costly and laborious routine of turning the heaps. This, I have found, can be obviated by the use of a crowbar, which not only can be made to provide the necessary aeration during the first two months, but enables the minimum quantity of water to be used effectively. In this way, the heaps can be protected by adequate coverings of earth, or other suitable material, without excessive heat or moisture loss.

The methods of application of composts vary in Mauritius. In general—that is in those districts where the rainfall is between 60 and 100 inches per annum, a comparatively small amount is applied with the setts on planting, and the remainder when the cane is from four to six months old (about 17 tons per acre is the total average application). The second application is made in small furrows around each stool. The breaking of the surface roots is said to cause the plant to tiller and so send out fresh roots. The beneficial result is said to be visually apparent.

In the drier districts—that is those with less than 60 inches per annum—all the manure is applied at planting. This encourages germination and assists in the conservation of moisture.

Conversely, where the rainfall is over 100 inches, composts are only applied after the cane is from four to six months old.

No further additions of pen manures are made until the third ratoon, which conforms with Turner's observations in Trinidad, that organic manures have a residual effect up to the second ratoon.

Considering the rocky nature of the island, it is not surprising that the growing and ploughing-in of green crops, such as sunn hemp, is not practised.

At Maidstone, Natal, sunn hemp has been gathered and composted. Following this method, I find that a normal crop of sunn hemp (roots and stalks), approximately 4 feet 6 inches high, means 9.9 tons of green material per acre. Of this, 6.4 tons is water and 3.5 tons dry matter. The nitrogen amounts to 150 lbs. per acre and the total ash 240 lbs.

Sunn hemp can be composted with trash, kraal manure or filter cake, but by itself rotting is delayed, due probably to its

physical condition and excessive air penetration. The following are the analyses of composts made with various sunn hemp admixtures:—

	Sunn hemp only.	Sunn hemp and kraal manure.	Sunn hemp, trash and filter cake.	Sunn hemp, trash and kraal manure.
Moisture	76.00	54.25	60.00	66.75
Loss on ignition	48.80	31.35	33.85	38.55
Nitrogen	1.78	1.28	1.55	1.44
Total P_2O_5	0.44	0.44	0.57	0.67
Available P_2O_5	0.20	0.23	0.25	0.27
Total K_2O	0.70	0.41	0.75	0.44
Available K_2O	0.45	0.14	0.54	0.17

I am not prepared to venture an opinion, at this stage, into the relative merits of ploughing-in the green crop or composting if off the field. Pot tests by either method give excellent results, but costs can only be ascertained by careful measurements.

As is to be expected, composts made from sunn hemp give better nitrogen results than that from trash only. Thus:—

	Trash and filter cake.	Trash and kraal manure.	Trash, kraal manure and molasses inoculated.	Garden refuse with inoculated kraal manure.
Moisture	58.60	56.90	56.10	51.30
Organic matter	26.05	24.00	26.00	18.35
Nitrogen	0.87	1.05	1.08	0.84
Total P_2O_5	1.54	0.45	0.42	0.45
Available P_2O_5	0.25	0.24	0.25	0.31
Total K_2O	0.31	0.52	0.67	0.93

Owing to the war and the consequent lack and high price of artificials, interest in composts has increased, though practice in this country will doubtless wait upon the blessing of the Experiment Station.

The subject has, however, been very well reviewed in the November issue of the International Sugar Journal.¹ This is the concluding paragraph:—

"It is no longer sufficient to consider it (soil fertility) in its purely physical and chemical aspects, a problem of soil texture in which the rôle assigned to humus is the simple one of affecting texture, or of amounts of available plant-food, particularly nitrogen, phosphorus and potash. Humus undoubtedly plays a far more subtle rôle, the details of which have yet to be worked out. In a recent paper R. J. Borden writes: 'It is quite apparent from the data presented herein that soil fertility includes something else besides N, P and K. It is our feeling that this "something else" is largely the relationship between the soil organic matter and its rate of decomposition. Its (organic matter) rate of decomposition will be governed by the number and kind of micro-organisms.'

"May not the key which will provide an answer to this questioning, be found in the mycorrhiza associated with the cane plant?"

In conclusion, I hope that these notes will add to the sum-total of knowledge on an age-old method, and that practice will not wait upon the slow scientific final proof, but will rapidly develop along the long-view policy of making and keeping our land fertile for the centuries ahead.

Reference.

¹H. M. L. (1941): "Specialization, Susceptibility and Symbiosis." I.S.J., 43, 330.