COMPOST MANUFACTURE AND USE ON TEA ESTATES.*

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During the last six months the subject of compost has occupied an important part of the time I have devoted to estate visits, correspondence and interviews. I cannot in one lecture deal in detail with all the points that have cropped up, but I propose to give a broad outline of the theoretical and practical problems that face anyone who embarks on this interesting adventure of compost manufacture. Some of the details will doubtless be filled in when discussion time comes.

The best starting point for my present address will, I think, be a reminder of what I have previously said and written on the subject, and I will cover the ground as briefly as possible. In its original form, composting by the Indore process was a highly successful attempt to make use of *waste* vegetable matter, by fermenting crop residues with dung and urine in shallow pits. The result was a well-rotted homogeneous bulk manure. It was designed to meet the needs, and exploit the resources, of a system of annual crop husbandry which produces a very considerable quantity of crop residues from threshing, crushing or picking of crops such as grains, sugarcane and cotton. In their crude state many of these products were not suitable for direct application to the land, but composting rendered them eminently so.

I pointed out in my previous lecture that such a profuse supply of easily collected material, not already used to conserve soil resources, was not generally available on Ceylon tea estates, and I predicted that in our case special material would have to be grown, or at least garnered in its place. With our somewhat difficult and primitive transport facilities, I foresaw an increase in cost of the

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finished material that would far outclass the low rates published from India. I quoted an estimate of Rs. 8·00 per ton, and suggested that experience would show ways of reducing that figure to a more manageable size. I still maintain that even under favourable circumstances, we cannot compete with the Indore figure of 50 cents per ton.

In Ceylon there are two classes of materials that may be made into compost :—

(1) Waste materials, *i.e.*, materials that would not normally find their way back to the land, such as weeds, factory sweepings, line refuse; and vegetation from outside sources, such as sunflower, manna-grass, and any kind of cut cheddy.

(2) Materials growing already on tea land, and already used in some form or other. These are mainly prunings and green manure loppings.

There is a very vital difference between these two kinds of material. The one is bringing in continually new nutrient material; the other is not.

Experience has shown that the majority of people making compost have been driven by force of circumstances in the shape of scarcity of *real waste materials*, to use large proportions of prunings and green manures as the source of vegetable material. In this they have confirmed my prediction. At the same time they have completed the process at a much less cost. To what extent they have made a real saving, and not just a book-entry saving, we have now to enquire.

When I gave the figure of Rs. 8/- per ton, the assumption was that green manures in tea and prunings of tea would not be used for composting. If they are used, then obviously the process costs less because a vote already exists to cover the cost of lopping and pruning. But at the same time the compost is of less value because it is not supplying new humus and new nitrogen. On the financial side it follows that we can afford to spend more per ton in producing compost from the waste materials class, than from the other class. To emphasise this important point thoroughly I will state it in

another way. If we find that compost is being made more cheaply from green manures and prunings, it does not inevitably follow that this method is more sound economically than that producing compost from waste materials only. You will see that the lie of the land has been radically altered, and I shall accordingly deal more specifically with what for brevity I will call green manure compost. By that I mean compost having a preponderance of green manure in its make-up.

We now have actual working costs over a period, for the daily manufacture of two tons. The proportion of green manures used is 60 per cent. and the cost works out at between two and three rupees per ton. This figure allows for some specially organised transport to supplement what can be arranged on journeys from the field by labourers returning to their quarters.

I am going to turn now to a more theoretical aspect of composting, but this seems a suitable place to draw your attention to the fact that, manufactured in the way described, compost application will have to be regarded as a substitute for green manuring rather than for artificial manuring. The balance between the two views will, of course, depend upon the proportions of outside materials used. I think it will be found that compost will be best applied shortly after pruning, but that at other periods in the pruning cycle, artifical manures will still have to be used.

We have now to assess what possible benefits accrue from composting green manures instead of using them direct, since we are paying an appreciable sum of money for the transformation. Here we are on rather more controversial ground. It is held by some, including Howard himself, that direct green manuring confers no benefit to the associated crop, apart from the actual fact of growth of a leguminous species, and that the incorporation of loppings is harmful. I do not subscribe to this view in the case of tea, though I have been at pains from time to time to warn the community against the injudicious use of loppings in too late a stage of development. I do not think I am called upon to compare composting

with bad practice in green manuring. I will, however, go so far as to say that material not eminently suitable, on account of age, for direct application, will be rendered more suitable by composting. To that extent it is more foolproof. My main contention is that the benefits of composting are more demonstrable on annual crops than on perennial ones. I think it will be worth while to explain this in some detail.

Annual crops are sharply divided from perennials by requiring the constant production of a good seed bed, and by the very short period of their life during which they can usefully absorb nitrogen. For grain crops, a period of about two months only for optimum nutrient absorption has been observed. Now in the first place a seed bed tilth cannot be procured immediately after ploughing in green manure, but a good compost offers no difficulty. Then secondly, the successful use of green manures with annual crops depends on the products of decomposition being available at the critical time just mentioned. The ideal conjunction of conditions is seldom realized in practice. Either green manure is still unavailable when the main crop is planted, or the products of decomposition have been leached away. The former difficulty is likely to be caused by too little rain, and the latter by too much, through the impossibility of procuring a seed bed at just the right time.

Under these conditions, compost scores heavily because, if I may mix my metaphors, it first puts the green-stuff nutrients into cold storage for use at the appropriate time, and then, as the advertisements for patent cereal foods say, presents it in a 'predigested form.' But with a crop such as tea, capable of absorbing and using nitrogen throughout its life, except just at time of pruning, this particular advantage is at a discount, and superiority for compost cannot be claimed on these grounds.

In special cases some advantage remains with compost. There are still considerable areas of tea which for a number of reasons come into pruning in dry weather. As I explained at the Institute's Conference, the forking in of prunings then and there will only aggravate the drought conditions without conferring any nutritional benefit.

A mulch may be expected to help the preservation of moisture, but it is definitely a wasteful way of dealing with the nutritional side of pruning material. Under these circumstances compost can be made, for application at a more convenient season. The same sort of argument applies to those lopping operations in green manures which do not coincide with cultivation programme. This material forms a suitable source of compost. For those who find that the climate is an enemy in the regulation of lopping and forking programes, composting may be expected to ease the situation, since the lopping can be done when the shoots are neither too young nor too old.

I think I have dealt fairly with the green manure versus compost controversy but when it comes to considering whether the estimated advantages are worth from Rs. 15·00 to Rs. 30·00 per acre, neither I nor anyone else at present, can say. With costs of production cut to a low figure, I consider it is worthy of a trial and we intend to pursue the matter in formal experiments.

COMPOSITION OF INDORE COMPOST.

	Moisture Content	Nitrogen per cent. Dry Matter	Soluble Humus per cent. Dry Matter	Vegetable Material used
Ceylon	62	1·41	26·75	Green Manure 60 per cent.
	52	1·13	27·44	Green Manure 60 per cent.
	18	1·57	37·45	Weed 70 per cent.
	50	0·73	20·62	
	34	0·89	18·47	Green Manure 65 per cent. Coarse Tea Leaf 31 per cent.
Indore	—	1·61	11·56	Cotton residues
	—	0·81	5·36	Mixed residues
	—	0·86	4·01	Weeds

Turning now to a new aspect of the subject, I can give you some information as to the manurial quality of Ceylon compost compared with the Indore product. It does vary considerably according to the individual manufacture and the material used; but on the whole because green manures are richer in nitrogen than annual crop residues, Ceylon compost should be richer than Indore.

This is borne out by our analyses, some of which are displayed in the table. There is a distinct difference in nitrogen and a greater proportion of what Howard calls 'soluble humus.' I have no information as to how Howard determined this. I have taken it to be easily oxidisable humus, and to some extent the term soluble humus is in any case a misnomer. At any rate the data show that a thoroughly useful product can be turned out.

In closing I merely want to underline certain points. The real value of compost is determined by the amount of new material not previously used, that contributes to its manufacture. This amounts to the transference of the fertility of hitherto unexploited land on to tea land.

The production costs when green manure is the chief source of supply must be watched, realising that the cost is additional to that of green manuring, but that the benefit is problematical except in special cases.

Finally, until more experience is forthcoming, composting should only replace green manuring and not the normal programme of artificial fertilisers.