

Losses of Nitrogen from Green Manures and Tea Prunings through Drying Under Field Conditions.

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IT is the practice on many Ceylon estates to leave the loppings of green manure trees and tea prunings to dry or decay on the surface of the soil before the leafy material is forked, if at all. An experiment was therefore started by the Chemical Division to determine the amounts, if any, of the nitrogen and organic matter of green materials lost as a result of this practice and the factors contributing to these losses. Under field conditions losses of organic matter from leafy green materials through oxidation, fermentation and micro-organic activity and of nitrogen either through leaching or in the gaseous form may be expected.

The experiment was carried out as follows. Large quantities of freshly cut loppings or prunings were placed between the rows of tea behind the laboratory and there left exposed to weather conditions. At the same time representative samples of the leafy portions of the green materials were taken for nitrogen and organic matter determinations. When the exposed materials were dried to a degree at which the leaves could be separated from the stems on shaking, portions of the leaves were brought into the laboratory, and nitrogen and organic matter determinations were made on them. In every case at least two determinations and in most cases three and four determinations were made and their means obtained. Further samples of the exposed materials were taken later, when they had just begun to decompose and when they were fairly well decomposed. The experiment was carried out with *Gliricidia*, dadap, *Grevillea* and tea leaves. The mean results are shown in the table below. They are calculated on dry matter at 100°C.

	Nitrogen in laboratory-dried sample. Per cent.	Nitrogen in field-dried sample. Per cent.	Loss of nitrogen. Per cent.	Percentage of original nitrogen lost.	Organic matter in laboratory-dried sample. Per cent.	Organic matter in field-dried sample. Per cent.	Loss of organic matter. Per cent.	Percentage of original organic matter lost.	Remarks.	Weather conditions during drying period.
1. <i>Gliricidia</i> leaves	3.640	2.050	1.590	43.7	89.4	80.4	9.0	10.1	Sample left on field for 18 days. Quite well decomposed.	Alternately dry weather and rain.
2. <i>Gliricidia</i> leaves (2nd sample)	3.312	3.265	0.047	1.42	89.6	87.4	2.2	2.5	Sample left on the field for 18 days. Well preserved.	Dry weather. No rain.
3. do	3.312	2.225	1.087	32.8	89.6	77.5	12.1	13.8	Above sample left for further period of 12 days. Fairly well decomposed.	Rain followed by dry weather.
4. Dadap leaves	3.996	2.493	1.503	37.6	88.9	85.5	3.4	3.8	Sample left on field for 18 days. Fairly well decomposed.	Alternately dry weather and rain.
5. Tea leaves	2.477	1.870	0.607	24.5	90.3	—	—	—	Sample left on field for 18 days. Decomposition just beginning.	do
6. <i>Grevillea</i> leaves	1.349	1.465	0.016	Gain	95.0	94.0	1.0	1.05	Sample left on field for 21 days. Quite well preserved.	Dry weather. Slight shower just prior to sampling.
7. do	1.349	1.186	0.163	12.1	95.0	93.4	1.6	1.7	Above sample left for 16 days longer. Decomposition just beginning.	Alternately dry weather and heavy rain.

An examination of the above table will show clearly that large percentage losses of the nitrogen of the leafy portions of the loppings can occur as a result of leaving the latter to dry on the surface of the soil exposed to weather conditions. In these experiments as much as 43.7 per cent. of the original nitrogen of *Gliricidia* and 37.6 per cent. of dadap leaves were lost during a period of eighteen days. These losses are to a great extent dependent on weather conditions. Dry weather alone does not encourage decomposition and loss of nitrogen, but alternate dry and wet weather hastens decomposition and increases the losses of nitrogen from the leafy materials. This is clearly seen in the case of the *Gliricidia* samples. Thus, in the case of the first *Gliricidia* sample when the weather conditions during a period of eighteen days were alternately dry and wet, the loss of nitrogen was 43.7 per cent. while in the case of the second sample, when the weather was dry throughout, the loss of nitrogen during the same period was only 1.42 per cent. A second sampling of the latter taken after a subsequent period of rainy and dry weather showed a large loss of nitrogen. In the case of *Grevillea* leaves, during a period of dry weather not only was there no percentage loss but an apparent gain of 1.2 per cent. of nitrogen. This was probably due to the loss of some of the carbohydrate material from the *Grevillea* leaves during the drying process. A second sample of *Grevillea* leaves taken after a period of alternate rainy and dry weather showed a loss of nitrogen of 12.1 per cent.

An examination of the figures of the table will also show that the losses of nitrogen from the more easily decomposed *Gliricidia* and dadap leaves are greater than from the more resistant tea and *Grevillea* leaves, when both are exposed to the same weather conditions. The losses from *Grevillea* are least of all. This may be due to the more resistant nature of its tissues or to a smaller nitrogen content or to both. It will also be noted that, in all these cases, the nitrogen losses become greater as the degree of decomposition is greater.

Although the analytical determinations show very appreciable losses of nitrogen in most cases, it has to be pointed out that not all of it is entirely lost, for some is probably washed down into the soil below as nitrates. The fact, however, remains that the losses of nitrogen from green materials when they are left to dry on the surface of the soil can be great.

Losses of nitrogen as a result of leaving green materials to decay on the soil have also been found in temperate countries. Petch in a paper in the *Tropical Agriculturist* of November, 1924, entitled "The absorption of atmospheric nitrogen by leguminous plants" refers to work done in Canada with clover. As a result of leaving a crop of clover containing from 100 to 150 pounds of nitrogen per acre to decay on the land, it was found

that all but 50 lb. was dissipated by bacterial activity. André, * analysing chestnut leaves in October and again in the following April after they had wintered on the ground, found a loss of 7·5 per cent. of the nitrogen, 67·4 per cent. of the phosphoric acid and 87·7 per cent. of the potash contained in the green leaves. The figures for potash and phosphoric acid are interesting, and would seem to indicate that these constituents are leached into the soil below. Boltz & Schollenberger†, experimenting with clover, found that during a period of one hundred and eighty seven days, the average loss of carbon from clover left on the surface of the soil was 84·4 per cent. and from that incorporated in the soil 34·2 per cent.

The losses of organic matter from plant materials used in these experiments as a result of drying on the field are also shown in the table above. These losses are much smaller than the corresponding nitrogen losses and would seem to indicate that, though in the initial stages of drying losses of carbohydrate constituents alone take place, in the later stages of the decomposition the losses of nitrogen are proportionately greater than those of the carbohydrate constituents. The organic matter losses are dependent on the weather conditions as well as on the nature of the green materials. The figures in the table clearly show this.

Conclusions.

From the results of the experiments dealt with above, it will be realised that the practice of leaving green loppings and tea prunings to dry on the field before the leafy materials are incorporated into the soil is one which may result in large losses of the nitrogen and to a lesser extent of the organic matter they contain. Thus losses of over 43 per cent. of the nitrogen of *Gliricidia* and 37 per cent. of dadap leaves were found in these experiments. The losses are dependent on weather conditions and also on the nature of the plant materials. Alternate dry and wet weather favours increased losses. The losses are greater from the more easily decomposed *Gliricidia* and dadap leaves than from the more resistant tea and *Grevillea* leaves. The burial of these organic materials green is therefore advocated.

* Com. Rend. Acad. Sc.—Chem. Abstracts Vol. 10. 1916 No. 6.

† Journ. Amer. Soc: Agron. Vol. 10. No. 5.