

Organic Manures and Availability of Plant Food.

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It is well known that for nutrition all plants depend upon the food material available in the soil and in the manure applied. It is therefore of some importance to determine how much of the food material in any manure becomes available when added to a soil. Food stuffs are valued for their digestibility or availability of food material. The same is true of manures.

Organic Nitrogenous manures when applied to a soil undergo a series of changes owing to the activity of soil bacteria resulting first in the breaking down of complex albuminoid substances. Next comes a change leading to the production of Ammonia and its final oxidation into nitrous and nitric acids. The Nitrogen in an organic manure is said to be "available" to the degree in which it is readily converted into nitrates. Nitrates are the end product of these changes and are readily assimilated by all plants. Nitrifiability is, therefore, considered a safe measure of the availability of Nitrogen in manures. Many soil Biologists in Europe, America and India have often emphasised this view, and some of them consider that the fertility of a soil could be safely predicted.

In order to ascertain the availability of plant food in Indian manures when applied to important soil-types, experiments described below were carried out at Coimbatore. Figures available relate to green-leaf manures and oil-cakes.

The soil selected for the purpose was gardenland taken from the insectary plot in the Central-Farm. In colour it is reddish and forms an important soil-type.

TABLE 1.—ANALYSIS OF GREEN-LEAF MANURES.

No.	Common Name.		Botanical Name.	Percentage of Nitrogen in Fresh Leaf with 90% Water.
	Tamil	Telugu		
1.	Erukam	Jilledu	<i>Calotropis gigantea</i>	0.3669
2.	Avārai	Tangedu	<i>Cassia auriculata</i>	0.3135
3.	Pungam	Kanuga	<i>Pongamia glabra</i>	0.3669

TABLE II.—ANALYSIS OF OIL CAKES.

No.	Common Name.	Botanical Name.	Percentage of Nitrogen in
1.	Illuppai cake	Bassia Longifolia	2.41
2.	Pungam cake	Pongamia glabra	3.50
3.	Black Castor cake	Ricinus Communis	5.60
4.	White Castor cake	Ditto	6.10
5.	Neem cake	Azadirachta Indica	3.88

N. B.:—Cakes that are used as cattle food were omitted from the experiment.

Green-leaf manures were added to give 30 milligrams of Nitrogen per 100 grams soil. Optimum moisture was determined and sufficient water added. The soil was air-dried, sampled and sieved before use. 200 gram lots of dry soil were taken, requisite quantities of water and leaves added, the whole mass mixed well, put in glass jars and incubated at 30° C. for a period of eight weeks. Loss in moisture was made up every fourth day. Amounts of ammonia, nitrates and nitrites were determined once at the end of four weeks, and a second time at the end of the experiment.

Soil equivalent of 100 grams dry soil was taken. This was made up to 300 c. cs. with water and shaken for 30 minutes. The soil emulsion was then filtered until 30 c. cs. of clear filtrate had been collected, and the remaining portion of the emulsion was set apart for estimating ammonia. Nitrites in the filtrate were estimated by Griess-Illosway method, and nitrates by the Phenol-sulphonic acid method, the colours obtained matching the standardized glasses in the Tintometer. The remaining portion of soil extract was acidified with dilute hydrochloric acid and left for twentyfour hours. From this, aliquot parts of the supernatant liquid were distilled off with 30 per cent caustic soda and ammonia was estimated by the Titration method. N/20 acid and N/20 alkali were used for the purpose. Table III. shows results. Both Ammoniacal and Nitric Nitrogen figures are given, since these leaves are commonly applied as manures to Rice Soils.

TABLE III.—GREEN—LEAF MANURES.

No.	Common Name.	Milligrams of Nitrogen in the leaf added.	Milligrams of active Nitrogen formed after			Percentage of availability at the end of 8 weeks.			
			4 Weeks.		8 Weeks.				
			NH ₃	NO ₂	NO ₃	(NH ₃ —NO ₃)			
1.	Avārai	30	6.50	Nil	Nil	6.75	Nil	1.00	25.83
2.	Erukam	30	7.02	„	5.14	7.60	„	8.40	53.33
3.	Pungam	30	6.02	Trace	3.60	7.30	Trace	4.20	38.33

In the case of Oil Cakes, the determinations were made once in two weeks. 400 gram lots of dry soil were used. Eight weeks was the period of incubation. Cake was added at 30 milligrams per 100 grams soil. Deficiencies of moisture were made up once in four days. Estimations of ammonia nitrates, and nitrites were made as per methods described above. Table IV shows results of nitric Nitrogen. Only nitric Nitrogen figures are given, since the cakes are generally applied to arable land.

TABLE IV.—OIL CAKES.

No.	Common Name.	Milligrams of Nitrogen in the cake added.	Milligrams of Nitrate Nitro- gen formed after				Percentage of availability (No. 3) at the end of 8 weeks.
			Two weeks	Four weeks	Six weeks	Eight weeks	
1.	Black Castor Cake	30	7	13	15	17	57 per cent
2.	White „	30	7	12	18	24	80 „
3.	Illupai Cake	30	—	—	—	—	— „
4.	Pungam Cake	30	7.5	11	13.5	15	50 „
5.	Neem Cake	30	6.5	11	13	17	57 „

The above Tables (III. and IV.) represent figures given after deducting the controls.

SUMMARY AND CONCLUSIONS.

Green-Leaf Manures:—Cassia auriculata which is largely used by the Indian cultivator as a green-leaf manure does not seem to be of immediate use to the first crop. The Nitrogen becomes so slowly available that this leaf does not compare favourably with other green-leaf manures. This aspect of the manure problem is being experimented upon at the present time. It seems likely that the tannic acid in the leaf is really responsible for the initial inhibitory action. In a period of eight weeks only 3.33 per cent of Nitrogen was available as nitrate: but if we add ammonia also, nearly 25.83 per cent of the Nitrogen becomes available.

Pongamia glabra is the next higher, but does not fulfil the hopes entertained of it by the cultivators, only 14 per cent of its Nitrogen being available as nitrates in the course of eight weeks. With ammonia, the percentage of available Nitrogen increases to 38.33 per cent.

Calotropis gigantia is the best since 28 per cent of its Nitrogen is available as nitrates during the same period. This is in entire accord with the popular practice. When ammoniacal Nitrogen is added on, the availability rises to 55.33 per cent.

Oil Cakes. Of all the cakes tested, White Castor was found to be the best, as 80 per cent of its Nitrogen becomes available for the nutrition of a growing crop in the course of eight weeks. In the same period 57 percent of Nitrogen in Black Castor Cake is nitrified, thus showing that the removal of the husk (i. e., decorticating) enhanced the availability of Castor, and the Ryot may with advantage go in for the decorticated cake wherever possible. 57 percent of the Nitrogen in Neem and 50 percent in Pungam become available in the same period. In some localities Pungam is in great demand, but the value of Neem is not sufficiently realised.

Illuppai Cake is peculiar. It resists all bacterial action in the soil at least during a period of eight weeks. This inhibitory character is perhaps due to the presence of a large percentage of a poisonous glucoside "Saponin" (29 per cent to 31 per cent), and it is a problem whether it would not be worth while attempting to remove the 'Saponin' with a view to make it nitrifiable as the cake contains 2.41 per cent Nitrogen, i. e., five times as much as is contained in the Farmyard manure. Further work will elucidate this point. In its raw state it has absolutely no manurial value.

EXTRACTS.

SOME ASPECTS OF ECONOMICS IN RELATION TO AGRICULTURE.

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The Agricultural Department of Madras is the only Agricultural Department in India which has a Statistical Section attached to it. We publish a weekly season report showing the progress of the sowing and harvesting of the main crops, and the influence of the