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Studies in Green Leaves II

Seasonal Variations in the Nitrogen and Carbon Contents of Green Leaf Manures.

by

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Introduction : The application of green manure to paddy soils under water-logged conditions has been found to be beneficial for increasing the yield of the paddy crop (in most cases) and is almost an universal practice in this country. The incorporation of the manure is effected either by raising a crop and ploughing it in situ, or by applying the material brought from roadside trees and forest areas. The former practice is generally adopted where sufficient water facilities are available. In places where this is not possible green leaves are collected from outside and added to the soil just prior to puddling or two or three weeks before transplanting the paddy seedlings.

A study of the comparative merits of the commonly used green leaf manures was carried out by Varadarajan and Raju (1956). They found that while application of green leaves gave enhanced yields generally, the variety of green leaf applied had no influence on the increase of yield.

That the usefulness of plant materials added to the soil has a relationship to the carbon nitrogen ratio of the material has been established by several workers. The material with a high nitrogen content decomposed at a more rapid rate than did the material of low nitrogen content. Jenson (1929) and Martin (1921) have adduced evidence to show that more narrow the carbon to nitrogen ratio of freshly added materials the greater is the amount of nitrogen mineralized in the first several weeks of decomposition. Bower (1951) and Waksman *et al* (1927) have shown that if the carbon to nitrogen ratio is greater than 33 to 1 immobilization, and, if the ratio is as narrow as 17 to 1 mineralization, can be expected. There is evidence to show that materials with a carbon to nitrogen ratio of about 40 to 1 require 2 to 4 weeks for decomposition under favourable weather before the crop is planted. Pink *et al* (1948)

found the critical carbon to nitrogen ratio at near 35. Thus it is seen that the value of a green manure crop or material depends on its carbon and nitrogen contents. These studies were therefore undertaken to find out the extent of variation if any in the succulency and carbon/nitrogen ratio of the commonly used green leaf manure owing to changes in season. Such data may be useful to show when the green leaves may be very rich in nitrogen and low in carbon or vice versa, so that they may be cut and applied straight or composted before application for better crop growth.

Experimental: Green leaf manures were gathered as per local practice by lopping the small branches comprising leaves and stems from the following six trees.

(A) *Gliricidia maculta*
(B) *Pongamia glabra*
(C) *Delonix regia*
(D) *Enterolobium saman*
(E) *Thespesia populnea*
(F) *Azadirachta indica*

Representative samples were taken from the green leaf cuttings and amalysed for total nitrogen and organic carbon contents. The nitrogen was estimated by the Kjeldahl method and the organic carbon by the Walkley and Black method.

Samples were taken at monthly intervals for a period of one year.

Results and discussion: The succulency as revealed by the moisture content of the green leaf manures are presented in Table I. The data of organic carbon content of the green leaf manures are given in Table II. The nitrogen content is presented in Table III and the carbon to nitrogen ratio in Table IV.

The original moisture varies from about 50 percent to about 76 percent. Generally at any one period Gliricidia and Portia are more succulent than the rest, but between the two, Gliricidia is more succulent. The least succulent is Neem. If the period is divided into four seasons as North East Monsoon, South West monsoon, Premonsoon and Winter, there is a general increase in the moisture content of the leaves in all cases during the monsoon periods. The data on nitrogen, organic carbon and the carbon to nitrogen ratio were statistically analysed. The conclusions are as below:

Mean Nitrogen percentage in the different green manures on moisture free basis.

Green manure	Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
	(A)	(B)	(C)	(D)	(E)	(F)
Mean N. Percent	2·64	3·10	3·47	3·43	2·57	2·40
C. D. at 5%	0·19%					
Conclusion :—	C	D	B	A	E	E

Mean Nitrogen percentage in the different season

Seasons	N. E. M.	Winter	Pre-monsoon	S. W. M.
	(K)	(L)	(M)	(N)
Mean N percent	2·94	2·89	3·11	2·81
C. D. at 5%	0.15%			
Conclusion :–			M	K L N

From the above it is evident that the differences in the percentage of nitrogen in the different green leaf manures are significant. Delonix and Raintree cuttings show the highest values but there is no significant difference between them. Portia and Neem cuttings have the lowest nitrogen percentage.

" Green manures " and " seasons " do not interact revealing thereby that the differences in nitrogen content of green manures are uniform throughout the seasons considered. In the Pre-monsoon period all the green manures show the maximum nitrogen content.

Organic carbon — Mean percentage.

Green manure	Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
	(A)	(B)	(C)	(D)	(E)	(F)
Organic carbon Per cent	36·10	36·09	41·81	37·91	34·14	35·68
C. D. at 5%	1·936%					
Conclusion :—			C	D	A B	F E

It may be seen that the Delonix cuttings have the maximum content of organic carbon. Portia and Neem cuttings have the lowest, the trend being similar as in the case of nitrogen content. There was no significant variation due to seasons. The interaction between green manure and season was not of any significance.

Carbon–Nitrogen ratio

Green manures	Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
	(A)	(B)	(C)	(D)	(E)	(F)
C/N ratio	13·71	11·65	12·14	11·15	13·29	14·97

Conclusion :— D B C E A F

Carbon to nitrogen ratio in the different seasons

Seasons	NEM	Winter	Premonsoon	S. W. M.
	(K)	(L)	(M)	(N)
C/N ratio	13·01	12·82	12·26	13·18
C. D.	0·648			

Conclusion :— M L K N

It is seen from the above that the Carbon to Nitrogen ratio is narrowest for rain-tree cuttings but is in no way significantly different from that of Pungam or Delonix. Neem cuttings have the widest ratio. Seasonal effect though not significantly different is seen to some extent, and during premonsoon period, tends to be narrow.

Conclusion : From the foregoing statistical results the following conclusions may be drawn.

1. Though there is variation in the nitrogen content of the different green manures, there is no variation in one and the same green leaf manure due to season.
2. Organic carbon content also varies in the different green manures but there is no variaton due to seasonal effects.
3. There is idication to show that the carbon to nitrogen ratio is different in different grren manures but there seems to be very little variation due to changes in season.
3. Thus it can be said that the green leaves of any of the trees studied may be used for green manuring purpose or for composting at any time of the year.

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REFERENCES

1. Bower, C. A. 1951 *Soil Sci. Soc. Amer. Proc 15* : 119–122.
2. Jenson, H. L. 1929 *J. Agric Sci. 19* : 71–82
3. Pink L. A. 1948 *J. Amer. Soc. Agr. on* 40 ; 236
4. Martin, T. L. 1921 *Cornell Univ. Agr. Expt. Sta. Bull.* 406.
5. Thompson L. M. 1957 *Soils and Soil Fertility.* MC. Graw Hill. N.Y.
6. Vardarajan S. and Raju M. S. 1956 *Madras* Agric. J. 43 :59–68
7. Waksman S. A. and Tenny F. G. 1927 *Soil Sci. 24* : 317–333.

TABLE I

Moisture percentage of fresh green leaf cuttings

Seasons		Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
		(A)	(B)	(C)	(D)	(E)	(F)
Sep.	N. E. M.	70·40	64·35	67·65	60·90	68·10	61·55
Oct.		71·70	65·15	68·00	61·20	70·25	61·40
Nov.		72·75	65·50	66·60	56·70	69·85	57·95
Dec.	Winter	68·20	53·50	64·35	52·10	69·45	55·60
Jan.		68·65	55·20	62·40	50·05	69·10	54·25
Feb.		69·50	52·90	64·65	56·60	64.05	50·65
March	Premonsoon	67·35	53·65	62·40	59·05	60·55	54·25
April		65·10	52·35	59·50	51·70	57·45	52·00
May		75·85	68·05	66·45	63·35	68·15	63·75
June	S. W. M.	72·00	63·10	67·20	64·10	64·50	61·35
July		73·10	61·25	70·95	64·40	68·05	66·90
Aug.		76·50	62·75	65·05	61·40	66·80	59·50

TABLE II

Organic carbon content of green leaf cuttings

(Expressed as % on moisture free basis)

Seasons		Gliricidia	Pungam	Delonix	Rain-tree	Partia	Neem
		(A)	(B)	(C)	(D)	(E)	(F)
Sept.	N. E. M	34·72	31·51	41·12	40·93	33·99	35·16
Oct.		37·19	32·87	42·67	41·04	35·43	36·58
Nov.		37·35	37·05	46·39	40·22	35·31	37·77
Dec.	Winter	36·07	36·08	42·38	37·77	35·13	36·30
Jan.		36·53	37·07	39·97	38·70	36·54	36·68
Feb.		33·74	34·48	38·91	33·60	36·15	33·17
Mar.	Premonsoon	40·03	39·63	41·14	36·41	35·22	37·47
April		36·42	39·50	40·22	36·88	32·96	35·14
May		31·69	39·37	42·21	36·91	32·10	36·30
June	S. W. M.	35·70	35·71	42·27	37·41	32·17	36·70
July		39·86	34·77	44·51	36·71	31·14	33·28
Aug.		33·96	35·07	39·90	38·32	32·53	33·58

TABLE III

Nitrogen Contents of Green Leaf Cuttings (Expressed as % on moisture free basis)

Seasons		Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
		(A)	(B)	(C)	(D)	(E)	(F)
Sep.	N. E. M.	2·59	2·85	3·32	3·31	2·44	2·26
Oct.		2·61	2·85	3·54	3·44	2·48	2·41
Nov.		2·81	3·41	4·08	3·23	2·75	2·59
Dec.	Winter	2·43	2·95	3·87	2·96	2·81	2·63
Jan.		2·81	3·08	3·24	3·40	2·77	2·70
Feb.		2·56	2·85	3·19	2·88	2·72	2·11
March	Premonsoon	2·95	3·49	3·78	3·72	2·76	2·59
April		2·72	3·22	3·67	4·15	2·42	2·24
May		2·46	3·40	3·73	3·71	2·47	2·56
June	S. W. M.	2·68	2·92	2·92	3·85	2·39	2·54
July		2·67	2·95	3·24	3·08	2·37	2·00
Aug.		2·41	3·28	3·10	3·49	2·48	2·13

TABLE IV

Carbon/Nitrogen ratio of the green leaf cuttings

Seasons		Gliricidia	Pungam	Delonix	Rain-tree	Portia	Neem
		(A)	(B)	(C)	(D)	(E)	(F)
Sept.	N. E. M.	13·41	11·06	12·39	12·38	13·93	15·56
Oct.		14·58	11·57	12·06	11·93	14·29	15·17
Nov.		13·19	10·86	11·37	12·47	13·20	14·58
Dec.	Winter	14·88	12·23	10·95	12·76	12·50	13·80
Jan.		13·00	12·03	12·34	11·39	13·19	13·58
Feb.		13·18	12·10	12·20	11·66	13·30	15·71
Mar.	Premonsoon	13·57	11·36	10·96	9·78	12·76	14·46
April		13·39	12·27	10·96	8·89	13·62	15·69
May.		12·88	11·58	11·32	9·95	12·99	14·19
June	S. W. M.	13·32	12·23	14·47	9·72	13·46	14·45
July		14·93	11·79	13·74	11·92	13·14	16·64
Aug.		14·09	10·69	12·87	11·01	13·11	15·76