Studies on Certain Problems of Nitrogen Estimations Adopted at Soil Testing Laboratories in Tamil Nadu

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The alkaline permanganate N and the organic carbon N are the two estimations of N which are widely used for assessing the soil fertility for evaluating recommendations based on soil tests. The soil testing laboratories in India use either one of the methods as both are suited for rapid analysis. The alkaline permanganate releases N from easily hydrolysable fraction of organic matter which is reported to constitute about 10-12 percent of total N (Fraser, 1955). This, therefore, represents available fraction by mineralization during the crop growth phase. The organic carbon, on the other hand, represents total N universally.

The alkaline permanganate N is released slowly by mineralization and hence a certain degree of elasticity in availability exists. This has made possible the utilisation of Mitscherlich-Bray concepts for soil test-crop response studies for N (Bray, 1948, and Ranganathan *et al.*, 1967). Since the Soil Testing Laboratories use one of the methods depending upon their convenience, it is felt necessary to study the relation between these two methods so that the work of the laboratories can be co-ordinated.

Materials and Methods: Twenty-nine red soils, 10 black soils and 48 alluvial soils were collected from different localities in Tamil Nadu. Nitrogen was estimated both by organic carbon method (Datta *et al.*, 1962) and the alkaline-permanganate method (Subbiah and Asija, 1956). The methods were tested for their reproducibility. The relation between the two methods of N estimations was also studied.

The reproducibility in alkaline-permanganate method is of higher order than the organic carbon method inspite of all precautions like particle size, sampling etc., taken in the case of latter method. In routine analysis such care cannot be attended to and hence the reproducibility in routine analysis will be much less in organic carbon method.

The high degree of reproducibility in the case of alkaline-permanganate method with lesser care is an added advantage besides this being a representation of the available form.

Results and Discussion: 1. *Reproducibility:* The soil test values for both the methods are given in Table 1. The co-efficient of variation of soil test values as estimated by the two methods is given in Table 2.

TABLE 1. *Soil test values (reproducibility)*

Red Soil		Alluvial soil	
Alkaline $KMnO_4$ method (lb. per acre)	Organic carbon method %	Alkaline $KMnO_4$ method (lb. per acre)	Organic carbon method %
182	0.40	182	1.00
168	0.48	168	0.94
168	0.88	182	0.88
182	0.44	182	0.92
196	0.64	196	1.12
196	0.60	182	0.94
182	0.62	182	0.90
182	0.48	168	1.12
154	0.88	182	1.22
182	0.84	168	0.79

TABLE 2. *Coefficient of variation of soil test values*

Soil group	No. of determi-nation	Alkaline $KMnO_4$ method	Organic carbon method	Coefficient of variation	
				Alkaline $KMnO_4$ method	Organic carbon method
Red soil	10	180 ± 5	0.63 ± 0.07	8%	32%
Alluvial soil	10	180 ± 2	0 98 ± 0.04	5%	15%

2. *Relationship:* The results are presented in Table 3.

TABLE 3. *Relationship between the two methods*

Soil group	No. of samples	Correlation between organic carbon and alkaline-per manganate N	
		r	Significance
Red soil	29	0.26	Not significant
Black soil	10	0.19	Not significant
Alluvial soil	48	0.44**	Significant

alkaline-permanganate N bear no significant relations. The fundamental homogenesis of alluvial soils of Madras State was reported by Premanathan (1963) from a study of thermal analysis and relations between soil physical and chemical properties. This fundamental homogeneity of alluvial soils coupled with a uniform degradation of organic matter in stagnating water of the paddy soils may probably explain the significant correlations. The red soils differ much and heterogeneity arising from the proportions of the dominating clay mineral was also reported from a study, correlation between mechanical fractions and single value physical constants (Krishnamoorthy *et al.*, 1964). The percent release of N in different soils under similar conditions also differs much as shown in Table 4.

TABLE 4. *Percent release of N under similar conditions*

Soil type	Total N (lb/acre)	Available N (lb/acre)	Percentage release
Red	390	151	38.72
Alluvial	880	195	22.16
Black	996	174	17.47

This clearly indicates the effect of clay-organic matter complex on the release of N by oxidation and hydrolysis.

It is, therefore, expected that the relations could exist only in uniform soils and the relations cannot be extended to cover wider soil groups and conditions. Even in black soils, though a certain homogeneity is reported, no significant relation was obtained in the present study. Hence it seems essential that the relation between the organic carbon and the available N have to be established in different soil groups over different areas, if the organic carbon method has to be extended for routine work for general adoption.

Summary and Conclusion: The reproducibility of alkaline-permanganate method is of higher order and therefore, suited for routine analysis. The relation between organic-carbon and available N exists only in homogeneous soils and the extension of organic carbon method has to be made only with caution with an added disadvantage of its low reproducibility.

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REFERENCES

Datta, N. P., M. S. Khera and T. R. Saini. 1962. A rapid colorimetric procedure for the determination of the organic carbon in soils. *J. Indian Soc. Soil Sci.*, **10** : 67-74.

Fraser, K. George. 1955. Soil organic matter. pp. 149-176 in Chemistry of the Soil. *Ed. Bear, Reinhold Publ Co., New York.*

Krishnamoorthy, V. S., A. Gopalswamy, V. Ranganathan and S. Varadarajan. 1964. Studies on the black and red soils of Coimbatore district. (Uupubl.)

Premanathan, S. 1963. Study of the alluvial soils of Madras State. M. Sc. (Ag.) thesis, *Madras Univ.*

Ranganathan, V., R. Soundararajan, C. S. Balasundaram and K. Govindaraj. 1969. Studies on the applicability of Mitscherlich-Bray equation for correlating crop responses. *Fertilite.*, **33** : 31-42.

Subbiah, B. V. and G. L. Asija. 1956. A rapid procedure for the estimation of available nitrogen in soils. *Curr. Sci.*, **25** : 258-60.

Substitution Relationship of Resources in the Groundnut Farms

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Introduction: Profits from groundnut farm in India are not appreciable on account of the high cost of production. In the present study an attempt has been made to reduce the cost of production through reorganisation of resources by (i) input-output relationship of resources, (ii) yield iso-quants for different levels of output, (iii) the marginal rate of substitution of resources and (iv) least-cost combination of resources through iso-clines for different price ratios.

Materials and Methods: A production function of Cobb-Douglas model is fitted to the data collected during 1963-65 from 120 groundnut farmers in the Pollachi tract of Coimbatore region. Based on the estimated function, input-output relationships were derived; iso-quants for four levels of output were drawn; marginal rate of substitution of resources calculated for each level of output and iso-clines for different price ratios derived to arrive the least-cost combination of input factors.

Results: The production function fitted is (2)

$$Y = 20.75\ X_1^{\underset{(0\ 9363)}{0.25543^*}}\ X_2^{\underset{(0.1082)}{0.03588}}\ X_3^{\underset{(0.0938)}{0.10920}}\ X_4^{\underset{(0.0568)}{0.35817^{**}}}\ X_5^{\underset{(0.1002)}{0.24487^*}}$$

$R^2 = 0.92^{**}$

where, Y = output in rupees; X_1 = land in acres; X_2 = human labour in man