REFERENCES

Fisher, D. J. 1976. Effects of some fungicides on *Rhizobium trifolii* and its symbiotic relationship with white clover. *Pesticide Sci.* 7 : 10-18.

Manickasundaram, G. and Ramabadran, R. 1976. Effect of different fungicidal application on the nodulation of groundnut varieties. *Madras Agric. J. 63* : 644-645.

Ramadoss, S. 1985. *Studies on the interaction of fungicides and insec icides on Macrophomina phaseolina (Tassi)* Goid. and *Ophiomyia phaseoli Tryon* on *cowpea*. M. Sc. (Ag.) Thesis. Tamil Nadu Agricultural University, Coimbatore. 199pp.

Rangarajan, M. and Subramaniam, C. L. 1971. Compatibility between fungicides and *Rhizobium* and their interaction on the nodulation and yield in blackgram and redgram. Abstr. Fourth Southern Regional Conf. Microbial inoculants, Parbhani, P. 5.

Ravindaran, A. D. 1980. *Rhizobium-Blackgram symbiosis as influenced by certain environmental factors*. M. Sc. (Ag.) Thesis. Tamil Nadu Agricultural University, Coimbatore. 97 pp.

Sekar, T. and Balasubramanian, A. 1978. Influence of three soil applied pesticides on nodulation and nitrogen fixation by cowpea plants *(Vigna unguiculata* (L.) Walp.). *Madras Agric. J. 65* : 617-619.

Subba Rao, N. S. 1977. *Soil micro-organisms and plant growth*. Oxford and IBH publishing Co , New Delhi. 289 pp.

https://doi.org/10.29321/MAJ.10.A02039

Madras Agric. J. 76 [3] : 138—142 March, 1989

EVALUATION OF SOIL TESTING PROCEDURES FOR SUGARCANE CROP*

V. MURUGAPPAN, G. V. KOTHANDARAMAN and T. S. MANICKAM
Department of Soil Science, Tamil Nadu Agricultural University, Coimbatore-641 003.

ABSTRACT

Field experiments were conducted with the primary objective of investigating the soil test crop response relationships of sugarcane crop. Surface soil samples collected from the plots of these experiments were analysed for available nitrogen (alkaline $KMnO_4$-N and organic carbon), phosphorus (Olsen's-P and Bray's-P) and potassium (neutral N NH_4OAc-K and 0.1N HNO_3-K). Relationship between soil test values and cane yield/ nutrient uptake was established by simple correlat on studies and multiple regression analysis with linear, quadratic polynomial and square root polynomial functions. The results revealed that the organic carbon, Olsen's-P and 0.1N HNO_3-K are the best indices, respectively of nitrogen, phosphorus and potassium availabilities to sugarcane crop.

Keywords : Sugarcane, Soil testing procedures, Nutrient uptake

Soil fertility research and associated laboratory studies over the past 30 years have established the efficacy of soil testing as a means for predicting the nutrient needs of crops. The success of soil testing and fertilizer prescription

* A part of Ph. D. thesis of the first author submitted to the Tamil Nadu Agricultural University, Coimeatore-641 003.

programme depends, to a considerable axtend, on choosing and employing the most suitable soil testing procedures which can able to extract proportional amounts of available nutrients for a soil-crop combination.

While selecting the suitable soil testing procedures, comparison is often made by working out simple correlations between available nutrients in soil as estimated by various procedures and crop responses (Kanwar and Bhumbla, 1967; Datta and Kalbande, 1967; Dubey *et al.*, 1972). In yet another approach, Ramamoorthy (1968) demonstrated how multiple regression analysis could be made use of in selecting the most appropriate soil testing status in soils. Attempts so far made were few in screening suitable soil testing procedures for sugarcane crop. The present investigation was undertaken with the objective of selecting suitable soil testing procedures for estimating the available nitrogen, phosphorus and potassium for sugarcane crop.

MATERIALS AND METHODS

Field experiments were conducted during May, 1979 to August, 1981 in a sandy clay loam soil representing Somayanur series (Udic Haplustalfs) of Coimbatore district, Tamil nadu. The objective of these experiments was to investigate the soil test crop response relationships of sugarcane crop (*Saccharum officinarum* var. Co 6304) employing the inductive methodology outlined by Ramamoorthy and Velayudham (1971). Surface (0-15 cm) soil samples were obtained from the ninety six experimental plots in two stages, i.e., before planting of the crop and after the harvest of the plant crop before allowing for ratooning. Estimations on nitrogen, phosphorus and potassium availabilities were made in these samples employing two commonly followed soil testing procedures for each nutrient as given below:

Nitrogen : SN_1 Alkaline $KMnO_4$-N (Subbiah and Asija, 1956)

Table 1. Correlation of cane yield/nutrient uptake of N, P and K in plant and ratoon sugarcane with respective soil test values

Crop	Soil test values by different methods / Variable correlated	Alkaline KMnO-N (SN_1)	Organic carbon (SN_2)	Olsen's -P (SP_1)	Bray's-P (SP_2)	NH_4OAc-K (SK_1)	0.1 N HNO_3-K (SK_2)
Plant crop	Cane yield	0.3086**	0.5329**	0.1688	0.0047	0.2985**	0.0938
	Nutrient uptake	0.2816**	0.4844**	0.0615	—0.0414	0.3059**	0.0787
Ratoon crop	Cane yield	0.1569	0.6593**	0.0616	0.0067	0.0448	0.0039
	Nutrient uptake	0 1091	0.4847**	—0.0193	0.0006	0.1015	0.0637

Significant at P=0.01

SN_2 Organic carbon (Walkey and Black, 1934)

Phosphours : SP_1 Olsens-P (Olsens *et al.*, 1954)
SP_2 Btay's-P using No. 1 extractant (Bray and Kurtz, 1945)

Potassium : SK_1 Neutral N NH_4 OAC-K (Stanford and English, 1949)
SK_2 0.1N HNO_3-K (Ramanathan, 1977)

Simple correlations between cane yield/nutrient uptake of nitrogen, phosphorus and potassium and soil test values by different procedures were worked out separately for plant and ratoon sugarcane. Linear, quadratic polynomial and square root polynomial functions were fitted using cane yield and the soil test values of all the three nutrients, in all possible combinations of soil testing procedures, separately for plant and ratoon sugarcane. The same functions were also fitted using nutrient uptake values and the respective soil test values. For these statistical processing of the data the procedure outlined by Snedecor and Cochran (1968) was followed.

RESULTS AND DISCUSSIONS

The results of the correlation studies indicated that the alkaline $KMnO_4$ -N, organic carbon and NH_4OAc-L were significantly correlated with cane yield and respective nutrient uptake values of plant sugarcane (Table 1). Among the two nitrogen availability indices tried, organic carbon ($r = 0.5329^{**}$ and 0.4844^{**}, respectively with cane yield and nutrient uptake) proved its superiority over alkaline KMnO-N ($r = 0.3086^{**}$) and 0.2816^{**}, respectively with cane yield and nutrient uptake. In the case of ratoon sugarcane, only the organic carbon content of the soil had shown an association with cane yield and nitrogen uptake. None of the other

Table 2. The multiple coefficients of determination (R^2) of different functions fitted with soil test values by different methods and nutrient uptake of plant and ratoon sugarcane

Variables regressed	Plant crop			Ratoon crop		
	Linear	Quadratic polynomial	Square root polynomial	Linear	Quadratic polynomial	Square root polynomial
N-uptake and SN_1	0.0793	0.1005*	0.1034**	0.0119	0.0145	0.0139
N-uptake and SN_2	0.2347	0.2452**	0.2339**	0 2349	0.2578**	0.2378**
P-uptake and SP_1	0.0038	0.0087	0.0093	0.0004	0.0181	0.0206
P-uptake and SP_2	0.0017	0.0022	0 0023	0.0000004	0.0065	0.0093
K-uptake and SK_1	0.0936	0.0960*	0.0965*	0.0103	0.0112	0.0115
K-uptake and SK_2	0.0062	0.0063	0 0109	0.0041	0.0080	0.0067

** Significant at P = 0.01
* Significant at P = 0.05

Table 3. The multiple coefficients of determination (R^2) of different functions fitted with soil test values of all possible combinations of soil test methods and cane yield of plant and ratoon sugarcane

Combination of soil test methods	Plant crop			Ratoon crop		
	Linear	Quadratic polynomial	Square root polynomial	Linear	Quadratic polynomial	Square root polynomial
SN_1 SP_1 SK_1	0.1572**	0.2019**	0.2088**	0.2074	0.3750	0.0382
SN_1 SP_1 SK_2	0.1284**	0.1669**	0.2919**	0.0438	0.0819	0.0803
SN_1 SP_2 SK_1	0.1822**	0.2158**	0.2195**	0.0369	0.0499	0.0495
SN_1 SP_2 SK_2	0.1465**	0.1735**	0.2867**	0.0378	0.0619	0.0596
SN_2 SP_1 SK_1	0.2987**	0.5320**	0.3069**	0.4374**	0.4634**	0.4422**
SN_2 SP_1 SK_2	0.2899**	0.8181**	0.2932**	0.4371**	0.4651**	0.4441**
SN_2 SP_2 SK_1	0.3051**	0.5268**	0.3227**	0.4410**	0.4772**	0.4555**
SN_2 SP_2 SK_2	0.2951**	0.6776**	0.3109**	0.4478**	0.4784**	0.4532**

** Signifcant at P = 0.01

soil test values including those for phosphorus and potassium had shown this association.

In multiple regression analysis, the magnitude of the multiple coefficients of determination (R^2), which indicate the degree of fit of the data, is usually the chief guiding factor for selecting the most appropriate combination of soil testing procedures (Ramamoorthy, 1968; Velayudham et al., 1979). Hence, the multiple coefficients of determination obtained in the multiple regression analyses are given in Tables 2 and 3. In general, higher R^2 values were obtained in majority cases under quadratic polynomial function indicating better utility of this function than others in screening the best combination of soil testing procedures.

In the case of multiple regression analysis by quadratic polynomial function relating nutrient uptake values with respective soil test values, alkaline $KMnO_4$ method and organic carbon estimation for nitrogen and neutral N NH_4OAc extraction for potassium gave significant R^2 values for plant sugarcane (Table 2). In the case of ratoon sugarcane, only the R^2 values obtained for the regression of organic carbon content with nitrogen uptake was significant. A comparison of R^2 values of alkaline $KMnO_4$-N and nitrogen uptake revealed that organic carbon content was a better index of nitrogen availability for sugarcane since it gave higher R^2 values than those obtained for alkaline $KMnO_4$-N. This is in agreement with the conclusions drawn by Sachan (1978) in Tarai soils of Pantnagar for sugarcane crop.

In the case of the quadratic polynomial functions fitted with cane

yield of plant sugarcane and the soil test values in all possible combinations of the various soil testing procedure tried, all the R^2 values were significant (Table 3). The highest value of 0.8181** was obtained for the combination of organic carbon for nitrogen, Olsen's extractant for phosphours and 0.1 N HNO3 for potassium. In the case of ratoon sugarcane, all the combinations of soil testing procedures containing alkaline KMnO4 method failed to give significant R^2 values, whereas the combinations containing organic carbon method gave significant R^2 values. Among the four combinations containing organic carbon, those two with Bray's-P gave higher R^2 values than those with Olsen's-P. However, the differences in R^2 values between these two groups of combinations were not much indicating a parity between them in their predictability.

Thus, from the results of the correlation studies and multiple regression analysis, it can be concluded that the organic carbon method for available nitrogen, Olsen's procedure for available phosphorus and 0.1 N HNO_3 method for available potassium (SN_2, SP_1 and SK_2) are better soil testing procedures of choice than others for sugarcane crop.

REFERENCES

Bray, R. H. and Kurtz, L. T. 1945. Determination of total, organic and available phosphorus in soils. *Soil Sci. 59* : 39-45.

Datta, N. P. and Kalbande, A. R. 1967. Correlation of response in paddy with soil tests for potassium in different Indian soils. *J. Indian Soc. Soil Sci. 15* : 1-6.

Dubey, S. M., Commen, P. K. and Khera, M. S. 1972. Evaluation of nitrogen soil tests. *Fert. News. 17* : 27-30.

Kanwar, J. S. and Bhumbla, D. R. 1967. Evaluation of different methods for the determination of P in acid soils of Punjab. *J. Res.* (PAU). *4* : 7-15.

Olsen, S. R., Cole, C. V., Watanabe, F. S. and Dean, L. A. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate, USDA Circ. 939, U. S. Govt. Printing Office, Washington, D. C.

Ramamoorthy, B. 1968. Annual progress report of the All India Co-ordinated soil test crop response correlation scheme, Jabalpur.

Ramamoorthy, B. and Velayudham, M. 1971. Soil test crop response correlation work in India. Soil resources report No. 41, Soil Survey and Soil Fertility Res. in Asia. *14* : 19-105.

Ramanathan, K. M. 1977. Studies on dynamics o soil otassium Ph D Thesis Tam' Nadu Agricultural University, Coimbatore.

Sachan, R. S. 1978. Progress report of All Inda Coordinated Soil test Crop Response Correlation Project, 1976-78, Govind Ballabh Plant University of Agriculture and Technology. p. 51-58.

Snedecor, G. W. and Cochran, W. G. 1968. Statistical methods. 6th Edn. Oxford and IBH Publishing Co., Eton. Press, Calcutta.

Stanford, S. and English, L. 1949. Use of flame photometer in rapid soil tests of K and Ca. *Agron. J. 41* : 446-447.

Subbiah, B. V. and Asija, G. L. 1956. A rapid procedure for estimation of available nitrogen in soils. *Curr. Sci. 25* : 259-260.

Velayudham, M., Rani Perumal and Dhanapalan Mosi, A. 1979. Estimation of fertilizer requirments for rice based on soil test crop response correlation. Proc. of the Seminar on response of crops to application of P and K and soil fertility evaluation, Tamil Nadu Agricultural Universitv. Coimbatore p. 426-434.

Walkley, A. and Black, I. A. 1934. An examination of the Degtiareff method for determining soil organic matter and a proposed modification of the chromicacid titration ..th Soil .. 37 : 2 4 1