GAU Res. J. 1979. 5 (1) 40-41

Note on Relationship Among Total Nitrogen, available Nitrogen, Organic Carbon and C/N Ratio in Cold Desert Soils

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Although nearly 80% of atmospheric gas is nitrogen, but is estimated to be only 2% of the total nitrogen of the earth. The bulk of the soil nitrogen is in organic form which has been accumulated from the elemental form in the atmosphere by fixation processes. In spite of this fact, the growth of agricultural plants is limited more often by a deficiency of nitrogen than of any other nutrient. Climate plays a dominant role in determining the nitrogen content of soil through the influence of temperature and water supply on the activities of plants and microorganisms. The cold desert soils also have low temperature and limited water supply. In keeping view the above points the present investigation was undertaken to study the relationships of total nitrogen, available nitrogen, organic carbon and C/N ratio in the cold desert soils of Kinnaur district (H.P.) with the help of multiple regression analysis.

For the present investigation, 155 surface soils samples were collected representing the whoe district. Air dried samples were passed through 2 mm sieve. Total nitrogen was estimated according to the modified Kjeldahl method (Jackson, 1967), available nitrogen by distilling the soil with alkaline potassium permanganate solution (Subbiah & Asija, 1956) and organic carbon by rapid colorimetric procedure (Datta *et al.*, 1962). Correlation and regression analysis was carried out with the help of Computer (IBM model 1620).

TABLE 1

Simple correlation coefficient among total and available nitrogen, organic carbon and C/N ratio.

	Available-N	*Organic carbon*	*C/N ratio*
Total-N	0·859***	0·653***	—0·497***
Available-N	—	0·615***	—0·393***
Organic carbon	—	—	0·214*

* Significant at 10% level
*** Significant at 1% level

The simple correlation co-efficient among total nitrogen, available nitrogen, organic carbon and C/N ratio was significant (Table 1) but the relationship of total and available nitrogen with C/N ratio was negative. This negative relationship of C/N ratio may be because of the fact that mineralization of nitrogen in the soil is not taking place due to low temperature of the area and fresh organic matter added to soils remains as

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such. Black (1973) also gave the same reason for poor index of C/N ratio for susceptibility of soil nitrogen to mineralization.

Following are the regression equations obtained in the investigation:

(i) $N_A = 124{\cdot}7 + 1269{\cdot}2^{***}\ N_T + 37{\cdot}77^{*}$ Org. C $- 2{\cdot}813$ C/N
$R^2 = 74{\cdot}41^{***}$

(ii) $N_A = 98{\cdot}4 + 1402{\cdot}77^{***}\ N_T + 22{\cdot}42^{*}$ Org. C
$R^2 = 74{\cdot}30^{***}$

(iii) $N_A = 122{\cdot}39 + 1510{\cdot}55^{***}\ N_T$
$R^2 = 73{\cdot}79^{***}$

N_A = Available N, N_T = Total N, Org. C = Organic carbon

* Significant at 10% level,
*** Significant at 1% level.

The regression equations clearly indicate that available nitrogen in cold desert soils is governed mainly by total nitrogen followed by organic carbon. As given in equation (i), the independent variable total nitrogen is significant at 1% level and organic carbon is only significant at 10% level. Variable C/N ratio is not at all significant which indicates that C/N ratio is not giving the true picture of available nitrogen in cold desert soils. The significance of organic carbon at 10% level and nonsignificance of C/N ratio may be due to slow decomposition of organic matter in the soils because of prevailing low temperature in the area. The R^2 values in all the three equations are almost same which indicate that only total nitrogen gives the better picture of available nitrogen in the soils under investigation. In equation (ii) the independent variables are total nitrogen and organic carbon whereas in equation (iii) it is only total nitrogen. By eliminating non significant and less significant independent variables in regression equations, it was possible to identify the variable which gave more clear picture of a available nitrogen in the soils.

The present investigation indicates that the relationship expressed in the form of multiple regression equations is a better index than the relationship expressed in simple correlation form.

(Received on June 2, '78)

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