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RESEARCH ARTICLE :

Depth-wise distribution of different forms of nitrogen in apple growing soils of Pulwama district of Kashmir Valley

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SUMMARY : Depth-wise distribution of different fractions of nitrogen in some selective sites (soil depths) of district Pulwama of Kashmir valley was studied. In all the soil profiles nitrogen fractions (forms) decreased with increase in depth except the fixed NH_4-N which increased with decreased depth. Organic nitrogen showed high significant positive correlations with total nitrogen (r=0.987***), organic nitrogen decreased with depth while the fixed NH_4-N increased and these two fraction were also showed highly significant correlation with each other (r=0.645***)

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KEY WORDS :
Nitrogen fractions, Profile distribution, Correlation, Accumulation

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BACKGROUND AND OBJECTIVES

Nitrogen has most importance nutrient element in fertility management in valley soil under apple orchards. Nitrogen has been recognised as a universally deficient plant nutrient. Nitrogen content in soil profiles is not uniformly distributed with depth. In most of the soils total N content is high in the surface (0-15 cm) layers, and below these it decreases considerably. Kaitha *et al.* (1990) reported that average available N content in the A horizon was higher (300-500ppm) than the underlying horizon, the available N showed a regular decrease with soil depth in all the profiles. Present study was taken upto characterize the soil profiles of some selective productive soils under apple orchard with respect to nitrogen fractions and attempts were made to establish the relationships among the various forms of nitrogen in the soil profiles.

RESOURCES AND METHODS

The present study was carried out in the year 2010-2011. The area under study runs approximately from 74°.57' N and 33°.52'E comprising of the Pulwama district of the Kashmir valley. Relief position is between 1630-1650 m above mean sea level. The climate of the area is temperate

Sampling sites were selected considering contrasting differences in texture, topography,

Table 1 : The depth wise distribution of nitrogen fraction ($mgkg^{-1}$) in apple growing soil of Pulwama district

Soil series	Depth (cm)	Total-N	Inorganic nitrogen	Fixed- NH_4-N	Organic- N	NO_3-N
Pampori	0-11	671.0	16.0	11.4	41.9	591.5
	11-20	460.0	12.5	8.3	47.4	384.8
	20-40	390.0	9.9	13.8	54.5	301.7
	40-60	366.0	8.5	12.0	62.2	278.4
	60-90	355.0	7.9	15.4	66.4	260.5
	90-110	288.0	7.0	12.0	70.8	190.3
	110-130	247.0	5.0	15.2	78.0	141.6
Bangund	0-11	600.0	24.5	17.0	126.7	422.9
	11-26	293.0	22.5	15.4	35.7	186.2
	26-51	252.0	19.3	10.8	38.6	177.6
	51-86	222.0	14.0	12.2	31.0	143.0
	86-93	180.0	10.0	10.9	16.6	94.0
	93-	130.0	6.3	10.3	12.0	71.5
Ranzipori	0-22	680.0	22.0	12.5	44.3	582.9
	22-43	386.0	19.0	15.0	49.0	294.7
	43-62	244.0	17.5	14.2	54.5	163.8
	62-93	205.0	16.5	6.8	60.4	113.5
	93-160	196.0	14.6	6.4	63.1	106.9
	160-180	180.0	8.5	6.2	76.9	88.9
Lathpora	0-16	445.0	25.5	10.8	81.5	294.3
	16-35	203.0	24.0	17.2	4.6	115.4
	35-68	160.0	20.0	15.2	10.3	114.5
	68-108	145.0	15.5	11.0	14.1	101.5
	108-140	121.0	10.0	10.0	8.5	72.6
	140	77.0	7.6	10.7	11.6	40.3
Malangpori	0-14	1082.0	22.6	13.4	265.3	758.9
	14-32	687.0	15.0	8.9	174.0	486.2
	32-52	537.0	8.8	10.0	132.2	379.0
	52-66	470.2	8.6	12.0	117.2	342.1
	66-94	450.0	8.0	10.9	119.0	341.0
	94-124	421.0	7.5	12.8	95.4	293.3
	124-145	350.0	7.1	10.7	79.1	244.0
	145	289.0	5.0	12.5	63.8	201.2
Khandgund	0-15	694.0	23.9	15.5	155.4	485.7
	15-30	350.0	18.0	12.5	66.4	243.1
	30-53	335.0	18.5	15.4	60.6	236.0
	53-89	321.0	12.3	10.0	66.5	223.0
	89-115	296.0	10.0	13.3	59.0	208.4
	115-130	265.0	8.4	12.0	50.8	177.9
	130	218.0	7.6	8.8	40.6	143.0
Drubgam	0-22	290.0	18.9	8.9	42.2	210.2
	22-61	276.0	13.8	15.6	46.6	183.9
	61-90	224.0	8.9	18.7	52.5	137.8
	90-145	128.0	6.5	15.4	62.3	86.8
	145+	80.0	5.8	12.0	63.5	35.7
Churso	0-18	660.0	25.0	8.8	45.8	552.5
	18-36	310.0	12.5	7.2	52.9	217.4
	36-60	240.0	10.3	14.2	58.2	144.5
	60-101	228.0	8.8	12.0	62.9	137.3
	101-150	175.0	8.5	13.3	66.8	81.9

drainage, development of horizons and types of vegetation. Selection of soil sample was done randomly across the entire district. Laboratory analyses were to study the distribution of nitrogen forms in eight selected soil series from the district. The analysis of physical and chemical characteristics of the selected soils was carried out using the standard analytical methods (Jackson, 1958 and Black, 1965). The pH ranged from 5.58-6.67, Ec 3.12-3.82 dSm^{-1} and OC ranged from 1.63-6.25gkg^{-1}.

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Distribution of nitrogen fractions :

The total N content in the soil varied widely and was higher at the surface soil as compared to the sub-surface, as indicated in (Table 1). In all the profiles, the total N content showed a distinct decreasing trend with depth and thus closely followed the same pattern as did the organic nitrogen. The organic N accounted for the major proportion (67.9-87.5%) of the total N in these soils and showed highly significant positive correlation with total N (r=0.987**) in the soils under investigation (Table 2).

The inorganic N content (NH_4-N and NO_3^--N) in these soils was quite low as compared to the organic N content, it indicating that only a small portion of the organic N is mineralized at a given point of time. The inorganic N content in the top layer of soil was higher as compared to the lower one. The inorganic forms of N are always in a state of dynamic change, and hence, their contents in soil are highly variable. This observation is in accordance with earlier reported by Walia *et al.* (1998).

The fixed ammonical-N accounted for the major fraction of inorganic –N in these soils. The fixed NH_4-N content in soil depths varied from 4.5 to 265.3 $mgkg^{-1}$.In sub-surface soil, the values of fixed NH_4-N were relatively high under all the land uses. The second dominant inorganic -N fraction in these soils appears to be exchangeable NH_4-N. These exchangeable NH_4-N content in soil depths varied from 5.0 to 25.5 $mgkg^{-1}$. The surface soils are richer with respect to exchangeable NH_4-N content than the sub-soils and constituting 1.75 to 12.6 per cent of total –N. The exchangeable NH_4-N content, however did not show much variation in the sub-soils of the different profiles. These observations corroborate with earlier reported by Minhas and Bora (1982).The magnitude of No_3-N was lesser than that of fixed NH_4-N and was more or less similar to the exchangeable NH_4-N. The NO_3-N content ranged from 6.2 to 18.7$mgkg^{-1}$ in these soil profiles. The total nitrogen present range was 1.3 to15.2 per cent.These data indicate that the surface soil had relatively higher NO_3—N content as compared to the sub-surface. Soils showed a declining trend of NO_3-N with depth, which may be attributed to lower intensity of mineralization in the lower horizons. These observations are in accordance with earlier reported by Walia *et al.* (1998)

The organic –N decreased with depth while the ammonical –N increased in depth almost the same ratio. The organic-N and ammonical-N fractions where highly significantly correlated with each other (r=0.645**). Depth wise distribution also carried out that unlike other soil series the ratio of organic –N did not decrease significantly in the Khandgund and Drubgam soils depths. The ammonical-N and nitrate-N, while could not record significant correlation with each other as such in these soils, however, proportion of both of these fractions tends to increase with depth in upper part of the soil in all soil series except Ranzipora series where only the nitrate-N increased with depth. These observations are in accordance with earlier reported by Singh and Singh (2007).

Table 2 : Correlation co-efficients among nitrogen fractions

	Total -N	Organic-N	NH_4-N	NO_3-N	Fixed NH_4-N
Total –N	-	0.987**	0.465**	0.039	0.756**
Organic-N			0.461**	0.007	0.645**
NH_4-N				0.150	0.124
NO_3-N					0.043
Fixed NH_4-N					

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Correlationships of different forms of nitrogen :

Total-N had positive correlations with NH_4-N (r=0.465**) and fixed NH_4-N (r=0.756**), while exchangeable NH_4-N and NO_3^--N fractions although were positively correlated with each other but had non-significant relations with fixed NH_4-N (Table 2). This may be due to the fact that while exchangeable NH_4-N and NO_3^--N are readily available ions, which decreased with soil depth. The fixed NH_4-N only slowly available to plants and increased with soil depth. These observations are in accordance with earlier reported by Singh *et al.* (1996)

Conclusion :

In all the soil series the nitrogen fractions decreased with increase in soil depth except the fixed NH_4-N, which increased with increase in soil depth. It is clear understandable as the organic nitrogen constituents the major component of the total nitrogen.

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