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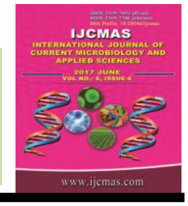

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Depth Wise Distribution of Primary Nutrients in Pear Orchard Soils of Kashmir, India

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ABSTRACT

The present study revealed that pH of pear orchard soils increased with decrease in altitude while as organic carbon decreased with decrease in altitude. The textural class of soils ranged between clay loam to silt clay loam with normal electrical conductivity. The available nitrogen status was low to medium, whereas, available phosphorus status was medium to high and available potassium status was high. The effect of altitude on the available nitrogen, phosphorus and potassium was found significant statistically, thereby showing that altitude bears effect on their content in pear orchard soils of Kashmir.

Introduction

Fruit production is considered as the backbone of the economy of Jammu And Kashmir State. About 80 percent of the rural population is directly as well as indirectly related with this occupation. The fruit production in the state is 5515.41 thousand metric tones during 2006-07 from an area of 472.70 thousand hectares. Among temperate fresh fruits grown in the state, the pear is rank next to apple. It is cultivated in valley of Kashmir and higher reaches of Jammu like Doda, Poonch and Rajouri. The area under pear is 15.99 thousand hectares with a production of 70.84 thousand metric tones (Anonymous, 2007). Nutrition plays an important role in the production of quality fruits. In pear also, proper amount of nutrients is essential for the growth and development of plants leading to maximum production of quality fruits. It has been observed that availability of nutrients to the plants is affected by many factors, which includes, soil texture, moisture, soil pH, slope, drainage, aspect, altitude, climate, stock, scion, etc. The effect of altitude on availability of plant nutrients is obvious as it affects the various factors of climate like temperature, rainfall, solar radiation etc. These in turn bear effect on the availability of nutrients to the plants. The altitude of valley varied from 1500 to 2500 meters above mean sea level. The present investigation has been taken to study the effect of altitude on the availability of primary nutrients like nitrogen, phosphorus and potassium in pear orchard soils of Kashmir valley as no such investigation/research was conducted so far with respect to pear orchard soils.

Materials and Methods

Description and collection of soil samples from experimental site

The study are *i.e.* Kashmir valley is spread over Latitude of 32° 17′ to 80° 30′ E. The present investigation was carried out in 21 pear orchards of uniform age group (15-20 years) from pear growing areas of the valley located at different altitudes and grouped into three groups i.e., high altitude, mid altitude and low altitude as shown in table 1. Seven sites from each altitude were selected which represented the different districts (Budgam, Kulgam, Pulwama, Ganderbal, Kupwara and Srinagar) of the valley. The texture of the soils ranged from clay loam to silty clay loam. Soil samples were collected up to depth of 50 cm with an increment of 25cm. The samples were air dried and crushed with a wooden pestle and mortar followed by sieving through a sieve of 2mm size and stored in polythene bags for analysis. A portion was passed through a sieve of 0.5mm and stored separately for estimation of organic carbon.

Methods for estimation of various soil parameters

The pH and electrical conductivity were estimated in 1:2.5 soil water suspensions by standard procedure given by Jackson (1973). The organic carbon was determined by the method outlined by Walkley and Black (1934) and calcium carbonate was found by the method given by Piper (1966). The available nitrogen was determined by alkaline permanganate method outlined by Subbiah and Asija (1956). Available phosphorus was extracted with 0.5N sodium bicarbonate at pH 8.5 (Olsen *et al.*, 1954) and estimated by ammonium molybdate method (Jackson, 1973). The available potassium was extracted with normal ammonium acetate and determined on flame photometer as described by Jackson (1973).

Experimental design

Mean values were used to obtain estimation of variance components as per methods suggested by Panse and Sukhatime (1967). Nutrient standards as per established procedure (Table 2) were used for the determination of nutrient status in soils.

Results and Discussion

Depth-wise distribution of physico-chemical attributes

Soil pH (1:2.5)

Soil reaction being the most important physico-chemical property influences the soil health from chemical, physical, biological and mineralogical point of view. The pH in the surface layer (0-25cm) ranged from 6.10 to 6.41, 6.52 to 6.75 and 6.92 to 7.76 in high, mid and low altitudes, respectively, with an overall average and mean value of 6.10 to 7.76 and 6.75 in surface soil respectively (Table 3). The soil pH in subsurface layer (25-50cm) ranged from 6.20-6.48, 6.60-6.83 and 6.99-7.85 in high, mid and low altitudes, respectively, with an overall range and mean value of 6.20 to 7.85 and 6.87 in subsurface soil respectively. The pH decreases with increase in altitude, but increases with increase in soil depth, in general soils were slightly acidic to slightly alkaline. However the effect of altitude on soil pH was observed to be significant. This could be due to leaching of bases due to high rainfall, besides higher amount of organic matter in high altitude soils. These are supported with the findings of Lahiri and Chakravarti (1989) and Mandal *et al*., (1990).

Electrical conductivity (dSm^{-1})

Soils generally differ in their salt content, which affects their ability to grow crops. Excess salts interfere with water and nutrient uptake. The soil Ec in the surface layer (0-25cm) varied from 0.10 to 0.25, 0.14 to 0.42 and 0.16 to 0.44 dSm^{-1} in high, mid and low altitudes, respectively, with an overall range and mean value of 0.10 to 0.44 and 0.26 dSm^{-1} in surface soil respectively (Table 4). Whereas, in subsurface layer (25-50cm) it ranged from 0.13 to 0.23, 0.18 to 0.34 and 0.11to 0.37 dSm^{-1} in high, mid and low altitudes, respectively, with an overall range and mean value of 0.13 to 0.37 and 0.21 dSm^{-1} in subsurface soil respectively. The electrical conductivity of all soils was observed normal and it showed an irregular trend with an increase in soil depth (Table 4). The electrical conductivity varied significantly in these soils with relatively lower value in soils of high altitude. This could be due to leaching of soluble salts and runoff transportation due to high precipitation. This is in accordance with the results of Balanagoudar and Satyanarayana (1990) and Najar (2002).

Calcium carbonate (%)

Calcium in soils effects the soil reaction, thereby affecting the availability of plant nutrients. The calcium carbonate in the surface layer (0-25cm) varied from 6.4 to 8.2, 8.4 to 9.8 and 6.8 to 8.2 percent, in high, mid and low altitudes, respectively, with an overall range and mean value of 6.4 to 9.8 percent and 7.9 percent in surface soil respectively (Table 5). Whereas, in subsurface layer (25-50cm) it ranged from 7.0 to 9.0, 8.8 to 10.2 and 7.2 to 8.6 percent in high, mid and low altitudes, respectively, With an overall range and mean value of 7.0 to 10.2 percent and 8.39 percent in subsurface soil respectively with higher content in mid altitude soils, which may be due to calcareous nature of parent material. In general, the contents of calcium carbonate increased with depth, which could be due to leaching of bases from surface to subsurface layers. Similar results were reported by Talib (1984) and Kher and Singh (1993).

Organic carbon content (%)

Soil organic carbon serves as an index of soil productivity. The organic carbon in the surface layer (0-25cm) varied from 1.28 to 2.36, 1.14 to 2.21 and 0.66 to 1.72 percent, in high, mid and low altitudes, respectively, with an overall range and mean value of 0.66 to 2.36 percent and 1.54 percent in surface soil respectively (Table 6). Whereas, in subsurface layer (25-50cm) organic carbon ranged from 1.02 to 1.56, 0.99 to 1.49 and 0.54 to 1.56 percent in high, mid and low altitudes, respectively, With an overall range and mean value of 0.54 to 1.56 percent and 1.10 percent in subsurface soil respectively. The surface soils showed higher content of organic carbon, which decreases with an increase in soil depth. The high content of organic carbon in surface layer is due to natural vegetation and addition of organic matter to pear orchards. The organic carbon content varied significantly with altitude and high content of organic carbon was observed in high altitude soils and in general decreases with the decrease in altitude. This is due to luxurious vegetation because of high rainfall and slow rate of decomposition due to low temperature leading to accumulation of organic matter at high altitudes. These findings are supported by Minhas and Bora (1982) and Sharma *et al.*, (2005).

Table.1 Selected sites with altitudes of pear orchards

S.No.	Location	District	Altitude (a.m.s.l) (meters)
1	Chrarisharief	Budgam	2100
2	Pakherpora	Budgam	2020
3	Footlipora	Budgam	2000
4	Kamrazipora	Pulwama	1920
5	Kanigam	Pulwama	1880
6	Tujan	Pulwama	1850
7	Adijan	Kulgam	1840
8	Drabagam	Pulwama	1800
9	Pombay	Kulgam	1800
10	Astanpora	Srinagar	1790
11	Rajpora	Pulwama	1780
12	Tral	Pulwama	1760
13	Nawpora	Budgam	1750
14	Pirpora	Pulwama	1730
15	Wakura	Ganderbal	1690
16	Zazna	Ganderbal	1640
17	New Thead	Srinagar	1620
18	Manzgam	Srinagar	1580
19	Khanda	Budgam	1580
20	Handwara	Kupwara	1560
21	Pohru	Budgam	1520

Table.2 Critical limits of available nutrient elements in soils

Nutrient Element	Soil Fertility Classes				Reference
	Unit	Low	Medium	High	
Organic carbon	%	< 0.5	0.5 – 1.0	> 1.0	Walkley and Black (1934)
Nitrogen	ppm	< 125	125 – 250	> 250	Subbiah and Asija (1956)
Phosphorus	ppm	< 4	4 – 11	> 11	Olsen *et al.*, (1954)
Potassium	ppm	< 44	44 – 125	> 125	Hanway and Heidal (1952)
Sulphur	ppm	< 10	-	-	Kanwar and Mohan (1964)
Zinc	ppm	< 0.6	0.6 – 1.2	> 1.2	Takkar and Mann (1975)
Copper	ppm	< 0.2	0.2 – 2.0	> 2.0	Follet and Lindsay (1970)
Manganese	ppm	< 1.0	-	-	Follet and Lindsay (1970)
Iron	ppm	< 4.5	-	-	Lindsay and Norvell (1978)

Table.3 Soil reaction (pH) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	6.10	6.20
	Pakherpora	2020	6.26	6.37
	Eootlipora	2000	6.28	6.39
	Kamrazipora	1920	6.35	6.41
	Kanigam	1880	6.39	6.42
	Tujan	1850	6.41	6.47
	Adijan	1840	6.40	6.48
	Surface Range: 6.10-6.41 Mean: 6.31 Sub-surface Range: 6.20-6.48 Mean: 6.39			
	Drabagam	1800	6.52	6.60
	Pombay	1800	6.61	6.67
	Asthanpora	1790	6.54	6.63
	Rajpora	1780	6.65	6.74
	Tral	1760	6.69	6.87
	Nawpora	1750	6.70	6.76
	Pirpora	1730	6.75	6.83
	Surface Range: 6.52-6.75 Mean: 6.64 Sub-surface Range: 6.60-6.83 Mean: 6.73			
	Wakura	1690	6.92	6.99
	Zazan	1640	7.20	7.38
	New Thead	1620	7.32	7.35
	Manzgam	1580	7.36	7.45
	Khanda	1580	6.94	7.65
	Handwara	1560	7.62	7.71
	Pohru	1520	7.76	7.85
	Surface Range: 6.92-7.76 Mean: 7.30 Sub-surface Range: 6.99-7.85 Mean: 7.48			
LSD(0.05)	**0.14**			
±SED	**0.07**			

Table.4 Electrical conductivity in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	0.10	0.16
	Pakherpora	2020	0.16	0.19
	Eootlipora	2000	0.25	0.13
	Kamrazipora	1920	0.12	0.17
	Kanigam	1880	0.24	0.18
	Tujan	1850	0.15	0.23
	Adijan	2100	0.10	0.16
	Surface Range: 0.10-0.25 Mean: 0.18 Sub-surface Range: 0.13-0.23 Mean: 0.17			
	Drabagam	1800	0.15	0.22
	Pombay	1800	0.35	0.26
	Asthanpora	1790	0.14	0.23
	Rajpora	1780	0.42	0.25
	Tral	1760	0.37	0.34
	Nawpora	1750	0.25	0.18
	Pirpora	1730	0.35	0.19
	Surface Range: 0.14-0.42 Mean: 0.29 Sub-surface Range: 0.18-0.34 Mean: 0.23			
	Wakura	1690	0.27	0.11
	Zazan	1640	0.31	0.37
	New Thead	1620	0.16	0.28
	Manzgam	1580	0.44	0.28
	Khanda	1580	0.24	0.18
	Handwara	1560	0.36	0.25
	Pohru	1520	0.29	0.17
	Surface Range: 0.16-0.44 Mean: 0.30 Sub-surface Range: 0.11-0.37 Mean: 0.23			
LSD(0.05)	**0.06**			
±SED	**0.03**			

Table.5 Calcium carbonate (%) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	6.4	7.0
	Pakherpora	2020	6.6	7.4
	Eootlipora	2000	6.6	7.6
	Kamrazipora	1920	7.4	7.6
	Kanigam	1880	7.6	7.8
	Tujan	1850	8.0	8.4
	Adijan	1840	8.2	9.0
	Surface Range: 6.4-8.2 Mean: 7.26 Sub-surface Range: 7.0-9.0 Mean: 7.82			
	Drabagam	1800	8.4	8.8
	Pombay	1800	8.6	9.4
	Asthanpora	1790	8.4	9.0
	Rajpora	1780	8.8	9.2
	Tral	1760	9.6	10.2
	Nawpora	1750	9.6	10.2
	Pirpora	1730	9.8	10.0
	Surface Range: 8.4-9.8 Mean: 9.03 Sub-surface Range: 8.8-10.2 Mean: 9.54			
	Wakura	1690	6.8	7.2
	Zazan	1640	7.0	7.7
	New Thead	1620	7.0	7.4
	Manzgam	1580	7.4	7.6
	Khanda	1580	7.6	7.8
	Handwara	1560	7.8	8.4
	Pohru	1520	8.2	8.6
	Surface Range: 6.8-8.2 Mean: 7.40 Sub-surface Range: 7.2-8.6 Mean: 7.81			
LSD(0.05)	**0.45**			
±SED	**0.22**			

Table.6 Organic carbon (%) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	2.36	1.53
	Pakherpora	2020	1.95	1.56
	Eootlipora	2000	2.04	1.11
	Kamrazipora	1920	1.87	1.19
	Kanigam	1880	1.32	1.17
	Tujan	1850	1.65	1.17
	Adijan	1840	1.28	1.02
	Surface Range: 1.28-2.36 Mean: 1.78 Sub-surface Range: 1.02-1.56 Mean: 1.25			
	Drabagam	1800	1.78	1.17
	Pombay	1800	1.27	1.15
	Asthanpora	1790	2.21	1.49
	Rajpora	1780	1.82	1.27
	Tral	1760	1.45	1.07
	Nawpora	1750	1.14	0.99
	Pirpora	1730	1.52	1.03
	Surface Range: 1.14-2.21 Mean: 1.60 Sub-surface Range: 0.99-1.49 Mean: 1.17			
	Wakura	1690	1.61	1.02
	Zazan	1640	1.09	0.99
	New Thead	1620	1.46	1.00
	Manzgam	1580	1.19	0.87
	Khanda	1580	1.72	1.21
	Handwara	1560	0.92	0.54
	Pohru	1520	0.66	0.58
	Surface Range: 0.66-1.72 Mean: 1.24 Sub-surface Range: 0.54-1.21 Mean: 0.89			
LSD(0.05)	**0.22**			
±SED	**0.11**			

Table.7 Nitrogen (Kg/ha^{-1}) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	439.4	400.0
	Pakherpora	2020	426.9	342.2
	Eootlipora	2000	408.5	316.2
	Kamrazipora	1920	378.5	285.8
	Kanigam	1880	395.5	303.3
	Tujan	1850	377.2	316.2
	Adijan	1840	384.3	309.1
	Surface Range: 377.2– 439.4 Mean: 401.54 Sub-surface Range: 285.8– 400.0 Mean: 324.73			
	Drabagam	1800	419.3	333.3
	Pombay	1800	339.1	257.1
	Asthanpora	1790	383.4	314.5
	Rajpora	1780	325.2	228.9
	Tral	1760	302.4	237.8
	Nawpora	1750	283.5	242.3
	Pirpora	1730	366.9	315.8
	Surface Range: 283.5-419.3 Mean: 345.72 Sub-surface Range: 228.9-333.3 Mean: 275.71			
	Wakura	1690	393.7	294.7
	Zazan	1640	316.7	287.1
	New Thead	1620	363.7	305.9
	Manzgam	1580	272.3	164.8
	Khanda	1580	360.1	280.4
	Handwara	1560	272.3	172.9
	Pohru	1520	207.8	177.4
	Surface Range: 207.8-393.7 Mean: 312.46 Sub-surface Range: 164.8-305.9 Mean: 240.51			
LSD(0.05)	**32.61**			
±SED	**16.08**			

Table.8 Phosphorus (Kg/ha^{-1}) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	41.66	37.18
	Pakherpora	2020	34.05	28.67
	Eootlipora	2000	35.39	34.05
	Kamrazipora	1920	38.98	27.78
	Kanigam	1880	34.94	30.02
	Tujan	1850	32.70	25.54
	Adijan	1840	40.32	31.81
	Surface Range: 32.70- 41.66 Mean: 36.87 Sub-surface Range: 25.54– 37.18 Mean: 30.72			
	Drabagam	1800	40.77	34.05
	Pombay	1800	37.63	32.70
	Asthanpora	1790	39.42	36.74
	Rajpora	1780	33.60	30.02
	Tral	1760	33.15	26.43
	Nawpora	1750	34.50	22.85
	Pirpora	1730	33.15	25.09
	Surface Range: 33.15-40.77 Mean: 36.04 Sub-surface Range: 22.85-36.74 Mean: 29.70			
	Wakura	1690	39.42	24.19
	Zazan	1640	29.57	28.67
	New Thead	1620	33.60	27.78
	Manzgam	1580	28.22	23.30
	Khanda	1580	31.81	23.30
	Handwara	1560	25.09	21.95
	Pohru	1520	21.06	19.71
	Surface Range: 21.06-39.42 Mean: 29.81 Sub-surface Range: 19.71-28.67 Mean: 24.13			
LSD(0.05)	**2.78**			
±SED	**1.37**			

Table.9 Potassium (Kg/ha^{-1}) in surface and sub-surface soils with different altitudes of pear orchard

Altitude Range	Location	Altitude (meters) (amsl)	Depth (cm)	
High Altitude			**0-25**	**25- 50**
	Chrarisharief	2100	456.9	389.7
	Pakherpora	2020	407.6	407.6
	Eootlipora	2000	474.8	347.2
	Kamrazipora	1920	434.5	398.7
	Kanigam	1880	356.1	331.5
	Tujan	1850	416.6	277.7
	Adijan	1840	371.8	315.8
	Surface Range: 356.1 – 474.8 Mean: 416.95 Sub-surface Range: 277.7– 407.6 Mean: 352.64			
	Drabagam	1800	465.9	376.3
	Pombay	1800	340.4	295.6
	Asthanpora	1790	358.4	253.9
	Rajpora	1780	416.6	383.0
	Tral	1760	362.8	188.1
	Nawpora	1750	331.5	284.4
	Pirpora	1730	430.0	237.4
	Surface Range: 331.5-465.9 Mean: 386.56 Sub-surface Range: 188.1-383.0 Mean: 288.43			
	Wakura	1690	456.9	277.7
	Zazan	1640	439.0	275.5
	New Thead	1620	470.4	239.6
	Manzgam	1580	403.2	206.0
	Khanda	1580	374.0	188.1
	Handwara	1560	349.4	228.4
	Pohru	1520	318.0	235.2
	Surface Range: 318.0-470.4 Mean: 401.61 Sub-surface Range: 188.1-277.7 Mean: 235.84			
LSD(0.05)	**31.38**			
±SED	**15.48**			

Depth-wise distribution of primary nutrients

Nitrogen (Kg/ha^{-1})

The available nitrogen in surface layers (0-25 cm) of high, mid, and low altitude soils of pear orchards varied from 377.2 to 439.4, 283.5 to 419.3 and 207.8 to 393.7 Kg per hectare with mean value of 401.5, 345.7 and 312.4 Kg per hectare, respectively. While as in subsurface layer (25-50 cm) it ranged from 285.8 to 400.0, 228.9 to 333.3and 164.8-305.9 Kg per hectare with mean value of 324.73, 275.71 and 240.51Kg per hectare, respectively (Table 7). It has been observed that 86 percent samples have medium status and 14 percent have low status of available nitrogen. This could be due to continuous removal of added as well as mineralized nitrogen by intensive cropping, leaching/ denitrification losses and also its correlation with organic matter content. The available nitrogen was high in surface layers with regular decreasing trend with soil depth. The available nitrogen differed significantly with altitude. Nitrogen was observed high in high altitude soils then in soils of mid and low altitude and it decreases with decrease in altitude, which may be due to climatic and physiographic conditions favourable for the accumulation of high organic matter content in high altitude. This is supported by the similar observations of Kaistha *et al.,* (1990) and Najar *et al.,* (2006).

Phosphorus (Kg/ha^{-1})

The available phosphorus in surface layers (0-25 cm) of high, mid and low altitude soils ranged from32.7 to 41.6, 33.1 to 40.7 and 21.0 to 39.4 Kg per hectare with mean value of 36.8, 36.0 and 29.8 Kg per hectare, respectively, however, it varied from 25.5 to 37.1, 22.8 to 36.7 and 19.71-28.6 Kg per hectare with mean value of 30.7, 29.7 and 24.1 Kg per hectare in subsurface layers (25-50 cm) of high, mid and low altitude soils, respectively (Table 8). The available phosphorus status of pear orchard soils under study was found medium to high and it exhibited decreasing trend with an increase in soil depth. The available phosphorus was high in high altitude soils followed by mid altitude and low altitude soils, respectively. The available phosphorus in low altitude soils varied significantly with that of mid and high altitude soils, while as, its difference between mid and high altitude soils was at par statistically, which could be attributed to favourable soil reaction and high organic matter content leading to formation of organophosphate complexes and coating of iron and aluminum particles by humus. This is supported by the research work of Gupta *et al.,* (1990) and Wani (2001).

Potassium (Kg/ha^{-1})

In surface layers (0-25 cm) of high, mid and low altitude pear orchard soils of Kashmir, the available potassium varied from 356.1 to 474.8, 331.5 to 465.9 and 318.0 to 470.0 Kg per hectare with mean value of 416.9, 386.5 and 401.6 Kg per hectare, respectively, whereas, in subsurface layers (25-50 cm) it ranged from 277.7– 407.6, 188.1-383.0 and 188.1-277.7Kg per hectare with mean value of 352.64, 288.43 and 235.84Kg per hectare, respectively (Table 9). The available potassium in high altitude soils differed significantly with that of mid altitude and low altitude soils, whereas, its difference between mid and low altitude soils was at par statically. The available potassium status of soils under study was high and it did not show any definite trend in its depth-wise distribution, which could be due to presence of high clay content and illitic nature of these clays. This is supported by the findings of Talib (1984) and Najar (2002).

From the study it was concluded that the soils in general were medium to moderately fine textured with clay loam to silt clay loam as dominant texture in surface and subsurface layers. The soils were slightly acidic to slightly alkaline in reaction and pH exhibited an increasing trend with soil depth with lowest in surface soils of high altitude. The electrical conductivity was normal in surface and sub surface soils, respectively, with a decreasing trend with an increase in soil depth. The calcium carbonate was found to be higher in mid altitude soils indicating their calcareous nature. The organic carbon content was medium to high in soils under study in surface layers and decreased gradually with an increase in soil depth. The pH, EC, $CaCo_3$ and OC exhibited significant differences with altitude.

The available nitrogen status of soils was low to medium. Available nitrogen showed a decreasing trend with soil depth. The available phosphorus exhibited a decreasing trend with an increase in soil depth and its status was found medium to high. The soils under study were high in available potassium without any definite trend in its vertical distribution. Thus, the available phosphorus and available potassium are by and large medium to high in pear orchard soils except nitrogen which is low in low altitude soils. The study revealed that altitude bears effect on the available primary nutrients and physico-chemical properties of soils which may be due to climatic factors and mineralogical composition of soils.

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