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Micro-nutrient Indexing of Pear Orchards of Pulwama District in Jammu and Kashmir, India

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A survey was conducted to assess the micronutrient status and their relationship of representative pear (*Pyrus Communis* L.) growing orchards in district Pulwama during 2014-15. Thirty six surface soil samples at 0-30 cm and equal number of leaf samples were collected from the selected pear orchards. Results of the soil chemical analysis revealed that none of the surveyed pear orchards was deficit in available micronutrients and were medium to high in available Zn (0.64-1.60) and Cu (1.30-1.80), high in available Fe (29.88-58.82) and Mn (22.74-59.69) and low to medium status in B (0.64-1.58) and Mo (0.24-0.43) ppm. The micronutrient content of leaf analysis on dry weight basis ranged from 40.41 to 51.45, 12.88 to 16.74, 89.65 to 111.05, 106.84-144.82 and 35.12 to 44.50 ppm. Significant and positive correlation of available Cu, Mn Fe and B with corresponding leaf nutrients (Cu =0.632*, Mn = 0.584*, Fe = 0.715 and B = 0.596*) was recorded. All the available soil and leaf nutrients were in the optimum range except B which was low in some orchards.**

Key words: Available Micronutrients, Pear orchards, Soil and Leaf Analysis,b

Pear is grown in all the continents of the world under warm temperate to temperate climatic conditions. In the fruit map of India, the state of Jammu and Kashmir offers favorable agro-ecological potential for pear. Currently the area under pear is 13883 ha with annual production of 54847 MT in our state (Anonymous, 2015). The low pear production compared to other is primarily owing to the poor soil fertility status besides improper management practices. The nutrient supplying power of a soil depends on dissociation of the nutrients from the exchange site, which is in turn depend on the degree of saturation of the nutrients on the exchange site, type of clay and complementary ion-effect (Foth and Ellis, 1997).

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Continued removal of nutrients, with little or no replacement has aggravated the potential for future nutrient related plant stress and yield loss. It is therefore, inevitable to consider the analysis assessing the nutritional availability of fruit growing crops with deep and ramified root system (Najar *et al*., 2009). The excessive use of macro-nutrient fertilizers has lead to nutritional imbalances through micronutrient decline. Nutritional imbalances in the soil cause nutritional disorders and consequently affect both quality and quantity of fruit. Soil and plant analysis are complimentary to each other, because at a time one component may or may not provide the requisite information. Shen (1990) proposed that diagnosis of the nutrient status of the fruit plant neither depends on the leaf analysis nor on soil analysis alone, but on careful interpretation and integration of the results of both the techniques.The nutritional analysis of soil and

plant thus provides a valuable tool for understanding the nutrient supplying capacity of soil for ascertaining the relationship between available nutrients and leaf nutrient status and therefore predicting the yield levels (Dar *et al.*, 2012). A study has been therefore, conducted in Kashmir valley to determine the soil and leaf nutrient status and their relationship so as to use such knowledge as a tool in optimizing fertilizers use for better fruit yield and quality.

MATERIAL METHODS

A total of thirty six each soil and leaf samples collected respectively from twelve representative soil profiles in pear (*Pyrus communis*, "William Bartlett") orchards of district Pulwama in Jammu and Kashmir during 2014-15. Stratified random soil sampling was preferred due to large number of pear orchards present in this region. The surface soil samples collected at depth of 0-30 cm were air dried, crushed with wooden pestle and mortar and passed through 0.2 mm sieve. The processed composite soil samples were analysed for micro-nutrients using standard analytical methods (Jackson, 1973) and (Piper, 1966). The available Zn, Cu, Mn, and Fe (DTPA-extractable) were extracted by method outlined by Lindsay and Norvell (1978); B was extracted by hot water extraction method and Mo by Grigg's method (1953). Leaf samples collected from the same pear orchards as per the procedure outlined by Chapman (1964) and Waller (1980) were analysed for micro-nutrient estimation after due preparation and digestion. The concentration of these micronutrients in the extract was determined by atomic absorption spectrophotometer (AAS). Simple correlation coefficients were computed relating available micronutrient and corresponding leaf nutrient status (Panse and Sukhatame, 1967).

RESULTS AND DISCUSSION

Available micronutrients Status

By considering the critical limits, micronutrients like Zn, Cu, Fe, Mn, B and Mo were categorized as high, medium and low status. At 95% CI, the soils of pear orchards were medium to high in available Zn (0.64-1.60) and Cu (1.30-1.80), high in available Fe (29.88-58.82) and Mn (22.74-59.69) and low to medium in B (0.64-1.58) and Mo (0.24-0.43) status with the average values of 1.12, 1.56, 44.36, 41.22, 1.11 and 0.34 ppm respectively. Analysis of the results (Table 1) of pear orchard soils clearly revealed that 25 per cent of orchards were medium and 75 per cent high in available Zn (critical limit < 0.6 ppm); 50 per cent soils were medium and 50 per cent high in available Cu (critical limit < 0.2 ppm); 100 per cent high in available Mn, Fe and Mo (critical limit <1, <4.5 and <0.1ppm); 25 per cent of the orchards were low and 75 per cent medium in available B (critical limit < 0.5-1 ppm) in the fertility status of pear orchards. Similar results for DTPA-extractable micronutrient cations and micronutrient anions status were reported by a number of workers (Ahmad *et al.* 2005; Najar *et al.* 2005; Dar *et al.* 2012) while studying nutritional status of fruit growing orchards in Kashmir.

Micronutrient Concentrations in Pear Leaf Samples

Data obtained on micronutrient concentrations in leaf samples on dry weight basis inferred that the concentration of micronutrients varied greatly among 'Bartlett' cultivars pear orchards. At 95% CI, Zn, Cu, Mn, Fe, B and Mo concentration on dry weight basis in leaf samples ranged from 40.41 to 51.45, 12.88 to 16.74, 89.65 to 111.05, 106.84-144.82, 35.12 to 44.50 and 0.46 to 0.59 with average value of 45.93±2.5, 14.81±0.88, 100.35±4.86, 125.83±8.6, 39.81±2.5 and 0.52±0.1% (Table 2). From the leaf micronutrient analysis, it was observed 67% leaf sample were optimum and 33 % high in Zn (critical limit < 10 ppm); 92% optimum and 8% low in Mn (critical limit < 20 ppm) and 100% leaf sample were in the sufficient range of Cu, Fe, B and Mo. The optimum concentration of Zn and Mo in pear leaf samples results from adequate status of available Zn and Mo while as that of Cu and Fe results from their sufficient status as indicated by the significantly positive correlation. These results are comparatively similar to those reported by Singh and Singh (2004) and Dar *et al.* (2012) while studying such relationship in pear growing orchards. Lower amounts of available B against sufficient range in leaves may be attributed to foliar spray of boric acid in the immediate need to overcome B deficiency. These results are closely associated with the findings by Najar *et al.* (2005).

Table 1. Available micronutrients Status of pear orchards

Location	Zn (ppm)	Cu	Mn	Fe	B	Mo
Tujan	1.56	2.85	45.15	78.20	1.84	0.38
Rohomu	2.0	1.95	38.12	53.04	1.56	0.30
Newa	1.36	2.72	55.70	61.00	1.04	0.35
Khrew	1.72	2.72	64.50	43.90	0.70	0.45
Newa	1.51	2.53	60.24	65.08	0.92	0.26
Bundzoo	1.16	2.43	48.96	46.00	1.35	0.42
Chakora	1.35	1.84	42.00	57.90	1.64	0.38
Urcherso	1.71	2.16	33.40	50.10	1.90	0.32
Katibugh	0.79	1.64	39.70	40.12	1.24	0.44
Pampore	1.44	1.50	25.80	48.08	0.96	0.28
Pahu	1.30	1.72	46.50	55.00	1.45	0.34
Gundbag	0.96	1.36	52.90	34.20	0.78	0.40
Average	1.12±0.1	1.56±0.15	41.22±3.2	44.36±3.4	1.11±0.1	0.34±0.1
95%CI	0.64-1.60	1.30-1.80	22.74-59.69	29.88- 58.82	0.64-1.58	0.24-0.43

95%CI = Confidence Interval at 95 per cent

Table 2. Micro-nutrient content (%) of Pear leaves on dry weight basis

Location	Zn	Cu	Mn	Fe	B	Mo
Tujan	51.86	15.90	109.64	168.20	52.70	0.56
Rohomu	60.25	14.42	95.85	150.35	45.94	0.41
Newa	56.40	17.54	116.86	182.08	30.56	0.52
Khrew	46.74	19.80	124.40	135.14	37.45	0.66
Newa	44.82	15.64	105.14	120.50	24.38	0.41
Bundzoo	41.74	17.50	118.05	94.12	32.98	0.62
Chakora	50.12	10.24	82.22	138.45	38.15	0.58
Urcherso	47.90	13.48	91.35	107.95	44.82	0.43
Katibugh	45.28	11.94	82.14	108.35	51.48	0.64
Pampore	42.35	14.64	70.12	97.48	40.12	0.40
Pahu	28.00	16.82	112.60	120.80	45.68	0.48
Gundbag	35.76	9.80	95.82	86.58	33.45	0.60
Average	45.93±2.5	14.81±0.88	100.35±4.86	125.83±8.6	39.81±2.5	0.52±0.1
95%CI	40.41-51.45	12.88-16.74	89.65-111.05	106.84-144.82	35.12- 44.50	0.46-0.59

95%CI = Confidence Interval at 95 per cent

Table 3. Correlation between available soil nutrients and leaf nutrients of pear orchards

Nutrient	Correlation coefficient (r)
Zn	NS
Cu	0.632*
Mn	0.584*
Fe	0.715*
B	0.596*
Mo	NS

*Significant at 5 per cent level (2-tailed)

Relationship between soil and leaf micronutrients

Results of the present study showed that micronutrients i.e, Cu, Mn Fe and B recorded significant and positive correlation with leaf nutrients (Cu =0.632*, Mn = 0.584*, Fe = 0.715* and B = 0.596*) respectively indicating that sufficient availability range of Cu, Mn, Fe and B improves their uptake of the studied pear orchards (Table 3). Similar relationship between available and leaf micronutrients was earlier reported by Ahmad *et al.* (2005) and Dar *et al.* (2012) while studying such relationship in fruit growing soils in Kashmir.

CONCLUSION

It can be concluded from findings of the present study that although pear orchards had adequate soil and leaf micro-nutrient status except B which was in some orchards seem to be the limiting factors of pear productivity. Therefore, micronutrient requirement especially be essentially considered when preparing a fertilizer recommendation.

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