Indian J. Hort. 68(1), March 2011: 113-115

Short communication

Vegetative and fruiting behaviour of hard pear strains in relation to nutrient status

B.S. Dhillon*, W.S. Dhillon and B.S. Brar**
Department of Horticulture, Punjab Agricultural University, Ludhiana 141 004

The pear occupies second position both in area and production among the temperate fruits of the world as well as India. The hard pear cultivars are well adapted to sub-tropical conditions of north-western states of India. Punjab occupies a place of prominence in pear cultivation and 'Patharnakh' is the leading pear cultivar commercially grown in state. It requires less chilling hours and makes good vegetative and reproductive growth. The recent year's new superior strains of hard pear (*Pyrus pyrifolia* Burm. Nakai) have been collected from different sources. The foliar content of fruit plant has been considered as one of the best indices of their nutrient status and nutrient plays an important role in improving the yield and quality of fruit crops. The present study, therefore, was undertaken to assess the nutrient status and correlation of macro and micronutrient status with tree volume, yield and total soluble solids of different strains.

The studies were carried out in the New Orchard of PAU, Ludhiana on 14-15 years old eleven hard pear strains (*Pyrus pyrifolia* Burm. Nakai). These strains were ARPS-89-1, ARPS-89-2, ARPS-89-3, ARPS-89-4, ARPS-89-5, ARPS 89-6, ARPS-90-7, ARPS-90-8, Strain 9 (White Gold), Strain 10 (Local Selection) and Strain 11 (Local Selection). All the strains were grafted on *Kainth* (*Pyrus pashia* Buch. Ham.) rootstocks and planted 7.5 m × 7.5 m apart. This region gets nearly 250-300 h of chilling period. Soil of experimental field was sandy-loam. The uniform cultural practices were followed as per the recommendations given in package of practices for cultivation of fruits (Anon., 1).These strains were selected to study the correlation between tree volume, yield and total soluble solids and leaf macro- and micro-nutrient contents. The leaf samples were taken from the middle of shoots around the periphery of tree in September. These samples were rinsed, washed and dried at 60°C for analysis. The standard procedures were followed to determine N and P with microKjeldahl distillation and vanadomolyydo-phosphoric yellow colour methods, respectively, whereas K and Ca with flame photometer method. Sulphur was determined by the turbity method of Bradsley and Lancaster (2).Total Mg, Mn, Zn, Fe and Cu were determined by atomic absorption spectrophotometer. The formula of Westwood (9) was used to calculate the tree volume. The yield per plant was estimated from the average weight of ten fruits multiplied by number of fruits harvested at the time of full maturity and calculated in kg per tree. The TSS was determined with the help of hand refractometer (%).

The tree volume (Table 1) showed a significantly positive correlation with both nitrogen (r = 0.662) and phosphorus (r = 0.646). However, potassium showed a negative correlation (r = -0.334) with tree volume. On the other hand, calcium (r = 0.578), magnesium (r = 0.342) and sulphur (r = 0.119) content of leaf had positive but non-significant correlation with tree volume. In case of micronutrients, the leaf status of ferrous (r = 0.270), manganese (r = 0.191) and copper (r = 0.345) of different strains showed non-significant but positive correlation with tree volume. However, zinc had negative correlation (r = -0.080) with tree volume. The different strains have shown a nitrogen in 2.21-2.41 per cent, phosphorus in 0.14-0.17 per cent, potassium in 1.10-1.35 per cent, calcium 2.21-2.69 in per cent, magnesium 0.34-0.60 in per cent and sulphur 0.12-0.18 in per cent range in different strains of hard pear (Table 1). Similarly, Kamboj *et al.* (4) found that mid shoot leaves of 'Patharnakh' registered 2.15, 0.13, 1.14, 2.02, and 0.42 per cent of mean value of nitrogen, phosphorus, potassium, calcium and magnesium, respectively which have been recommended for leaf analysis under sub-tropics of India. A positive correlation of tree volume with N, P, Ca and Mg content but negative with K content was also observed by Singh *et al.* (8) in leaves of semi-soft pear strains. However, the leaf Zn, Fe, Mn and Cu status varied from 31 to 48 ppm, 163 to 221 ppm, 61 to 90 ppm and 10 to 20 ppm, respectively in different hard pear strains. The present findings in respect of variation in micronutrient status in leaves are similar to those reported by Kamboj *et al.* (4) in leaves of Patharnakh pear. The yield

*Corresponding author's present address: KVK, Amritsar 143 001; E-mail: bsdhillon69@yahoo.com
**Department of Soils, PAU, Ludhiana 141 004

Table 1. Correlation of tree volume with macro- and micro-nutrients status of leaf in different hard pear strains.

Strain No.	Tree volume (m^3)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)
I	166.43	2.38	0.16	1.14	2.58	0.53	0.18	39	216	65	19
II	154.45	2.39	0.17	1.13	2.39	0.52	0.12	32	203	64	16
III	161.13	2.41	0.17	1.16	2.69	0.56	0.13	46	163	90	19
IV	144.62	2.24	0.16	1.26	2.58	0.60	0.14	37	171	73	20
V	137.92	2.26	0.15	1.15	2.21	0.51	0.14	35	196	65	18
VI	140.17	2.35	0.16	1.20	2.33	0.52	0.18	36	199	88	15
VII	105.43	2.26	0.16	1.24	2.32	0.48	0.13	48	176	61	14
VIII	115.29	2.22	0.15	1.19	2.25	0.47	0.15	47	199	85	15
IX	139.31	2.37	0.17	1.10	2.56	0.34	0.18	36	221	71	10
X	149.64	2.22	0.14	1.35	2.25	0.36	0.14	31	217	65	11
XI	117.65	2.21	0.14	1.32	2.34	0.37	0.14	34	213	62	15
'r' value	-	0.662*	0.646*	-0.334	0.578	0.342	0.119	-0.080	0.270	0.191	0.345
CD at 5%	28.69	0.15	0.016	0.061	0.17	0.12	0.04	7.77	34.61	11.74	4.33
Optimum range**	-	2.3-2.7	0.14-0.20	1.2-2.0	1.4-2.1	0.30-0.50	0.17-0.26	20-50	60-100	60-120	9-20

*Significant at 5% level.

**Rathore (6).

was (Table 2) positively correlated with nitrogen (r = 0.749), phosphorus (r = 0.838) and calcium (r = 0.684). These correlations were significant. However, potassium had negative correlation (r = -0.845) with yield. The magnesium (r = 0.407) and sulphur (r = 0.451) status of leaf had positive but non-significant correlation with yield. It is clear from the data in Table 2 that the nitrogen, phosphorus, potassium, calcium, magnesium and sulphur in leaves were ranged between 2.18 to 2.44, 0.14 to 0.17, 1.11 to 1.52, 2.21 to 2.69, 0.36 to 0.61 and 0.13 to 0.17 per cent, respectively. These results are in line with the findings of Kamboj *et al.* (4). The positive correlation of nitrogen with yield in present study was supported by Raese and Staiff (5), who reported that high rate of nitrogen fertilizer, resulted in higher yield of 'Golden Delicious' apple and 'Anjou' pear. Furthermore, the correlations were also worked out between yield and micronutrients of leaf. The data indicate that leaf status of ferrous (r = 0.224), manganese (r = 0.419) and copper (r = 0.422) had positive but non-significant correlation with fruit yield. However, the range of Zn (32-48 ppm), Fe (169-219 ppm), Mn (63-91 ppm) and Cu (12-20 ppm) of micro-nutrients in present study are similar to the findings of Kaith and Awasthi (3) who reported that leaf Mn and Cu contents showed positive but non-significant correlation with fruit yield, whereas Zn content showed a negative and non-significant correlation. Similarly, Singh *et al.* (8) reported that leaf content of N, P, Ca, Mn and Cu showed a positive and significant correlation with fruit yield. The data in Table 2 indicate that nitrogen (r = 0.436), calcium (r = 0.337) and sulphur (0.429) showed a positive but non-significant correlation with total soluble solids. On the contrary, phosphorus (r = -0.658) and magnesium (r = -0.773) had a negative and non-significant correlation. However, leaf potassium (r = 0.674) showed positive and significant correlation with total soluble solids. Similar trend was also reported by Singh *et al.* (8) who found that only K content of leaf showed significant correlation with total soluble solids. The concentration of N, P and K ranged from 2.18 to 2.44, 0.14 to 0.17 and 1.11 to 1.52 per cent, respectively in leaves of hard pear strains of present study are in line with the findings of Kamboj *et al.* (4) in hard pear. The correlation between total soluble solids and leaf Zn and Fe content was positive but non-significant. While the Mn and Cu content of leaves recorded a negative but non-significant correlation with total soluble solids. Similar observations were also reported by Shah (7) in Patharnakh fruits. He noted a significantly positive correlation between leaf Cu and Mn content with total soluble solids.

The studies show that the leaf N and P contents had significant and positive correlation with tree volume whereas it was negatively correlated with

Table 2. Correlation of yield (kg/tree) and TSS (%) with macro- and micro-nutrients status of leaf in different hard pear strains.

Strain No.	Yield (kg/tree)	TSS (%)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)
I	147.96	11.15	2.39	0.16	1.39	2.59	0.54	0.16	38	213	64	17
II	188.26	11.35	2.40	0.17	1.52	2.39	0.53	0.15	33	202	63	17
III	108.83	11.52	2.44	0.16	1.16	2.69	0.56	0.13	46	188	91	19
IV	112.46	11.70	2.30	0.16	1.26	2.58	0.61	0.16	37	185	72	20
V	123.54	11.25	2.30	0.16	1.15	2.21	0.51	0.14	35	196	65	19
VI	134.90	11.52	2.31	0.16	1.14	2.37	0.52	0.16	36	200	87	16
VII	105.16	12.12	2.23	0.15	1.21	2.30	0.48	0.16	47	169	64	15
VIII	113.83	12.30	2.24	0.15	1.20	2.24	0.47	0.15	48	180	85	15
IX	147.55	12.20	2.38	0.17	1.11	2.57	0.36	0.17	36	219	71	13
X	58.90	12.55	2.18	0.14	1.35	2.25	0.38	0.14	32	217	66	12
XI	60.55	12.60	2.21	0.14	1.33	2.35	0.38	0.14	34	190	63	13
'r' value : Yield	-	-	0.749*	0.838*	-0.845	0.684*	0.407	0.451	-0.041	0.224	0.419	0.422
TSS	-	-	0.436	-0.658	0.674*	0.337	-0.773	0.429	0.045	0.296	-0.071	-0.806
CD at 5%	45.35	0.73	0.12	0.011	0.04	0.12	0.08	0.04	5.47	23.10	7.61	3.63
Optimum range**	-	-	2.3-2.7	0.14-0.20	1.2-2.0	1.4-2.1	0.30-0.50	0.17-0.26	20-50	60-100	60-120	9-20

*Significant at 5% level (critical value of 'r' = 0.602).

**Rathore (6).

K and Zn. A significantly positive correlation with that of fruit yield was noted with leaf N, P and Ca, while it was negatively correlated with K and Zn. K content of leaf showed a positive and significant correlation with TSS. On the other hand, a non-significant correlation with all other nutrients was worked out with TSS.

REFERENCES

1. Anonymous. 2010. *Package of Practices for Cultivation of Fruits.* Punjab Agricultural University, Ludhiana.
2. Bradsley, C.E. and Lancaster, J.D. 1960. Determination of reserve sulphur and soluble sulphates in soils. *Soil Sci. Soc. Amer. Proc.* **24**: 265-68.
3. Kainth, N.S. and Awasthi, R.P. 1994. Correlation and regression analysis between yield and nutrient status of 'Starking Delicious' apple. *Indian J. Hort.* **51**: 226-28.
4. Kamboj, J.S., Dhatt, A.S. and Rehalia, A.S. 1987. Standardization of leaf-sampling technique in sub-tropical pear. *Punjab Hort. J.* **27**: 121-32.
5. Raese, J.T. and Staiff, D.L. 1988. 'Chlorosis'in 'Anjou' pear reduced with foliar sprays of iron compound. *J. Plant Nutr.* **11**: 1379-85.
6. Rathore, D.S. 1991. *Pears*. **In**: *Temperate Fruits.* Mitra, S.K., Bose, T.K. and Rathore, D.S. (Eds). Horticultural and Allied Publishers 27/3, Chakraberia Lane, Calcutta, pp. 123-78.
7. Shah, V.L. 1998. Nutritional survey of Patharnakh orchards in Amritsar. M.Sc. thesis, Punjab Agricultural University, Ludhiana.
8. Singh, T., Sandhu, A.S., Singh, R. and Dhillon, W.S. 2005. Vegetative and fruiting behaviour of semi-soft pear strains in relation to nutrient status. *Indian J. Hort.* **62**: 231-34.
9. Westwood, M.N. 1978. *Temperate Zone Pomology,* W.H. Freeman and Company, San Francisco, 248 p.

Received: September, 2007; Revised: December, 2010; Accepted : January, 2011