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Short communication

Determination of sampling period and leaf position for critical nutrient analysis in pomegranate cv. Bhagwa

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ABSTRACT

For precise diagnosis of leaf nutrient content, it is essential to determine the season of sampling and position of leaves. A field trial was conducted to standardize the leaf sampling technique for nutrient diagnosis in pomegranate cv. Bhagwa grown under semi-arid tropical climate of Solapur, Maharashtra. The results revealed that the seasonal variation in leaf nutrient content was higher and most unstable during rainy season followed by winter and summer season. Monthly analysis of leaf samples showed that leaf N (0.70 to 0.99%), K (1.08 to 1.14%) and Ca (1.41 to 1.58%) content stabilized during November to June, April to June and February to June month respectively. Leaf P content remained more or less constant while Fe and Cu showed maximum fluctuation throughout the year. There was gradual reduction in P (0.195 to 0.121%), Zn (30.6 to 21.4 ppm) and increase in Ca (1.40 to 1.79%) content up to 10th leaf pair from growing tip. It is ideal to collect 10th leaf pair from growing tip during the month of February to March for nutrient diagnosis in the plant.

Key words: Pomegranate, leaf sampling, season, leaf position, nutrient content.

Pomegranate (*Punica granatum* L.) is globally considered as a foreign exchange earning crop and it assumes great significance under arid and semi-arid tracts of India. The cultivation of pomegranate is spread over an area of 131 thousand ha in India. Though pomegranate is very hardy crop, it responds well to nutrition. In fruit crops, foliar analysis has been recognized as more reliable tool for nutrient application and success of foliar analysis as diagnostic tool largely depends on sampling of representative index tissue and proper period of sampling. The leaf nutrient content was found to vary with season (Bacha, 2), leaf age (Bhargava and Dhandar, 3), cultivar and growth of the plant and hence, it is necessary to standardize the proper leaf age and position for particular nutrient in a given soil type and climatic conditions. As Bhagwa occupies about 90% of the area under cultivation, the present study was undertaken in pomegranate cv. Bhagwa to find out the location of leaves on growing shoot, which will serve as an index tissue and proper season for leaf sampling.

The investigation was carried out in full grown plants of pomegranate cv. Bhagwa during pre-bearing stage which were planted at the experimental research farm of National Research Centre on Pomegranate, Solapur, Maharashtra (17°65'' N and 75°90'' E, 457 m above msl). The climate of the study area is semi-arid with an average (year 2001 to 2014) annual rainfall of 472.8 mm occurring mostly during the months of July-September. To find out the right position of leaves and season for leaf sampling, leaf samples were collected since August at monthly interval till July for two years from all new shoots starting from just opened pair of leaves at 2nd position to 4th, 6th, 8th, 10th, 12th and 14th position towards the base from growing tip. Each sample composed of 50 leaves, washed thoroughly in sequence with water, liquid soap, acidic water and distilled water and dried in shade for four days followed by oven drying at 70°C till constant weight. The dried samples were ground, mixed well and used for analysing total N by microkjeldhal steam distillation method. The samples were digested in di-acid mixture (Chapman and Pratt, 4) and analysed for P using vanadomolybdo phosphoric acid method, K flame photometrically, Ca and Mg by titrimetric method employing disodium salt of EDTA and micronutrients, *viz.*, Fe, Zn, Mn and Cu using atomic absorption spectrophotometer (Perkin Elmer, USA make). The data obtained were statistically analysed using randomized block design having seven treatments for standardization of leaf position and 12 for sampling period (Panse and Sukhatme, 8).

Results (Table 1) revealed very high variation in nutrient content in the leaves during different seasons (67.0 to 265.5%) compared to nutrient content in the leaves located at different positions (5.2 to 62.0%). Seasonal variation of Cu, P, Mn and Fe in leaf content was high (145.9 to 265.5%) compared to N, Ca, Zn, K and Mg (67.0 to 137.0%). Amongst different seasons, leaf nutrient content variation was higher and most unstable during rainy season followed by

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Table 1. Seasonal and positional variation in the leaf nutrient content of pomegranate cv. Bhagwa.

Treatment	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
Leaves sampling month									
August	1.66	0.209	1.37	2.24	0.57	124.4	41.7	14.0	32.2
September	1.66	0.170	1.07	2.00	0.56	145.7	38.2	14.9	33.3
October	1.27	0.187	1.57	2.19	0.61	115.7	34.0	71.1	35.3
November	0.81	0.088	1.71	1.39	0.43	93.9	26.8	22.6	17.6
December	0.83	0.173	1.44	1.58	0.47	140.7	42.0	26.6	24.4
January	0.99	0.118	0.94	0.98	0.26	61.5	26.6	15.1	21.5
February	0.84	0.210	1.48	1.53	0.67	132.4	43.1	14.5	26.2
March	0.84	0.174	1.42	1.52	0.40	139.7	40.5	18.0	24.1
April	0.83	0.143	1.11	1.51	0.42	105.8	37.5	16.4	21.8
May	0.70	0.137	1.08	1.58	0.43	76.8	38.1	13.6	18.0
June	0.99	0.075	1.14	1.41	0.43	151.2	71.7	4.5	15.9
July	0.77	0.096	1.38	1.55	0.43	77.1	33.2	9.6	16.1
CD (p = 0.05)	0.191*	0.033*	0.271*	0.317*	0.094*	22.8*	5.03*	9.07*	4.97*
Leaves position from tip									
2nd leaf pair	0.97	0.196	1.48	1.40	0.45	121.2	39.2	23.4	30.6
4th leaf pair	1.02	0.181	1.40	1.39	0.42	105.3	38.5	19.8	27.2
6th leaf pair	0.95	0.160	1.34	1.62	0.49	124.1	39.4	23.0	24.6
8th leaf pair	1.07	0.138	1.24	1.60	0.46	111.6	39.3	18.4	21.3
10th leaf pair	1.11	0.121	1.26	1.79	0.49	111.5	40.5	21.1	21.4
12th leaves	0.97	0.123	1.21	1.80	0.52	108.3	39.9	16.3	21.0
14th leaf pair	1.02	0.121	1.23	1.76	0.48	114.0	39.2	18.7	21.0`
CD (p = 0.05)	NS	0.025*	NS	0.242*	NS	NS	NS	NS	3.80*

winter and summer season. Variation in leaf nutrient content during different months revealed that all the nutrients showed highly significant variation amongst the treatments. Amongst macro-nutrients, leaf N content varied from 0.70 to 1.66% during different months. It showed decreasing trend during the months of August to October, which stabilized during November to June months. Leaf P content varied from 0.075 to 0.209% but did not show any fixed trend during all 12 months. The graphical presentation of P showed almost steady curve for all the months (Fig. 1), which corroborated with the results obtained on Ganesh pomegranate grown under black soils of Parbhani (Munde *et al*., 7). Leaf K content showed highly significant variation from 0.94 to 1.71% amongst the treatments. It had shown decreasing trend from August to November and again increased up to February. It was stable for short period during the month of April to June. Leaf Ca content was high during the month of August to October, which decreased during November and remained more or less stable during February to July month. Leaf Mg content also did not show much variation throughout the year and ranged between 0.26 to 0.67% in January and February, respectively.

Seasonal variation in micro-nutrient content was very high as compared to macronutrient content in the leaves. Graphical depiction of leaf Fe content (61.5 to 151.2 ppm) showed very high fluctuation during different months and was not stable even for any three months of the year. Earlier, Munde *et al*. (7) reported uneven variation in Fe content in leaves of different age in pomegranate. Leaf Mn content showed decreasing trend from August to November month (41.7 to 26.8 ppm) followed by irregular increase or decrease but showed some stability during the months of February to May. Leaf Cu content showed very wide (4.5 to 71.1 ppm) and highly irregular variation during different months. It might be due to the sprays of copper fungicides as a part of prophylactic measures to control fungal diseases. It can be sampled during Feb to April months. Amongst micronutrients, leaf Zn content showed less variation and was stable during December to April month.

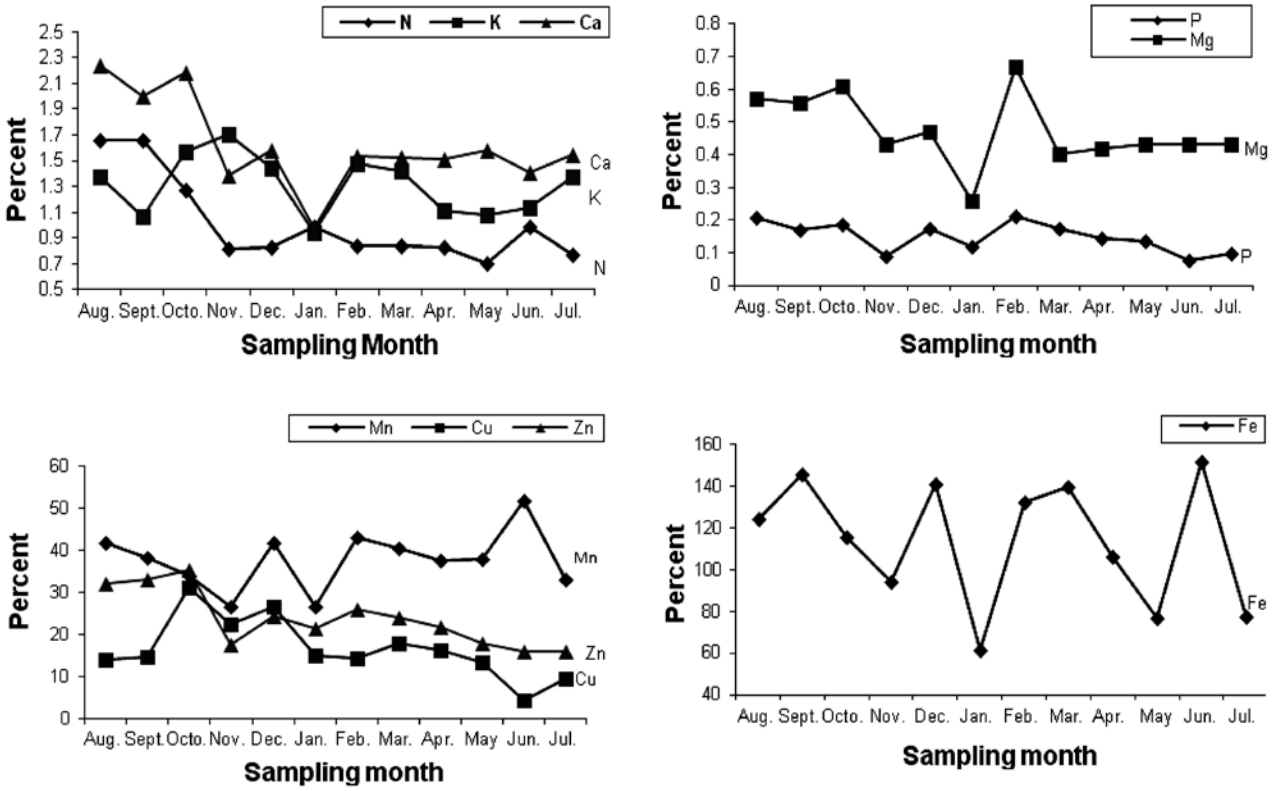

Fig. 1. Seasonal variation in leaf nutrient content of pomegranate cv. Bhagwa.

On the basis of seasonal variation, it can be concluded that the best time for leaf sampling for pomegranate would be during February to May for most of the nutrients except Mg for which sampling has to be done during March to June. Earlier, April month was suggested as the sampling period for February crop of pomegranate cv. Bassein Seedless (Bhargava and Dhandar, 3), whereas for pomegranate cv. Jodhpur Red, it was February for N, June for P and April for K nutrients (Afria *et al*., 1).

Results of leaf nutrient content as influenced by its position on shoot revealed significant variation in P, Ca and Zn nutrients while it was non-significant in other nutrients (Table 1). Positional variation in leaf N content (0.95 to 1.11%) was less and did not show any fixed trend. Leaf P content was high in youngest leaves (2nd pair) located towards tip which decreased gradually up to 10th leaf pair, afterwards it stabilized up to 14th pair. Earlier, significant decrease in leaf N, P and K content was observed in cv. Jodhpur Red, while moving from youngest to oldest pair of leaves or with advancing age of leaves (Afria *et al*., 1) and also in cv. Bassein Seedless grown under red soils of Bengaluru areas (Bhargava and Dhandar, 3). Higher mobility of K and P nutrients in plant system might have led to its higher content in young leaves. On the contrary, leaf Ca content increased with the position of the leaf up to 10th pair and stabilized, thereafter, which is in accordance with the earlier results of Kumar and Pandey (6) and Kotur *et al*. (5) in other fruit crops like guava and passion fruit. Leaf Mg content increased slightly with increasing position from the tip and recorded higher values in 12th leaf pair. The graphical depiction of the leaf macro-nutrient content indicated that leaf N, K and Mg were more or less stable in 8th to 14th leaf pair, while P and Ca were stabilized between 10th to 14th pair from growing tip.

Amongst micronutrients, leaf Cu content was most unstable and showed non-significant variation with respect to position on the twig, might be due use of Cu as prophylactic sprays for the control of diseases as already reported. Similarly, leaf Fe content did not showed any fixed trend and showed large variation in different leaf pairs. Leaf Mn concentration was almost same in youngest to oldest leaves and showed non-significant variation. Leaf Zn content decreased from 2nd to 8th leaf pair and stabilized afterwards up to 14th leaf pair from the growing leaf tip. Micronutrients stability was observed in 10th to 12th leaf pair. In this stability zone, higher values were recorded in 10th leaf pair. These findings are also supported by field observations, where it

observed that in Bhagwa variety of pomegranate, the primary branch have maximum 14 to 16 leaf pairs and recommended leaves are fairly mature leaves having green colour and are not rigid and brittle like other old leaves.

It is concluded that for leaf sampling in pomegranate cv. Bhagwa, it is ideal to choose 10th pair of leaves during the period of February-March for determination of most of the nutrients except K for which sampling has to be done during April-June.

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