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Short Communication

Nitrogen Status of Soil and Plants in Apple Orchards of Quetta Valley, Pakistan

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Abstract. The study was planned to assess the nitrogen status of apple orchards around Quetta valley, Pakistan, through soil and plant analysis. Two hundred and forty soil samples were collected from 40 different locations of 05 orchards at 0-15, 15-30, 30-45, 45-60, 60- 75 and 75-90 cm depths. The soil samples were analysed for total nitrogen by Kjeldhal's method. At the same time forty apple trees were selected for leaves samples and analysed for the total nitrogen content. Total nitrogen content in soil showed a sizeable variation ranging from 0.009 to 0.148%. Whereby, plant analysis registered minimum nitrogen content 1.06% and the maximum nitrogen content were 3.14% in apple plant leaves which confirms a great deficiency of nitrogen in apple orchards of Quetta valley.

Keywords: apple orchard, nitrogen content, fruit yield

Establishment of proper nutrient balance in the soil can well alleviate many deficiencies. Nitrogen is one of the major plant nutrients required by plants in large quantities, necessary for many tree functions, including growth, fruit bud formation, fruit set and fruit size. Its important role for growth and composition of fruit has been studied by many earlier researchers (Iqbal *et al.,* 2012, Sugar *et al.,* 1992, Lernaire *et al.,* 1990; Samuel *et al.,* 1985; Wild and Jones, 1972). The soils of Quetta valley, Pakistan are mostly calcareous and their major crops are deciduous fruits among which apple is the most important throughout Baluchistan. The apple orchards are mostly found in Quetta, Ziarat, Pishin, Mustung and Kalat districts. These orchards produce quality fruits which are consumed not only in local market but also exported to several other countries, but yield and quality are decreasing year after year. This may be due to some nutritional upsets in the soils. Hence, analysis of soil and plants from apple orchard was carried out to investigate the status of nitrogen in apple orchard to address the decreasing trend of yield and quality of apple in Quetta valley.

Apple orchards namely: Dr. Farm, Deciduous Fruit Development Centre (DFDC), Agriculture Research Institute (ARI), Balochistan Agriculture College (BAC) and Haji Sangeen Khan Garden (HSK) from Quetta, Balochistan were assessed for nitrogen status. The soil samples were collected from 40 different locations of 05 orchards in Quetta valley. At each location samples were taken from 06 depths i.e. 0-15, 15-30, 30-45, 45-60, 60-75, and 75-90 cm. The samples were air dried in the laboratory, ground with wooden mortar and passed through 2 mm nylon sieve, finally packed in the polythene bags and labeled for conducting analysis. Separate sampling was done from two varieties of apple, i.e. red delicious (T.K) and golden delicious (S.K). Nitrogen (%) in soil was determined by Kjeldahl' s method (Kanwar and Chopra, 1959).

The 18-20 mid shoot leaves were taken randomly from each orchard washed with distilled water, initially air dried and then dried in the oven at 72 ºC for 48 h, the dried samples were ground sieved through 2 mm mesh and stored in bottles. To record the nutrients, 0.5 mg of plant samples were taken in100 mL flask, 10 mL concentrated HNO_3 was added and kept over night and then 4 mL of concentrated HCl was added. These samples were digested using a hot plate, the samples were filtered in 100 mL volumetric flask and the volume was made up to the mark with distilled water (Black, 1965). Total nitrogen (%) in plant was determined by Kjeldhal's method (Kanwar and Chopra, 1959).

The data regarding total nitrogen content in soil at different depths are shown in (Table 1). The lowest and highest values for nitrogen content were 0.025 - 0.099, 0.034 - 0.148, 0.16 - 0.057, 0.022 - 0.064, 0.009 - 0.064, and 0.009 - 0.044% at 0 - 15, 15 - 30, 30 - 45, 45 - 60, 60 - 75 and 75 - 90 cm depths, respectively. The mean value of all the depths was 0.070, 0.060, 0.034, 0.042, 0.027, and 0.021%,

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respectively. These data have been grouped into four categories based on the categorisation suggested by Melherb (1963). He grouped the soils as poor, when N was < 0.05 %, medium 0.05-1%, fairly fertile 0.1- 0.2% and fertile > 0.2%. The data revealed that in 0-15 cm depth 10% samples were poor and 90% samples were medium. At 15-30 cm depth 40% were poor, 50% were medium and 10%were fairly fertile. At 30-45 cm depth 80% were poor and 20% were medium whereas, 45-60 cm depth 70% poor and 30% were medium at 60-75 cm 80% were poor and 20% were medium but in 75-90 cm layer 100% were poor in total nitrogen. The results for chemical analysis of apple leaves for nitrogen content showed that N in red delicious ranged from 1.57 to 1.08, 1.6 to 1.79, 1.54 to 1.85, 1.06 to 1.90 and 2.13 to 2.35% at 5 different orchards, respectively. Similarly, in the variety for Golden Delicious it ranged from 1.50 to 1.60, 1.74 to 1.85, 1.26 to 1.57, 1.60 to 1.85 and 2.13 to 3.14% from five different orchards, respectively. The results were compared with the previous reports by Rueter and Robinson (1986) for the deficiency and adequacy of N in the leaves of apple plants (Table 2). It was found that 32.5% were deficient, 47.5% were marginal, 17.5% were high and 2.5% samples were excessive in the total nitrogen. This means that N content decreased with increase in soil depth. The change in organic matter, pH, soil texture, drainage condition, volatilisation, and leaching may be responsible for low N concentration in surface soil (Midrar-ul-Haq *et al*., 2003).

The results of study depicted N deficiency in soil and leaves of apple orchards. Additional N supply is required to improve nutritional status of apple orchards in the study area and consequently optimising sustainable orchards' productivity along with fruit quality.

Table 1. Percent of soil nitrogen at different sites

Depths (cm)	Dr.Farm	DFDC	BAC	HSK	ARI	values
0-15	0.87(TK)	0.084	0.056	0.099	0.064	Min.0.025
	0.62(SK)	0.068	0.025	0.088	0.075	Max.0.099
15-30	0.063(TK)	0.057	0.034	0.053	0.046	Min 0.034
	0.056(SK)	0.043	0.053	0.037	0.148	Max 0.148
30-45	0.032(TK)	0.022	0.038	0.022	0.043	Min 0.016
	0.057(SK)	0.019	0.038	0.016	0.054	Max 0.057
45-60	0.064(TK)	0.022	0.041	0.044	0.043	Min 0.022
	0.050(SK)	0.025	0.044	0.041	0.050	Max 0.064
60-75	0.050(TK)	0.016	0.009	0.009	0.064	Min 0.009
	0.039(SK)	0.019	0.016	0.019	0.036	Max 0.064
75-90	0.025(TK)	0.013	0,016	0.009	0.032	Min 0.009
	0.022(SK)	0.016	0.013	0.022	0.044	Max 0.044

TK = Tor Kulu; SK = Shen Kulu; DFDC = Deciduous Fruit Development Center; BAC= Balochistan Agriculture College; HSK= Haji Sangeen Khan Garden; ARI= Agriculture Research Institute.

Table 2. Categorisation of apple leaves samples for N content in Quetta valley

N status	Interpretation of values range (%)	No. of samples	Samples (%)
Deficient	<1.6	6.5	32.5
Marginal	1.6-1.9	9.5	47.5
Adequate	2.0-2.4	-	-
High	2.5-3.0	3.5	17.5
Excessive	> 3	0.5	2.5
Total	-	20	100

Source: Rueter and Robinson (1986)

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