Eco. Env. & Cons. 29 (October Suppl. Issue) : 2023; pp. (S104-S107) Copyright@ EM International ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i05s.019

Soil primary nutritional constraints in Pomegranate growing fields from Satana Tehsil of Nashik District, India

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(Received 22 March, 2023; Accepted 24 May, 2023)

ABSTRACT

Nitrogen, Phosphorus and Potassium are the fundamental macronutrients in soil which can be a major influence on plant growth and development. In order to accelerate growth of crops and increase yield, the soil must have sufficient levels of N, P, and K. It becomes important to evaluate the N, P, and K proportions of various soils before growing crops which helps the farmers to minimize their expenses. Thus, with this view, soil samples from Satana Tehsil of Nashik District were collected by visiting 15 pomegranate cultivated fields to analyse pH, Electrical Conductivity (EC), Organic Carbon (OC), Nitrogen (N), Phosphorus (P), Potassium (K). Such type of soil sample analysisis beneficial to understand the concentration of various parameters present in the soil so that appropriate measures can be taken to maintain or improve the soil quality. It is observed from the above study that, soil of the selected area had pH in the range neutral to slightly alkaline and EC below 1.0 mmhos/ cm both these parameters were found within tolerable limit for pomegranate cultivation. OC content was observed in low to medium range. Soil nutrient status indicated that P was the most limiting nutrient, followed by N. Higher K content was found in very few orchards (20.0 %). The studies reveal that, primary nutrients to the soil should be supplied in a balanced ratio, and the organics should be applied on a regular basis to preserve soil health.

Key words: Pomegranate, Soil fertility, Nutrients, Nitrogen, Phosphorus, Potassium.

Introduction

Nashik is the largest pomegranate growing district in Maharashtra. Satana Tehsil from Nashik District is popular for production of pomegranate fruits. The pomegranate fruit crop is a high value perennial crop and stands in a field for 10 -12 years. Hence, proper soil conditioning for best economic explorations is highly demanded (Phule, 2002). It has also been observed that soil from different areas have different physico-chemical properties. The availability of nutrients in soil depends on different factors including type of soil, pH, Organic Matter, Irrigation facilities etc. In fact, the proportion of NPK in various soils is affected by climatic conditions, geomorphology, type of rocks and biological activities. Presence of sufficient amount of NPK in the soil is highly essential to accelerate growth of a crop and boosting the yield. The efficient management and improvement of fertility status in the soil should be facili-

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tated by correctly applying appropriate inorganic fertilisers (NPK) (Meshram *et al.*, 2017; Yadav and Verma, 2019). It has been noticed that there is a paucity of information regarding the primary nutritional constraints of the study area, so an effort was made to assess the availability of primary nutrients in the soils of the chosen study area.

Materials and Methods

Nashik district is situated partly in Tapi river basin and partly in the upper Godavari River basin. It lies between 19°332 to 20°532 north latitude and 73°152 to 75° 162 east longitude. Satana Tehsil from Nashik District is located at 20°592733 N and 74°202023 E (Ahire, 2018). In order to know the soil fertility status in Satana Tehsil of Nashik district, 15 pomegranate orchards from villages; Chaugaon, Virgaon, and



Fig. 1. Map showing soil sampling villages in the study area.

Bhakshi (Figure 1) were randomly selected and soil samples were collected within the canopy of 0.5 m away from tree trunk and at the depth of 30 cm in 2019 (Table 1). From each village 5 soil samples were collected, dried and analysed to determine pH, Electrical Conductivity, Organic Carbon following standard procedures (Jackson, 1973), Available N by alkaline permanganate method (Subbiah and Asija, 1956), Available P by Olsen's method (Olsen, 1954), Available K by flame photometric method (Jackson, 1973).

Results and Discussion

The nutrient availability in the soil is totally governed by soil pH and considered as the most important parameter. Soils of all the orchards in Satana Tehsil were identified as neutral to slightly alkaline soils having pH in the range of 6.5-7.5 (46.67 %) and 7.5 - 8.5 (53.34 %) respectively. Soil electrical conductivity in all the orchards was below 1.0 mmhos/cm. Both these parameters were found to be within tolerable limit for pomegranate cultivation. Soil Organic Carbon content was observed in low to medium (40.0 % to 60.0 %) range in orchards (Table 2). The low level of organic carbon may be due to soil alkaline conditions (pH > 7.5), which might have dissolved the humic components of soil and caused them to be lost from the soils. To eliminate such a problem, these soils need to be properly fertilised with organic manure, farmyard manure, green manure, etc. (Dwivedi et al., 2010).

Nitrogen is an essential component of chlorophyll present in the plant which promotes crop growth and raises agricultural output. It is the limiting nutrient in most cases because it required in large amounts and reduces from soil bygetting washed out from root zone (leaching) or by readily volatising to gaseous form (Waikar *et al.*, 2014). The results of a study presented in the Table 2 indicated that soil Available N was in lowto medium (26.6 % to 73.4 %) range. It might be a result of the different soil Organic Matter contents and the low rainfall

Village Name	Latitude N	Longitude E	No. of orchards	Age of orchards (In Years)	
Chaugaon	20°372213	74°142053	5	5-7	
Bhakshi Virgaon	20°372 173 20°412153	74°122323 74°082193	5 5	5-7 4.5-6	

Table 1. Details of Pomegranate orchards selected for the study

pН	Category	Acidic (< 6.5)	Neutral (6.5-7.5)	Slightly alkaline (7.5 - 8.5)	alkaline (> 8.5)
	% Orchards	0.0	46.67	53.34	0.0
EC	Category	Safe	Critical for	Injurious to Crops (> 4.0)	
(mmhos/cm)		(< 1)	germination		-
			(1.1 - 4.0)		
	% Orchards	100.0	0.0	0.0	
OC (%)	Category	Low(< 0.50)	Medium(0.50 -0.75)	High(> 0.75)	
	% Orchards	40.0	60.0	0.0	
Available N	Category	Low(< 280)	Medium(280 - 560)	High(> 560)	
(kg/ha)	% Orchards	26.6	73.4	0.0	
Available P	Category	Low(< 28)	Medium(28 - 56)	High(> 56)	
(kg/ha)	% Orchards	100.0	0.0	0.0	
Available K	Category	Low(< 140)	Medium(140 - 280)	High(> 2	280)
(kg/ha)	% Orchards	33.3	46.7	20.0	

Table 2. Categorization of pH, EC, OC and Macronutrient status in pomegranate orchard Soils.

(Source for Rating limits: National Research Centre on Pomegranate, Solapur)

levels in the region. Soil Available Phosphorus, an important element in plant nutrition was found deficient in all the orchards. It is well known that the majority of phosphate fertilisers supplied to soil are either chemically fixed by Ca, Al, Fe, and Mg or highly absorbed by some soil compounds and the majority of the phosphorus in the soil is only partially available to plants (Reddy et al., 2000). Potassium is dynamic ion in plant system and second to Nitrogen in plant tissue. Availability of soil Potassium was in lower range 33.3% of the orchards and medium in 46.7% of the orchards. while it was higher in very few orchards (20.0 %). It is found that, orchards having Potassium deficiency are more prone to diseases. The bacterial blight disease is mostly responsible for the fall of pomegranates in Maharashtra State (Patil, 2014).

Conclusion

The study of evaluation of soil fertility status with regard to primary nutrients revealed that the soils from selected Pomegranate Orchards of Satana Tehsil, Nashik District were neutral to slightly alkaline. Soil EC (below 1.0 mmhos/cm) was found within normal range for pomegranate cultivation. Phosphorus was the most limiting nutrient. The Available Nitrogen and Organic Carbon content was observed in low to medium range. Only a few orchards contained higher potassium levels. Poor agricultural practises, monoculture cropping, excessive irrigation, limited use of Organic Matter, soil alkaline pH are the major causes affecting soil fertility.

To improve these conditions for boosting the production, effort should be made to exploit all the available resources of nutrients under the integrated nutrient management (INM). A superior choice for getting high-quality fruit is fertilisation, which ensures more divided applications of primary nutrients. Farmers involved in pomegranate production should preferably cultivate leguminous crops once a year or use bio-fertilisers, vermi-compost fertilisers and chemical fertilisers which are rich inNitrogen, Phosphorus and Potassium. The study results lay its emphasis on the need of using slightly higher amount of primary nutrients than the present use during active growth stage of the crop, so that pomegranate fruit productivity can be enhanced.

Acknowledgement

Authors would like to acknowledge Mr. Ramdas Patil, Shejami Laboratories, Satana, Nashik, Maharashtra for valuable guidance regarding soil sampling and selection of study area. The research work was financially supported by the Dr. Babasaheb Ambedkar Research & Training Institute (BARTI), Pune, Maharashtra which is also thankfully acknowledged. The authors also express their sincere gratitude to the department of Environmental Science K.T.H.M. College, M.V.P. Samaj, Nashik, Maharashtra for providing laboratory facilities.

Conflict of interest

The authors hereby certify that they have NO affili-

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ations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this research article.

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