International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1183-1184

Received: 10-05-2018
Accepted: 13-06-2018

JS Shekhawat
Department of Horticulture College of Agriculture Bikaner, Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan, India

IM Verma,
Department of Horticulture College of Agriculture Bikaner, Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan, India

SR Yadav
Department of Soil Science, College of Agriculture Bikaner, Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan, India

SVS Manohar
Department of Horticulture College of Agriculture Bikaner, Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan, India

Correspondence
SR Yadav
Department of Soil Science, College of Agriculture Bikaner, Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan, India

Micronutrient status of soil in kinnow orchard in irrigated area of Sri Ganganagar district of Rajasthan

JS Shekhawat, IM Verma, SR Yadav and SVS Manohar

Abstract
The experiment was conducted on "Micronutrient status of soil in kinnow orchard in irrigated area of Sriganganagar district of rajasthan" during April, 2016 to April, 2017. The ninety soil samples with three depths *i.e.*, 0-30, 30-60 and 60-90 cm were collected from thirty kinnow orchards from different five tehsil (Suratgarh, Raisinghnagar, Sri Vijaynagar, Sri Karanpur and Sri Ganaganagar) of Sri Ganganagar district. The soil samples were analyzed for micronutrient status of kinnow orchards being grown at farmer's field. The kinnow orchard soils in this investigation were found the results showed that Low to high in available Fe and Cu. Majority of soil samples were medium in available Zn and high in available Mn contents.

Keywords: orchard, depth, soil, L (location), sample

Introduction
India has large arid zones covering an area of 317090 sq km mainly located in the North-West parts of the country Rajasthan alone covers 62 per cent area under arid zone. Fruit cultivation in India is spread over an area of 6.8 million hectares with 92.84 MT fruit production (NHB 2016-17) [2]. In Rajasthan, fruit crops cover an area of 46.5 thousand hectares, out of which area under kinnow cultivation is 8821 hectare and production is 189483 tonnes (Rajasthan Agricultural Statistics at a glance) indicated that still there is a scope to increase the area and productivity level of kinnow fruits cultivation in the state. Kinnow mandarin is one of the introduced citrus varieties, occupies a predominant place in the citrus industry of India. Most of the kinnow growing areas are confined to north western arid zones of India. Introduction of kinnow to this area changed the landscape of arid Thar Desert. North western India is characterized by low rainfall with temperature ranging from 5^0C in winter to 48^0C in summer having soil type of old alluvium to sandy. Soils are mainly alkaline with pH ranging from 7.5 to 9.0. The production of high quality fruits of kinnow requires semi-arid and subtropical climate with less than 300 mm rainfall. It can grow successfully in almost all types of soils, but deep sandy loam soils are best suitable for kinnow orchard.

Materials and Methods
The investigation entitled "micro nutrient status of soil in kinnow orchard in irrigated area of sriganganagar district of rajasthan" was under taken during April 2016 to April 2017. The materials used and the methods followed the course of investigation are described in this chapter.

Location
Kinnow orchards under study are located in different villages/chaks of Sriganganagar district comprising a part of Agro climate zone I b (Irrigated north-western plain) of Rajasthan. It is situated between $28°4^1$ to $30°6^1$ north latitude and $72°31^1$ 'to 75° east longitude. It is Surrounded by Firozepur district of Punjab in north. Hanumangarh district in east; Bikaner district in south and the international border of the Pakistan in north and north-west.

Characteristics of Soil
The soils have developed from alluvial deposit of river Gaggar in the of flood plains of Sriganganagar district and are yellowish brown to light grey, well drained medium soil

texture which varies from sandy loam to loam. In the upper layer in some pockets is calcareous but the lower horizons are calcareous in nature with accumulation of concentrations.

Soil sampling and analysis

Collection of soil samples

Soil sample were collected from 30 Kinnow orchards located at different locations of Sriganganagar district. In all ninety samples are representative of composite soil samples from different depths *vi.,* 0-30, 30-60, 60-90 cm were collected. Samples were air dried, ground and passed through 2 mm sieve and stored properly labeled polythene bags for analysis.Fe, Zn, Mn and Cu (mg kg^{-1}) Extract with DTPA and determination by AAS given by Lindsay and Norvell (1978) [1].

Results and Discussion

DTPA extractable iron

DTPA extractable Fe presented in Table 1 revealed that the DTPA extractable iron at 0-30 cm depth varied from 3.54 (L_3) to 8.41 (L_{15}) mg ha^{-1} recorded in the soil orchard. While the mean value of Fe at this depth was 6.12 mg ha^{-1}. Similarly, the DTPA extractable Fe content at depth 30 to 60 cm varied from 2.10 (L_4) to 7.67 (L_{18}) mg ha^{-1} with mean value of 5.07 mg ha^{-1} in the soil. On the other hand, the DTPA extractable Fe content at the depth of 60 to 90 cm varied from 1.98 to 6.25 mg ha^{-1}. However, minimum and maximum DTPA extractable iron contents were recorded in soils of orchards L_3 and L_{13} with the mean value of iron 4.05 mg kg^{-1} was recorded at this depth of soil, respectively. The available iron content was found to decrease with the depth in most of the soil.Lindsay and Norvell (1978) [1] and Takkar and Randhawa (1978) [1] suggested 4.5 mg kg^{-1} soil of DTPA-extractable iron as critical limit for available iron. Considering the limit given by Lindsay and Norvell (1978) [1] and Takkar and Randhawa (1978) [5] 20.00 and 80.00 per cent samples were found deficient and sufficient, 33.33 and 66.67 per cent samples were found deficient and sufficient and 63.33 and 36.67 per cent samples were found deficient and sufficient in available Fe in kinnow orchards in 0-30, 30-60 and 60-90 cm depth of soil, respectively. Singh (2009b) [3] also reported decreasing trend of iron with increasing soil dept which is lron in confirmation with the present findings.

Table 1: DTPA extractable iron (mg kg^{-1}) in kinnow orchards of Sriganganagar district at different soil depths

Sample No.	Depths (cm)			Mean
	0-30	30-60	60-90	
L_1	3.81	2.95	2.23	2.99
L_2	3.81	2.26	2.12	2.73
L_3	3.54	2.21	1.98	2.58
L_4	3.78	2.10	2.08	2.65
L_5	3.83	2.63	2.10	2.85
L_6	4.20	3.24	2.14	3.19
L_7	6.66	5.63	3.46	5.25
L_8	6.69	5.64	3.68	5.34
L_9	6.70	5.68	3.75	5.38
L_{10}	6.49	5.57	4.12	5.40
L_{11}	6.47	5.12	3.85	5.15
L_{12}	6.51	5.49	3.97	5.33
L_{13}	8.19	6.95	6.25	7.13
L_{14}	7.85	6.66	5.99	6.84
L_{15}	8.41	7.39	6.20	7.34
L_{16}	7.18	6.88	5.56	6.54
L_{17}	6.73	6.55	5.75	6.34
L_{18}	8.19	7.67	5.90	7.25
L_{19}	4.99	3.93	3.66	4.19
L_{20}	5.41	4.24	4.24	4.63
L_{21}	5.87	4.33	3.99	4.73
L_{22}	6.08	5.35	4.57	5.33
L_{23}	5.88	4.50	3.73	4.70
L_{24}	5.49	4.45	4.11	4.68
L_{25}	6.94	5.71	4.25	5.63
L_{26}	6.66	5.06	4.21	5.31
L_{27}	6.96	5.80	4.19	5.65
L_{28}	6.57	5.74	3.98	5.43
L_{29}	6.77	6.32	4.56	5.88
L_{30}	6.86	6.18	4.74	5.93
Minimum	3.54	2.10	1.98	-
Maximum	8.41	7.67	6.25	-
Average	6.12	5.07	4.05	-
C.V.	22.83	30.90	31.30	-

DTPA extractable manganese

It is evident from the data, presented in table 2 that the DTPA extractable manganese content in 0-30 cm depth of soil varied from 2.40 (L_3) to 4.91 (L_{15}) mg kg^{-1} with mean value 3.83. Similarly, the minimum (1.43 mg kg^{-1}) DTPA extractable Mn content at depth 30 to 60 cm was recorded in soils of orchard L_4, whereas, at the same depth, its maximum (3.73 mg kg^{-1}) content was observed in soils of orchard L_{15} with mean value of 2.77 mg kg^{-1}. It is further revealed that the lowest value of available Mn at depth 60-90 cm was 1.20 in L_4 and maximum contents at this depth was 3.12 mg kg^{-1} in orchard L_{30} with mean value 2.19 mg kg^{-1}.

Lindsay and Norvell (1978) [1] suggested 2 mg kg^{-1} soil of DTPA-extractable Mn as critical limit for available Mn. Considering the limit given by Lindsay and Norvell (1978) [1] All the soil samples were found sufficient in available Mn of kinnow orchards in 0-30 cm depths, 20.00 and 80.00 per cent and 43.33 and 56.67 samples were found deficient and sufficient in available Mn content at 30-60 and 60-90 cm depths of soil, respectively. Singh (2009b) [3] also reported manganese content in orchards soils of Sikar district varied from 1.37 to 5.15 mg kg^{-1} with the mean value of 3.01 mg kg^{-1} of all the soil depths.

Table 2: DTPA extractable manganese (mg kg^{-1}) in kinnow orchards of Sriganganagar district at different soil depths

Sample No.	Depths (cm)			Mean
	0-30	30-60	60-90	
L_1	2.58	1.66	1.30	1.85
L_2	2.58	1.53	1.35	1.82
L_3	2.40	1.50	1.25	1.72
L_4	2.56	1.43	1.20	1.73
L_5	2.60	1.44	1.44	1.83
L_6	2.85	1.52	1.42	1.93
L_7	3.91	3.01	2.87	3.26
L_8	3.92	3.31	2.98	3.4
L_9	3.93	3.04	2.73	3.23
L_{10}	3.81	2.97	2.65	3.14
L_{11}	3.79	3.00	2.57	3.12
L_{12}	3.82	2.93	2.43	3.06
L_{13}	4.78	3.47	2.96	3.74
L_{14}	4.59	3.51	2.79	3.63
L_{15}	4.91	3.73	2.64	3.76
L_{16}	4.19	3.14	1.99	3.11
L_{17}	3.93	2.95	2.25	3.04
L_{18}	4.78	3.60	2.35	3.58
L_{19}	3.30	2.27	1.96	2.51
L_{20}	3.57	2.47	1.75	2.6
L_{21}	3.87	2.86	1.27	2.66
L_{22}	4.02	2.54	1.84	2.8
L_{23}	3.88	2.64	1.38	2.63
L_{24}	3.62	2.61	1.70	2.64
L_{25}	4.54	3.41	2.41	3.45
L_{26}	4.36	3.31	2.96	3.54
L_{27}	4.55	3.47	2.88	3.63
L_{28}	4.30	3.42	2.65	3.46
L_{29}	4.43	3.15	2.72	3.43
L_{30}	4.49	3.06	3.12	3.56
Minimum	2.40	1.43	1.20	-
Maximum	4.91	3.73	3.12	-
Average	3.83	2.77	2.19	-
C.V.	19.23	26.14	29.47	-

DTPA extractable copper

DTPA extractable copper of soils are presented in Table 3 elucidate that the DTPA extractable copper in surface soils (0-30 cm depth) of kinnow orchards lied between 0.19 to 0.47 mg kg^{-1} with mean value of 0.37 mg kg^{-1} in the soil with the mean value of DTPA extracted copper was 0.27 mg kg^{-1}, respectively.

The lowest amount of DTPA extractable copper in surface soils was recorded in L_3 and highest in soils of orchard L_{15}. Soil samples of 30 to 60 cm depth, DTPA extractable copper varied from 0.11 to 0.36 mg kg^{-1}. The minimum and maximum amount of DTPA extractable copper in soils at this depth was noted in soils of orchards L_4, L_5 and L_8, L_{15}, respectively. Further, the DTPA extractable copper content of soils at 60 to 90 cm depth ranged between 0.09 to 0.30 mg kg^{-1} in the soil. The lowest amount of DTPA extractable copper in this depth was observed in soils of orchard L_2, L_4, L_5 and highest amount of copper was observed in soils of orchard L_9 L_{11} L_{12} L_{16}, and the mean value of DTPA extracted copper was 0.21 mg kg^{-1}, respectively.

According to critical limit of 0.2 ppm as described by Lindsay and Norvell (1978) [1], the soils of study area were rated as deficient (3.33, 20.00 and 43.33 per cent samples) to sufficient (96.67, 80.00 and 56.67 per cent samples) with respect to DTPA extractable copper for kinnow orchards at 0-30, 30-60 and 30-60 cm depth of study area, respectively. Somasundaram *et al*. (2011) [4] recorded mean value of DTPA copper in surface soil from 0.14 to 0.46 mg kg^{-1} and sub-surface soil from 0.07 to 0.20 mg kg^{-1}.

Table 3: DTPA extractable copper (mg kg^{-1}) in kinnow orchards of Sriganganagar district at different soil depths

Sample No.	Depths (cm)			Mean
	0-30	30-60	60-90	
L_1	0.21	0.13	0.11	0.15
L_2	0.21	0.12	0.09	0.14
L_3	0.19	0.12	0.11	0.14
L_4	0.20	0.11	0.09	0.13
L_5	0.21	0.11	0.09	0.14
L_6	0.23	0.12	0.11	0.15
L_7	0.42	0.32	0.26	0.33
L_8	0.42	0.36	0.25	0.34
L_9	0.42	0.33	0.30	0.35
L_{10}	0.41	0.32	0.27	0.33
L_{11}	0.41	0.32	0.30	0.34
L_{12}	0.41	0.31	0.30	0.34
L_{13}	0.46	0.33	0.26	0.35
L_{14}	0.44	0.29	0.27	0.33
L_{15}	0.47	0.36	0.29	0.37
L_{16}	0.40	0.30	0.30	0.33
L_{17}	0.38	0.28	0.28	0.31
L_{18}	0.46	0.35	0.26	0.36
L_{19}	0.31	0.21	0.20	0.24
L_{20}	0.34	0.23	0.18	0.25
L_{21}	0.37	0.27	0.19	0.27
L_{22}	0.38	0.24	0.18	0.27
L_{23}	0.37	0.25	0.19	0.27
L_{24}	0.34	0.25	0.16	0.25
L_{25}	0.44	0.33	0.21	0.32
L_{26}	0.42	0.32	0.23	0.32
L_{27}	0.44	0.33	0.24	0.34
L_{28}	0.41	0.33	0.19	0.31
L_{29}	0.43	0.30	0.26	0.33
L_{30}	0.43	0.29	0.19	0.30
Minimum	0.19	0.11	0.09	-
Maximum	0.47	0.36	0.30	-
Average	0.37	0.27	0.21	-
C.V.	24.14	31.35	33.11	-

DTPA extractable zinc

It is evident from the data (Table 4) that the DTPA extractable zinc content at depth 0 to 30 cm ranged from 0.40 mg kg^{-1} (minimum) to 1.08 mg kg^{-1} (maximum) in soils of orchards L_3 and L_{15} and the mean value of DTPA extracted zinc was 0.72 mg kg^{-1} respectively. On the other hand, the DTPA extractable zinc at depth 30 to 60 cm varied from 0.24 to 0.82 mg kg^{-1} and the mean value of DTPA extracted of zinc in soil was 0.52 mg kg^{-1}, respectively. Minimum and maximum DTPA extractable zinc content at this depth were recorded in soils of orchards L_4, L_5 and L_{15}, respectively. The DTPA extractable zinc content in soils of lower most depth (60 to 90 cm) varied from 0.19 to 0.51 mg kg^{-1} and the mean value of DTPA extracted zinc in soil was 0.36 mg kg^{-1}, respectively. Minimum and maximum zinc content at this depth were recorded in soils of orchards L_3 and L_{10}, L_{15} and L_{27}. In general, DTPA extractable zinc content showed a decreasing trend with depth.

Lindsay and Norvell (1978) [1] considered 0.5 ppm of DTPA extractable Zn as critical level considering less than 0.5 ppm deficient 0.5 to 1.0 ppm marginal and more then 1.0 ppm sufficient. About 20.00, 40.00 and 86.67 per cent samples fall in the category of deficient, 70.00, 60.00 and 10.00 per cent in marginal and 10.00 and 3.33 per cent samples were found sufficient in available Zn content at 0-30, 30-60 and 30-60 cm depths of the kinnow orchard soils, respectively. Somasundaram *et al*. (2011) [4] also reported decreasing trend of zinc content with increasing soil depth both surface and sub-surface soil.

Table 4: DTPA extractable zinc (mg kg^{-1}) in kinnow orchards of Sriganganagar district at different soil depths

Sample No.	Depths (cm)			Mean
	0-30	30-60	60-90	
L_1	0.43	0.28	0.21	0.30
L_2	0.43	0.25	0.20	0.29
L_3	0.40	0.25	0.19	0.28
L_4	0.42	0.24	0.20	0.29
L_5	0.43	0.24	0.21	0.29
L_6	0.47	0.25	0.20	0.31
L_7	0.79	0.61	0.43	0.61
L_8	0.80	0.67	0.40	0.62
L_9	0.80	0.62	0.49	0.63
L_{10}	0.77	0.60	0.51	0.63
L_{11}	0.77	0.61	0.40	0.59
L_{12}	0.77	0.59	0.46	0.61
L_{13}	1.05	0.76	0.46	0.76
L_{14}	1.00	0.66	0.40	0.69
L_{15}	1.08	0.82	0.51	0.80
L_{16}	0.92	0.69	0.49	0.70
L_{17}	0.86	0.65	0.50	0.67
L_{18}	1.05	0.79	0.33	0.72
L_{19}	0.54	0.37	0.26	0.39
L_{20}	0.59	0.41	0.27	0.42
L_{21}	0.64	0.47	0.24	0.45
L_{22}	0.66	0.42	0.26	0.45
L_{23}	0.64	0.44	0.24	0.44
L_{24}	0.60	0.43	0.22	0.42
L_{25}	0.80	0.60	0.43	0.61
L_{26}	0.77	0.58	0.48	0.61
L_{27}	0.80	0.61	0.51	0.64
L_{28}	0.76	0.60	0.44	0.60
L_{29}	0.78	0.56	0.45	0.60
L_{30}	0.79	0.54	0.47	0.60
Minimum	0.40	0.24	0.19	-
Maximum	1.08	0.82	0.51	-
Average	0.72	0.52	0.36	-
C.V.	27.32	33.23	33.42	-

Conclusion

The soils of the study area were found medium to high in DTPA extractable iron and manganese content. Low in DTPA extractable zinc and copper content in kinnow orchards soil.

References

1. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese, and copper. Soil Scicenc Society of American Journal. 1978; 42:421-428.
2. NHB. National Horticulture Board, Horticulture Information Service-2016-2017.
3. Singh B. Studies on nutrient status of orchards in Sikar district of Rajasthan.Ph.D. Thesis, Rajasthan Agricultural University, Bikaner, 2009.
4. Somasundaram J, Meena HR, Singh RK, Prasad SN, Parandiyal AK. Diagnosis of micronutrient imbalance in lime crop in semi-arid region of Rajasthan India. Communications in Soil Science and Plant Analysis. 2011; 42(7):858-869.
5. Takkar Randhawa PN. Micronutrients in Indian agriculture: A review. Fertilizer News. 1978; 23:3-26.