Int.J.Curr.Microbiol.App.Sci (2018) *7*(1): 3596-3602

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 01 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.701.422

Cationic Micronutrient Status of Some Soils under Different Cropping System of Kishtwar District (J&K), India

A. P. Rai[1*], Phuntsog Tundup[2], A. K. Mondal[1], Vijay Kumar[3], A. Samanta[4], Manoj Kumar[5], Rohit Kumar Arora[6] and M. C. Dwivedi[7]

[1]Division of Soil Science and Agriculture Chemistry, FoA, Chatha, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India
[2] KVK, Leh, SKUAST-Kashmir-194 101, India
[3]Rainfed Research Sub-station for Sub-tropical fruits, Raya, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India
[4]Water management Research Centre, Chatha, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India
[5]Regional Horticultural Research Sub-station, Bhaderwah, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India
[6]Directorate of Research, Administrative Building Main Campus, Chatha, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India
[7]Research Farm, Chatha, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu -180009(J&K), India

**Corresponding author*

Keywords

Soil properties, micronutrient, cropping system, correlation

Article Info

Accepted:
30 December 2017
Available Online:
10 January 2018

A B S T R A C T

A study of the cationic micronutrient status of soils of district Kishtwar was made at five different cropping systems (Maize –oats, Rice – mustard, Moong –Berseem, Agri - horti system and Vegetable). The DTPA-extractable micronutrient cations and their relationship with different soil properties were studied in different cropping system of Kishtwar district (J&K). Soil samples were collected at a depth of 0-15cm and analyzed for DTPA- extractable iron, copper, zinc, manganese. The DTPA extractable Iron, Copper, Zinc and Manganese ranged from 5.37-23.36, 0.59-4.38, 0.74-2.08 and 4.59-21.08 mg kg^{-1}. Soil DTPA-extractable micro-nutrients, Zn, Cu, Mn, and Fe ranged from 1.24 to 5.55, 1.20 to 2.97, 13.26 to 47.56 and 7.17 to 17.17 mg kg^{-1} (mean value of 2.34, 2.10, 22.35 and 10.65 mg kg^{-1}), respectively. Correlation between the soil physico-chemical properties and nutrient concentrations showed a significant and positive relationship between CEC and clay content (r=0.827**). Soil pH of the surface layer had a significant and negative correlation with Cu, Mn and Fe (r=-0.281**, r=-0.455**, r=-0.367**). Soil organic carbon showed a significant positive relationship with the available nitrogen, and copper (r= 0.846**, r= 0.256*).

Introduction

Role of cationic micronutrient in balanced plant nutrient is well established. There are important for maintaining soil health and also increasing productivity of crops. These are needed in very small amount (Rattan *et al.,* 2009). The required micronutrients by the plants zinc, copper, manganese and iron (Zn, Cu, Mn and Fe). Although these nutrients are present relatively in small amount in nearly all the soils, yet their availability presents a problem in many soils. The nature and amount of various forms of micronutrients are affected by the factors like soil moisture, soil temperature, pH, organic matter content, etc. It was, therefore, reasonable to expect that concentration of different forms of these micronutrients in soils of different physico-chemical properties is likely to vary (Sharma and Chaudhary 2007). Thus, knowledge of status of micronutrient and their interrelationship with soil characteristic will be helpful in understanding the inherent capacity of soil to supply these nutrients to plant. Beside soil characteristics, land use pattern also plays a vital role in governing the nutrient dynamics and fertility of soils (Venkatesh *et al.,* 2003). Major crops of the district Kishtwar are Maize, Paddy, wheat and barley, rajmash, vegetables, and horticulture. The average productivity of major crops were below national average, may be because of the landscape of these hilly terrain of the district and complex nature of the soil; fertility status and available cropping pattern.

The relatively minor problem of soil micronutrient deficiency at the beginning of the green revolution three decades ago was a factor to reckon with in present times in sustaining the productivity of crop. Proper management of the different cropping system was a key to minimize crop yield reduction induced by micronutrient deficiency. The micronutrient content of soils are of limited value to plant growth and responses to their application. To match the levels of micronutrient was soil with plant requirement; their available contents in soils were to be determined. Like total contents, the available micronutrient status of soils is also highly variable. Soil properties exercise a considerable influence on the availability of micronutrients. Since the state of Jammu and Kashmir has also got on an ambitious agricultural development programme with a great stress on intensive farming, it is likely that the farmers of this state may face the problem of macro as well as micronutrient deficiencies in their soils. This has caused concern to those who are associated with the crop in Kishtwar in one way or the other. Among other things, low productivity, may be attributed to low fertility of these soils, both in respect of micronutrients. This was authenticated by the fact that Karewas have been reported deficient in Zn Tundup, *et al.,* (2015). Since no systematic information was yet available on status of micronutrient in different cropping system soil of Kishtwar District. The present work was conducted to assess the status of micronutrient in different cropping system soil of Kishtwar District. There was a general lack of awareness among farmers on micronutrient deficiency problem.

Materials and Methods

The present investigation was undertaken in Kishtwar district of J&K State. These study area has severely to moderately eroded soils located between at $32^{0}53'$ and 34021'N latitude and $75^{0}1'$ and 76^{0} 47' E longitude of 1600 to 1800 m above MSL. Five different cropping system (Maize –oats, Rice – mustard, Moong –Berseem, Agri - horti system and Vegetable) of Kishtwar were selected for random soil sampling to study the as well as micronutrients status. Seventy five surface (0-15 cm) soil sample, representing five different cropping system i.e. 15 each

were collected from Kishtwar district of J&K. The processed soil samples are analyzed for physico-chemical properties using standard procedures (Jackson, 1973). The available Zn, Cu, Fe, Mn in soil samples were extracted with solution consisting of 0.005M DTPA, 0.01M $CaCl_2$ and 0.1 M Triethanolamine (pH 7.3) as per the procedure described by Lindsay and Norvell (1978) for available micronutrient cations. The Zn, Cu, Fe, Mn in DTPA-extracts were estimated using atomic absorption spectrophotometer Model, Z2300 (Hitachi).

Results and Discussion

Physico-chemical Characteristics of soils

The important soil properties of soils of the five different cropping system under study are presented in Table 1. However, the average pH of Maize –oats, Rice – mustard, Moong – Berseem, Agri - horti and Vegetable system soils were 6.51, 6.14, 7.01, 7.11 and 6.88, respectively which shows that the majority of the soils is acidic to neutral in reaction. The electrical conductivity (EC) of these soils varied from 0.05 to 0.35 dSm^{-1}. These values are within the safe limits for the growth of the crop. The organic carbon content of the soils was medium to high. The soil of organic carbon content five different cropping systems ranged from 5.1 to 8.5g kg^{-1} with the mean value of 6.1, 5.9, 6.5, 7.4 and 7.1g kg^{-1}. The fertility status of the soil for the quantity of organic carbon content of soils was wide variation. Similar results are reported by Kumar *et al.,* (2010) and Kumar and Sohan (2012).

The clay content of the soils ranged from 26.93 to 34.91 percent which subscribe to same range as reported by Rai, *et al.,* (2017). Cation exchange capacity (CEC) ranged between 10.46 to 16.41 [cmol(p+)kg^{-1}]with mean value of 12.51, 14.61, 13.44, 12.54 and 13.41. These observations are corroborated by Gupta and Khanna (1994) while studying soils of agricultural research farm of Jammu.

Micronutrient cations

Zinc: DTPA- extractable zinc content of soils under different cropping system varied from 0.40 to 3.41 mg kg^{-1} with an average value of 1.21, 0.68, 1.34, 1.94 and 1.41mg kg^{-1}soil under Maize –oats, Rice – mustard, Moong – Berseem, Agri - horti system and Vegetable system, respectively (Table 2). The lower cotent of Zn under Maize –oats and Rice – mustard system soil showed that these soils might develop Zn deficiency in the agronomy practiceses. The high amount of zinc might have resulted with high organic matter content and more weathered soil conditions. Present investigation indicated that 73 per cent of the different cropping system area was sufficient in available zinc considering, 0.6 mg kg^{-1} as the critical limit as suggested by Lindsay and Norvell (1978). This was supported by the findings of Chattopadhyay *et al.,* (1996) who also found sufficient values of zinc in the hilly soils. Nazif *et al.,* (2006) also reported that micronutrient availability enhanced in soils with organic matter over no organic manure. Organic carbon was found significant positive correlation with Zn (r = 0.401**). The available Zn in soil has been found negatively correlated with pH of the soil (r = -0.143) which is in line with the earlier findings of Vadivelu and Bandyopadhyay (1995). This positive correlation may be due to the formation of organic complexes between organic matter and zinc that protect it from leaching. These results were similar to the findings of Perveen *et al.,* (1993) and Chinchmalatpure *et al.,* (2000). Copper: DTPA-extractable copper ranged from 1.20–4.89mg kg^{-1} with an average value of 1.67, 2.22, 1.98, 2.44 and 2.46 mg kg^{-1} under different cropping system and other agri-horti system soil recorded highest content, whereas, Moong-Berseem system lowest content.

Table.1 Physico-chemical properties of the soils of different cropping system of Kishtwar district

Cropping System	pH	EC (dSm^{-1})	OC ($g\ kg^{-1}$)	CEC [cmol (p^{+}) kg^{-1}]	Clay (%)
Maize -oats	6.26 - 6.82 (6.51)	0.16 - 0.24 (0.19)	5.8 - 6.8 (6.1)	12.25 - 14.41 (12.51)	29.34 – 33.45 (30.41)
Rice - mustard	5.93 - 6.48 (6.14)	0.17 - 0.35 (0.21)	5.4 – 6.9 (5.9)	13.51 - 16.32 (14.61)	30.62 – 34.51 (32.15)
Moong -Berseem	6.30 - 7.10 (7.01)	0.05 - 0.18 (0.11)	5.1 – 7.1 (6.5)	14.70 - 16.41 (13.44)	27.93 – 31.45 (29.45)
Agri - horti system	5.29 - 7.31 (7.11)	0.16 - 0.25 (0.17)	6.9 – 8.5 (7.4)	11.01 - 14.74 (12.54)	28.65 – 35.45 (33.65)
Vegetable	6.14 - 7.28 (6.88)	0.02 - 0.25 (0.09)	6.3 – 7.8 (7.1)	10.46 - 15.61 (13.41)	26.01 – 32.61 (30.84)

Table.2 Range and mean of DTPA-extractable micronutrients in soils under different cropping system of Kishtwar district

Village	Micro nutrients ($mg\ kg^{-1}$)			
	Zn	**Cu**	**Mn**	**Fe**
Maize -oats	0.40 - 2.02 (1.21)	1.47 – 2.15 (1.67)	23.41 - 31.23 (26.51)	17.17 – 19.45 (18.41)
Rice -mustard	0.51 - 1.45 (0.68)	2.12 – 3.45 (2.22)	21.14 - 37.56 (29.41)	14.25 – 16.41 (15.34)
Moong-Berseem	1.24 – 2.14 (1.34)	1.44 – 2.41 (1.98)	11.23 - 24.23 (19.41)	11.02 - 21.03 (16.348)
Agri-horti system	1.21 – 3.41 (1.94)	1.20 -4.89 (2.44)	16.45 - 26.18 (20.54)	19.45 – 23.14 (21.35)
Vegetable	0.91 – 2.14 (1.41)	2.40 – 3.16 (2.46)	14.51 - 24.60 (18.64)	9.45 – 23.54 (16.54)

Table.3 Correlation between soil properties and micronutrients

Soil properties	Macronutrients			
	Zn	Cu	Mn	Fe
pH	-0.143	-0.295*	-0.415**	-0.397**
EC	0.168	0.061	-0.039	0.154
OC	0.401**	0.266*	0.121	0.127
CEC	-0.131	-0.031	0.284*	0.083
Clay	0.031	-0.249**	0.395**	0.114

*Significant at the 5% level.
**Significant at the 1% level.

No deficiency was observed as the values are above the critical limit of 0.2 mg kg^{-1}, (Lindsay and Norvell, 1978). This was in agreement with the study of Chattopadhyay *et al.,* (1996).Soils with good organic matter content have high micronutrient availability due to chelating action of organic compounds released during decomposition and prevention of cations from fixation, precipitation, oxidation and leaching (Babu *et al.,* 2007). Copper and soil pH was negatively and significantly correlated with r value of -0.295* (Table 3) indicating that a decline in pH leads to significant increase in copper availability. Similar correlation coefficients were also worked out by Bhandari and Randhawa (1985). Further data indicated that Cu was positively correlated with soil organic carbon (r = 0.266*). Similar results were reported by Khalifa *et al.,* (1996) and Rajakumar *et al.,* (1996) who also reported a positive correlation between copper and organic matter.

Manganese: DTPA-Mn study varied from 11.32 –31.23mg kg^{-1} in five different cropping system with mean value of 26.51, 29.41, 19.41, 20.54 and 18.64mg kg^{-1}respectively. Manganese content of the soils varied widely and was higher under Rice – mustard cropping than other cropping system. Considering 1.0 mg kg^{-1} as the critical limit for Mn deficiency (Lindsay and Norvell 1978), cent percent of the soils have sufficient available Mn to sustain different cropping system. Soils with good organic matter content have high micronutrient availability due to chelating action of organic compounds released during decomposition of these manures and prevention of cations from fixation, precipitation, oxidation and leaching (Babu *et al.,* 2007).Mn and soil pH was negatively and significantly correlated with r value of -0.415** (Table 3). It was showed significant positive correlation with CEC and clay content (r=0.284* and 0.395**). The significant relationships between clay and Mn signify the importance of clay in the availability of this micronutrient. The result was positively significant and in conformity with Oyinlola *et al.,* (2010) and Tundup, *et al.,* (2015).

Iron: The data in table 2, indicated that available iron (Fe) content of the soil under five different cropping system varied from 9.45 – 23.54 mg kg^{-1} with mean value of 18.41, 15.34, 16.34, 21.35 and 16.54 mg kg^{-1}respectively. Available Fe was sufficient in the soils assuming 4.5 mg kg^{-1} as a critical limit as suggested by Lindsay and Norvell (1978). These findings were in conformity with that of Nazif *et al.,* (2006) and Kirmani *et al.,* (2011). This might be attributed to synergistic relationship of physico-chemical characteristics and micronutrient in soil. Soils with good organic matter content have high micronutrient availability due to chelating action of organic compounds released during decomposition of these manures and prevention of cations from fixation, precipitation, oxidation and leaching (Babu *et al.,* 2007). There was a negative and significant relationship between DTPA-Fe and pH (r = -0.397**). It was observed that availability of Fe like other micronutrients (Cu and Mn) decreases with the increase in soil pH. These results are supported by the earlier findings of Rajakumar *et al.,* (1996) and Tundup, *et al.,* (2015).

Thus it may be concluded that the five different cropping system (Maize –oats, Rice – mustard, Moong –Berseem, Agri - horti and Vegetable) areas of Kishtwar district of Jammu province were sufficient in DTPA-extractable Zn, Cu, Mn and Fe contents. The information regarding the micronutrient status of the soils of Kishtwar district in present investigation may be helpful in the formulation of integrated nutrient management schedule for the better

cultivation practices and sustainance for long term of soil health.

References

Babu, M.V.S., Reddy, M.C., Subramanyam, A. and Balaguravaih, D. 2007. Effect of integrated use of organic and inorganic fertilizers on soil properties and yield of sugarcane. Journal of the Indian Society of Soil Science, 55(2): 161-166.

Bhandari, A. R. and Randhawa, N. S. 1985. Distribution of available micronutrients in soils of apple orchards of Himachal Pradesh. Journal of the Indian Society of Soil Science, 33: 171-173.

Chattopadhyay, T. Sahoo, A.K. Singh, R.S. and Shyampura, R.L. 1996. Available micronutrient status in the soils of vindhyan scarp lands of Rajasthan in relation to soil characteristics. Journal of the Indian Society of Soil Science, 44(4): 678-681.

Chinchmalatpure, A. R., Brij Lal, Challa, O., Sehgal, J. 2000. Available micronutrient status of soils on different parent materials and landforms in a micro-watershed of Wunna catchment near Nagpur (Maharashtra). Agropedology, 10(1): 53-58.

Gupta, J. P. and Khanna, Y. P. 1994. Nutrient status of the soil of agricultural research farms of Jammu region (J&K).Research and Development Reporter, 11(1-2):67-70.

Jackson, M. L. 1973. Soil chemical analysis: Advanced course. The Author. Madison, Wisconsin, USA.

Khalifa, E. M., El-Desoky, M. A., Gameh, M. A. and Faragallah, M. E. 1996. Status of some micronutrients and their relations to mineral composition of the Nile valley desert interference zone soils, East of Assiut city. Assiut Journal of Agricultural Sciences, 27(3): 107-127.

Kirmani, N.A., Sofi, J.A., Bhat, M.A., Bangroo, S.A. and Bhat, S.A. 2011. Soil Micronutrient Status of District Budgam. Research Journal of Agricultural Sciences, 2(1): 30-32.

Kumar, V. and Sohan, P. 2012. Status of Major Nutrients in soils of Raya orchard under rainfed condition. An Asian Journal of Soil Science 7(2):402-403.

Kumar, V., Singh, G.R., Kumar, A. and Pathinia, K. 2010. Status of Major Nutrients in soils of Haridwar District. Environment and Ecology 28(2): 759-761.

Lindsay, W. L. and Norvell, W. A. 1978. Development of a DTPA soil test for zinc, iron, manganese, and copper. Journal of the American Society of Soil Science, 42: 421–428.

Nazif, W., Perveen, S. and Saleem, I. 2006. Status of micronutrients in soils of district Bhimber (Azad Jammu and Kashmir). Journal of Agricultural and Biological Science, 1(2): 35-40

Oyinlola, E.Y. and Chude, V.O. 2010. Status of available micronutrients of the basement complex rock-derived alfisols in northern Nigeria savanna. Tropical and Subtropical Agroecosystems, 12: 229-237.

Perveen, S., Tariq, M., Farmanuallah, Khattak, T.K. and Hamid, A. 1993. Study of some important sites of N.W.F.P., Pakistan. Sarhad Journal of Agriculture, 9(5): 467-473.

Rai, A.P., Mondal, A.K., Rai, P.K., Gupta R. and Kumar V. 2017. Micronutrient Status of Rice Growing Soils in Samba District of J&K (Edited by Sanjay Arora Suraj Bhan) Sustainable Farming and Soil Health Management, Soil Conservation Society of India, New Delhi. Chapter 8 Pp. 66-70.

Rajakumar, G.R., Patil, C.V., Prakash, S.S., Yeledhalli, N.A. and Math, K.K. 1996. Micronutrient distribution in paddy soils in relation to parent material and soil

properties. Karnataka Journal of Agricultural Sciences, 9(2): 231-235.

Rattan, R. K., Patel, K. P., Manjaiah, K. M. and Datta, S. P. 2009. Micronutrient in soil, plant animal and human health. Journal of the Indian Society of Soil Science 57, 546-558

Sharma, J. C., and Chaudhary, S. K. 2007.Vertical distribution of micronutrient cations in relation to soil characteristics in lower Shiwaliks of Solan district in North-West Himalayas. *Journal of the Indian Society of Soil Science* 44(4): 746-752.

Tundup, P., Rai, A. P., Mondal A. K., Kumar, V. and Wali P. 2015. Nutrient status of saffron growing soils of Kishtwar district (J&K). Journal of the Indian Society of Soil Science, 63(4): 394-399.

Vadivelu, S. and Bandyopadhyay, A.K. 1995. Distribution of DTPA extractable Fe, Mn, Cu and Zn in the soils of Minicoy Island, Lakshadweep. Journal of the Indian Society of Soil Science, 43(1): 133-134.

Venkatesh, M. S., S. Aetia, R. K., Sharma, P. K., Khurana M. P., S. and Kang, G. S. 2003. Status of micronutrient cation under various land use system of Meghalaya. Journal of the Indian Society of Soil Science, 51: 60-64.

How to cite this article:

Rai A. P., Phuntsog Tundup, A. K. Mondal, Vijay Kumar, A. Samanta, Manoj Kumar, Rohit Kumar Arora and Dwivedi M. C. 2018. Cationic Micronutrient Status of Some Soils under Different Cropping System of Kishtwar District (J&K), India. *Int.J.Curr.Microbiol.App.Sci.* 7(01): 3596-3602. doi: https://doi.org/10.20546/ijcmas.2018.701.422