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Short Communication

Available Micronutrient Status of Mothbean Growing Soils of Poonch District (Jammu and Kashmir) in Relation to Soil Properties

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The application of high analysis fertilizer and less use of organic matter in soil caused micronutrient deficiencies in Jammu (Mondal *et al.* 2007). Micronutrients are not only important for better crop productivity, but also essential for sustaining human and animal health. Mothbean is cultivated widely in areas of Poonch and Kishtwar districts of Jammu province. Scanty information is available on availability of cationic micronutrients under mothbean growing soils in Poonch district with a view to address their deficiencies for increasing the productivity of mothbean.

One Hundred eight representative surface (0-0.15 m) soil samples with GPS location were collected from twenty seven mothbean growing villages of the district Poonch. Soils were air-dried, ground with wooden pestle and mortar and passed through 2-mm stainless steel sieve. Soil samples were analyzed for pH, electrical conductivity (EC), organic carbon (OC) and cation exchange capacity (CEC) by standard procedures (Jackson 1973). These soil samples were extracted with solution consisting of 0.005 *M* DTPA, 0.01*M* $CaCl_2$ and 0.1 *M* triethanolamine (pH 7.3) as per the procedure described by Lindsay and Norvell (1978) for the determination of available micronutrient cations. The zinc (Zn), copper (Cu), iron (Fe) and manganese (Mn) in the extracts were estimated using atomic absorption spectrophotometer Model, Z2300 (Hitachi).

The texture of the soils varied from loam to clay loam (Table 1). The pH of the soils ranged from 4.78 to 6.87 with the mean value of 5.84. Decomposition of the organic matter in the soil there might be related to the release of certain organic acids which results in decrease of soil pH (Aziz *et al.* 2012). The EC ranged from 0.11 to 0.33 dS m^{-1} with the mean value of 0.25 dS m^{-1}. The soluble salt content in the soil was in the safe limit for growing of any crop. The OC content ranged from 5.2 to 8.4 g kg^{-1} with the mean value of 6.4 g kg^{-1}. The OC accumulation in soil may also be attributed to better root biomass in legume crop. The CEC ranged between 11.75 to 14.20 cmol $(p^+)kg^{-1}$ with a mean value of 13.08 cmol$(p^+)kg^{-1}$.

The DTPA-extractable Zn ranged from 1.20 to 4.31 mg kg^{-1} with an average value of 2.66 mg kg^{-1} (Table 2). The high content of Zn in soil might be associated with high organic matter content and lower weathered soil conditions. Present investigation indicated that 100% of the mothbean growing areas are sufficient in available Zn considering, 0.6 mg kg^{-1} as the critical limit (Lindsay and Norvell 1978). This was supported by the findings of Chattopadhyay *et al*. (1996) who also found sufficient values of Zn in the hilly soils. The OC had significant positive correlation with Zn (r = 0.289**). This positive correlation may be due to the formation of organic complexes between organic matter and Zn that protect it from leaching. These results were similar to the findings of Chinchmalatpure *et al*. (2000). The available Zn (Table 3) in soil was negatively correlated with pH of the soil (r = -0.019) which is in line with the earlier findings of Saha *et al*. (1996). The DTPA-extractable Cu ranged from 1.15-3.59 mg kg^{-1} with a mean value of 2.14 mg kg^{-1}. Its content in soil could be considered as sufficient as the values are above the critical limit of 0.2 mg kg^{-1}. This is in

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Table 1. Physicochemical properties of the soils of mothbean growing areas of Poonch district

Village	GPS Location	pH	EC (dS m^{-1})	OC (g kg^{-1})	Sand (%)	Silt (%)	Clay (%)	CEC [cmol(p^+)kg^{-1}]
Bufliaz	33°36'667" N 74°21'059" E	5.51	0.21	6.2	36.1	34.2	29.7	12.6
Dhraba	33°36'620" N 74°19'614" E	5.48	0.17	5.4	36.3	32.9	30.8	11.8
Surankote	33°38'079" N 74°16'225" E	5.30	0.15	6.3	35.4	31.8	32.8	12.4
Duntar	33°41'506" N 74°14'530" E	5.25	0.17	6.2	32.5	32.6	34.9	13.1
Shindra	33°44'313" N 74°11'885" E	5.93	0.33	6.9	43.6	38.2	18.2	11.8
Dalera	33°45'406" N 74°08'118" E	5.84	0.25	6.6	46.0	37.0	17.0	13.1
Kankote	33°46'115" N 74°08'151" E	6.49	0.29	7.6	35.1	37.4	27.5	12.5
Dingla	33°45'487" N 74°09'721" E	6.23	0.25	8.4	35.5	40.5	24.0	12.3
Chandak	33°44'951" N 74°11'066" E	5.09	0.15	6.5	26.2	26.4	46.9	13.2
Timbra	33°45'657" N 74°12'298" E	5.96	0.31	6.3	45.0	38.0	17.0	12.8
Sathra	33°46'222" N 74°13'104" E	5.68	0.29	6.0	28.6	48.2	23.2	14.1
Saiklu	35°47'336" N 74°14'656" E	5.25	0.19	5.7	36.4	29.8	33.7	12.5
Raj Pura	33°48'289" N 74°16'792" E	5.39	0.19	5.6	36.0	32.7	31.3	12.3
Palera	33°48'564" N 74°17'997" E	4.78	0.12	5.8	35.4	28.3	36.3	12.5
Lohil Bella	33°48'902" N 74°18'516" E	6.28	0.24	5.8	29.5	46.3	24.2	13.0
Barathrad	33°49'248" N 74°18'593" E	6.45	0.26	5.4	35.1	37.5	27.4	12.0
Loran	33°49'738" N 74°19'194" E	6.77	0.28	5.2	47.4	34.8	17.8	12.7
Band Gaidi	33°50'151" N 74°19'832" E	6.82	0.12	6.7	47.5	35.0	17.5	13.3
Tann	33°50'127" N 74°20'096" E	6.87	0.11	5.3	35.5	39.0	25.5	13.9
Biyada	33°50'070" N 74°20'544" E	6.19	0.11	5.7	34.5	38.1	27.4	14.2
Batalkote	33°49'784" N 74°20'840" E	5.51	0.13	6.9	36.3	32.8	30.9	14.0
Danna	33°50'383" N 74°20'172" E	6.47	0.28	6.6	43.5	37.5	19.0	13.9
Jabdi	33°50'254" N 74°20'350" E	5.32	0.23	5.6	32.5	34.3	33.2	14.2
Potha	33°39'252" N 74°14'743" E	5.44	0.29	6.0	35.2	33.6	31.2	13.3
Jhera Gali	33°36'991" N 74°15'730" E	6.19	0.17	7.6	43.5	35.0	21.5	13.9
Bata Dorian	33°34'846" N 74°16'425" E	5.74	0.22	8.0	41.2	32.5	26.3	14.0
Bhimber Galli	33°33'360" N 74°13'963" E	5.65	0.18	7.1	37.1	39.5	23.4	14.1
Range		4.51-6.87	0.11-0.33	5.2-8.4	26.2-47.5	26.4-48.2	17.0-46.9	11.8-14.2
Overall mean		5.84	0.25	6.40	37.3	35.7	27.0	13.1

Table 2. DTPA-extractable micronutrients of mothbean growing soils

Village	GPS location	Micronutrients (mg kg^{-1})			
		Zn	Cu	Mn	Fe
Bufliaz	33°36'667" N 74°21'059" E	1.83	2.31	20.20	9.53
Dhraba	33°36'620" N 74°19'614" E	2.51	2.76	18.53	12.18
Surankote	33°38'079" N 74°16'225" E	2.16	2.91	12.90	12.65
Duntar	33°41'506" N 74°14'530" E	2.16	1.51	16.36	9.43
Shindra	33°44'313" N 74°11'885" E	1.47	1.94	17.78	5.39
Dalera	33°45'406" N 74°08'118" E	3.14	2.22	21.61	10.95
Kankote	33°46'115" N 74°08'151" E	4.10	3.03	19.95	7.52
Dingla	33°45'487" N 74°09'721" E	3.61	2.03	30.16	7.22
Chandak	33°44'951" N 74°11'066" E	3.12	3.23	24.41	15.63
Timbra	33°45'657" N 74°12'298" E	4.31	1.72	15.99	10.78
Sathra	33°46'222" N 74°13'104" E	2.72	1.89	21.18	14.92
Saiklu	35°47'336" N 74°14'656" E	1.79	2.20	22.09	15.21
Raj Pura	33°48'289" N 74°16'792" E	2.03	2.22	16.19	9.61
Palera	33°48'564" N 74°17'997" E	3.05	3.04	28.48	23.11
Lohil Bella	33°48'902" N 74°18'516" E	3.79	3.59	11.32	14.65
Barathrad	33°49'248" N 74°18'593" E	2.53	2.39	21.32	13.67
Loran	33°49'738" N 74°19'194" E	1.20	1.21	20.80	18.51
Band Gaidi	33°50'151" N 74°19'832" E	4.14	1.88	17.65	29.41
Tann	33°50'127" N 74°20'096" E	3.07	1.33	23.60	9.36
Biyada	33°50'070" N 74°20'544" E	3.95	1.25	17.30	21.76
Batalkote	33°49'784" N 74°20'840" E	3.65	2.93	25.15	25.36
Danna	33°50'383" N 74°20'172" E	1.35	2.15	14.93	23.11
Jabdi	33°50'254" N 74°20'350" E	2.78	1.18	21.96	19.91
Potha	33°39'252" N 74°14'743" E	1.35	1.83	15.48	24.37
Jhera Gali	33°36'991" N 74°15'730" E	2.80	2.35	17.38	15.63
Bata Dorian	33°34'846" N 74°16'425" E	1.25	1.67	18.80	18.81
Bhimber Galli	33°33'360" N 74°13'963" E	2.00	1.15	18.81	26.01
Range		1.20-4.31	1.15-3.59	11.32-30.16	5.39-29.41
Overall mean		2.66	2.14	19.64	15.45

Table 3. Correlation between soil properties and DTPA-extractable micronutrients

Soil properties	Micronutrients			
	Zn	Cu	Mn	Fe
pH	-0.09	-0.274*	-0.037	-0.332**
EC	-0.018	0.052	0.112	-0.287*
OC	0.289**	0.269*	0.058	0.025
CEC	-0.046	-0.111	-0.042	0.358**
Sand	-0.082	-0.162	-0.068	-0.207
Silt	0.181	0.239	0.037	-0.405**
Clay	0.080	0.327*	-0.084	0.499**

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

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 had negative and significant correlation with r value of -0.274* (Table 3) indicating that a decline in pH leads to significant increase in Cu availability. Organic carbon was significant positive correlation (r = 0.269*) with Cu (Jalali *et al*. 1989). The DTPA-extractable Mn in soil varied from 11.32-30.16 mg kg^{-1} with mean value of 19.64 mg kg^{-1}. Considering 1.0 mg kg^{-1} as the critical limit for Mn deficiency, 100% of the soils were sufficient in available Mn to sustain mothbean crop. It has been reported that soils with good organic matter content have high micronutrient availability due to chelating action of organic compounds released during decomposition which prevents cations from fixation, precipitation, oxidation and leaching (Babu *et al*. 2007). The DTPA-extractable Fe varied from 5.39-29.41 mg kg^{-1} with a mean value of 15.45 mg kg^{-1} (Table 2), showing sufficiency of available Fe in the soils assuming 4.5 mg kg^{-1} as a critical limit. These findings are in conformity with that of Jalali *et al*. (1989). There was a negative and significant relationship between DTPA-Fe and pH (r = -0.332**). It can be observed that availability of Fe like other micronutrients (Cu and Mn) decreased with the increase in soil pH. A positive significant correlation between Fe and clay (r = 0.499**) in present study has been substantiated by the previous studies (Haque *et al.* 2000).

It is apparent from the study that the DTPA-extractable micronutrients *viz.*, Zn, Cu, Mn and Fe were found in sufficient in mothbean growing soils of Poonch. Soil organic carbon and pH were important

factors affecting micronutrient availability in mothbean growing soils.

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