J. Agric. Res. Technol., 49 (2) : 298-303 (2024)

Assessment of Secondary Nutrients Status of Inceptisol Soils from Manjra Basin Area of Latur Tahsil of Latur District

M. S. Shelke[1], B. S. Indulkar[2], S. G. Boradkar[3] and U. S. Mutkule[3]
Department of Soil Science and Agriculture chemistry, college of Agriculture, Selu,
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani - 431 402 (India)
(Received : 26.01.2024 Accepted : 29.02.2024)

Abstract

The present investigation carried out entitled "Assessment of secondary and micronutrient status of soils of Manjra basin area of Latur tahsil in Latur district." was undertaken for assessing the fertility status of soils from Latur tahsil. For this purpose total 100 soil samples were collected from twenty villages, among each village five soil samples were collected from Manjra basin area of Latur tahsil. These soil samples were distributed according to their representative depth as per order. Out of which which 61 samples, 27 samples and 12 number of samples were categorized as Inceptisols, Entisols and Vertisols respectively. Further, this collected soil samples were analyzed for their physico-chemical properties (pH, Electrical conductivity, organic carbon and calcium carbonate) and available secondary nutrients calcium, magnesium and sulphur. The soils of Manjra basin area of Latur tahsil under Inceptisols, Entisols and Vertisol were neutral to moderately alkaline in soil pH, safe in electrical conductivity for crop growth, low to moderately high in organic carbon content and non-calcareous to calcareous in nature. Medium in exchangeable calcium and magnesium while high in available sulphur content. According to the concept of "Soil Nutrient Index", the availability of these nutrients was medium in exchangeable calcium and magnesium and high in available Sulphur.

Key words : Inceptisol, Entisols, Vertisol, soil nutrient index.

Soil fertility is the major component of productivity which primarily deals with nutrient supplying capacity of the soil to the plant. Thus, it has been always considered to carry out genetic study as well as to find out fertility evaluation for making best use of the soil for crop production (Anonymous 2011). The physico-chemical properties viz, soil pH, EC, calcium carbonate and organic carbon were important in deciding availability of essential nutrient in soil and thereby for crop production. The nutrient supply in the soil is influenced by the level of organic matter which acts as a buffering agent and after decomposition produce organic acids and CO2 which help to dissolve the mineral, calcium carbonate, degree of microbial activity, change in pH and soil moisture status. The supply of essential nutrients from soil can be augmented by proper management of these properties. The macronutrients were also important in crop production which helps in nutrient availability. The secondary nutrients like Ca and Mg both increases soil pH and primary function of calcium is to provide structural support to cell wall and magnesium was considered as constituent of chlorophyll, activator of enzymes and helps in formation of polypeptide chain and transport of phosphorus. Sulphur improves crop quality by increasing oil content. As the deficiency of secondary nutrients was observed in Manjra basin area of Latur tahsil hence the soil testing and on the basis of NIV, the fertility map is prepared which helps the farmers for increasing crop production. Soil test-based fertility management might be one of an approach for sustainable agricultural production system. To maintain the fertility status of soil addition of organic matter, growing of legume crops, crop rotation, use of biofertilizers, green

1. Assistant Professor, 2. Professor and 3. MSc Scholar.

manuring which leads to improved soil structure and promotes healthy, fertile soil.

Materials and Methods

The Latur district is located between N 17° 55' N 18° 50' North and E 76°15' E 77°15' East in deccan plateau respectively. The soils of Latur district comes under the category Vertisol, Inceptisol, and Entisol. Major soils of Latur district are derived from "Deccan trap" rocks. These soils were deep to shallow black and light textured. The soils of Latur districts are varied in colours due to occurance of minerals like smectite, kaolinite, and vermiculite. On the basis of soil depth and texture, these soils have been classified into deep to medium black and shallow black soils (Gajbe *et al*. 1976). All the collected soil samples were brought to the laboratory and dried After drying, a part of each sample meant for analysis were ground with wooden mortar and pestle, passed through 0.5 mm sieve and used for further anaylsis. the soil pH and EC was estimated by 1:2.5 soil water suspension as per the method described by Jackson (1973).and categorized by rating given by Muhr (1965). Modified Walkley and Black's (1934) rapid titration procedure was followed for estimating the organic carbon content $CaCo_3$ was estimated by rapid titration method as described by Piper (1966) Exchangeable Ca and Mg determined by Versenate titration method by Kanwar and Chopra, 1976. Available S was determined by Turbidity method (Williams and Steinberger, 1969). Ratings of Secondary nutrients given by More *et al.*, (2005). The nutrient index approach introduced by Ramamurthy and Bajaj (1969) was used to evaluate the fertility status of soils based on the samples in each of the six classes.

Results and Discussion

Physico-Chemical properties of soils from Manjra basin area of Latur tahsil under Inceptisol : The data on pH, electrical conductivity, organic carbon and calcium carbonate of Manjra basin area of Latur tahsil under Inceptisol were presented in Table 1 and categorization of each parameter in Table 2 The data shows that, the pH of these soil was ranged from 6.31 to 7.86 with an average value of 7.52. with SE value 0.03 and CV value 36 percent. Out of 61 soil samples in inceptisol soil 39 soil samples (63.93 %) were moderately alkaline (7.5- 8.5) in reaction, 21 (34.42%) were neutral (6.5-7.5) and only 1 (1.63%) was slightly acidic (6.0-6.5.) in nature. Most of soil samples were observed neutral to moderately alkaline in reaction. The value indicates that the soils of Inceptisol of Manjra basin area were neutral to moderately alkaline in reaction this might be due to presence of high degree of base saturation. Nirawar *et al.* (2009) reported that, pH of Ahmedpur tahsil, were ranges from 6.56 to 8.6. The electrical conductivity of soil was varied from 0.25 to 1.19 dS m^{-1} with a mean value of 0.59 dS m^{-1}. out of 61 soil samples from Inceptisol 59 (96.73%) were safe and have no deleterious effect on crops (<1.0 dS m^{-1}). Whereas, only 2 (3.27%) soil samples were observed in range of critical for germination (1-2 dS m^{-1}) The low EC content of these soil was due to high precipitation and leaching of salts to lower horizon. Shinde (2007) reported that, EC of soils from Udgir and Deoni tahsil were varied from 0.10 to 2.17 and 0.13 to 1.17 dS m^{-1}. The organic carbon content of Inceptisol soils of Manjra basin area of Latur tahsil were ranged from 1.4 to 8.1 g kg^{-1} with an average value of 4.2 g kg^{-1}. Among the 61 soil samples, 09

Table 1. Status of Physico-Chemical properties of soils from Inceptisol of Latur tahsil

Particular	pH	EC (dS m^{-1})	OC (g kg^{-1})	$CaCO_3$ (g kg^{-1})
Range	6.31-7.86	0.25-1.19	8.1-1.4	5-68.5
Mean	7.528	0.591	4.2	26.66
SE	0.035	0.023	0.2	1.40
CV (%)	0.036	0.304	0.4	0.40

Table 2. Categorization of soils from Inceptisol based on Physicochemical properties

pH	**Strongly acid (< 5.5)**	**Mod. acid (5.5-6.0)**	**Slightly acid (6.0-6.5)**	**Neutral (6.5-7.5)**	**Mod. alkaline (7.5-8.5)**	**Strongly alkaline (> 8.5)**
%	-	-	1.6	34.4	63.9	-
No. of sample	-	-	1	21	39	-
EC (dSm^{-1})	**No deleterious effect on crop (< 1)**	**Critical for germination (1-2)**	**Critical for crop growth (2-3)**	**Injuries to most of the crop (> 3)**		
%	96.73	3.27	-	-		
No. of sample	59	2	-	-		
OC (g kg^{-1})	**Very low (< 2)**	**Low (2.1- 4)**	**Medium (4.1- 6)**	**Mod. high (6.1-8)**	**High (8.1-10)**	**Very high (> 10)**
%	14.75	34.42	31.14	18.03	1.63	-
No. of sample	9	21	19	11	1	-
CaCO3 (g kg^{-1})	**Non-calcareous (< 50)**	**Calcareous (50-150)**	**Highly calcareous (> 150)**			
%	98.36	1.63	-			
No. of sample	60	1	-			

(14.75%) were very low, 21 (34.42%) were low, 19 (31.14%) were medium, 11(18.03) were moderately high and only 1(1.63%) was high in organic carbon content. organic carbon content of Inceptisol were low to medium in range was due to factors like temperature, which is responsible for accelerate the rate of oxidation as well as very little addition of organic matter and crop residues in to soil. Hadole *et al.* (2020) observed that organic carbon content in soils of Solapur districts were ranged from 2.67 to 13.37 g kg^{-1} in soils of Solapur district. The calcium carbonate content from Inceptisol soil were varied from 5 to 68.5 g kg^{-1} with an average value of 26.8 g kg^{-1}. Among the 61 samples, 60 were non-calcareous and only 1 was calcareous in nature. the $CaCO_3$ content in soils of Inceptisol were low to medium this might be due to presence of $CaCO_3$ in powdery form and hyper thermic temperature of Latur tahsil. Patil *et al*. (2019) reported that calcium carbonate in Inceptisol of washi tahsil were ranged from 4.0 to 168 g kg^{-1}. These results

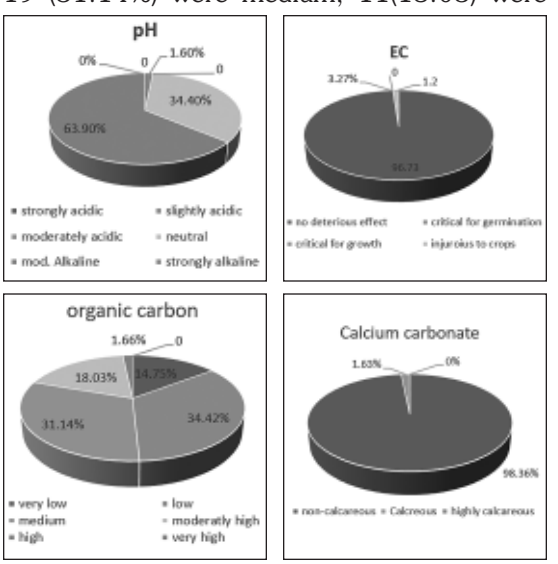

Fig. 1. Status of Physico-chemical properties of soils from Manjra basin area of Latur tahsil in Inceptisol.

Table 3. Available Secondary nutrients in soils of Latur tahsil under Inceptisol

Parameter	Ex. Ca Cmol (p^+) kg^{-1}	Ex. Ca Cmol (p^+) kg^{-1}	S (mg kg^{-1})
Minimum	0.5	0.21	3.66
Maximum	7.35	3.52	44.3
Mean	3.94	1.02	15.59
SE	0.01	0.9	0.12
CV (%)	27.77	57.25	50.28

were in confirmatory with results reported by Hadole *et al*. (2020).

Status of available Secondary nutrients in soils of Manjra basin area of Latur tahsil : The data on status of exchangeable Ca, Mg and S in soils of Manjra basin area of Latur tahsil were indicated in Table 3 and categorization of each parameter in Table 4 and revealed that, the exchangeable calcium content of these soil were varied from 0.5 to 7.35 Cmol (p^{+}) kg^{-1} with amean value of 3.94 Cmol (p^+) kg^{-1} with SE and CV value 0.01, 27.77 percent respectively. Out of 61 soil samples from Inceptisol soil 32 percent in low (less than 4 Cmol kg^{-1}), 48 percent medium (4 to 4.25 Cmol (p^+) kg^{-1}) 20 percent high (more than 4.25 Cmol (p+) kg^{-1}) in exchangeable calcium content. The above data revealed that, the majority soils of Manjra basin area were medium in exchangeable Ca. The sufficiency in exchangeable Ca might be due to homogenous parent material rich in Calcium. Ramana et al. (2015) reported that calcium content in soils of Gangapur district were varied from 0.4 to 10.2 cmol kg^{-1}. The exchangeable Mg content in these soils were varied from 0.21 to 3.52 Cmol (p^+) kg^{-1}. with SE value of 0.9 and CV value of 57.25 percent. Further, data indicates that, magnesium content in Manjra basin area of Latur tahsil in Inceptisol were medium in magnesium content. This might be due to high clay content and homogenous nature of parent material. Waikar *et al.* (2014) reported that, exchangeable magnesium in soils of Parbhani were ranged from 7.5 to 35.90 Cmol kg^{-1}. The available S content in these soils were varied from 3.66 to 44.3 mg kg^{-1} with an average value of 15.59 mg kg^{-1} with SE value 0.12 and CV value 50.28 percent. Out of total 61 soil samples 21.31 percent were low in available

Table 4. Categorization of available secondary nutrients of Manjra basin area of Latur tahsil

	Exchangeable calcium			Exchangeable magnesium			Available sulphur		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
No. of samples	20	29	12	19	28	14	13	3	45
Percentage	32	48	20	31.14	45.90	22.95	21.32	4.91	73.77

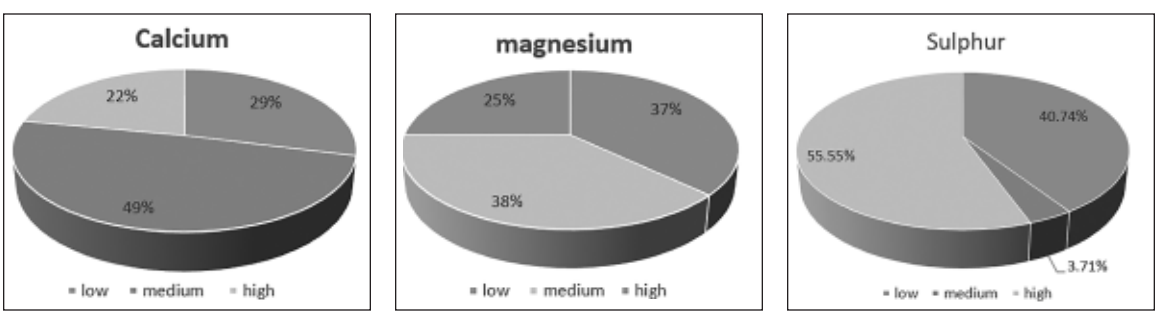

Fig. 2. Status of available Secondary nutrients from Manjra basin area of Latur tahsil under Inceptisol

Table 5. Soil nutrient index values for available nutrients

Available nutrients	NIV	Category
Exchangeable Ca	1.86	Medium
Exchangeable mg	1.91	Medium
Available S	2.52	High

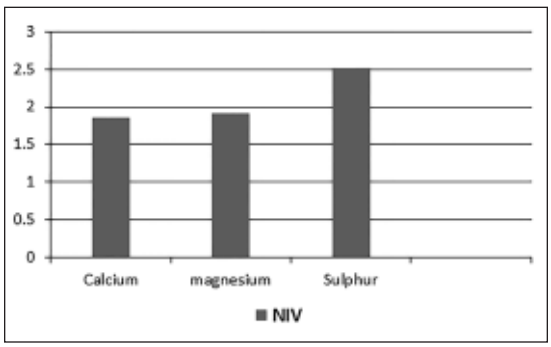

Fig. 3. Nutrient index values of secondary nutrients of Latur tahsil under Inceptisol

Sulphur content, only 5 percent were medium in available Sulphur content and 73.75 percent were high in available Sulphur content. The sufficiency or high content of available Sulphur might be due to high amount of clay content in soil which can be adsorbed varying amounts of Sulphur. Patil et al. (2018) reported that, available S content were ranged from 0.06 to 11.8 mg kg^{-1}.

Soil nutrient index of available secondary nutrients of Inceptisol : The nutrient index values for Inceptisol were medium for Calcium, Magnesium and high in available Sulphur content. The values obtained from nutrient index for calcium, magnesium and sulphur are 1.86, 1.91 and 2.52 respectively (Table 5).

Conclusion

All the soils from Manjra basin area of Latur tahsil were neutral to moderately alkaline in nature, safe in Electrical conductivity, noncalcareous to Calcareous in nature and low to medium. According to soil nutrient index values of Inceptisol exchangeable calcium and Magnesium were sufficient in Latur tahsil, high in available Sulphur content. Hence, for maintaining soil fertility of these soil application of organic along with inorganic fertilizers, addition of organic matter, growing of legume crops, crop rotation, use of biofertilizers, green manuring practices should be adopted which leads to improvement in physical condition, nutrient availability and better crop production in soils of Manjra basin area of Latur tahsil.

References

Anonymous. 2011. Report on Agricultural statistics. Department of agriculture and Statistical Information, Haryana.

Gajbe, M. V., Londe, M. G., Varade, S. B. Soils of Marathwada J. Maharashtra Agricultural University 1976; 1(2-6): 55-59.

Hadole, S. S. Sarap, P. A., Parmar, J. N., Lakhe, S. R., Rakhonde, O. S., Dhule, D. T., Sathynarayan, E., & Nandurkar, S. D. 2020. Study of soil chemical properties, available sulphur and micronutrients status of soils in Solapur district of Maharashtra. Indian Journal of Pure & Applied Bioscience. 8(6), 67-72.

Jackson, M. L. Soil Chemical analysis. Prentice Hall of India Pvt. Ltd. New Delhi, 1973.

Kanwar, J. S. and Chopra, S. L. 1976. Practical agricultural chemistry (New Delhi).

More, S. D., Adsul, P. B. and More, A. B. 2005. Bulletin on soil, water, and tissue testing technology for quality Agril. Production VNMKV, Parbhani.

Muhr, G. R., Datta, N. P., Subramoney, S. H., Liley, V. K. and Danahue, R. R. 1965. soil testing in India. US agency for international development, New Delhi 11-12.

Nirawar, G. V., Mali, C. V. and Waghmare, M. S. 2009. Physico-chemical characteristics and status of available N, P and K in soils from Ahmedpur tahsil of Latur district. An Asian Journal of Soil Science. 4(1), 130-134.

Patil, P. L., Bansode, C., Pawdashetti, D., Ramachandraiah, H. C., Devaranavadagi, V. S., Naik, A., Hundekar, S. T. and Dasog, G. S. 2018. Identification of soil fertility constraints by GIS in northern dry zone of Karnataka for site specific recommendations. Journal Farm

Science. 31 (1), 54-63.

Patil, P. B., Jatkar, P. R. and Adsul, P. B. 2019. Physico-chemical properties in soils from Washi tahsil of Osmanabad district. Journal of Pharmacognosy and Phytochemistry. 8(4), 149-151.

Piper, C. S. 1966. Soil and Plant analysis. Hans Publisher, Bombay.

Ramamurthy, B. and Bajaj, J. C. 1969. Available N, P and K status of the Indian soils. Fertilizer News. 14 (8), 24-26.

Ramana, Y. V., Singh, L. K., Jat, Santosh K., Meena, Lakhapati, Singh, H. S. Jatav and Alpana Paul. 2015. Available macro nutrient status and their Relationship with Soil physico-chemical properties of Sri Ganganagar District of Rajasthan, India. Journal of Pure and Applied Microbiology. 9(4), 2887-2894.

Shinde, Y. R. 2007. Physico-chemical properties and nutrient availability of soils of Udgir and Deoni tahsil of Latur district, M.Sc. Thesis Vasantrao Naik Marathwada Agril. University, Parbhani.

Waikar, S. L., Patil, V. D. and Dhamak, A. L. 2014. Status of macro nutrients in some soils of central farm of MKV, Parbhani (Maharashtra). International Journal of Agriculture and Veterinary Science. 7(12), 54-57.

Walkley, A. and Black, I. A. 1934. An examination of the digital seff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science. 37, 29-38.