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Research Article

Assessment of Soil Fertility Status for Sustainable Agricultural Production in Chithamur Block, Kanchipuram District, Tamil Nadu, India

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ABSTRACT

Soil fertility evaluation in a particular region is a crucial aspect in the perspective of sustainable agricultural production. The nutrient status of the soil governs the fertility and overall crop growth and yield. The Chithamur block of Kanchipuram District in Tamil Nadu was selected for the nutrient fertility indexing study. Fifteen representative villages with high agriculture potential areas were chosen as study location and totally 678 surface soil sample (0 – 30 cm) were collected and analysed for physico – chemical properties, available macro nutrients (N, P and K), Secondary nutrients (Ca, Mg and S) and Micronutrients (Zn, Mn, Fe, Cu and B) status. Results revealed that the pH of most of the sample were neutral, Electrical conductivity (EC) was harmless and the Organic Carbon (OC) which is the key indicator of nutrient fertility was low. The available nitrogen and potassium were low whereas the phosphorus was low in acidic soils and high in alkaline soils. Almost all the secondary nutrients (Ca, Mg and S) and the micro nutrients (Zn, Mn, Cu and B) were found to be low and deficient respectively while the Fe alone showed sufficient status. Overall the fertility status of the Chithamur block was noticed to be poor and the outcome of this study has provided an insight into the unbalanced fertilization practices adopted in this block. Therefore, there is a critical need to adopt technologies like "lean farming" which is the judicious combination of organic, bio and inorganic inputs without compromising on the yield potentialities as well as ecological sustainability.

Keywords: *Soil fertility, Available nutrient, Low fertility, Balanced fertilization, Lean farming.*

INTRODUCTION

Agriculture is the main sector which is contributing about 15 per cent of National Gross Domestic Product (GDP) and thus, it is the backbone of Indian economy. The fifty percent of Indian population is solely or partially dependent on agriculture and allied activities for their day to day life (Amutha, 2013).

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Soil, land and water are the three basic resources which are essentially required for the sustainable human life and agricultural development (Das, Bandyopadhyay, Chakraborty, Srivastava, & Rajeev, 2009). The sustainable management of soil and water resource is the biggest challenge for the researchers, administrators and also farmers to ensure safe food, water and environment for the now and future (Das, 1998; Kanwar, 2000). Soil is the key component of the universe, significantly plays a role not only in the production of food, fodder and fiber but also in the maintenance of environmental quality. For centuries, Asian farmers have practiced a cultural system with ensured stable yield as well as desired fertility level of soil. The trend of cultivation of high yielding varieties, increased usage of chemical fertilizers, pesticides and herbicides etc started during the 1960s in India to make the country self sufficient in food grains production. Though the increased production ensured the nutritional security in the country; the intensive cultivation of high yielding varieties and the usage of fertilizers have led to the decreased utilization of organic manures, crop residues and nutritional imbalance in the soils. The primary reason for the deficiency is the low contents of secondary and micronutrients whereas the secondary reason was soil properties which reduce the availability of nutrients (Sharma & Chaudhary, 2007). So, there is a need to determine the fertility status of the soil for the sustainable use of land to increase crop production. Nowadays, farmers have increased the usage of chemical fertilizers and herbicides in order to achieve more yields and also practicing continuous cropping without any fallow cycles (Zhang & Zhang, 2007). Loss of productivity has been directly related to the loss of soil organic matter (SOM) and stored nutrients due to intensive agriculture (Juo & Manu, 1996).

Soil nutrient indexing is a novel view to understand the soil properties at the field scale and it is essential for optimizing agricultural management practices and assessing the effects of agriculture on environmental quality (Cambardella, Moorman, Novak, Parkin, Karlen, Turco, & Konopka, 1994). Soil Fertility Indexes (SFI) have been used as an estimation of spatial variability in soil measurements in soil fertility studies (Andrews, Karlen, & Cambardella, 2004). A high SFI value indicates the spatial variability of a single measurement (Mukashema, 2007). Since, Soil Fertility Index varies with both spatially and temporally, soil fertility recommendations and management must be approached with sustainable agricultural as well as environmental view. If the soil fertility index and map show the distribution and status of soil nutrients along with their spatial variability, it will be easy for the farmers to evaluate the fertility status of their own fields and further they can choose the appropriate land management practice (e.g. fertilizer type, application time and concentration as well as the most suitable crop type to harvest). It will be useful in delineating specific areas where deficiencies or toxicities are likely for agriculture, and in determining localized soil characteristics that may be associated with such problems. With these view points, in the present study the nutrient index value for Chithamur block of Kanchipuram District, Tamil Nadu, India was calculated using different soil parameters such as pH, EC, organic carbon, primary, secondary and micro nutrients. Further, the soil fertility status was also assessed for the Chithamur block of Kanchipuram District, Tamil Nadu, India based on nutrient value index in order to recommend the farmers to follow good agriculture practices.

I. STUDY AREA

Kanchipuram District is situated on the North East coast of Tamil Nadu. The district is bounded by Bay of Bengal in the East side while it is surrounded by Vellore and Thiruvannamalai Districts in the west, Thiruvallur and Chennai Districts in the north, and Villuppuram District in the south. It lies between 11° 00' to 12° 00' latitudes and 77° 28' to 78° 50' longitudes. The total geographical area of the district is 4, 43, 210 hectares and it has a coastline of 57 km. The entire district has uniform pre-monsoon rainfall but the coastal regions are receiving more rainfall than interior regions. If the monsoon fails, a distress condition will be developed. Northeast and Southwest monsoon are the majorly contributing with 54% and 36% each to the total annual rainfall. During normal monsoon, the District receives a rainfall of 1200 mm. Agriculture is the main occupation of the people with 47% of the population engaged in it. Paddy is the major crop cultivated whereas other crops such as Groundnut, Sugarcane, Cereals & Millets and Pulses are also cultivated. Kanchipuram District covers major soil resources of Red Sandy Loam, Clay Loam and Saline Coastal Alluvium. The main sources of irrigation are Palar River along with Tanks and wells. The study area Chithamur block (Fig. 1) is a revenue block in the Kanchipuram District of Tamil Nadu, India covering total geographical area of 33872 ha.

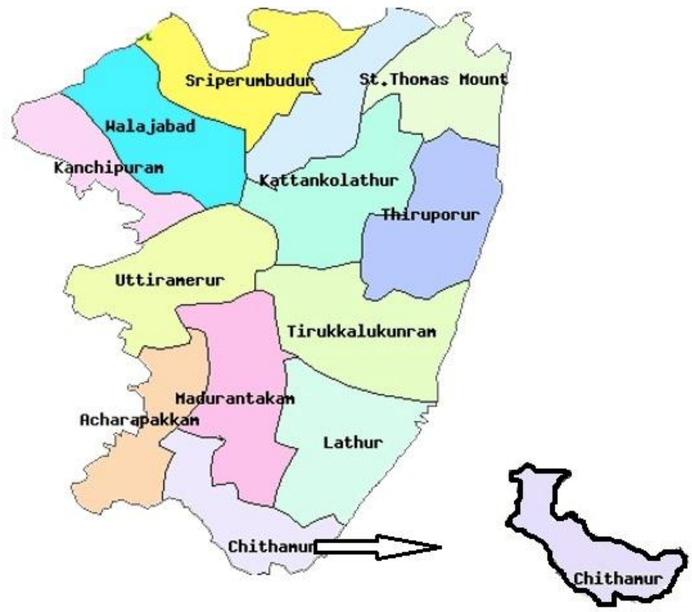

Fig. 1: Study Area Chithamur block in the Kanchipuram District of Tamil Nadu

The block has 65 villages and there are total 22279 families in this block. As per Census 2012-13, Chithamur population is 121098 persons. Out of total population count the working people of Chithamur block is 50.09% while 49.91% were non-working. And out of 50.09 % employed persons, 10.24% people are totally dependent on farming. The Chithamur block is dominated by red soil and major crops cultivated in this area are paddy, sugarcane and groundnut. The source of irrigation is a well with net area irrigated is 14678 ha. Though agriculture is the main occupation of Kanchipuram District but only sporadic information on soil characteristic and nutrient status are available. Since inventory of detailed and systematic information on soil chemical properties, available macro and micronutrients status of the soils help in demarcating areas where the application of particular nutrient is needed for profitable crop production, the effort has been taken with main objective to study the present nutrient status of Chithamur block of Kanchipuram District and to prepare soil nutrient index.

MATERIALS AND METHODS

A. COLLECTION OF SOIL SAMPLES

Totally 678 surface soil samples covering 15 major villages in Chithamur block of Kanchipuram District were collected randomly at 0-30 cm depth by adopting the standard procedures of soil sample collection. The collected soil samples were air dried, gently bound, sieved using 2 mm sieve for almost all the analysis and 0.5 mm sieved sample used only for organic matter estimation. The processed soil samples were preserved in polythene bags for further analysis.

B. CHEMICAL EXAMINATION OF SOIL SAMPLES

The chemical examination of the soil samples of all the sites was done using standard procedures following 'Guide to laboratory establishment for plant nutrient analysis' by Food and Agriculture Organization (FAO) of United Nations, 2008 and Methods of Analysis of Soils, Plants, Waters, Fertilizers and Organic Manures by HLS Tandon, Fertilizer Development and Consultation Organization (FDCO), 2009. The following formula was used for the calculation of Nutrient index values

NIV = [(PH*3) + (PM*2) + (PL*1)] / 100

Where,

NIV = Nutrient Index Value

PL, PM and PH are the percentage of soil samples falling under the categories such as low, medium and high nutrient status and given numerical value of one, two and three respectively (Ramamurthy and Bajaj, 1969). Fertility ratings and corresponding index values are given in Table 1.

Table 1: Fertility Rating Class and Nutrient Index Value

S.No	Nutrient Index	Value
1	Low	<1.67
2	Medium	1.67-2.33
3	High	>2.33

RESULTS AND DISCUSSION

Based on the different physico-chemical properties of soil such as pH, EC, organic carbon, macro nutrients, secondary nutrients and micronutrients, soil fertility index were calculated and the soil fertility status of Chithamur block of Kanchipuram District was assessed. The results are discussed below.

A. Soil pH

The data pertaining to Range, Mean Values, Percent Sample Category, NIV and Fertility Rating of physico – chemical properties for Chithamur block of Kanchipuram District is given in the Table 2 where the pH of the soil sample ranges from 4.49 – 9.17 with mean value of 7.15. Among the total villages studied, nearly about 24.04, 39.23 and 36.73 per cent of samples were grouped under acidic, neutral and alkaline category respectively (Table 3). The fertility rating for pH based on nutrient index values ranged from acidic to alkaline and as a whole the block showed neutral pH. The variation in pH may be due to the inherent heterogeneity of soils and to some extent due to influence of resource region specific differences in the cultural and fertilizer management practices. The results were in accordance with those of Vijaya Kumar, Bakiyathu Saliha, Kannan and Mahendran (2015).

Table 2: Range, Mean Values, NIV and Fertility Rating of physico chemical properties for Chithamur block of Kanchipuram District

Parameters	Range	Mean	NIV	Fertility Rating
pH	4.49 – 9.17	7.15	2.13	Neutral
EC	0.02 – 3.35	0.17	1.02	Harmless
OC	0.05 – 1.28	0.46	1.27	Low

Table 3: Percent Sample Category of physico chemical properties for Chithamur block of Kanchipuram District

S. No	Parameters	Percent Sample Category	
1.	**pH**	**pH values**	**Range (No. of samples; %)**
		< 6.5 (Acidic)	4.49 – 6.50 (163; 24.04%)
		6.5 -7.5 (Neutral)	6.51 – 7.50 (266; 39.23%)
		>7.5 (Alkaline)	7.51 – 9.17 (249; 36.73%)
2.	**EC**	**EC values**	**Range (No. of samples; %)**
		< 1.0 (Harmless)	0.02 – 0. 97 (669; 98.67%)
		1.0 – 2.0 (Normal)	1.09 – 1.86 (7; 1.03%)
		> 2.0 (Harmful)	2.29 & 3.35 (2; 0.29%)
3.	**OC**	**OC values**	**Range (No. of samples; %)**
		< 1.0 (Low)	0.09 – 0.99 (521; 76.84%)
		1.0 – 1.5 (Medium)	1.0 – 1.49 (129; 19.03%)
		> 1.5 (High)	1.52 – 2.21 (28; 4.13%)

B. Electrical Conductivity (EC)

The Electrical Conductivity (EC) furnished in the Table 2. shows that the EC of the soil samples ranges from 0.02 – 3.35 mS/cm with mean value of 0.17 mS/cm and among total samples studied, the percent sample coming under harmless, normal and harmful were 98.67, 1.03 and 0.29 per cent respectively (Table 3.). Same way, the fertility index value for the whole block shows that the electrical conductivity was harmless. On the basis of limits suggested by Muhr, Datta. Shankara, Dever, Lecy and Donahue (1965) for judging salt problems of soils, most of the samples were found to be harmless. The low status of EC may be due to leaching of salts to lower horizons as suggested by Singh and Mishra (2012).

C. Organic Carbon (OC)

The data recorded on the Table 2 revealed that the organic carbon content of the studied block ranges from 0.05 – 1.28 % with mean value of 0.46 %. The per cent sample category were grouped as low, medium and high were 76.84 19.3 and 4.13 per cent falls under those category respectively (Table 3.). On the whole, the nutrient index value was rated as low for the studied block. Majority of the study area was found low in organic carbon content as the soil and remaining areas recorded medium organic carbon content. It might be due to low usage of inputs such as FYM and crop residues etc. In another point of view, the reason might be the rapid decomposition of organic matter due to high temperature. The organic matter degradation and removal taken place at faster rate coupled with low vegetation cover thereby, leaving less changes of accumulation of organic matter in the soil. These observations are in accordance with Govindarajan and Datta Biswas (1968); Pulakeshi, Patil, Dasog, Radder, Bidari and Mansur (2012).

D. Available Macro nutrients

Chithamur block recorded low nitrate content as per nutrient index value were the content ranges from 0.10 – 167.60 mg kg^{-1} with mean value of 9.23 mg kg^{-1} (Table 4) with sample category low, medium high of 83.78, 10.77 and 5.46 percent in each category respectively (Table 5). The low nitrogen in soil might be due to several factors, such as lower organic carbon and high pH. Soil available nitrogen had significant and positive correlation with organic carbon content. These findings are related with those of Sharma and Singh (2001) and Rakesh, Sarkar, Singh, Agarwal and Karmakar (2009). The phosphorus content of the acidic and alkaline soil was recorded separately in the Table 4 in which the phosphorus content of the acidic soil ranges from 0.60 – 198.60 mg kg^{-1} with mean value of 58.64 mg kg^{-1} among which 78.10, 1.25 and 20.63 percent samples comes under low, medium and high category (Table 5). The nutrient index value of the phosphorus for the acidic soil is rated as low. The low status of available phosphorus, which may be due to low CEC, low clay content and acidic soil reaction of <6.5 (Anon, 2003). Similar trends were noticed in the results of Pulakesh et al. (2012). Similarly, the phosphorus content of the alkaline soil ranged from 0.40 – 199.0 mg kg^{-1} with mean value of 65.20 mg kg^{-1}. The percent samples coming under low, medium and high were 13.90, 7.34 and 78.76 per cent respectively and the nutrient index value of the block on the whole indicates that the phosphorus content is high in alkaline soils of Chithamur block. The reason for the high status of phosphorus in alkaline soil may be due to injudicious and long term application of fertilizer by the farmers without assessing the soil available P status. Similar results were observed with Vijaya Kumar et al. (2015). The data on potassium content of Chithamur block (Table 4) ranges from 1.00 – 1805.0 mg kg^{-1} with mean value 54.44 mg kg^{-1} and the percent sample coming under the category low, medium and high were 98.53, 0.15 and 1.33 percent respectively (Table 5.). The nutrient index value shows that the potassium content of Chithamur block was rated as low. The results were in agreement with Ravikumar and Somashekar (2013).

Table 4: Range, Mean Values, NIV and Fertility Rating of Macro nutrients for Chithamur block of Kanchipuram District

Parameters	Range	Mean	NIV	Fertility Rating
N as NO_3^- (mg kg^{-1})	0.10 – 167.60	9.23	1.22	Low
P **(Acidic)** (mg kg^{-1})	0.60-198.60	58.64	1.43	Low
P **(Alkaline)** (mg kg^{-1})	0.40 -199.00	65.20	2.65	High
K (mg kg^{-1})	1.00 – 1805.00	54.44	1.03	Low

Table 5: Percent Sample Category of Macro nutrients for Chithamur block of Kanchipuram District

S. No	Parameters	Percent Sample Category	
1.	**N as NO_3^- (mg kg^{-1})**	**NO_3^- values**	**Range (No. of samples; %)**
		< 14.0 (Low)	0.10 – 13.80 (568; 83.78%)
		14.0 -20.0 (Medium)	14.0 – 19.80 (73; 10.77%)
		>20.0 (High)	20.10 – 167.60 (37; 5.46%)
2.	**P (mg kg^{-1})**	**P (Acidic soil) values**	**Range (No. of samples; %)**
		< 100.0 (Low)	0.6 – 98.1 (125; 78.10%)
		100.0 (Medium)	100.3 & 100.5 (2; 1.25%)
		>100.0 (High)	102.1 - 200 (33; 20.63%)
		P (Alkaline soil) values	**Range (No. of samples; %)**
		< 15.0 (Low)	BDL – 14.8 (72; 13.90%
		15.0 -22.0 (Medium)	15.0 – 21.9 (38; 7.34%)
		>22.0 (High)	22.4 - 200 (408; 78.76%)
3.	**K (mg kg^{-1})**	**K values**	**Range (No. of samples; %)**
		< 150 (Low)	1.0 – 144.0 (668; 98.53%
		150(Medium)	153 (1; 0.15%)
		>150 (High)	168 – 1805 (9; 1.33%)

E. Available Secondary nutrients

The secondary nutrients such as calcium, magnesium and sulphur content of Chithamur block shown in the Table 6 were rated as low according to nutrient index value. The calcium content ranges from 110.0 – 2835.0 mg kg^{-1} with mean value of 1198.26 mg kg^{-1}, the magnesium content ranges from 16.5 – 712.0 mg kg^{-1} with mean value 302.58 mg kg^{-1} and the sulphur content of the Chithamur block ranges from 0.20 – 832.50 mg kg^{-1} with mean value 17.61 mg kg^{-1}. The percent sample coming under the category of low, medium and high were 83.92, 0 and 16.08 percent for calcium, 82.89, 2.51 and 14.60 percent for magnesium and 82.45, 0.74 and 16.81 percent for sulphur nutrient (Table 7). Low and medium level of available sulphur in soils of the area might be due to the continuous removal of sulphur by the plants without any addition of sulphur to the soil through inputs (Balanagoudar, 1989). Low organic carbon may also influence sulphur status. There is a positive correlation between available sulphur and organic matter. This relationship existed because most of the sulphur is associated with organic matter (Nor, 1981). Similar results were noticed with Pulakesh et al. (2012). The presence of exchangeable Ca and Mg are attributed to the type and amount of clay, present in these soils (Alur, 1994). The low level of these exchangeable bases may be due to easy leaching of bases and low organic carbon values. These results are in confirmation with the findings of Pulakesh et al. (2012).

Table 6: Range, Mean Values, NIV and Fertility Rating of Secondary nutrient for Chithamur block of Kanchipuram District

Parameters	Range	Mean	NIV	Fertility Rating
Ca (mg kg^{-1})	110.00 – 2835.00	1198.26	1.32	Low
Mg (mg kg^{-1})	16.50 – 712.00	302.58	1.32	Low
S (mg kg^{-1})	0.20 – 832.50	17.61	1.34	Low

Table 7: Percent Sample Category of Secondary nutrient for Chithamur block of Kanchipuram District

S. No	Parameters	Percent Sample Category	
1.	**Ca (mg kg^{-1})**	**Ca values**	**Range (No. of samples; %)**
		< 2000 (Low	110 – 1199 (569; 83.92%)
		2000 (Medium)	-
		>2000 (High)	2005 – 2835 (109; 16.08%)
2.	**Mg (mg kg^{-1})**	**Mg values**	**Range (No. of samples; %)**
		< 500 (Low)	16.50 – 498 (562; 82.89%)
		500 (Medium)	500.1 – 500.9 (17; 2.51%)
		> 500 (High)	510 – 712.0 (99; 14.60%)
3.	**S (mg kg^{-1})**	**S values**	**Range (No. of samples; %)**
		< 20.0 (Low)	BDL – 19.90 (559; 82.45%)
		20.0 – 30.0 (Medium)	20.20 – 20.90 (5; 0.74%)
		> 30.0 (High)	21.20 – 832.50 (114; 16.81%)

F. Available Micronutrients

The data on micronutrient were recorded in the Table 8 in which the nutrient index value indicates the Zn, Mn, Cu and B were deficient while the Fe content was sufficient. Overall, the Zn content of the studied block ranges from 0.03 – 4.00 mg kg^{-1} with mean value 0.61 mg kg^{-1} while the Mn ranges from 0.15 – 80.34 mg kg^{-1} with mean value of 10.07 mg kg^{-1}. The Fe content ranges from 0.11 – 231.30 mg kg^{-1} with mean value 28.14 mg kg^{-1}, the Cu content of the soil samples on the whole ranges from 0.11 – 7.01 mg kg^{-1} with mean value 1.39 mg kg^{-1} and the B content were ranges from 0.00 – 1.70 mg kg^{-1} with mean value of 0.08 mg kg^{-1}. The percent samples were categorized as deficient, sufficient and excess in which about 97.94, 1.77 and 0.29 percent of samples were recorded for Zn respectively; whereas 68.88, 17.55 and 13.57 percent samples were recorded for Mn; while 39.53, 19.76 and 40.71 percent sample for Fe, Cu recorded 88.64, 7.96 and 3.39 percent and 99.12, 0.74 and 0.15 percent were recorded for B (Table 9).

Table 8: Range, Mean Values, NIV and Fertility Rating of Micro nutrient for Chithamur block of Kanchipuram District

Parameters	Range	Mean	NIV	Fertility Rating
Zn (mg kg^{-1})	0.03 – 4.00	0.61	1.02	Deficient
Mn (mg kg^{-1})	0.15 – 80.34	10.07	1.44	Deficient
Fe (mg kg^{-1})	0.11 – 231.30	28.14	2.01	Sufficient
Cu (mg kg^{-1})	0.11 – 7.01	1.39	1.14	Deficient
B	0.00 – 1.70	0.08	1.01	Deficient

Table 9: Percent Sample Category of Micro Secondary nutrient for Chithamur block of Kanchipuram District

S. No	Parameters	Percent Sample Category	
1.	**Zn (mg kg^{-1})**	**Zn values**	**Range (No. of samples; %)**
		< 2.5 (Low)	0.03 – 2.46 (664; 97.94%)
		2.5 – 3.5 (Medium)	2.55 – 3.24 (12; 1.77%)
		> 3.5 (High)	4.00 & 4.00 (2; 0.29%)
2.	**Mn (mg kg^{-1})**	**Mn values**	**Range (No. of samples; %)**
		< 10.0 (Low)	0.15 – 9.98 (467; 68.88%)
		10.0 – 20.0 (Medium)	10.01 – 19.78 (119; 17.55%)
		> 20.0 (High)	20.15 – 80.34 (92; 13.57%)
3.	**Fe (mg kg^{-1})**	**Fe values**	**Range (No. of samples; %)**
		< 9.0 (Low)	0.0911 – 8.99 (268; 39.53%)
		9.0 – 20.0 (Medium)	9.02 – 19.87 (134; 19.76%)
		> 20.0 (High)	20.11 – 231.30 (276; 40.71%)
4.	**Cu (mg kg^{-1})**	**Cu values**	**Range (No. of samples; %)**
		< 2.5 (Low)	BDL – 2.50 (601; 88.64%)
		2.5 – 3.5 (Medium)	2.54 – 3.47 (54; 7.96%)
		> 3.5 (High)	3.51 – 7.01(23; 3.39%)
5.	**B (mg kg^{-1})**	**B values**	**Range (No. of samples; %)**
		< 0.8 (Low)	0 – 0.80 (672; 99.12%)
		0.8 – 1.4 (Medium)	0.90 – 1.20 (5; 0.74%)
		> 1.4(High)	1.70 (1; 0.15%)

In most of the soils, zinc may be precipitated as hydroxides and carbonates under alkaline pH range. Therefore, their solubility and mobility may be decreased resulting in reduced availability (Arora, 2002). Similar trend were also reported by Pulakesh et al.

(2012). Manganese content is generally influenced by two more factors such as clay and basic soil productivity (BSP) which were found crucial in deciding the availability of manganese (Sharma & Chaudhary, 2007). The sufficient quantity of Fe content in the soil may be due to the influence of parent material (Nahak, 2016) and is the result were comparable with those reported by Talukdar, Basumatary and Dutta (2009). The soil properties such as pH, organic matter content, cation exchange capacity, content of clay, fine silt, coarse silt, and available P had a strong influence over the concentration of Cu in soil (Pendias & Pendias, 2001; Sterckeman, Douay, Baize, Fourrier, Proix, & Schvartz, 2004; Vega, Covelo, Andrade & Market, 2004; Mico, Recatala, Peris, & Sanchez, 2006). The available copper was decreased and it might be due to precipitation of copper as copper hydroxide in soil. Thus, the formed hydroxide would become the part of lattice or occluded with the hydroxides of Fe, Al and Mn (Jegan & Subramanian, 2006). As per the results of boron, several factors including soil pH, calcium, soil texture, organic matter, light and moisture are known to influence the availability level of boron in soil (Orlov, 1992). However the fact, boron deficiency may also occur in non irrigated area with high calcareousness causes B precipitation as calcium borate **(**Gupta, 1974). Similar trend was noticed by Deshmukh (2012).

CONCLUSION

The present study reveals that the soils are highly deficient in nutrients and suffers from poor soil fertility status. One of the main reasons for declining productivity is the lack of knowledge, awareness among the farmers and also non adoption of sustainable crop management strategies including comprehensive soil health management. Nowadays there is growing need for balanced fertilization and site specific fertilizer recommendations according to the crop type, yield level and soil conditions. With the obligatory need for intensification of crop production, the demand of crops for readily available soil nutrient increases. Strengthening and finding out right sources of amendments for improving fertility of problem soils, which will also supply more than one nutrient to economize the crop production, may be adopted as a means to improve problem soil and making wealth out of poor fertile lands. One such technology adopted is called as “Lean Farming” has been found to be effective in addressing the issue of declining soil health and fertility, over usage of unwarranted agro-chemicals without compromising on crop productivity and profitability of the farmers. The concept of Lean farming technologies is the judicious combination of organic, bio and inorganic inputs without compromising on the yield potentialities of high yielding varieties as well as environmental safety and ecological sustainability. The advantage of the concept of Lean Farming is applicable to all crops and cropping systems. It also does not deviate much from the conventional farming practices but only improves upon the existing practices and makes it simple for adoption by farmers. Lot of efforts was made and provided to farmers of Chithamur block to fulfill those gaps on knowledge constraints and the resultant capacity to learn and implement the technologies. The voluntary involvement of farmers and growers in adopting and implementing those above mentioned technologies and recommendations is very essential to bring improvement in their overall well being and income status by achieving good yield of crops. Thus, higher crop productivity through maintaining the soil health and fertility conditions can be achieved through sustainable crop management and lean farming practices in Chithamur block of Kanchipuram District, Tamil Nadu.

REFERENCES

Alur, A. S. (1994). Properties of Red Soils of Agroclimatic Zone-3 (Region II) of North Karnataka (Doctoral dissertation, University of Agricultural Sciences).

Amutha, D. (2013). Present Status of Indian Agriculture. *Available at SSRN 2739231*.

Andrews, S. S., Karlen, D. L., & Cambardella, C. A. (2004). The soil management assessment framework. *Soil Science Society of America Journal*, *68*(6), 1945-1962.

Anonymous (2003). *Malaprabha Command Area: Annual Progress report of AICRP on Water Management, Belvatagi*, Univ. Agril. Sci., Dharwad (India).

Arora, C. L. (2002). Analysis of soil, plant and fertilizer. *Fundamentals of Soil Science*, 548.

Balanagoudar, A. B. (1989). Investigation on status and forms of sulphur in soils of North Karnataka. *M. Sc.(Agri.) Thesis*.

Cambardella, C. A., Moorman, T. B., Parkin, T. B., Karlen, D. L., Novak, J. M., Turco, R. F., & Konopka, A. E. (1994). Field-scale variability of soil properties in central Iowa soils. *Soil science society of America journal*, *58*(5), 1501-1511.

Das, D. K., Bandyopadhyay, S., Chakraborty, D., & Srivastava, R. (2009). Application of modern techniques in characterization and management of soil and water resources. *Journal of the Indian Society of Soil Science*, *57*(4), 445-460.

Das, D.K. (1998). *Remote sensing application in management of agricultural resources. Research Highlights.* Indian Agricultural Research Institute, New Delhi.

Deshmukh, K. K. (2012). Evaluation of soil fertility status from Sangamner area, Ahmednagar district, Maharashtra, India. *Rasayan journal of Chemistry*, *5*(3), 398-406.

Govindarajan, S. V., & DattaBiswas, N. R. (1968). Characterization of certain soils in the sub-tropical humid zone in the south eastern part of Indian soils of Muchkand basin. *J. Indian Soc. Soil Sci*, *16*, 117-186.

Gupta, I. C. (1974). Lithium tolerance of wheat, barley, rice and gram at germination and seedling stage. *Indian Journal of Agricultural Research*, *8*, 103-107.

Jegan, R. A. & Subramanian, K. S. (2006). Delineation of Micronutrient status of surface soils of sivaganga block, Tamil Nadu. *Madras Agricultural Journal*, *93*(7-12), 187-194.

Juo, A. S. & Manu, A. (1996). Chemical dynamics in slash-and-burn agriculture. *Agriculture, Ecosystems & Environment*, *58*(1), 49-60.

Kabata-Pendias, A. & Pendias, H. (2001). Trace elements in soils and plants, 3rd edn CRC Press. *Boca Raton, FL, USA*.

Kanwar, J. S. (2000, February). Soil and water resource management for sustainable agriculture imperatives for India.In *International Conference on Managing Natural Resources for Sustainable Agricultural Production in the 21st Century, invited papers* (pp. 14-18).

Micó, C., Recatalá, L., Peris, M., & Sánchez, J. (2006). Assessing heavy metal sources in agricultural soils of an European Mediterranean area by multivariate analysis. *Chemosphere*, *65*(5), 863-872.

Muhr, G. R., Datta, N. P., Shankarasubramoney, H., Laley, V. K., & Donahue, K. L. (1965). Soil Testing in India, US-AID. *New Delhi*, 120.

Mukashema, A. (2007). Mapping and modelling Landscape based-soil fertility change in relation to human induction. *Case Study: Gishwati Watershed of the Rwandan Highlands. ITC University of Twente, Enschede, The Netherlands*.

Nahak, T., Mishra, A., Saren, S., & Pogula, S. (2016). GPS and GIS based soil fertility maps of Ranital KVK farm and identification of soil related production constraints. *International*

Journal of Agricultural Science, *8*(51), 2242-2251.

Nahak, T., Mishra, A., Saren, S., & Pogula, S. (2016). GPS and GIS based soil fertility maps of Ranital KVK farm and identification of soil related production constraints. *International Journal of Agricultural Science*, *8*(51), 2242-2251.

Nor, Y. M. (1981). Sulphur mineralization and adsorption in soils. *Plant and Soil*, *60*(3), 451-459.

Orlov, D. S. (1992). Soil Chemistry, p.213-300. (Oxford and IBH Publishing Co, New Delhi).

Pulakeshi, H. B. P., Patil, P. L., Dasog, G. S., Radder, B. M., Bidari, B. I., & Mansur, C. P. (2012). Mapping of nutrients status by geographic information system (GIS) in Mantagani village under northern transition zone of Karnataka. *Karnataka Journal of Agricultural Sciences*, *25*(3).

Ravikumar, P. (2013). Evaluation of nutrient index using organic carbon, available P and available K concentrations as a measure of soil fertility in Varahi River basin, India. *Proceedings of the International Academy of Ecology and Environmental Sciences*, *3*(4), 330.

Sharma, B. K. & Singh, N. (2001). Characteristics and properties of soils under two dominant land use systems in western Rajasthan. *Journal of the Indian Society of Soil Science*, *49*(2), 373-377.

Sharma, J. C. & 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*, *55*(1), 40-44.

Singh, R. P. & Mishra, S. K. (2012). Available macro nutrients (N, P, K and S) in the soils of Chiraigaon block of district Varanasi (UP) in relation to soil characteristics. *Indian Journal of Scientific Research*, 97-101.

Sterckeman, T., Douay, F., Baize, D., Fourrier, H., Proix, N., & Schvartz, C. (2004). Factors affecting trace element concentrations in soils developed on recent marine deposits from northern France. *Applied Geochemistry*, *19*(1), 89-103.

Talukdar, M. C., Basumatary, A., & Dutta, S. K. (2009). Status of DTPA–extractable Cationic Micronutrients in Soils under Rice and Sugarcane Ecosystems of GolaghatDictrict in Assam. *Journal of the Indian Society of Soil Science*, *57*(3), 313-316.

Vega, F. A., Covelo, E. F., Andrade, M. L. & Marcet, P. (2004). Relationships between heavy metals content and soil properties in minesoils. *Analytica Chimica Acta 524*(1-2), 141-150.

Vijaya Kumar, M., BakiyathuSaliha, B., Kannan, P., & Mahendran, P. P. (2015). Delineation and GIS mapping of soil nutrient status of sugarcane growing tracts of Theni district, Tamil Nadu. *African Journal Agricultural Research*, *10*(3), 3281-3291.

Zhang, W. & Zhang, X. (2007). A forecast analysis on fertilizers consumption worldwide. *Environmental Monitoring and Assessment*, *133*(1-3), 427-434.