PHYSICOCHEMICAL CHARACTERISTIC'S , MACRO AND MICRO NUTRIENTS STATUS IN SOME ORGANIC AND INORGANIC FARM, SIRKALI TALUK -TAMILNADU

[1]N.PASUPATHY, [2]A.AROKIYARAJ
[1&2] PG and ResearchDepartment of Chemistry, A.V.C.College (Autonomous),
Mannampandal-609 305, Mayiladuthurai, Tamilnadu, India. pasupathi2009@gmail.com

Abstract: Soil is the medium through which crops grow to perform the need of human for food and cloths. Agriculture refers to an act hoist plants from the soil and is one of the most economical factors for human beings. in achieving better crops yield the formers should be know the soil nutrients and management .The soil nutrients.,i.e (macro and micro). The soil samples collected some selective major rice producing villages in SirkazhiTaluk of Nagapattinam District of Tamilnadu. There both inorganic and organic methods are following in cultivation .This study was conducted to asses available macro and micro nutrient status in both inorganic and organic form of soils. The specific locations of the various soil sampling area situated at different villages were identified using Global Positioning System (GPS). Totally 100 soil samples collected from different locations were analyzed for their physical parameter (pH, EC,TDS) macro (N, P, K) and micro (Cu,Fe,Zn,Mn) nutrients. The different physical parameters and macro elements were tested in laboratory. The micro elements such as copper,zinc,iron ,manganese were estimated by atomic absorption spectroscopy(AAS).

Keywords: physicochemical parameters,pH,Electrical conductivity,Organic carbon,Soil Nutrients,GPS,Sirkazhi Taluk,Tamilnadu

Introduction

Agriculture is considered as backbone of our country. Agro Chemistry is the field which give more information to agriculturists as well as farmers. For a profitable growth in these fields, we should know about soil. A soil is an entity and it is an object in nature which has certain characteristics that distinguish it from all other objects in nature. Man is dependent on soils and to a certain extent good soils are dependent upon man and the use be makes of them. His very living standard is often determined by the quality of his soils and the kinds and qualities of plants and animals on them. The soil is considered to be a natural body having depth and surface area acting as a bio chemically weathered habitat.

Allee and Park definition that "Soil is a shallow upper layer of earth formed by weathering of underlying rocks". Another definition suggested by Treshow that "Soil is a complex physical, biological system which gives water, nutrient and plants etc. Apart from these activities of soil as defined above, it also gives additional support to plants. In order to get profitable yield, the soil to be ploughed must be fertile i.e., it must contain essential nutrients namely micro and macronutrients, which are needed for the growth of the plants. Macronutrients include nitrogen, Phosphorous, Potassium (NPK), Calcium and Magnesium. These are the major constituents needed for the plant growth Micronutrients like Zinc, Copper, Manganese, Iron, Cobalt etc., are also needed for plant growth only in small amounts.

In soil, naturally all those nutrients as mentioned above are present. But only some of them are in available form, i.e., the ease with which the plant takes up the nutrients are less in some case.

For that one of the parameter called pH (Pond of hydrogenic) of the soil is important. It is called soil reaction. pH is a measure of acidity and alkalinity of the soil. At a certain pH range, i.e., 6.5- 7.5, all the nutrients are available for plants. Hence we have to maintain soil pH for the availability of all nutrients to plants.

Electrical conductivity measurements will show various types of ions present in soil solution. When the electrical conductivity is more, it affects the plant growth. The plant could not take up water from soil. The normal range of EC should be 0.1 to 0.3 when it ranges from 1.0 to 3.0, the condition becomes serious while it exceeds 3.0 it becomes critical. At this stage the plants become dry.

Role of Nutrients To Plants

Macronutrients Potassium has a number of structural functions in plants and animals. It keeps the cell cytoplasm levels relatively constant, assists in protein synthesis and energy metabolism. Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and in some cases calcium.

Calcium which is an essential part of plant cell wall structure, provides for normal transport and retention of other elements as well as the strength in the plant. It also counteracts the effects of alkali salts and organic acids within a plant.

Phosphorous occurs in soil almost entirely as phosphates ($PO^{-3,4}$) and resembles nitrogen in that both inorganic and organic forms are of major significance in agricultural soil. Agricultural soils usually cannot meet demand for phosphate and application of fertilizer is essential. Phosphorus is an essential part of the process of photosynthesis. It is involved in the formation of all oils, sugars and starches. It helps with the transformation of solar energy into chemical energy; proper plant maturation; withstanding stress, affects rapid growth and encourages blooming and root growth.

Nitrogen in the inorganic form of (NO-3) is important because it is the one utilized by plants. Crop demand for this nutrient is high thus the need to apply fertilizer. Nitrogen is a part of all living cells and is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy. Nitrogen is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis. It assists plants with rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops.

Macronutrients are essential to plant growth but utilized in trace quantities. Their major role is as activators in numerous enzyme systems. Micronutrients are toxic when they are in very high levels thus they become a threat to human and animals life and cause stunted growth and poor yield in plants .

Copper is an essential micronutrient for plants and animals. It is involved in many enzyme systems of plants and animals. Iron is an essential minor nutrient for plants and animals. It is involved in chlorophyll synthesis in chloroplast. Zinc is essential for the transformation of carbohydrates. It regulates consumption of sugars. It is part of the enzyme systems which regulate plant growth.

Nitrogen, Phosphorous and Potassium contents are essential nutrients for plants. The deficiency of the above nutrients cause poor yield.

Deficiency of Nitrogen

(i) Cause yellow appearance of leaves
(ii) Cause early shedding of leaves in fruit trees.
(iii) There is a death of lateral buds.

Deficiency of Phosphorous

(i) Phosphorous is responsible for cell division. Due to the deficiency of phosphorous the cell division is retarded and the plants have stunted growth.
(ii) The appearance of dark green colour along with purple colour in seeding stage.
(iii) The maturity of crops and also the formation of seeds are delayed.

Increase in the phosphorous content will result in the formation of algae's which affect the plant growth.

In the case of Potassium, the high quantity of Potassium in soil will be helpful for the production from pests and other harmful living things.

Deficiency of The Potassium

(i) It causes the leaf scorch in plants.
(ii) There is a dull green colour in the leaves.
(iii) Severe potassium deficiency results in 'tip burn' in which the edges of the leaves turn yellow and finally die.

Those above constituents are applied in the form of natural fertilizers as well as synthetic fertilizers such as urea, super phosphate, potash and potassium nitrate etc.

Now a day, these synthetic fertilizers are used by farmers frequently. Since the farmers in India are mainly illiterate people. They could not know about the soil nature.

Frequent usage of artificial fertilizers may affect the nature of soil and in the later stage, it becomes barren. Hence to avoid those situations, people are advised to apply natural fertilizer in proper amounts. Hence we have to analyse the fertile status of the soil. This analysis will be helpful for the farmers to enhance the profitable yield of crops.

Materials and Methods

Study Area

Nagapattinam district ,the land of religious harmony, known for its rich religious heritage was carved out by bifurcating the composite Thanjavur district on 18-10-1991.This district is spread over eight taluks with a total geographical extent of 2715.83 sq.km with the head Quarters at Nagapattinam .This district lies on the shores of Bay of Bengal between Northern Latitude 10.7906 degrees and 79.8428 degrees Eastern Longitude .The district capital 'Nagapattinam' Lies on the eastern coast ,350 kilometers down south from the state capital 'Chennai' and 145 kilometers east , from Tiruchirappalli a central place of the state.

The study area is sirkahitaluk ofNagapattinam district coastal region in the southern Tamilnadu State located in the coastal region of Bay of Bengal 11.0290373 Latitude and 79.8506815 Longitude. This taluk is spread over in 27,726 hectares of Agriculture land. Fig.1 shows the study area.

Location map of Nagapattinam district

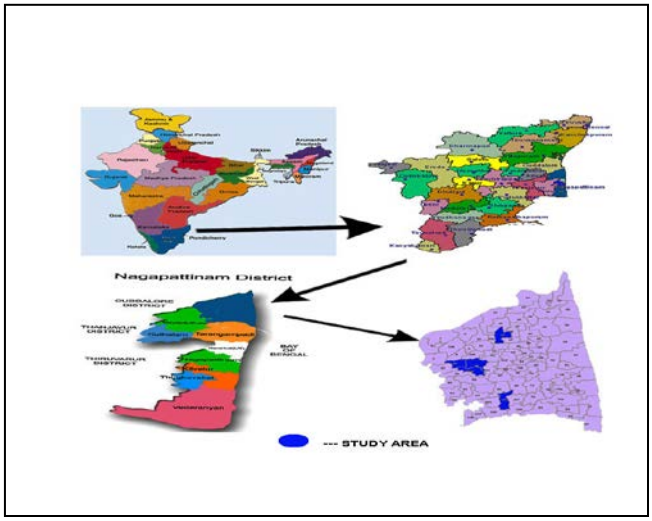

Table:1 Samples Collection GPS Location

S.no	Name of the villages	Longitute^{0}N	Latitute^{0}E
1	Agani	79^{0}25'0285''	11^{0}25'0285''
2	Athiyur	79^{0}70'1898''	11^{0}26'4408''
3	Nimmeli	79^{0}70'6630''	11^{0}23'5312''
4	Marudhangudy	79^{0}68'6824''	11^{0}23'1861''
5	Valluvakudi	79^{0}68'1739''	11^{0}25'1139''

Samples Collection

Soil samples (0-15cm) were collected from 100 sites each 50 from inorganic and organic farm (map.1) covering five selective major villages,

Preparation of the soil sample in the laboratory.

It involves the following steps

Drying,Grinding,Sieving,Mixing,Partitioning,Weighing, Storing

(i) Drying

Soil samples are dried. The soil chemical reactions in dried samples are more nearly at equilibrium. The soil samples are dried in shade at room temperature. Due to large and rapid changes that take place in the status of some ionic species on drying, many types of analysis must be carried out on moist samples immediately after collection. Examples are determinations of exchangeable ferrous iron, pH, exchangeable k, etc.

(ii) Grinding

By grinding, the soil aggregates are broken up, Roller, rubber pestle in an agate mortar, motorized grinder, wooden mortar etc., may be used for grinding. Wooden mortar is the best for avoiding contamination of other elements from the grinder itself. Crushing primary sand and gravel particles is avoided.

(iii) Sieving

There are generally two types of sieves (20 and 80 mesh) are used for sieving. The sieve should be made of brass or nylon. For micronutrient analysis nylon sieve is preferred. The sieve should possess round hole. For organic carbon, determination of pH, exchangeable cations etc. coarse sieve is used. Stones or gravels (coarser than 2mm) remaining on the screen are ignored and discarded. The "fine earth" is analysed.

Necessary correlation may then be made to express the results to refer to plough-layer volume. Though granular secondary particles are disaggregated and passed through sieve. This may be done by triturating in water. Entire partitioned sample is passed through the sieve. For silty and clayey soils, sieving a portion may be justified assuming that unsifted aggregated material is the same as that which has passed the sieve. For other soils this practice should not be done. Because, sieving only a portion of the gross sample and discarding the remainder increases the concentration of elements in the sample.

(iv) Mixing

Soil samples are spreader over a cloth or paper. Opposite corner of the cloth or paper are grasped and it is pulled diagonally across the sample slowly so that soil rolls over (but not slides) toward the opposite corner. Then the opposite corner of the cloth or paper is pulled back over the soil to roll it back. The process is repeated by grasping the other two opposite diagonals are repeated at least 5-10 times.

(v) Partition of sample

The soil samples may be partitioned by the following soil material to opposite sides.

a. Riffle technique

Riffle has a series of narrow slots. Alternate slots deliver soil material to opposite sides.

b. Quartering

The soil sample is coned in the center of the mixing sheet (polythene sheet or paper etc.) Care should be taken for making symmetry of fine and coarse soil material. The cone is flattened and divided through the center with a flat wooden sheet. One-half the foul quarters being separated into separate "quarters". Two diagonally "opposite quarters" are discarded quantitatively. The other two are mixed by rolling. This process is repeated until 250-500gm of soil material is obtained.

c. Paper quartering technique

For small samples this technique may be employed. Four strips of paper are woven together. Soil sample is coned in the center. Pulling the strips apart results in accurate quartering.

(vi) Weighing

Fine textured soil (e.g. clayey) which does not tend to segregate is weighed as usual i.e. a portion of the sample is taken with a spatula or clean fresh paper strip or spoon and weighed on a torsion of analytical balance having sensitivity 0.1-0.5 % of the sample weight . Camel's hair brush is used for completer transfer of the weighed soil material. Coarse textured soil samples, which tend to segregate, should be taken by partitioning to approximately the desired weight and then the entire portion would be weighed accurately.

(vii) Storage

Soil samples may be stored in a series of cardboard cups in a tray. Placing the samples in screw-cap jars is most satisfactory.

The Critical Levels For Dtpa Extractable Micronutrients Were Fixed (Tandon, 1999) As Follows

Fe – 3.7 mg Kg^{-1}
Mn – 2.0 mg kg^{-1}
Zn – 1.2 mg kg^{-1}
Cu – 1.2 mg kg^{-1}

The soil samples were analyzed and categorized viz.,low ,medium and high

Table:2-The Physico Chemical Parameter Standard Values(Tandon, 1999)

Physio-chemical parameter	Low	Medium	High
Soil reaction pH	<7.5	7.5-8.5	>8.5
EC(dsm-1)	<0.5	0.5-1.0	> 1.0
Organic Carbon	<0.4	0.4-0.75	> 0.75

Table:3-The Macro Nutrient Standard Values to Soil(Tandon, 1999)

Macro nutrients(kg ha-1)	Low	Medium	High
Nitrogen	< 280	280-560	> 560
Phosphorus	< 12.5	12.5-22.5	> 22.5
Pottasium	< 135	135-335	> 335

Results and Discussion

The results of all the relevant soil characteristics are described in table -3.

The inorganic and organic farm of soils are neutral to alkaline in reaction, pH of inorganic farm varied from 7.1 to 8.7 and organic farm varied from 7.3 to 8.2 ,with the mean value of pH 7.78 and 7.62. The electrical conductivity (EC) of inorganic and organic farm of soils varied from 0.4 to 0.84 dsm-1 and 0.54 to 0.82 dsm-1 with the mean values 0.048 and 0.744 dsm-1.And organic carbon (OC) of inorganic and organic farm of

soils varied from 0.35 to 0.48% and 0.27 to 0.43 % with the mean values 0.422 % and 0.38 % respectively (Table-4,Figure-2,3,4).

Available macro nutrients of nitrogen content in inorganic and organic farm of soils varied from 74.2 to 81.2 kg/ha-1 and 63.4 to 85.4 kg/ha-1 with the mean values 73.28 kg/ ha-1 and76.34 kg/ ha-1.Status of available phosphorus in inorganic and organic farm of soils varied from 1.0 to 3.5 kg/ha-1 and 1.0 to 3.7kg/ha-1 with the mean values 2.7 kg/ha-1 and 2.74 kg/ha-1.And available potassium in inorganic and organic farm of soils varied from 111.3 to141.2 kg/ha-1 and 117.5 to 121.4 kg/ha-1 with the mean values 126.28 kg/ha-1 and 120.22 kg/ha-1 (Table-4,Figure-5).

Available micro nutrients of zinc content in inorganic and organic farm of soils varied from 0.67 to 0.88 kg/ha-1 and 0.49 to 0.81 kg/ha-1 with the mean values 0.752 kg/ha-1 and 0.678 kg/ha-1.Status of available copper ,iron and manganese in inorganic of soils varied from 0.84 to 1.15 kg/ha-1,5.67 to 6.92 kg/ha-1 and 1.37 to 2.55 kg/ha-1 and organic farm of soils varied from 0.7 to 0.97 kg/ha-1, 5.79 to 8.74 kg/ha-1 and 2.14 to 2.92 kg/ha-1 with the mean values of inorganic farm 0.994 kg/ha-1,6.3 kg/ha-1 and 2.718 kg/ha-1 and farm values 0.894 kg/ha-1,0.906 kg/ha-1 and 2.57 kg/ha-1 (Table-4,Figure-6).

Table :4-Physico-Chemical,Macro And Micro Nutrients Status in Inorganic and Organifarm of Soils

S.No	Name of The Village	N.S	Physical Pharameter						Macro nutrients (mg ha-1)						Micro nutrients (kg/ha-1)							
			Inorganic form			Organic form			Inorganic form			Organic form			Inorganic form				Organic form			
			pH	EC(dsm-1)	OC%	pH	EC(dsm-1)	OC%	N	P	K	N	P	K	Zn	Cu	Fe	Mn	Zn	Cu	Fe	Mn
1	Agani	10	8.1	0.74	0.45	7.5	0.82	0.27	74.2	2.0	121.7	79.8	3.5	121.4	0.67	0.84	6.92	2.18	0.62	0.97	5.95	2.14
2	Athiyur	10	7.1	0.48	0.42	7.4	0.75	0.35	81.2	3.5	111.3	85.4	3.7	117.8	0.88	0.97	6.15	1.37	0.49	0.98	8.74	2.62
3	Nimmeli	10	7.4	0.84	0.41	7.7	0.54	0.43	55.4	3.5	124.8	85.4	1.0	125.3	0.74	1.15	6.64	2.32	0.81	0.88	6.84	2.57
4	Marudhangudy	10	7.6	0.4	0.35	8.2	0.80	0.42	81.2	1.0	141.2	63.4	2.0	119.5	0.78	1.04	5.67	2.55	0.74	0.7	5.79	2.92
5	valluvakudi	10	8.7	0.72	0.48	7.3	0.81	0.43	74.4	3.5	132.4	67.7	3.5	117.5	0.69	0.97	6.12	2.47	0.73	0.94	7.21	2.57
6	Range		7.1-8.7	0.4-0.84	0.35-0.48	7.3-8.2	0.54-0.82	0.27-0.43	74.2-81.2	1.0-3.5	111.3-141.2	63.4-85.4	1.0-3.7	117.5-121.4	0.67-0.88	0.84-1.15	5.67-6.92	1.37-2.55	0.49-0.81	0.7-0.97	5.79-8.74	2.14-2.92
7	Mean	10	7.78	0.486	0.422	7.62	0.744	0.38	73.28	2.7	126.28	76.34	2.74	120.22	0.752	0.994	6.3	2.178	0.678	0.894	0.906	2.57

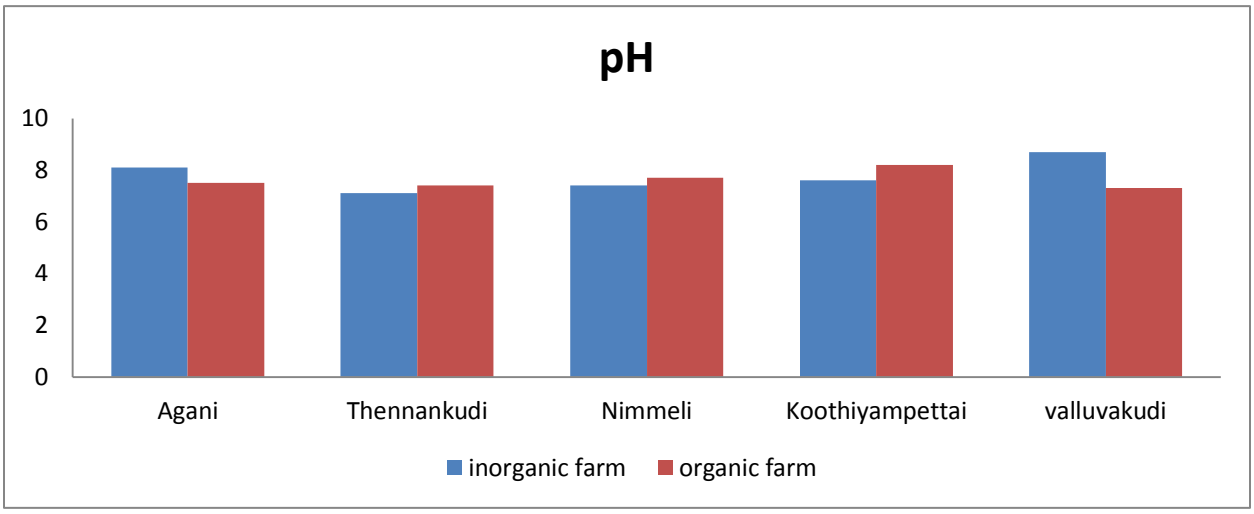

Figure :2 – Available pH in inorganic and organic farm of soils

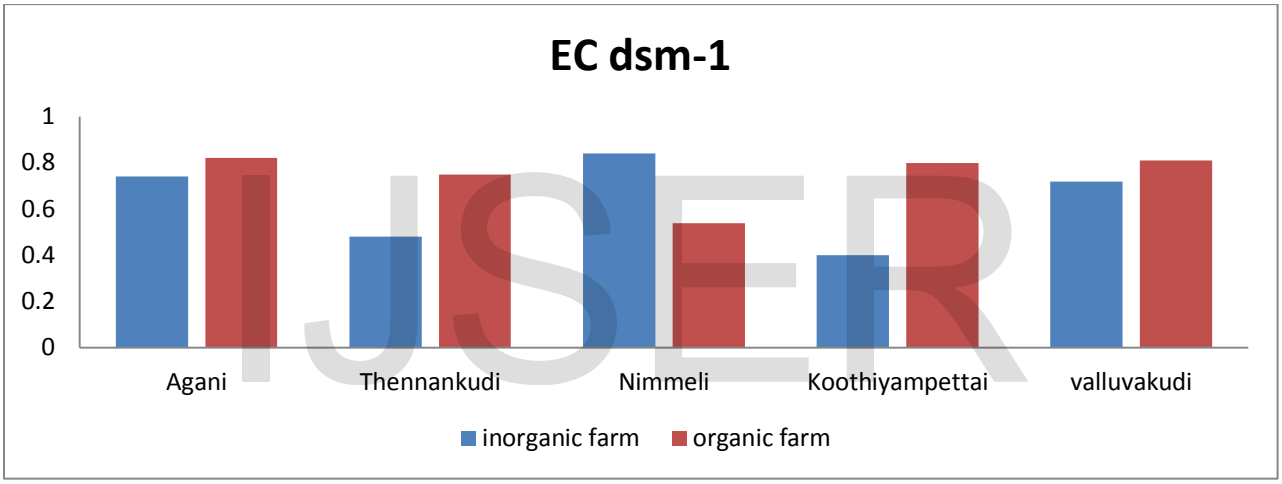

Figure:3- Available Electrical Conductivity (EC%) in inorganic and organic farm of soils

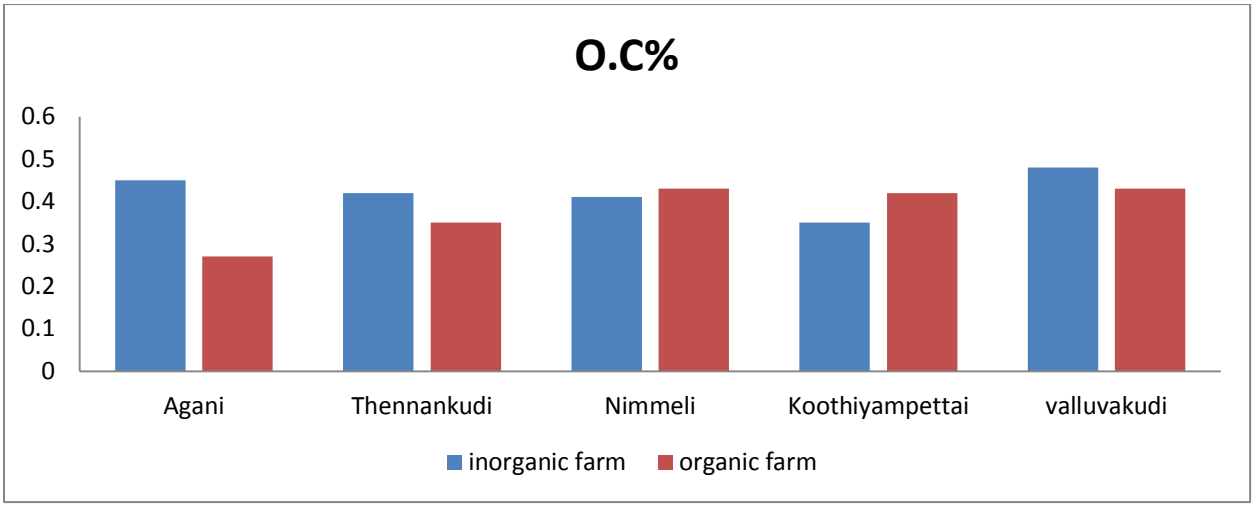

Figure:4- Available Organic Carbon (OC% in inorganic and organic farm of soils)

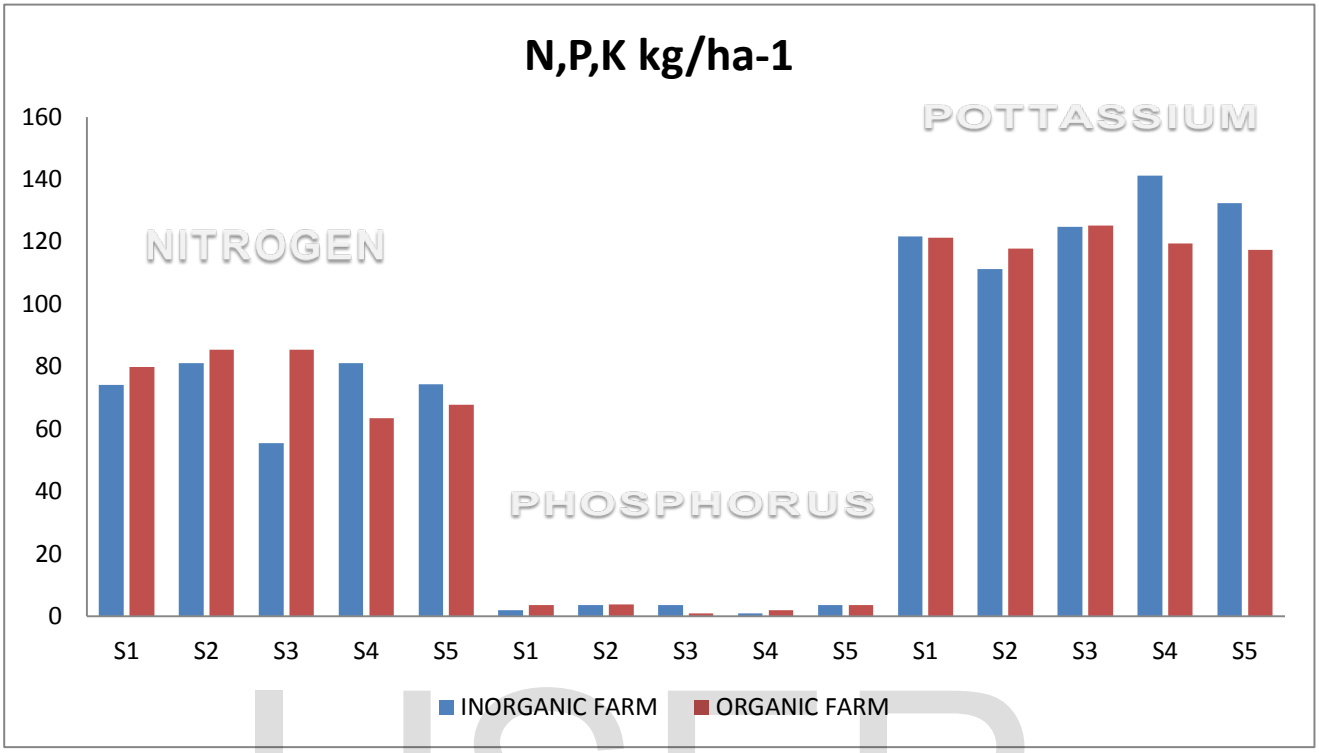

Figure:5- Available Macro Nutrients (N,P,K) in inorganic and organic farm of soils

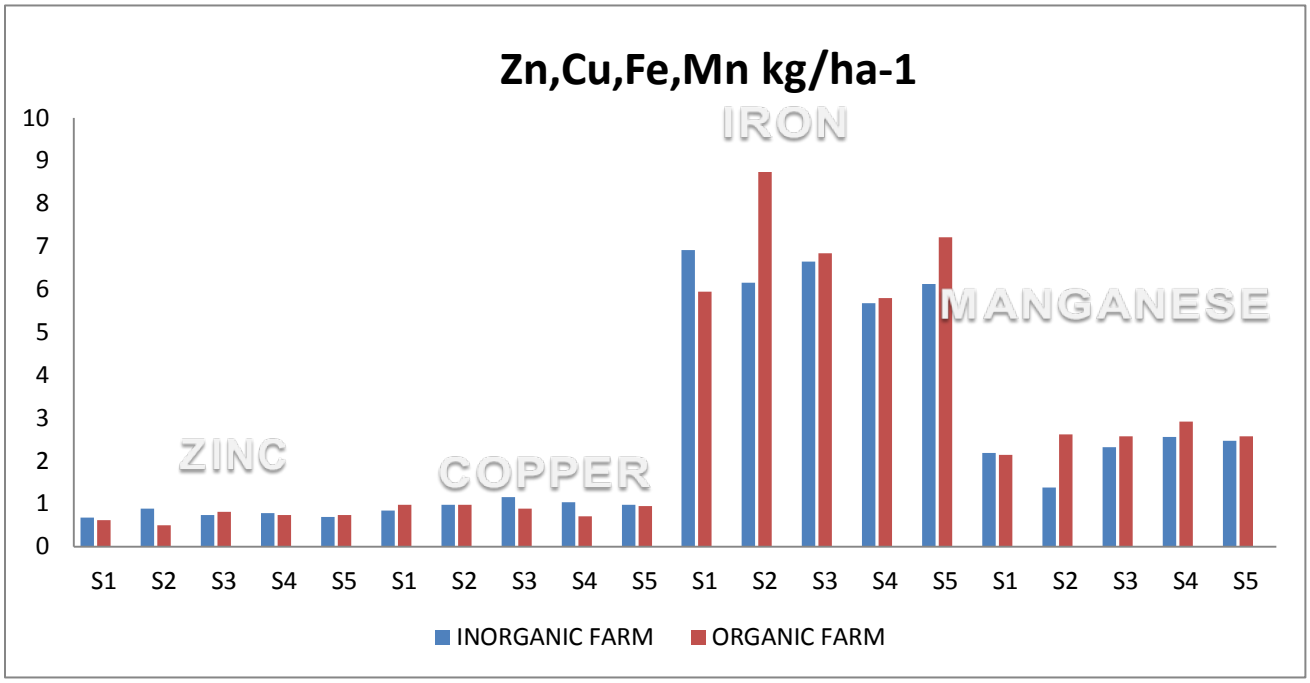

Figure:6- Available Micro Nutrients (Zn,Cu,Fe,Mn) in inorganic and organic farm of soils

Conclusions

Nutrient uptake by plants in organic manure applied field was comparatively lesser than the plants grown in inorganic fertilizer applied soil .since the decomposition and distribution of nutrients to the soil in organic manure field is slow and steady, the soil and plants grown in organic manure applied field has lesser nutrient management is recommended for production of crops for a developing and populated country like india.

The pH of inorganic soil samples are slightly higher than organic farm soils almost all are equal mean value of is higher in inorganic farm and lower in organic field

The mean value of N,Pand K are higher in organic farm and lower in inorganic farm and organic carbon in two fields are almost equal.

Micro nutrients status in inorganic and organic farm more or less equal in this present study asses the basic physic-chemical parameters, macro and micronutrients status in inorganic and organic farm soils of sirkazhitaluk. Average mean value of EC in higher then organic farm and organic carbon are almost equal in both farms.

Organic farm soil possess a sufficient level of micro nutrients than inorganic farm soil because organic decomposing materials vegetable waste ,animal and human excerpts gradually release the micro nutrient content to soil. such as the micro nutrient level is higher in inorganic farm soil and lower in organic farm soil. Because the selected field of sirkazhitaluk was recently started the organic farm methods.

Inorganic soluble salt (fertilizer) easily dissolved in water dissociated to ions. Be ionic concentration is higher in inorganic field .But organic farm ,since that decomposition and distribution of nutrients to the organic manure field slow and study the decomposition was very slow process. It release minimum quantity of nutrient to the soil, this process take up long time hence the macronutrients level is smaller than inorganic farm soil.

Integrated nutrient management is recommended for production of crops for a developing and populated country india.

References

[1] R.H.andkurtzs ,L.T.(1945);Determination of total organic and available form of phosphorus in soils.soil science,59;39-45

[2]Jackson,M.L, soil chemical analysis,prentice Hal of India Private Lmt,New Delhi(1973).

[3]R.I.Donahue,R.W.Miller and J.C.Shickluna,introduction to soil and plant growth,edition,library of A.V.C.College,mannampandal, Tamilnadu-India.

[4]Tandon,H.L.S.(1993): Methods of analysis of soils,Plants,water and fertilizer.