INNOVATIVE PRACTICES OF GREEN CHEMISTRY AND CATALYSIS IN CROP PRODUCTION BY SOIL HEALTH MANAGEMENT

Dr. Nisha Tiwari [1] , Dr. Meena Kshetrapal [2] and Dr. Madhuri Nanda [3]
Assistant Professor Chemistry
Govt Bilasa Girls PG College, Bilaspur (CG)
Bilaspur University Chhattisgarh
1. nishatiwari.cg@gmail.com , 2. meenark13@gmail.com, 3. madhuri11159@gmail.com

Abstract

Green Chemistry and Catalysis is field of applications and specific features of efficient , environment friendly process. Principle way to produce products of practical applications as plant protection agents. During transformation of starting materials into desired final products many heavy waste materials are produced which create heavy burden on environment. Problems are minimized by use of green catalyst. Major advantages of catalyst are elimination of dangerous, inconvenient and expensive reactants, low investment cost and low energy consumption.

Soil quality plays an important role in sustaining food security and essential ecosystem function. Modern techniques of farming like use of fertilizers, pesticides and insecticides replaced sound ecologically practices and heavy machinery cut short the time for soil to rejuvenate. Soil health degraded due to physical, chemical and biological changes. Apart from yield, growth decline, falling soil quality, hindered normal function of soil in chemical reactions. In fact farmers will be able to maintain soil organic carbon (SOC) and prevent soil fertility by manuring, infusion of crops by minimum disturbance to soil by simple tools. Various Physical and Chemical parameters pH, Conductance, Alkalinity, Acidity ,essential and trace elements like N, P, K, S, Zn, Fe were studied. So soil health management strategies were found out for quality production.

Soil Rejuvenation and Productivity Enhancement Project in field of agriculture is possible with the efficient use of available resources.

Materials and Methods

Soil testing is an important tool to know about soil health and prepare action plan for responsible nutrient application and reclamation of problematic soils.

Soil samples were collected and following parameters analyzed through pH meter, Conductivity meter, Flame Photometer, Spectrophotometer and by Quantitative Estimations.

1. Basic Parameters - pH, Electrical Conductivity (E C) and Organic Carbon (OC)
2. Major nutrient - N, P ,K
3. Secondary Nutrient- S
4. Micronutrient - Zn, B, Fe, Mn , Cu

In past year through KISAN HEALTH CARD recommendations for soil health management was applied in our farming land. Some of the Green Chemistry Principles were also applied on our farming land.

Result and Discussion

Soil health assessment was done by measurement of various parameters through qualitative and quantitative estimation.

Table-1 Nutrient deficiency percentage

S. No.	Nutrient	Chhattisgarh	India
1	N	100	95
2	P	100	95
3	K	59	48
4	S	-	24.7
5	Zn	20.1	43.4
6	Fe	6.8	14.4
7	Cu	3.2	6.1
8	Mn	14.1	7.9
9	B	-	20.6

Table-2 National project on soil health management in Chhattisgarh

Fund Distribution	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total amt released(lacs)
Amount released (lacs)	0	0	59.40	0	0	72.05	131.85
Manage Cost (lacs)	0	0	0	0	21.75	9.25	31.00
Fertilizers cost(lacs)	0	0	0	0	69.862	293.18	363.04
Total fund in India(lacs)	166.25	3796.00	1689.84	1129.73	851.33	1924.80	11053.96

Table-3 Effect of land degradation

S.No.	Area affected	Chhattisgarh(000 hectare)	India (000 hectare)
1	Water and wind erosion	2422	94864
2	Water logged	0	915
3	Alkali/Sodic soil	13	3708
4	Acid soil	2342	17926
5	Saline soil	0	2729
6	Mining/industrial water	7	258
7	Degraded area	4784	120404
8	Geographical Area	13481	328726
9	Wind erosion	-	11560

Table-4 Soil health analysis in Churaghat village, Bilha, Bilaspur (CG)

S.No.	Parameters	Sample A	Sample B
1	pH	7.4	7.2
2	EC	0.75	0.68
3	OC	0.7%	0.9%
4	N	202 kg/hectare	312 kg/hectare
5	P	13.5 kg/hectare	13.25 kg/hectare
6	K	210 kg/hectare	125 kg/hectare
7	S	18.70 ppm	18.70 ppm
8	Zn	2.16 ppm	1.66 ppm
9	B	4.0 ppm	4.0 ppm
10	Fe	36.64 ppm	37.24 ppm
11	Mn	30.80 ppm	48.80 ppm
12	Cu	1.14 ppm	1.11 ppm

Table-5 Fertilizers recommended for sample A

S.No	Crops	Bio-fertilizers		Fertilizer combination for NPK	
1	Paddy	Compost 4 tone/hectare	Phosphate solubilizing Bacteria	Neem coated urea	289 kg/hectare
				Single super phosphate	375 kg/hectare
				Potassium Chloride	67 kg/hectare
2	Wheat	Compost 4 tone/hectare	Phosphate solubilizing Bacteria	Neem coated urea	289 kg/hectare
				Single super phosphate	375 kg/hectare
				Potassium Chloride	67 kg/hectare

Table-6 Fertilizers recommended for sample B

S.No	Crops	Bio-fertilizers		Fertilizer combination for NPK	
1	Paddy	Compost 3 tone/hectare	Phosphate solubilizing Bacteria	Neem coated urea	217 kg/hectare
				Single super phosphate	375 kg/hectare
				Potassium Chloride	67 kg/hectare
2	Wheat	Compost 3 tone/hectare	Phosphate solubilizing Bacteria	Neem coated urea	217 kg/hectare
				Single super phosphate	375 kg/hectare
				Potassium Chloride	67 kg/hectare

Table-7 Soil Health management from 2014-2018 in Churaghat village, Bilha, Bilaspur

S.No.	Soil conservation strategy	Result
1	Crop rotation	Improves nutrient cycling ,crop production, holds soil moisture and decreases use of pesticides.
2	Cover crop- Sudan & Napier grass	Increases organic matter, crop production , nutrient use efficiency, suppresses weeds.
3	Mulching (applying plant residue to soil surface)	Reduces soil erosion from wing and rain, conserve soil moisture, dust. Increases crop production, decreases pesticide usage.
4	Nutrient management	Increases plant nutrient uptake, physical, biological, chemical properties of soil.
5	Pest management	Increases soil organic matter, decreases pesticides risks to soil air and water.
6	Green Manuring (Dhaincha)	Grafting Dhaincha to improve soil quality

Conclusion

Green Revolution shows significant growth in food production but it results soil fatigue and soil exploitation. Increasing food demand and applied fertilizers increases productivity but declines soil health day by day. Today nutrient use efficiency of soil degraded due to physical, biological and chemical health factors of environment. Soil health management is very important research field for increasing soil fertility and crop productivity. Green manure like Dhaincha , Cover Crop- Napier grass and Sudan plays important role as green catalyst for crop production and soil health rejuvenation.

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