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Physico-chemical characteristics of soil supporting to the growth of wheat jowar and maize crop plants from Baramati Tehsil Dist. Pune, Maharashtra, India.

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Abstract:
The soil test based nutrient management has emerged as a key issue in efforts to increase agriculture productivity. In the present investigation study focus on the physico-chemical analysis of a soil from crop fields in Baramati Tehsil region. Total 30 soil samples collected from 15 sites during December 2020 to February 2021. Collected soil samples from crop fields analyzed for parameters like soil pH, electrical conductivity (EC), organic carbon (OC), available nitrogen (N), phosphorus (P), potassium (K), Sodium (Na), Calcium Carbonate ($CaCO_3$) and micronutrients (Fe, Mn, Cu and Zn). All site soil samples in crop fields pH shows moderately alkaline to strong alkaline. Maximum site crop field's soil samples shows average electrical conductivity some sites soil samples shows more than average electrical conductivity. Organic carbon fluctuate ranges from ≥ 1.00 ≤0.81-1.00 ≤ 0.51-0.80≤ 0.41-0.50≤0.21 to 0.40. Nitrogen content shows ≥140-280 ≥140, Phosphorus content shows ≤8-14, ≤7.00, kg/hector Potassium content ≥300 kg/hector shows in all sites and abundant in amount. All sites crop field's soils shows luxuriant amount of sodium content. $CaCO_3$ content shows medium to abundance in quantity in all sites. In case of micronutrients analysis shows as low ranges of Fe, Mn, Zn, and Cuin ppm all sites crop field's soil samples.In modern agriculture excess use of chemical fertilizers affects the pH, EC, Organic carbon, N, P, K, Na, and $CaCO_3$.More than average 1.00 Electrical conductivity which are harmful for germination. Due to overdose of chemical fertilizers its affects soil fertility resulted to decreases crop yields production.

Keywords: *Crop fields, parameters, Physico-chemical analysis*

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I. Introduction:

Soil is a media for the plants. The soil physical, chemical and biological properties affect the plant growth. Soil management practices also greatly affect the soil organic matter and soil fertility. (Singh Yeshpal *et.al*. 2017). Soil is a naturally occurring, unconsolidated covering on the earth surface. Soil is a mixture of mineral and organic constituents that are solid, gaseous, and aqueous states. (Oyeyiola G.P. and Agbaje A.B. 2013).The soil a complex organization being made up of some six constituents is namely as inorganic matter, soil moisture, organic matter, soil organism, soil air and soil solution. Roughly, the soil contains50-60% mineral matter, 25-35% water, 15-25% air and small percentage of organic matter. (Chandak Nisha and Kamlesh Shah *et.al*., 2017).Soil is an important system of the terrestrial ecosystem. Quality of the soil depends on its physical properties (pH, moisture content, texture, colour and organic substance content etc.) and the chemical properties is (Nitrate, Nitrogen, Organic matter content, Nitrite, Cation exchange capacity and phosphate phosphorous etc).Soils are the main terrestrial reservoir of carbon and nutrients (Quinton *et al*, 2010, Carvalhais *et al*, 2014), which determine soil fertility, plant growth and ecosystem sustainability (Doran and Zeiss, 2000, Lal, 2004), and thus soils are crucial for human being (Lal, 2004).

The soil test based nutrient management has emerged as a key issue in efforts to increase agriculture productivity. In recent years agriculture development has been changed from conventional and traditional farming method too more intensive practices using chemical fertilizers and pesticides with irrigation facilities. Continuous use of chemical fertilizers slowly changed soil properties; ultimately the production in long run is reduced. It has resulted in leaching of chemical into the surface and ground water (Agarwal and Gupta, 1968,Barhate, 1971., Bharambe and Ghonsikar, 1984.,Bharambe and Ghonsikar, 1985.Bhattacharya *et.al*,1989)

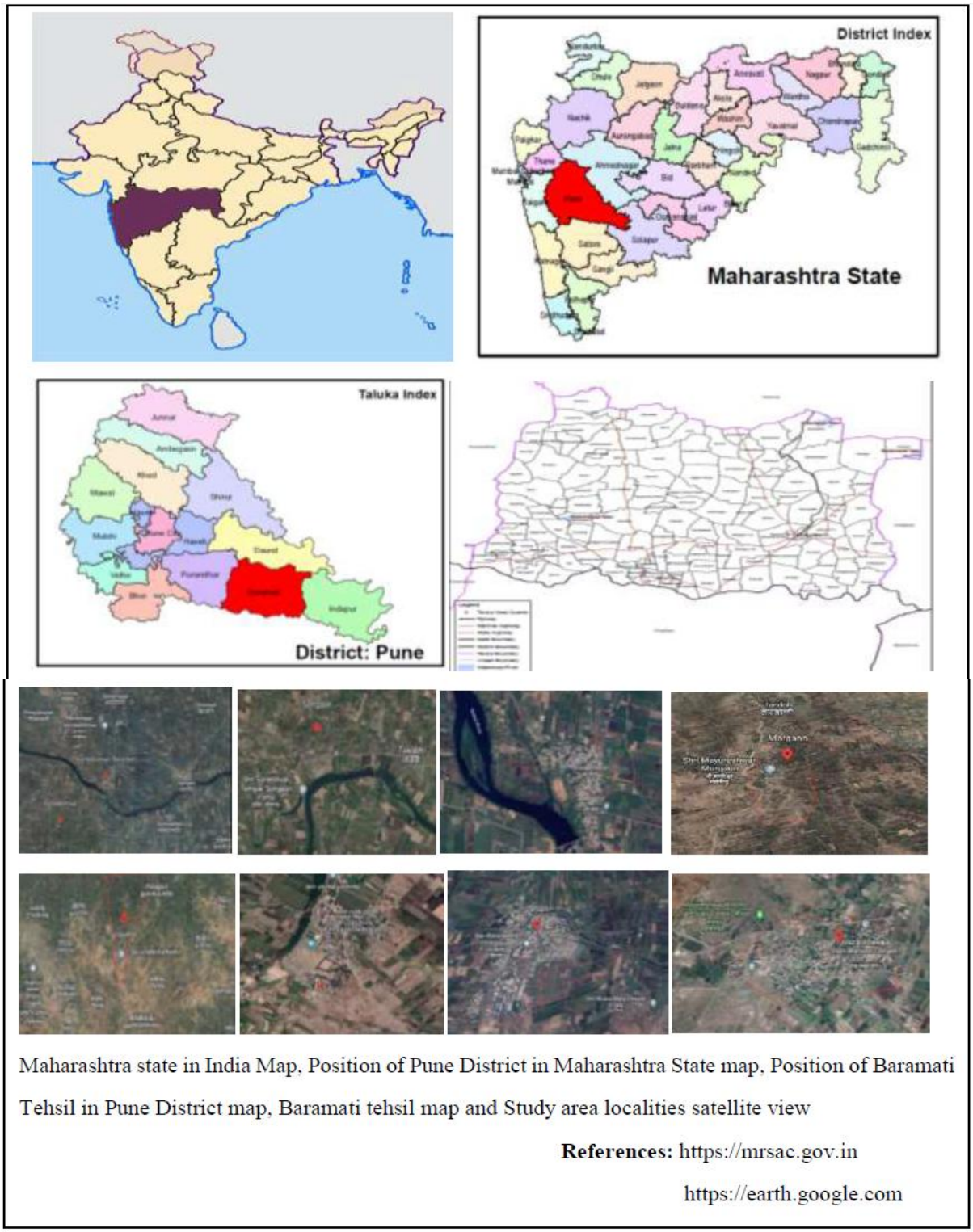
around study area is although most of the population depend upon agriculture produce such as wheat and Jowar, maize since long back. However generation after generation the soil supporting to wheat and Jowar is utilized for production with no any scientific analysis. So this research will add scientific knowledge about soil supporting to wheat, jowar and maize.

II. Material and Methods:

Study Area: Baramati tehsil, belong to western part of Maharashtra. It is belong to Pune division. Baramati tehsil is the fourth largest city in Pune district. Baramati tehsil lies between 18°04′ to 18°32′ N latitude and 74°26′ to 74 °69′ E longitude. It is located at altitude of 550 meter above the sea level.

Collections of soil samples:

Soil samples are collected December 2020 to February 2021.Each site 2 crop plants soil samples were collected representatively in the depth of soil from different places of the tehsil. During survey Nira, Karha river basin area, water resources like lakes reservoirs, Nira left canal, dry area with less water resources selected. While collecting soil samples the upper layer of vegetation, surface litter, stones stubble if any were cleared away and then layer of soil immediately below (0-20 cm) was collected in sterile polythene bag, noted location site, date of collection, agriculture crop plants. All soil samples bring in laboratory removed debris, stones, grass and making soil samples ready for soil analysis like various parameter



Maharashtra state in India Map, Position of Pune District in Maharashtra State map, Position of Baramati Tehsil in Pune District map, Baramati tehsil map and Study area localities satellite view

References: https://mrsac.gov.in

https://earth.google.com

Fig. 1 Study area map

Physico-Chemical Properties of soil

pH

The most significant property of soil is its pH level, its effects on all other parameters of soil. Therefore, pH is considered while analyzing any kind of soil. If the pH is less than 6 then it is said to be an acidic soil, the pH range from 6-8.5 it's a normal soil and greater than 8.5 then itis said to be alkaline soil.

Electrical conductivity

Electrical conductivity is also a very important property of the soil, it is used to check the quality of the soil. It is a measure of ions present in solution.

Organic Carbon

Organic matter estimation in the soil can be done by different methods. Loss of weight on ignition can be used as a direct measure of the organic matter contained in the soil. It can also be expressed as the content of organic carbon in the soil.Organic matter/organic carbon can also be estimated by Walkely and Black, 1934.

Nitrogen (N):

Total N includes all forms of inorganic N, like NH_4 –N, NO_3 -N and also NH_2 (Urea) –N, and the organic N compounds like proteins, amino acids and other derivatives. Depending upon the form of N present in a particular sample, specific method is to be adopted for getting the total nitrogen value.About 80% of the atmosphere is nitrogen gas. Nitrogen gas diffuses into water where it can be "fixed" (converted) by blue-green algae to ammonia for algal use.

Phosphorus

It is one of the most important micronutrient essential for plant growth.Phosphorus most often limits nutrients remains present in plant nuclei and act as an energy storage. In these methods, specific colour compounds are formed with the addition of appropriate reagents in the solution, the intensity of which is proportionate to the concentration of the element being estimated. The colour intensity is measured spectrophotometrically.

Sodium and Potassium:

Flame photometric method (Toth and Prince, 1949) Potassium present in the soil is extracted with neutral ammonium acetate of 1 molarity. This is considered as plant available K in the soils. It is estimated with the help of flame photometer. This is a well-accepted method.

Micronutrients (Fe, Zn, Cu and Mn)

The mean values of the micronutrients determined in the soils followed a decreasing order as Fe > Mn > Zn> Cu. (Table-2) Micronutrients estimated by using Atomic Absorption Spectroscopy method.

Observation Table:

Table No-1 Physico-chemical analysis of soil samples crop plants in study area.

Nira river sites soil analysis

Sites	**Crop Plants**	**pH**	**E.C.** ds.m-1	**O. C** %	**N** Kg/ha	**P** Kg/ha	**K+** Kg/ha	**Na++** Meq/lit	**CaCo3** %
Kambleshwar	Wheat	8.61	0.96	0.69	166.00	6.30	848.00	16.86	16.32
	Jowar	8.36	0.77	0.66	159.00	5.40	365.00	11.04	6.12
Songaon	Wheat	8.36	**1.50**	0.54	130.00	8.20	499.00	12.71	13.77
	Jowar	8.49	**1.16**	0.54	130.00	5.19	426.00	14.90	12.24
Korhale (KH)	Wheat	8.41	0.52	0.81	195.00	5.30	1070.00	8.17	15.81
	Maize	8.33	0.45	0.99	238.00	6.19	976.00	8.02	19.89

Karha river sites soil analysis

Sites	**Crop Plants**	**pH**	**E.C.** ds.m-1	**O. C** %	**N** Kg/ha	**P** Kg/ha	**K+** Kg/ha	**Na++** Meq/lit	**$CaCo_3$** %
Morgaon	Wheat	8.05	0.97	0.48	115.00	4.10	613.00	5.68	15.30
	Jowar	8.15	0.89	0.63	151.00	4.40	452.00	6.76	13.77
Anjangaon	Wheat	7.91	0.74	1.02	245.00	8.20	2492.00	3.94	15.81
	Jowar	8.34	0.34	0.33	79.53	5.30	874.00	4.94	17.34
Gunawadi	Wheat	8.69	0.85	0.48	115.00	6.20	409.00	8.46	31.95
	Jowar	8.73	0.71	0.49	118.00	4.40	875.00	9.81	29.25

Nira left canal sites soil analysis

Sites	**Crop Plants**	**pH**	**E.C.** ds.m-1	**O. C** %	**N** Kg/ha	**P** Kg/ha	**K+** Kg/ha	**Na++** Meq/lit	**$CaCo_3$** %
Katewadi	Wheat	8.27	0.35	0.78	187.00	8.80	513.00	4.74	19.89
	Jowar	7.82	0.60	0.66	159.00	4.40	455.00	2.60	12.24
Pandare	Wheat	7.63	0.22	0.69	166.00	7.77	460.00	3.26	5.10
	Jowar	8.12	0.42	0.78	187.00	4.44	728.00	3.76	10.20
	Wheat	8.40	0.97	0.60	144.00	4.20	449.00	6.69	12.75

Vadgaon Nimbalkar	Maize	8.73	0.62	0.93	224.00	4.40	311.00	9.25	12.75

Less water reservoir sites soil analysis

Sites	**Crop Plants**	**pH**	**E.C.** ds.m-^{1}	**O. C** %	**N** Kg/ha	**P** Kg/ha	**K+** Kg/ha	**Na++** Meq/lit	**$CaCo_3$** %
Sawal	Wheat	8.12	0.47	0.72	173.00	8.19	750.00	4.54	14.79
	Jowar	8.25	**1.26**	0.36	86.76	6.41	470.00	7.19	16.83
Parawadi	Wheat	8.83	0.56	0.54	130.00	5.11	464.00	9.99	19.38
	Jowar	7.97	**1.05**	0.63	151.00	5.19	1253.00	10.17	13.77
Supa	Wheat	8.14	0.50	0.36	86.76	6.20	1260.00	4.35	9.18
	Jowar	8.31	0.24	0.27	65.07	7.19	381.00	2.51	8.67
Murti	Wheat	8.05	0.75	0.84	202.00	6.19	1587.00	4.16	6.12
	Jowar	7.96	0.94	0.69	166.00	6.30	1864.00	2.79	3.57
Lonibhapkar	Wheat	7.99	0.49	0.84	202.00	5.30	660.00	4.52	4.08
	Jowar	8.16	0.59	0.96	231.00	6.30	669.00	4.23	9.69
Waki	Wheat	8.20	0.87	0.63	151.00	4.40	517.00	6.86	22.44
	Jowar	8.02	0.91	0.72	173.00	4.40	398.00	5.03	19.38

Table 2: Micro nutrient analysis

Nira river sites soil analysis

Sites	**Crop plants**	**Micro-elements**			
		Fe (PPM)	**Mn (PPM)**	**Zn (PPM)**	**Cu (PPM)**
Kambleshwar	Wheat	0.45	0.09	0.01	0.09
	Jowar	0.58	0.21	0.03	0.07
Songaon	Wheat	0.94	0.17	0.03	0.16
	Jowar	0.56	0.13	0.02	0.11
Korhale (KH)	Wheat	0.86	0.22	0.06	0.18
	Maize	0.29	0.21	0.02	0.16

karha river sites soil analysis

Sites	**Crop plants**	**Micro-elements**			
		Fe (PPM)	**Mn (PPM)**	**Zn (PPM)**	**Cu (PPM)**
Morgaon	Wheat	0.41	0.12	0.01	0.06
	Jowar	0.28	0.14	0.02	0.06
Anjangaon	Wheat	0.13	0.08	0.09	0.14
	Jowar	0.36	0.16	0.01	0.07
Gunawadi	Wheat	0.33	0.41	0.02	0.08
	Jowar	0.27	0.04	0.02	0.03

Nira left canal soil analysis

Sites	**Crop plants**	**Micro-elements**			
		Fe (PPM)	**Mn (PPM)**	**Zn (PPM)**	**Cu (PPM)**
Katewadi	Wheat	0.76	0.13	0.02	0.19
	Jowar	0.57	0.38	0.04	0.09
Pandare	Wheat	0.67	0.13	0.03	0.12
	Jowar	0.56	0.21	0.01	0.12
Vadgaon Nimbalkar	Wheat	0.72	0.22	0.03	0.15
	Maize	0.85	0.26	0.05	0.16

Less water reservoir soil analysis

Sites	**Crop plants**	**Micro-elements**			
		Fe (PPM)	**Mn (PPM)**	**Zn (PPM)**	**Cu (PPM)**
Sawal	Wheat	0.47	0.10	0.02	0.06
	Jowar	0.61	0.22	0.09	0.10
Parawadi	Wheat	0.31	0.18	0.08	0.05
	Jowar	0.52	0.60	0.03	0.06
Supa	Wheat	0.30	0.15	0.02	0.07
	Jowar	0.37	0.07	0.02	0.02
Murti	Wheat	0.70	0.23	0.02	0.17
	Jowar	0.47	0.23	0.03	0.10

Lonibhapkar	Wheat	0.27	0.09	0.02	0.08
	Jowar	0.28	0.18	0.01	0.07
Waki	Wheat	0.52	0.36	0.02	0.08
	Jowar	0.34	0.10	0.01	0.07

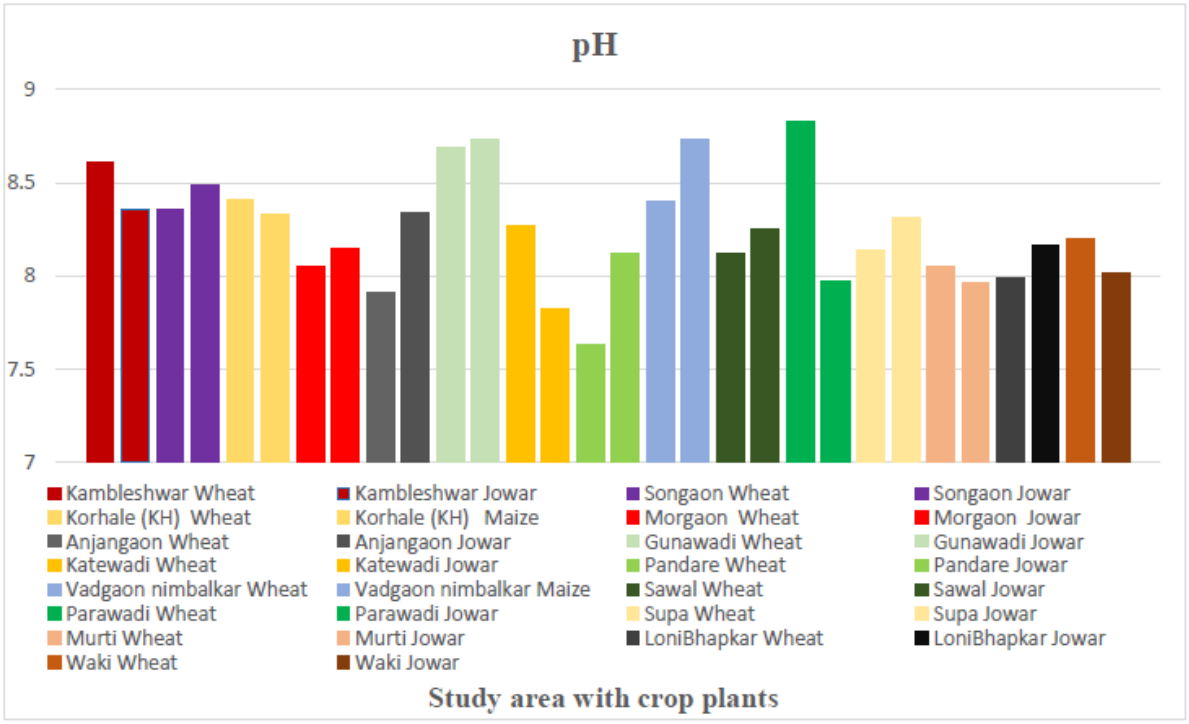


Fig.1 pH analysis

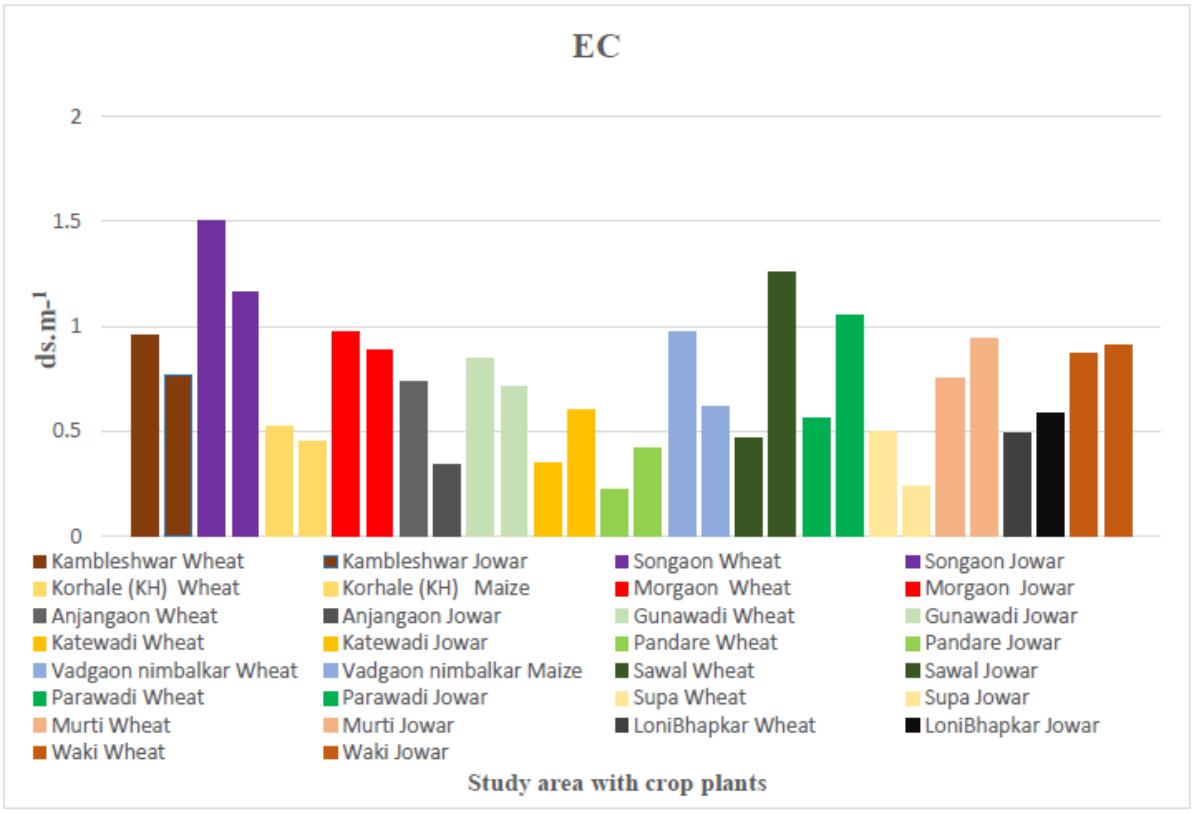


Fig. 2 Electrical conductivity analysis

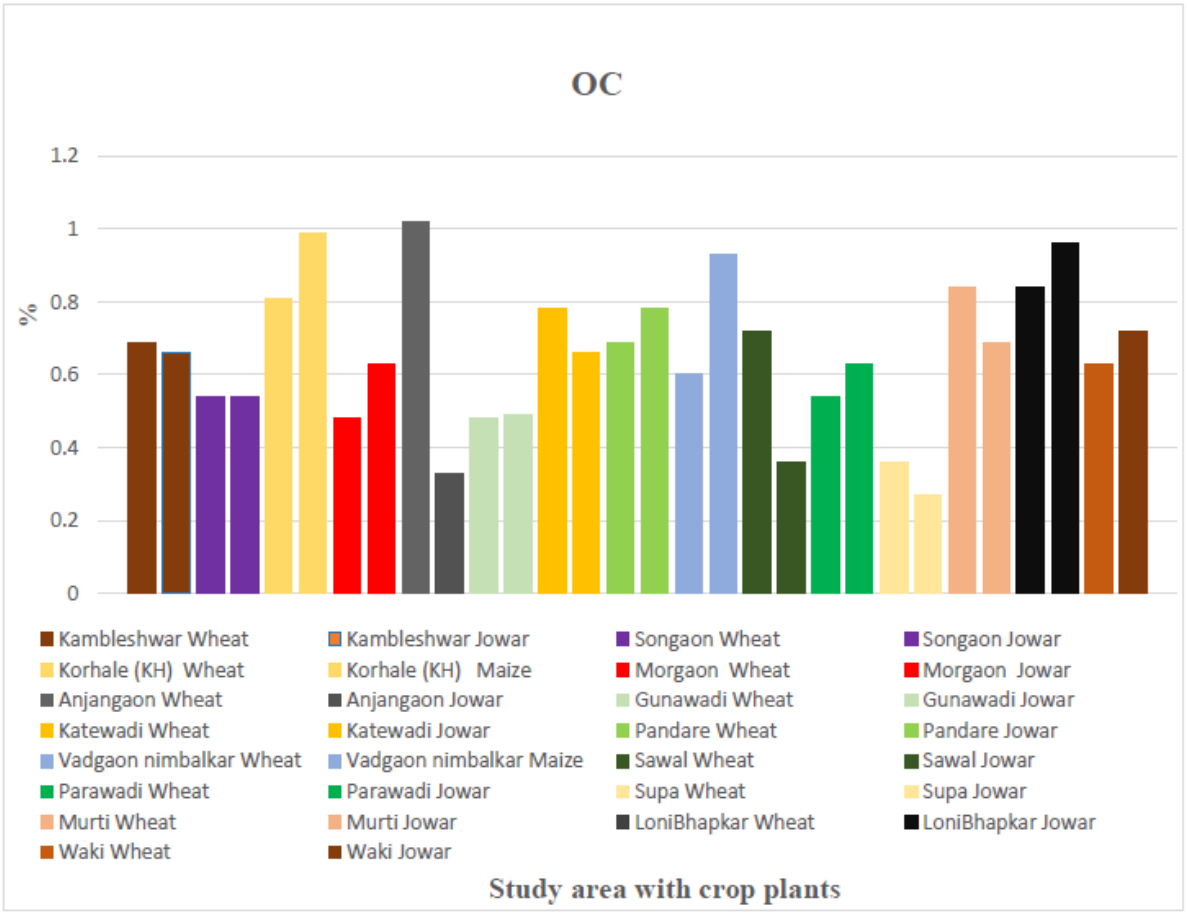


Fig. 3 Organic Carbon analysis

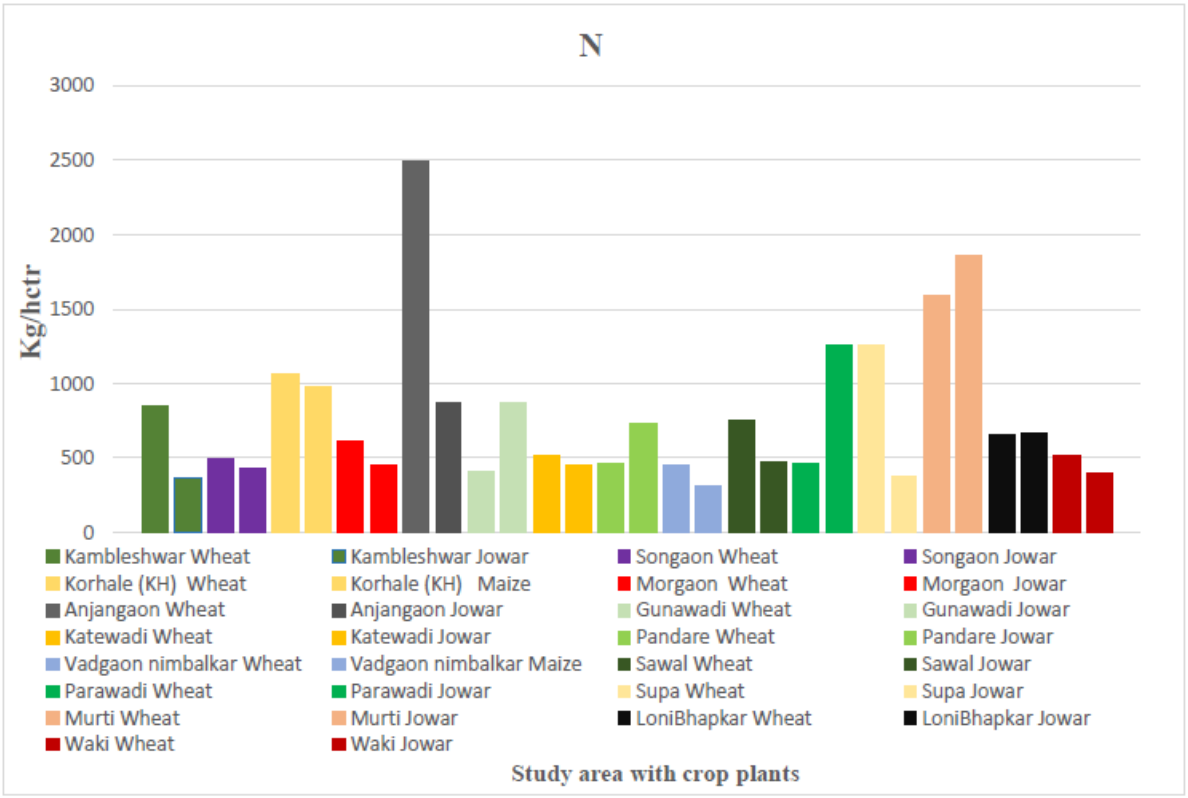


Fig. 4 Nitrogen analysis

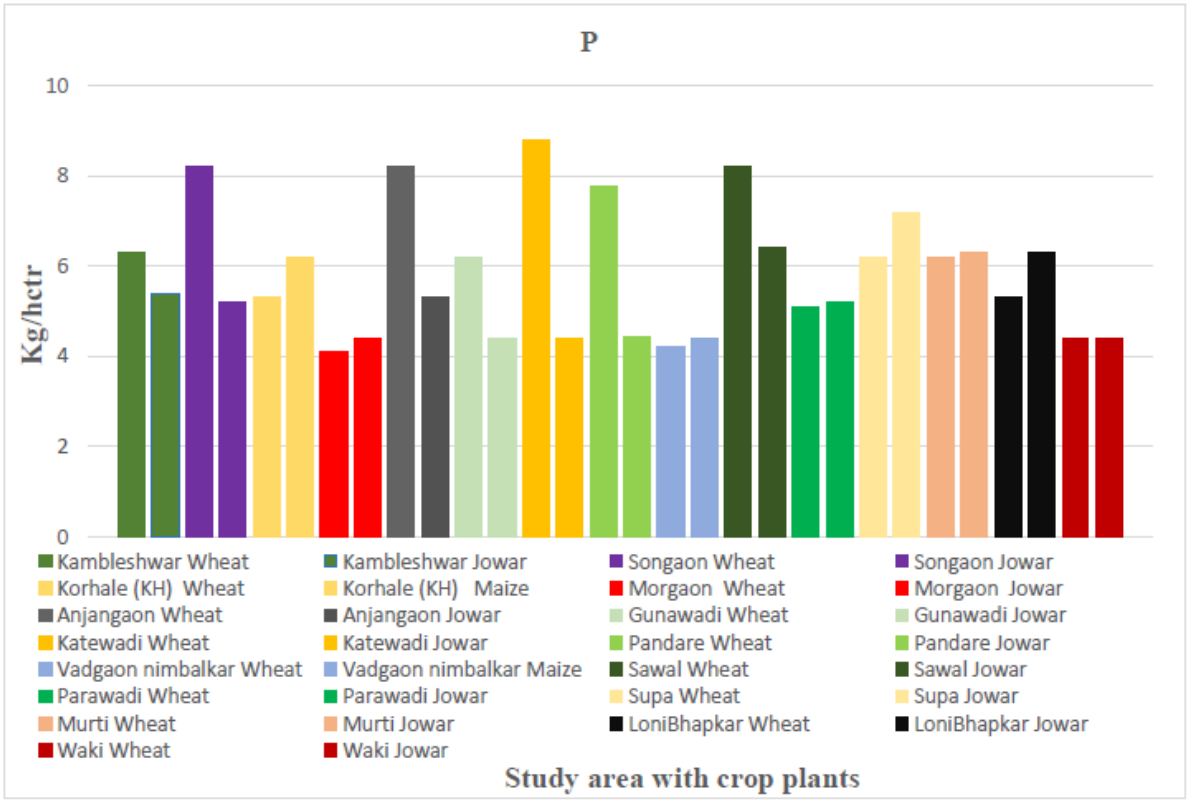


Fig. 5 Phosphorous analysis

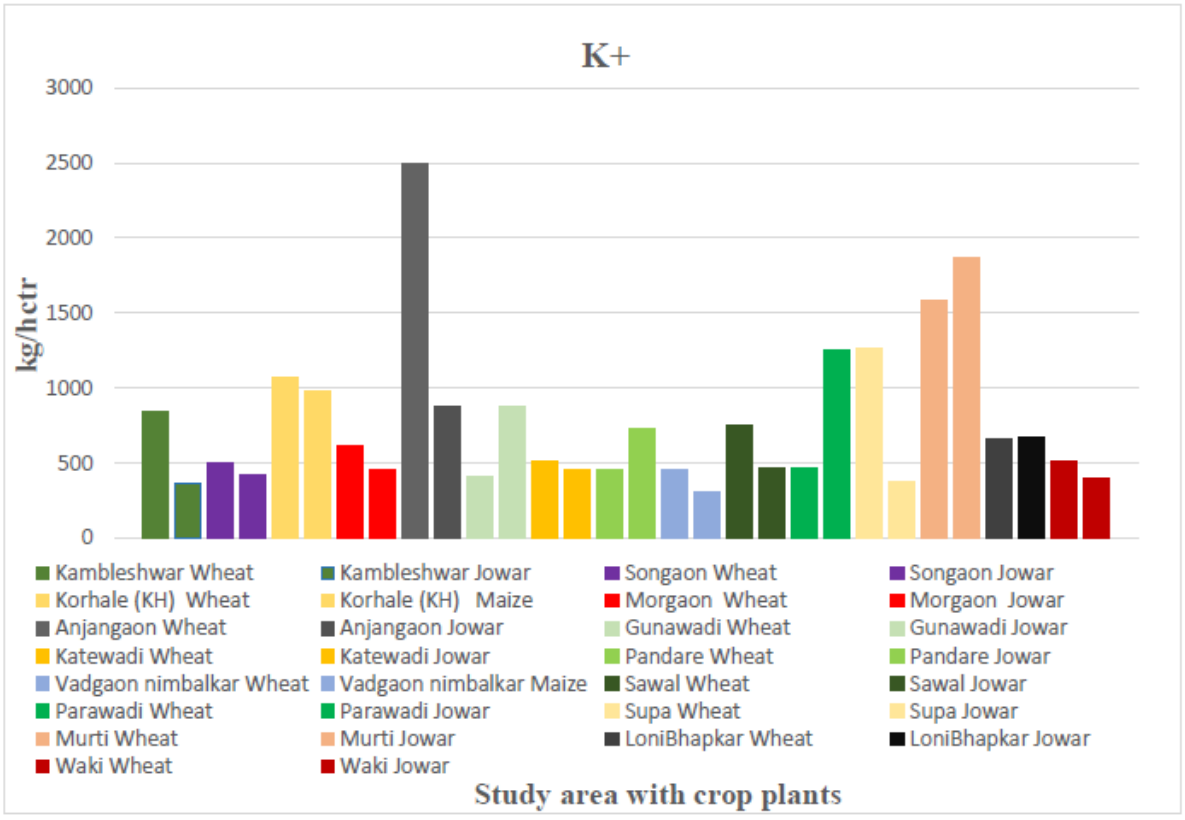


Fig. 6 Potassium analysis

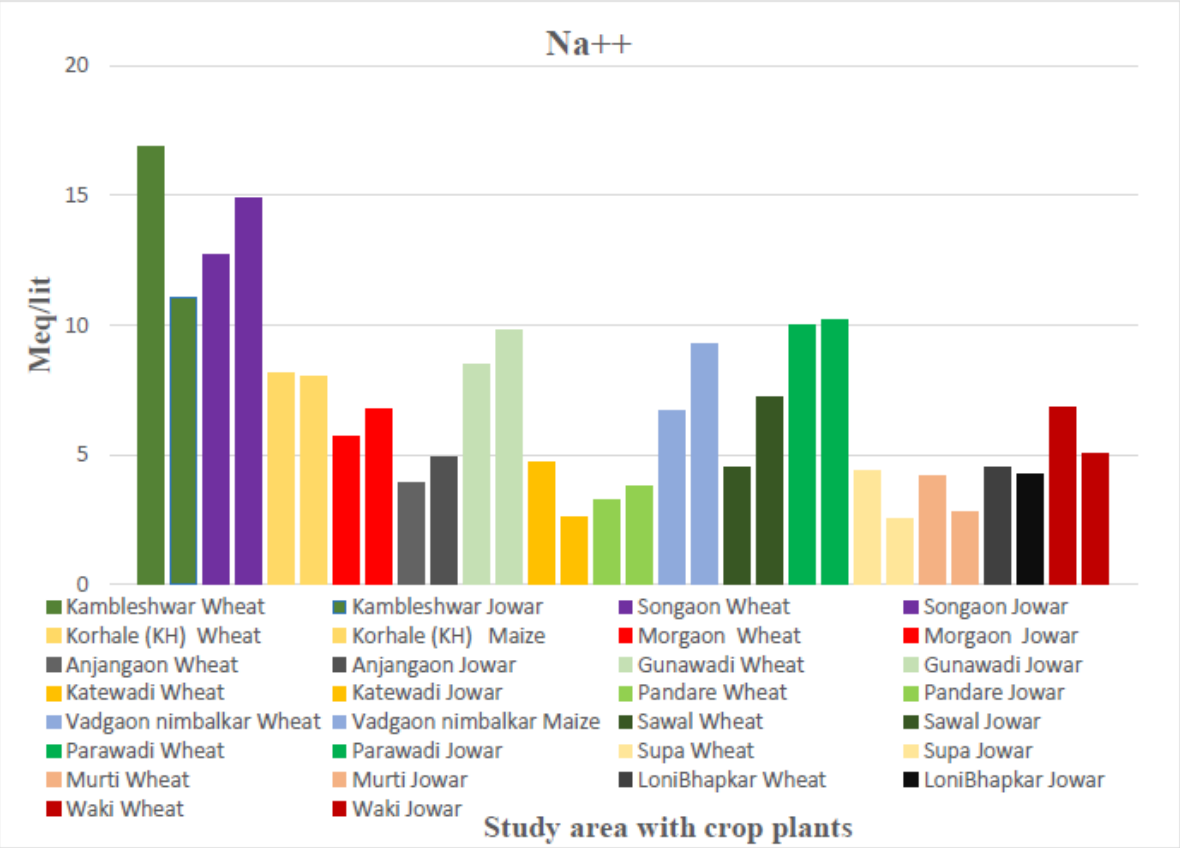


Fig 7. Sodium analysis

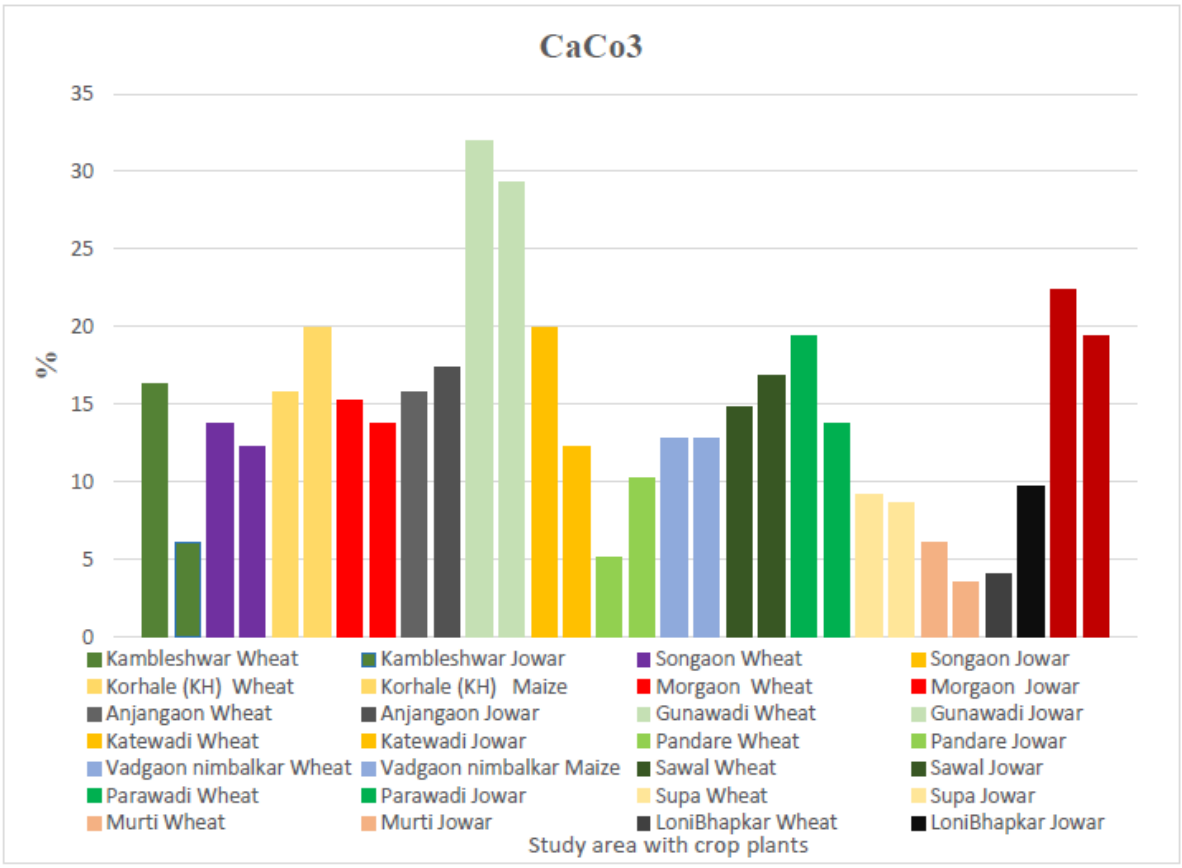


Fig. 8 $CaCo_3$ (Calcium Carbonate) analysis

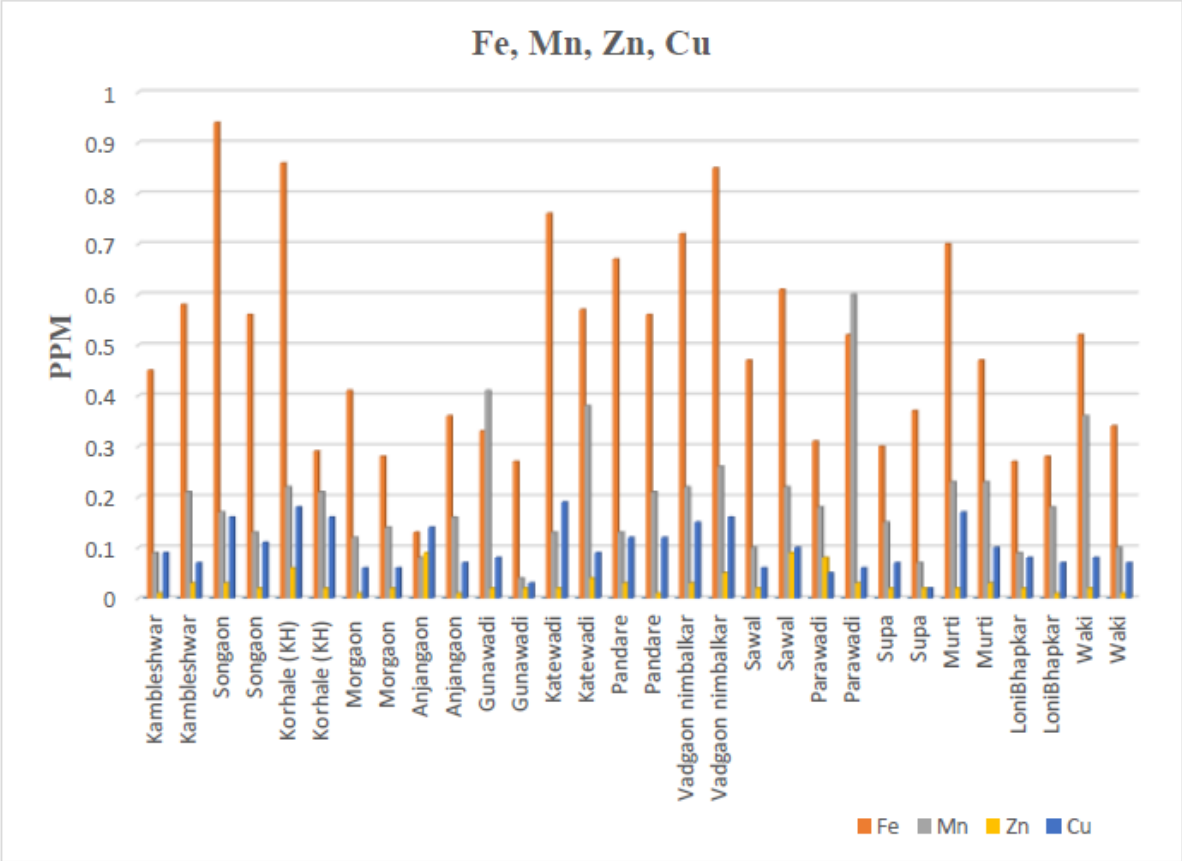


Fig. 9 Micro-nutrient analysis

III. Result and Discussion:

In the present investigation study focus on the physico-chemical analysis of a soil from crop fields in Baramati Tehsil region. During study preferred to investigate the soil samples for its physico-chemical analysis of some parameters. Total 30 soil samples collected from 15 sites during December 2020 to February 2021.Physico-chemical characteristics of soil were assessed by laboratory analysis. A physicochemical study of soil is based on various parameters like soil pH, electrical conductivity (EC), organic carbon (OC), available nitrogen (N), phosphorus (P), potassium (K), Sodium (Na), Calcium Carbonate ($CaCO_3$) and micronutrients (Fe, Mn, Cu and Zn). Soil samples were analyzed for their physico-chemical properties and their results were represented in table 1. However, micronutrient analysis results represented in table 2. All site soil samples in crop fields pH shows moderately alkaline to strong alkaline.Organic carbon fluctuate ranges from ≥ 1.00 ≤ 0.81-1.00 ≤ 0.51-0.80≤ 0.41-0.50≤0.21 to 0.40. Nitrogen content shows ≥140-280 ≥140, Phosphorus content shows ≤8-14, ≤7.00, kg/hector, Potassium content ≥300 kg/hector shows all sites abundance in amount. All sites crop field's soils shows luxuriant amount of sodium content. $CaCO_3$ content shows medium to abundance in quantity in all sites.In case of micronutrients analysis shows as low ranges of Fe ≥ Mn ≥ Zn ≥Cu in ppm all sites crop field's soil samples.

IV. Conclusion:

In this studysoil physicochemical characteristics were assessed by laboratory analysis. Different locality maximum site crop field's soil samples shows average electrical conductivity some sites soil samples shows more than average electrical conductivity. In modern agriculture excess use of chemical fertilizers affects the pH, EC, Organic carbon, N, P, K, Na, and $CaCO_3$.More than average 1.00 Electrical conductivity which are harmful for germination. Due to overdose of chemical fertilizers its affects soil fertility resulted to decreases crop yields production.

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