ELECTRO-CHEMICAL BEHAVIOR AND SALINE SOIL PROPERTIES DUE TO HEAVY IRRIGATION OF CULTIVATED LANDS IN BAGALKOT DISTRICT, KARNATAKA STATE, INDIA.

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ABSTRACT

The electro-chemical behavior, salinity assessment and deficiency of micro-nutrients in soil samples from selected locations of highly irrigated cultivated lands of Bagalkot district have been investigated on the basis of cation exchange capacity, the levels of Physico- and electro-chemical parameters such as Bulk density, soil texture, and water holding capacity, pH, EC, Sodium and Calcium carbonate. The major nutrients such as OC, available Nitrogen, available Phosphorous and available Potash and the Micro-nutrients such as Iron, Manganese, Zinc, Copper, Boron and Molybdenum were determined by using flame photometer, visible spectrophotometer and Atomic Absorption spectrophotometer followed by so far reported standard methods respectively. The secondary nutrients such as Calcium (%), Magnesium (%) and Sulphate (ppm) were determined by simple titration methods. The cation exchange capacity (CEC) in soils of heavy irrigated lands was dependent on the amount of Organic matter. Salinity of soils dependent on salt formation due to heavy irrigation has been adopted in agricultural practices and uses of compost and synthetic inorganic fertilizers in unlimited doses. The severe accumulation of salt in soil samples was determined by Electrical Conductivity values, the present investigation reveals the soils salinity may restrict growth of many vegetations and plants and suppression of yield potentials in fruits and seeds.

KEYWORDS: electro-chemical behavior, soil salinity, plant nutrients, heavy irrigation, cultivated lands, vegetations and plant growth.

I.   INTRODUCTION

It is a proper time to suggest the fertility status and salt formation (salinity) due to heavy irrigation in the of cultivated lands Bagalkot district, the northern part of Karnataka State. The formers of the area having an ambition to grow more sugar cane from their lands by heavy irrigation methods. Lodging more water table in the cultivated lands, leads to develop Calcium carbonate (lime stones) and washout the soil fertility and micro nutrients from the agriculture fields. Due to the lack of knowledge in using the synthetic inorganic fertilizers, pesticides and compost in proper doses, the soil of lands are completely declined in the quality.

Soil chemistry changed due to uses of pesticides, inorganic fertilizers, and accumulation of diversified mixture and decaying of organic matter. Without fertile soil and microbial fauna that inhabit it, food would not grow, dead things would not decay and nutrients would not be recycled. The soil is composed of four major components i.e., mineral matte (45%), Organic matter (5%), soil air (25%) and soil water (25%). The soil found to consist of various inorganic and organic chemical compounds. The organic matter in soil improves water holding capacity. Organic matter is main source of nutrients, energy for soil organisms, also increases the aeration status of the soil. Organic matter supply trace elements like Boron, Molybdenum to soil; these are quite essential for plant growth. The organic matter also contributes to the cation exchange capacity in soils. Soil pH is a measure of the acidity or alkalinity. The optimal pH of soils should be in between 6.5 to 7.5. An acidic soil affects availability of plant nutrients. Acidic soil results in an increase in aluminium. No doubt aluminium toxic to plants. The toxic metals in soils affects the activity of soil micro-organisms, thus affecting nutrient cyclining and disease risk.[1,4]

Humus enhances soil fertility, refers to all organic matter found in the soil. Humus is present in almost every type of soil in the form of colloidal substances which are formed by decomposition of plants and animal residues. The process of formation of humus is called humification. On complete decomposition, humus is changed into CO_2, water and minerals. This process is called mineralization. Heavy soils hold organic matter longer than do the light soils. The freshly fallen plant and animal matter on the soil is called litter. The litter undergoes a gradual decomposition to form humus. Humus provides the needed food for soil organisms. Humus also contributes to chemical action in the soil. Humus is destroyed by fire and tillage. It is also removed by wind and soil erosion.

Keeping in view the present investigation reveals the soil salinity and its impact on soil behavior. That is salts can come from irrigation water, fertilizers, compost and manure. The potential problem in irrigated soils due to high evaporation rates and low annual rain fall leaving salts to accumulate. The severe accumulation of salts may restrict growth of many vegetables. Even moderate accumulation of salts in soils requires more frequent irrigation. Hence, salts can be leached by slowly applying excess water e.g. 3 inches of water table removes about 50% of the soluble salt and 5 inches removes at 90% soluble salt from soil system. Uses of liming materials such as lime stone, wood ashes and some composts leads to increase the soil pH – value, the use of sulphur more than recommended doses, ammonium and ammonium forming N- fertilizers will decrease in soil pH; in both cases the soils and sediments put into the deficiency in micro-nutrients.

II.   MATERIALS AND METHODS

Soil samples were collected by scrapping using a pre-cleaned and acid washed plastic scales and immediately kept in clean polythene bags. 5 grams of soil sample were taken into 150 ml conical flasks separately, 50ml of 0.1 M HCl was added and flasks were kept on shaker for one hour. The content were filtered into 50 ml standard flask and made up to mark with 0.1 M HCl for determination of micro-nutrients using Atomic Absorption Spectrophotometer (AAS – Elico).[5]

The dried samples (50 mg) were digested in 2 ml of Nitric acid (70%) Merck, in a block thermostat at $80^{o}C$ for 3 to 4 hours until the solutions were clear.[6,7] The extracted soil solutions than made up to 25ml with double distilled water in 25ml volumetric flask separately, the micro-nutrients (trace elements) were analyzed in all samples by using AAS – Elico. The soils were analyzed for physicochemical parameters using respective instruments, Secondary and Major nutrients were analyzed according to the standard procedures by using Nitrogen analyzer and Flame photometer respectively, the values obtained were within 5 – 10% range from the reference values.

All the reagents used were of analytic grade, Deionized water (18 mega ohm resistivity) prepared from Millipore mili-Q water purification system, USA was use throughout. Hydrochloric acid (Merck) 40% ultra pure were used to carry the experiments.[8]

III. RESULTS AND DISCUSSION

Quality of soil samples was investigated seasonally from the selected locations of Bagalkot district. The district is composed with six taluks (Jamkhandi, Mudhol, Bilagi, Bagalkot, Badami and Hunagund). The research work was under taken to know the salinity condition in soil samples and micro-nutrients status in them. All the values were recorded in Tables 1 to 6 and the recorded values were compared with WHO, ISI and Bureau of standards. The figures I to VI reveal the comparative study of Major-nutrients in the Soil samples of cultivated lands of various regions of Bagalkot district.

1. Soil Salinity Condition of Jamkhandi location during the monitoring period.

Black sandy soil with 56% water holding capacity .the soil is highly acidic in nature, Sodium, calcium and magnesium salts found to be more indicates the wood ashes Applied to the soil. The organic carbon found to be normal to higher range. Available nitrogen &% of total nitrogen content in the soil samples found quit normal, indicates the regular and proper doses of nitrogenous containing fertilizers were used during agriculture activates. Available P deficiency was noticed in the samples. It is co related to the ph value and micronutrients such as iron, ph=6.45 and deficiency of iron level. Hence crops are prone to iron chlorosis and soil phosphorus is excess due to the lack of fertilization. Available K found lower limit in soil to enrich the soils with K, suitable and in proper proportions fertilizers are needed regularly. Available sulphur in the form of S04 in soils found very irregular in the soil samples lower in few spots and higher few soils. Micronutrients: iron, manganese found to be deficiency, boron, molybdenum found in legal limits where as zinc, copper found in higher levels.

Salinity Conditions

high soil salinity reduces crop yields in the long run. The soil salinity measured and justified by the EC values, if the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is less than 1.

2. Soil Salinity Condition of Mudhol location during the monitoring period

Sandy mixed red clay soil, having 57% water holding capacity. Organic carbon in three spots was recorded lower in level; whereas the spot S4 contains higher value of organic carbon. Available nitrogen and Total nitrogen percentage recorded with lower level. Nitrogen containing fertilizers should be essential for sensitive crops. Available P found above the normal range, indicates that during the agricultural activities soils were mixed with the DAP

regularly. Available K also noticed higher than the prescribed limits in first three spots, whereas at spot S4 K level in normal range. Available Sulphur in the form of Sulphate found just below the normal range the soils were highly alkaline in nature with normal electrical conductivity. Micro-Nutrients: Iron just below the normal, Manganese, Zinc and Born recorded with lower concentration in all the selected spots of soil samples, whereas Copper concentration in the soil sample just above the normal, but Molybdenum was in normal range.

Salinity Conditions

high soil salinity reduces crop yields. The soil salinity depends on the EC values, if the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is found more than 4 ds /m.

3.   Soil Salinity Condition of Bilagi location during the monitoring period

Black clay with good water holding capacity. The organic carbon in the soil samples were normal to medium, indicates that the organic manures used regularly during agriculture practices. Available nitrogen is slightly higher than the prescribed levels, total nitrogen in the soil samples were found to be in normal to slightly higher levels. Available phosphorus found in deficient level it is required to enrich the P content by using suitable fertilizer like DAP and others. Available potassium in the soil samples were found to be in lower levels, in total the selected soil samples deficient with P K suitable on proper doses should be selected. Available sulphur in the form sulphate lower levels, gypsum, zinc sulphate and borax should be used as fertilizer. Micronutrient: iron, zinc found normal to higher levels in soil samples, manganese found deficient, copper is found higher, where as boron and molybdenum found normal.

Salinity Conditions

high soil salinity reduces crop yields in the long run. The soil salinity is justified by the EC values, If the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is less than.

4.   Soil Salinity Condition of Bagalkot location during the monitoring period

Red clay soil with 50% water holding capacity and 1.12g/cc bulk density. The organic carbon found to be very low at three spots S1, S3, S4 and higher value at spot S2. Available nitrogen among the selected soil samples found to be higher values than prescribed limit indicates the

uses organic manures regularly during agriculture activities. Total nitrogen found normal range in all the spots of study Area. Available P in first two spot S1, S2 lower value, where as spots S3, S4 soils possesses normal range. Soil of the land needed P containing fertilizer. Available K found deficient in the soil samples. Available sulphur in the form of sulphate in the selected soil samples were found to be highly lower than the prescribed limit. Micronutrient: iron\n, manganese, zinc in ppm levels found to be lower than the prescribed limit except in the spot S1, where as in spots S1 the above nutrients were in normal range, micronutrient boron and molybdenum found in normal range, copper concentration in the soils found to be higher level than the legal limit.

Salinity Conditions

high soil salinity reduces crop yields in the long run. The soil salinity is measured by the EC values, If the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is less than.

5.   Soil Salinity Condition of Badami location during the monitoring period

Black-clay (sandy) alkaline soil with 58% water holding capacity, EC- values of soils spots S3 and S4 found to be in legal limit indicates such soils do not deleterious effect on crops, but samples of spots S1 and S2 were critical for germination because of high values of EC. Organic carbon varies from 0.15% to 1.17% indicates irregular uses of organic manures during agricultural practices. Available Nitrogen in soils was found to be lower in level, the neutral fertilizers like Urea should be used for growth and yield of plants and crops. CAN- can be used to increase the availability of micro-nutrients in the soil. Total Nitrogen found higher-limits. A pH = 8.59 probably create severe micronutrient deficiency (Fe, Mn) and (Ca, Mg) result in a general yellowing and poor growth. If the pH of soils found to be can be lower simply by using fertilizers containing Ammonium Nitrate, Ammonium Sulphates, Urea, Sulphur and Ammonium Sulphate (10 pounds of sulphur pr acre as a plant nutrient). Available Phosphorous in the soil samples found to be deficiency, suitable fertilizer should be used to enrich the nutrient. Available Potassium in soil samples found in higher limit, salts of Na and K are called high salts, the high salts will kill the plants and crops if they found higher limit. Available Sulphur in the form of Sulphate found deficiency, to enrich this nutrient it should be mixed suitably with any one of the fertilizer during cultivation. Micro-Nutrients: the situation could create a very high soil pH more than 8.0 due to the use of lime, basic slag, wood ashes make the soil with great mulch and it create the severe micro nutrient deficiency.

The micro nutrients in soil such as Fe, Mn found in lower level. Boron and Molybdenum found in normal level where as Zinc and Copper found in higher levels.

Salinity Conditions

high soil salinity reduces crop yields in the long run. The soil salinity measured and justified by the EC values, If the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is less than 1.

6.   Soil Salinity Condition of Hunagund location during the monitoring period

Percentage of organic carbon in the selected soils samples of the spots found to be more soil is black and red mixed clay with medium fertile. Available nitrogen and total nitrogen % in the soil samples found to be more than normal levels, such soil do not cause any deleterious effect on crops. Available P in the three sampling spots are very less in content, except spot S2. Used DAP fertilizer were washed from the soil by regular rains. Available K found in medium level of all the soil samples. Available S in the form of So4 were in normal to deficient in first of two spots S1&S2 and spots S3&S4 respectively. Micronutrients: Iron in ppm levels found to be deficient, Mn in ppm level was found maximum quantity. Zinc in ppm legal level, copper in ppm legal level in all selected spots were more than normal range, where as Boron & Mo levels were in prescribed limits.

Salinity Conditions

high soil salinity reduces crop yields in the long run. The soil salinity is depended upon by the EC values, If the EC value is more than 4 or above, the soil possess severe accumulation of salts may restrict the growth of plants and vegetations. The soil in the present location is less than 1.

Information and Suggestion Recommendations: The following fertilizers should be used for sensitive crops and sugar cane crop in Kg per hector and kg per acre.

Sensitive crops			sugar cane crop		
Urea	58 kg/ha	23kg/acre	Urea	210kg/ha	84kg/acre
DAP	95kg/ha	38kg/acre	DAP	160kg/ha	64kg/acre
Potash	18kg/ha	7kg/acre	Potash	150kg/ha	60kg/acre
Gypsum	160kg/ha	64 kg/acre	Gypsum	190kg/ha	76kg/acre
Org.Manure	100 kw/ha	40 kw/acre	Org.Manure	150kw/ha	60 kw/acre
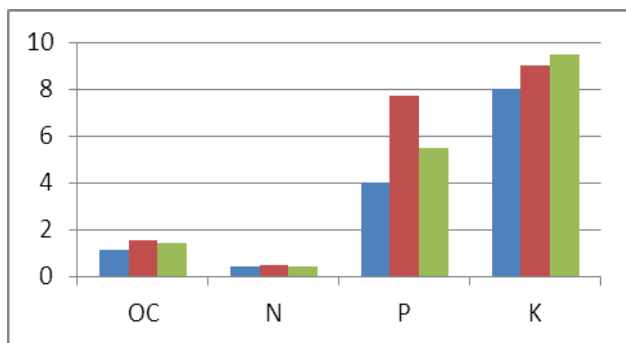
Figure I. Major Nutrients in Soil samples of Jamkhandi Region of Bagalkot District.
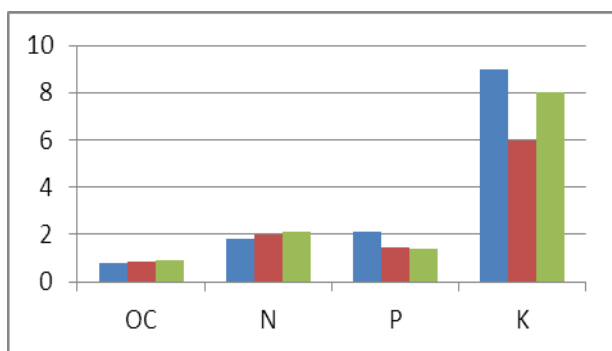
Figure II. Major Nutrients in Soil samples of Mudhol Region of Bagalkot District.
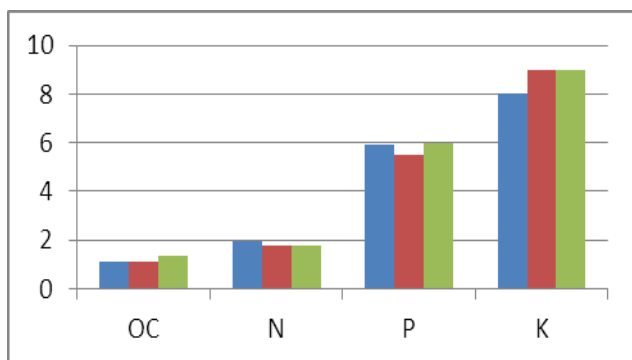
Figure III. Major Nutrients in Soil samples of Balagi Region of Bagalkot District.
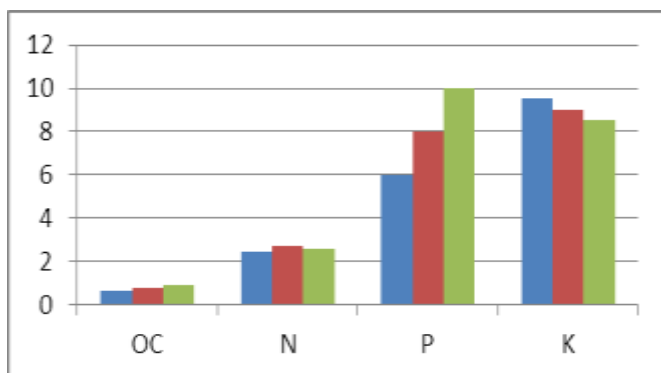
Figure IV. Major Nutrients in Soil samples of Bagalkot Region of Bagalkot District.
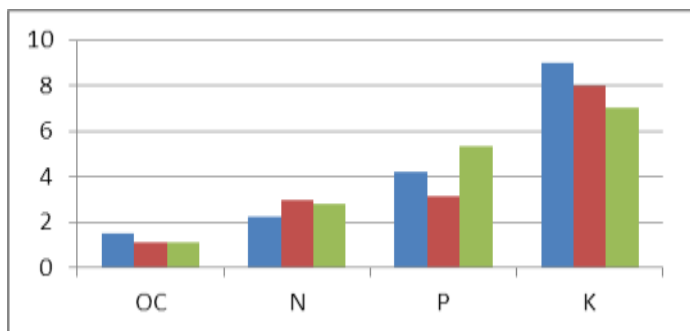
Figure V. Major Nutrients in Soil samples of Badami Region of Bagalkot District.
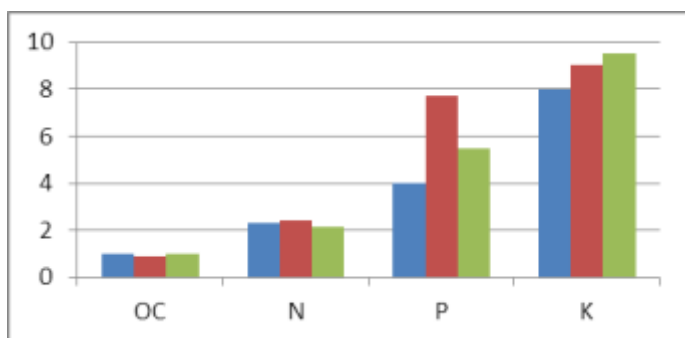
Figure VI. Major Nutrients in Soil samples of Hunagund Region of Bagalkot District.

TABLE 1 SOIL ANALYSIS

Soil analysis of Report of Jamkhandi locations of Bagalkot District

Village: Hire Padasalagi,   Analysis Date: 02.08.2015

During: Pre- Monsoon 2015.

| Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	**Physical-Parameters**						
	Bulk Density	g/cc	1.12	1.14	1.12	1.11	
	Water Holding Capacity	%	52	53	53	52	
	Texture		Sandy	Sandy	Sandy	Black	
II	**Chemical Parameters**						
	pH		7.56	7.84	7.86	7.78	6.5-7.5
	EC	ds/m	0.68	0.74	0.82	0.69	<1
	Sodium	%	1.21	1.22	1.32	1.29	<0.1
	Calcium Carbonate		Medium	Medium	Medium	Medium	
III	**Major Nutrients**						
	Organic Carbon	%	1.32	1.89	1.12	1.46	0.5-0.75
	Avail.N	Kg/h	275.3	268.4	291.2	284.3	250-280
	Total N	%	0.089	0.058	0.078	0.069	0.03-0.06
	Available P	Kg/h	11.2	10.3	9.23	9.87	20-60
	Available K	Kg/h	251	246	231	245	250-300
IV	**Secondary Nutrients**						
	Ca	%	16.2	14.3	15.6	13.4	<1
	Mg	%	1.9	2.0	2.2	2.8	<0.5

		Ppm	21.2	19.8	18.6	20.1	10-20
	SO4	Ppm	21.2	19.8	18.6	20.1	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	4.75	4.98	4.12	3.98	Min.4.50
	Manganese	Ppm	2.12	2.22	2.03	2.09	Min.2.00
	Zinc (Zn)	Ppm	1.01	1.22	1.21	1.29	Min.0.75
	Copper (Cu)	Ppm	1.98	2.01	1.89	2.10	Min.0.60
	Boron	Ppm	0.78	0.68	0.95	0.88	Min.0.50
	Molybdenum	ppm	0.11	0.10	0.09	0.08	0.05-0.2

TABLE 2 SOIL ANALYSIS REPORT

Soil analysis of Report of Mudhol locations of Bagalkot District

Village: Kajji Doni, Analysis Date: 16.08.2015.

During: Pre- Monsoon 2015.

Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	Physical-Parameters						
	Bulk Density	g/cc	1.12	1.10	1.12	1.14	
	Water Holding Capacity	%	56	54	56	54	
	Texture		Red-clay	Red-clay	Red-clay	Red-clay	
II	Chemical Parameters						
	pH		8.12	8.24	8.32	8.28	6.5-7.5
	EC	ds/m	4.46	4.52	4.34	4.58	<1
	Sodium	%	0.92	0.81	0.83	0.77	<0.1
	Calcium Carbonate		High	Medium	Medium	Medium	
III	Major Nutrients						
	Organic Carbon	%	0.85	0.87	0.95	0.99	0.5-0.75
	Avail.N	Kg/h	259.3	246.5	278.3	236.9	250-280
	Total N	%	0.036	0.042	0.038	0.051	0.03-0.06
	Available P	Kg/h	66.3	71.2	64.5	66.8	20-60
	Available K	Kg/h	365.3	386.1	298.9	310.5	250-300
IV	Secondary Nutrients						
	Ca	%	21.2	22.8	23.4	20.6	<1
	Mg	%	0.30	0.26	0.28	0.24	<0.5
	SO4	Ppm	18.3	17.3	16.5	16.9	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	3.12	3.21	3.56	2.99	Min.4.50
	Manganese	Ppm	1.12	1.32	1.51	1.09	Min.2.00
	Zinc (Zn)	Ppm	0.71	0.72	0.68	0.62	Min.0.75
	Copper (Cu)	Ppm	0.82	0.74	0.68	0.90	Min.0.60
	Boron	Ppm	0.52	0.42	0.39	0.33	Min.0.50
	Molybdenum	ppm	0.11	0.12	0.09	0.08	0.05-0.2

TABLE 3 SOIL ANALYSIS

Soil analysis of Report of Bilagi locations of Bagalkot District

Village: Chikalagundi, Analysis Date: 18.08.2015.

During: Monsoon 2015.

Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	Physical-Parameters						
	Bulk Density	g/cc	1.10	1.12	1.11	1.11	
	Water Holding Capacity	%	54	56	55	56	
	Texture		Black	Black-clay	Black-clay	Black-clay	
II	Chemical Parameters						
	pH		8.23	8.12	8.35	8.14	6.5-7.5
	EC	ds/m	0.24	0.22	0.29	0.26	<1
	Sodium	%	0.12	0.10	0.09	0.08	<0.1
	Calcium Carbonate		Medium	Medium	Medium	Medium	
III	Major Nutrients						
	Organic Carbon	%	0.72	0.68	0.59	0.74	0.5-0.75
	Avail.N	Kg/h	286.2	278.6	295.3	288.2	250-280
	Total N	%	0.066	0.086	0.075	0.085	0.03-0.06
	Available P	Kg/h	14.2	16.5	18.9	20.1	20-60
	Available K	Kg/h	201	212	234	241	250-300
IV	Secondary Nutrients						
	Ca	%	11.2	12.3	14.3	13.6	<1
	Mg	%	3.3	2.9	3.5	4.0	<0.5
	SO4	Ppm	18.6	16.9	17.8	16.5	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	6.82	8.12	7.36	6.89	Min.4.50
	Manganese	Ppm	0.98	0.86	0.99	0.87	Min.2.00
	Zinc (Zn)	Ppm	0.78	0.68	0.67	0.86	Min.0.75
	Copper (Cu)	Ppm	0.72	0.75	0.68	0.87	Min.0.60
	Boron	Ppm	0.38	0.41	0.48	0.46	Min.0.50
	Molybdenum	ppm	0.11	0.09	0.08	0.12	0.05-0.2

TABLE 4 SOIL ANALYSIS REPORT

Soil analysis of Report of Badami locations of Bagalkot District

Village: Guledagudda, Analysis Date: 22.08.2015.

During: Monsoon 2015.

Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	Physical-Parameters						
	Bulk Density	g/cc	1.14	1.12	1.13	1.14	
	Water Holding Capacity	%	54	59	56	58	
	Texture		Red-clay	Red-clay	Red-clay	Red-vlay	
II	Chemical Parameters						
	pH		7.56	7.42	7.81	7.72	6.5-7.5
	EC	ds/m	0.76	0.81	0.68	0.69	<1
	Sodium	%	0.98	0.89	0.78	0.81	<0.1

			Low	Low	Medium	Low	
III	Major Nutrients						
	Organic Carbon	%	0.78	0.82	0.86	0.91	0.5-0.75
	Avail.N	Kg/h	352.2	315.6	345.1	367.8	250-280
	Total N	%	0.065	0.071	0.068	0.073	0.03-0.06
	Available P	Kg/h	22.34	24.56	25.34	28.69	20-60
	Available K	Kg/h	152	187	198	213	250-300
IV	Secondary Nutrients						
	Ca	%	12.3	11.3	14.6	17.6	<1
	Mg	%	1.84	1.63	1.92	2.01	<0.5
	SO4	Ppm	11.32	12.23	14.32	16.54	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	3.12	3.14	3.25	3.46	Min.4.50
	Manganese	Ppm	1.21	1.32	1.08	1.09	Min.2.00
	Zinc (Zn)	Ppm	0.85	0.95	0.88	1.02	Min.0.75
	Copper (Cu)	Ppm	1.10	1.02	1.09	1.08	Min.0.60
	Boron	Ppm	0.62	0.54	0.58	0.71	Min.0.50
	Molybdenum	ppm	0.12	0.14	0.13	0.09	0.05-0.2

TABLE 5 SOIL ANALYSIS

Soil analysis of Report of Bagalkot locations of Bijapur District

Village: Chikkalagundi, Analysis Date: 25.08.2015.

During: Post- Monsoon 2015.

Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	Physical-Parameters						
	Bulk Density	g/cc	1.12	1.10	1.09	1.11	
	Water Holding Capacity	%	58	56	57	58	
	Texture		Loam	Sandy	Clay Loam	Clay Loam	
II	Chemical Parameters						
	pH		7.75	8.01	8.42	7.89	6.5-7.5
	EC	ds/m	0.89	0.75	0.45	0.58	<1
	Sodium	%	3.465	4.201	1.865	1.122	<0.1
	Calcium Carbonate		Low	Medium	Low	Medium	
III	Major Nutrients						
	Organic Carbon	%	0.81	0.86	0.92	0.99	0.5-0.75
	Avail.N	Kg/h	182.3	201.3	212.4	198.6	250-280
	Total N	%	0.23	0.28	0.52	0.41	0.03-0.06
	Available P	Kg/h	7.32	11.23	7.56	11.9	20-60
	Available K	Kg/h	312	280	254	298	250-300
IV	Secondary Nutrients						
	Ca	%	0.78	0.81	0.90	0.93	<1
	Mg	%	0.42	0.50	0.44	0.65	<0.5
	SO4	Ppm	5.01	4.98	4.72	2.10	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	2.01	1.98	1.53	1.76	Min.4.50
	Manganese	Ppm	0.12	0.82	0.75	0.62	Min.2.00

	Zinc (Zn)	Ppm	3.01	2.36	2.56	2.63	Min.0.75
	Copper (Cu)	Ppm	1.96	1.01	1.68	2.12	Min.0.60
	Boron	Ppm	0.83	0.91	0.68	0.49	Min.0.50
	Molybdenum	ppm	0.08	0.07	0.08	0.06	0.05-0.2

TABLE 6 SOIL ANALYSIS

Soil analysis of Report of Hunagund locations of Bagalkot District

Village: Kudalasangum, Analysis Date: 01.09.2015.

During: Post- Monsoon 2015.

Sl.No.	Parameter	UNIT	Spot S1	Spot S2	Spot S3	Spot S4	Legal limit
I	Physical-Parameters						
	Bulk Density	g/cc	1.10	1.12	1.14	1.14	
	Water Holding Capacity	%	54	56	52	54	
	Texture		Black-Clay	Red-Clay	Black-clay	Red-clay	
II	Chemical Parameters						
	pH		7.81	7.69	7.45	7.65	6.5-7.5
	EC	ds/m	0.51	0.62	0.48	0.42	<1
	Sodium	%	1.40	1.62	1.51	1.51	<0.1
	Calcium Carbonate		Medium	Medium	Medium	Medium	
III	Major Nutrients						
	Organic Carbon	%	1.01	1.10	1.13	1.20	0.5-0.75
	Avail.N	Kg/h	283.2	278.6	264.5	286.2	250-280
	Total N	%	0.080	0.0998	0.0885	0.102	0.03-0.06
	Available P	Kg/h	14.21	13.21	10.56	11.52	20-60
	Available K	Kg/h	256	245	236	264	250-300
IV	Secondary Nutrients						
	Ca	%	22.3	22.6	26.5	29.6	<1
	Mg	%	17.6	18.5	16.9	17.8	<0.5
	SO4	Ppm	12.01	16.32	15.68	18.36	10-20
V	Micro Nutrients						
	Iron (Fe)	Ppm	3.21	3.56	4.02	3.95	Min.4.50
	Manganese	Ppm	6.86	5.68	7.53	6.56	Min.2.00
	Zinc (Zn)	Ppm	3.01	2.86	2.45	2.99	Min.0.75
	Copper (Cu)	Ppm	2.10	2.32	2.41	2.16	Min.0.60
	Boron	Ppm	0.36	0.42	0.65	0.45	Min.0.50
	Molybdenum	ppm	0.10	0.11	0.12	0.09	0.05-0.2

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