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RESEARCH ARTICLE

Physico - chemical and micronutrients status of soils of Velhale village Bhusawal tehsil, Jalgaon district Maharashtra, India

■ Monika S. Bhavsar, Monika Naphade, Rajshri Shinde and Mayuri Deshmukh

SUMMARY

Soil fertility is the quality of soil to supply nutrients in the proper amount for plant growth without causing toxicity and deficiency. Soil fertility management is highly complex given the myriad of interacting factors that dictate the extent to which farming state farms invest in the fertility of their soils. To achieve precision in farming and to maximize crop production, there should be proper maintenance of soil health and minimize fertilizer mis application One hundred farmers were randomly selected from the Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra through the Soil Health Card Scheme under the Department of Soil Science and Agricultural Chemistry, Dr Ulhas Patil College of Agriculture, Jalgaon Maharashtra to assess the physico-chemical properties, macro and micronutrients status of soils in the year 2019-20. One hundred geo-referenced soil samples (0-20 cm) from Velhale Village Bhusawal were collected and analyzed in the laboratory for soil pH, electrical conductivity, organic carbon content, calcium carbonate content, available macronutrients *viz.,* N, P, K, S and micronutrients like Fe, Zn, Cu, Mn and B.The pH and EC of soils collected from the study area varied from 6.5 to 8.1 and 0.54 to 0.90 dS m^{-1} showing the neutral to alkaline nature of soil and soils are safe in total soluble salt content and organic carbon content was very low to medium 0.18 to 0.59%, respectively. The results obtained in the present study clearly showed large variability in the chemical properties of soil. The available sulphur varied from (6.92 to18.00 mg kg^{-1}) low to medium. Available iron and zinc content was low to medium (0.50-6.26 and 0.42-0.79 mg kg^{-1}, respectively) while, copper and manganese content was sufficient (0.31-0.82 and 0.50-4.64 mg kg^{-1}, respectively) across the study area. Available boron in soils of all the tehsil ranged from 0.56to 2.58 mg kg^{-1} (medium to high). Soil testing plays an important role in the use of fertilizers and other agricultural inputs. Soil test summaries and soil fertility maps are of vital necessity as reference materials for the scientific management of soil. This information could aid in decision making for the application of plant nutrients for higher monetary returns to the farmers.

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Key Words : Macronutrients, Micronutrients, Soil fertility status, Balance nutrients, Soil health, Soil testing, Balance fertilizers

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Increasing population pressure and over exploitation of productive lands create a serious problem of lowering the fertility status of soil and it leads to deterioration of soil. The deficiency of nutrients directly affects the growth of crops and crop response become poor (Jagtap *et al.*, 2018). Hence, for the sustainability of the present agricultural system and management of our soil resources, a database regarding the fertility status of soils is required. Application of fertilizers by the farmers in fields without prior knowledge of soil fertility status might result in adverse effects on soils as well as crops both in terms of micronutrient deficiency and toxicity either by inadequate or overuse of fertilizers. With the invention of modern technologies of remote sensing, GIS and GPS, it is now possible to monitor soil fertility and crop health through systematic surveys. This will be helpful to monitor the changes in fertility status of the studied area site-specific nutrient requirement of the crop. It is anticipated that with higher yields and more intensive agriculture the secondary and micronutrient deficiency will increase both in amount and extent (NAAS, 2018). Imbalanced and inadequate use of fertilizers coupled with low use efficiency of other inputs led to a decline in the response efficiency of chemical fertilizer nutrients under intensive agriculture in recent years. Micronutrients are important for maintaining soil health and increasing fertilizer use efficiency of major nutrients and ultimately the crop productivity. The deficiency of micronutrients has become a major constraint in the sustainable crop productivity of soils and hence, there is a need to know the status of nutrients of the soil (Katkar *et al.,* 2018). Keeping this in view, the present study was undertaken in Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra to study the micro nutrient status of the soils.

MATERIAL AND METHODS

Soil sampling and analysis :

One hundred surfacegeo-referenced soil samples (0-20 cm) were collected from Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra during the year 2019-20. The soil samples were processed and analyzed for pH and EC in soil: water suspensions (1:2.5 w/v) as described by Jackson (1973). Organic carbon was determined by Wet oxidation method described by Walkley and Black (Nelson and Sommers, 1982). Available S was estimated by the turbidimetric method (Chesnin and Yien, 1951). Soil samples were extracted with 0.005 M diethylene triamine penta acetic acid (DTPA) for estimation of available Zn, Fe, Cu and Mn using Atomic Absorption Spectrophotometer (Lindsay and Norvell, 1978). Available boron was determined by 0.01 M $CaCl_2$ toextract with the Azo-methine method (Berger and Troug, 1939).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

pH :

One hundred farmers were selected from the Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra for analyzed the pH of surface soil. The pH of soils collected from the study area varied from 6.5 to 8.1, the results are indicated that soils are neutral to slightly alkaline in reaction. This was distributed to the basaltic trap present material from which these soil are formed. The higher content of ferromagnesian minerals in basaltic trap material might have resulted in

Table 1 : Categorization of soil parameters and nutrients

Sr. No.	Parameters	Low	Medium	High
1.	pH (1:2.5)	<6.5 (Acidic)	6.5-7.5 (Neutral)	>7.5 (Alkaline)
2.	EC (dS m-1)	<1.0	1-2	>2.0
3.	O.C. (g kg-1)	<4.0	4-8	>8.0
4.	S (mg kg-1)	<10.0	10-20	>20.0
5.	Zn (mg kg-1)	<0.60	0.6-1.80	>1.80
6.	Fe (mg kg-1)	<4.50	4.50-18.0	>18.0
7.	Cu (mg kg-1)	<0.20	0.20-0.80	>0.80
8.	Mn (mg kg-1)	<2.0	2.0-8.0	>8.0
9.	B (mg kg-1)	<0.50	0.50-1.0	>1.0
10.	Mo (mg kg-1)	<0.10	0.10-0.40	>0.40

the alkaline soil reaction. Further, the Jalgaon district comes under semi-arid tropic, where precipitation is less and evapotranspiration losses are more which contribute towards accumulating of basic salts which favour the higher pH. These results are under the observation recorded by Chaudhari and Kadu (2007) and Ingle *et al.* (2017) from the region of Marathwada and Khandesh region, These findings support the observation of Padole and Mahajan (2003); Waikar *et al.* (2014); Chaudhari and Kadu (2007); Jibhakate *et al.* (2009); Desmukh (2012) and Shinde *et al.* (2014) as they reported that the black cotton, soils of Marathwada, Vidarbha and Khandesh region of Maharashtra are derived from basaltic parent material which contents higher ferroganesium minerals and less silica content.

EC (dSm^{-1}) :

Same as pH,the electrical conductivity of soil also analyzed and results are showed that EC of soil ranged from 0.54 to 0.90 dS m^{-1}. Soils are safe in total soluble salt content. It was an ability that basaltic parent material which is rich in basic cations Ca, Mg, Na, K adds salts of their cations.The EC is safe for crop production but if due care (soil as water conservation and utilization) is not taken it may become injurious to most of the crops. Many types of research from these regions and other regions of Maharashtra emphasized that non-judicious use of water resulted in black cotton soils into high total soluble salt concentration. A similar observation is also recorded in that study by Hadole *et al.* (2019).

Organic carbon (%) :

As pH and EC, organic carbon was also analyzed for the fertility status of soils of Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra. Organic carbon is the backbone of crop production and soil quality. Organic carbon content ranged from 0.18 to 0.59 %. The results are indicated that the organic carbon content of the soil is very low to medium in nature. This might be because of shallow and eroded soil observed in this area. Further Organic Carbon content was low because of high temperature and low moisture content. These two climatic parameters hasten the oxidation of organic carbon present in organic matter in these soils. These results are underWaikar *et al*. (2014)

Sulphur status :

The available sulphur varied from low to medium (6.92 to 18.00 mg kg^{-1}). The intensive cultivation of crops and application of fertilizers devoid of sulphur might be depleted from the soil. The application of balanced nutrition to the crops under intensive cultivation is essential for maintaining soil fertility and sustainable productivity. Among all nutrients availability of sulphur was found to be very low. It is difficult to understand the behaviour of S in these soils. So detailed fractional study of sulphur is more focused on this. However, Patil and Mali (2001) refused that the oilseed growing track of Marathwada emergingas a sulphur deficient area. They observed nearly 30 present soils of Parbhani and Latur district were sulphur deficient.

Micronutrients status :

Zinc status :

DTPA-Zn of Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra ranged from 0.42 to 0.79 mg $kg^{-1}$and varied from low to medium. The availability of micronutrient cations is generally low in alkaline soils and crops grown on these soils suffer from hidden hunger (Malewar, 2005). Under alkaline soil conditions (pH higher than 7.0) the micronutrient cations are changed largely to their oxides and hydroxides which ultimately reduced their availability (Deb *et al.,* 2012).

Iron status :

DTPA-Fe content showed a wide variety of low to medium (0.50 to 6.26 mg kg^{-1}) in the soils of the study area. Considering 4.5 mg kg^{-1} as the critical limit of available iron indicates that the soils are becoming deficient in iron followed by zinc. Increased removal of micronutrients as a consequence of the adoption of high yielding varieties and intensive cropping together with a shift towards the use of high analysis NPK fertilizers which might have caused a decline in the level of micronutrients in the soil below the critical level which is required for normal productivity of crops (Zende, 1987).

Copper status :

Copper availability in black cotton soils is relatively better as compared to another trace element The DTPA extractable Cu in the soils ranged from 0.31 to 0.82 mg kg^{-1}. All the soils in this village were found sufficient in Cu content.

Manganese status :

The DTPA-Mn status of soils ranged from 0.50 to 4.64 mg kg^{-1}. Manganese content was sufficient in this

Table 2 : Physico-chemical, available sulphur and micronutrient status (mg kg $^{-1}$) in soils of Velhale village Bhusawal tehsil, Jalgaon district Maharashtra

Sr. No.	Name of the farmer	pH	EC	OC	S	Zn	Bo	Fe	Mn	Cu
			(dSm-1)	(%)			mg kg^{-1}(ppm)			
1 .	Vishvanath Shantaram Koli	7.5	0.76	0.42	16.92	0.527	1.02	2.509	1.682	0.56
2.	Anant Raghu Chaudhari	7.4	0.77	0.41	16.20	0436	0.83	4.294	1.823	0.43
3 .	Gopal Chavdas Patil	7.8	0.72	0.36	15.48	0.582	1.11	1.497	0.603	0.40
4 .	SarsvatibaiSdashiv Patil	7.7	0.77	0.23	10.44	0.628	1.02	1.937	0.664	0.60
5 .	Vaishalibai Suresh Patil	7.3	0.76	0.24	14.76	0.483	0.74	2.448	1.102	0.42
6.	Dnyaneshwar Ramdas Chaudhari	7.4	0.84	0.36	13.68	0.444	0.83	2.643	1.082	0.56
7.	Ujvala Vijay Rane	7.9	0.80	0.38	8.64	0.463	1.11	3.334	3.324	0.40
8 .	Pajendra Narayan Patil	6.5	0.64	0.42	9.72	0.562	0.83	4.642	4.642	0.44
9.	Kacharu Ukhae Survale	7.8	0.75	0.33	18.00	0.451	1.57	1.028	3.266	0.63
10.	Dnyaneshwar Trabank Mahajan	7.5	0.88	0.29	7.56	0.542	0.74	2.643	2.631	0.36
11.	MurlidharRanbhaji Patil	7.8	0.75	0.36	10.08	0.456	0.83	4.762	1.65	0.63
12.	Murlidhar Shankar Borole	7.9	0.85	0.33	11.68	0.57	0.74	2.448	1.61.	0.45
13.	SupaduDhanaji Patil	7.2	0.83	0.23	10.08	0.66	1.11	2.584	1.66	0.44
14.	Rajendra Vaman Patil	7.8	0.68	0.29	13.32	0.535	1.30	2.447	1.57	0.52
15.	Rajendra Vaman Patil	7.5	0.84	0.30	10.44	0.52	0.93	3.286	1.48	0.31
16.	Umesh Pandrinath Patil	7.5	0.78	0.38	12.60	0.70	1.11	3.636	0.50	0.45
17.	Chandrakant Jagannath Patil	7.7	0.68	0.23	14.76	0.49	0.83	3.924	1.68	0.44
18.	SopanBhavdu Kolte	7.8	0.77	0.38	18.09	0.76	1.20	2.537	0.64	0.60
19.	Ashok Vaman Chaudhari	7.6	0.65	0.45	14.04	0.46	1.11	5.309	1.77	0.44
20.	Rangu Nathu Patil	7.8	0.78	0.29	14.76	0.45	0.65	2.048	1.31	0.36
21.	Jyoti Ulhas Engale	7.5	0.76	0.27	13.32	0.79	0.56	1.937	1.12	0.60
22.	ShwevantabaiLashman Patil	7.9	0.77	0.41	16.92	0.50	0.65	1.715	1.99	0.42
23.	Shantram Narayan Chaudhari	7.5	0.81	0.42	9.38	0.64	0.74	0.731	1.76	0.44
24.	SindhubaiTulashiram Patil	7.9	0.81	0.42	12.96	0.74	1.11	1.272	1.70	0.43
25.	Pramod Madhukar Patil	7.9	0.79	0.41	15.84	0.79	1.20	2.537	1.86	0.47
26.	MurlidharShadu Patil	7.7	0.74	0.36	11.62	0.45	1.11	4.831	1.60	0.67
27.	Nandkishor Ravindra Patil	7.0	0.82	0.33	16.56	0.70	1.20	0.662	1.46	0.25
28.	Vasant Devaji Patil	7.3	0.72	0.29	9.00	0.45	1.85	3.115	1.58	0.40
29.	Shialeja Prakash Yevale	7.9	0.80	0.29	12.24	0.74	1.30	3.715	1.88	0.56
30.	Nilesh Prabhakar Mahajan	7.9	0.76	0.29	13.32	0.56	1.57	3.75	1.48	0.63
31.	Eknath Lshman Chaudhari	6.7	0.83	0.29	13.58	0.71	1.02	4.831	1.10	0.82
32.	Dhanraj Revaji Patil	6.9	0.85	0.30	11.16	0.49	2.31	3.309	1.96	0.60
33.	Kailas Madhukar Bonde	7.1	0.97	0.33	16.92	0.70	1.39	5.748	1.94	0.82
34.	Supdu Kashinath Patil	8.0	0.75	0.26	16.20	0.45	1.11	2.047	1.96	0.43
35.	Pankaj Chandrakant Patil	7.0	0.45	0.29	15.12	0.70	1.94	3.279	1.58	0.62
36.	Vasudev Tukaram Patil	7.1	0.78	0.26	14.04	0.532	2.04	2.652	1.96	0.60
37.	Hitesha Sanjay Patil	7.8	0.80	0.35	16.92	0.64	1.11	5.31	1.00	0.60
38.	Aashisha Suresh Patil	6.8	0.84	0.60	16.56	0.70	1.57	3.66	162	0.60
39.	Najmabi Malij Ali	6.5	0.89	0.30	11.68	0.48	1.30	3.27	1.46	0.40
40.	Ashok Trayabak Patil	7.1	0.65	0.30	9.72	0.74	1.85	5.04	1.10	0.44
41.	Divakar Pralhat Koli	6.6	0.97	0.40	18.00	0.57	1.11	6.26	1.08	0.62
42.	Bhagvat Shravan Vagh	7.6	0.65	0.39	14.04	0.42	1.67	1.84	1.51	0.55
43.	Bhagvati Shankarlal Patel	7.7	0.78	0.33	11.52	0.48	2.50	3.05	1.48	0.36
44.	Pandurang Ramkrushan Patil	7.5	0.80	0.42	9.36	0.45	1.11	2.58	0.56	0.31
45.	Yshodabai Govinda Mali	7.6	0.79	0.29	11.52	0.70	2.04	0.52	0.50	0.56
46.	Dhansham Ramdas Patil	6.6	0.82	0.38	14.76	0.44	2.04	2.51	0.63	0.32
47.	Rajesh Rav Zhope	7.4	0.88	0.30	10.08	0.43	2.50	2.25	0.69	0.42
48.	Uakha Eknath Chaudhari	7.6	0.83	0.30	14.76	0.54	1.57	1.43	1.98	0.67
49.	Balu Sitaram Patil	7.0	0.90	0.41	11.16	0.45	1.11	1.49	1.51	0.64

Table 2 : Contd…….

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50.	Eknath Govinda Chaudhari	7.9	0.88	0.27	16.56	0.48	1.39	3.92	1.98	0.49
51.	Kachru Ukhai Survade	7.5	0.80	0.33	9.00	0.55	2.50	1.74	1.10	0.40
52.	Sangita Dilip Mahajan	7.2	0.78	0.38	10.44	0.55	1.30	1.74	1.28	0.44
53.	Subhas Devchand Beldar	6.8	0.55	0.26	6.92	0.52	1.57	2.64	1.88	0.39
54.	Chaya BaluBeldar	6.8	0.72	0.29	16.92	0.45	1.11	3.71	1.63	0.36
55.	Yuvraj Kadu Shinde	6.6	0.70	0.30	18.00	0.42	1.11	3.07	1.48	0.41
56.	Hausabai Narayan Survade	7.9	0.78	0.33	9.72	0.51	2.04	3.45	1.19	0.63
57.	Sunil Dinkar Narkhede	7.5	0.75	0.29	13.66	0.54	1.57	2.86	1.45	0.44
58.	Suryabhan Ukhai Koli	7.8	0.78	0.27	10.80	0.59	2.59	2.51	1.18	0.38
59.	Archana Balu Patil	7.7	0.75	0.59	14.04	0.52	2.78	1.82	1.40	0.61
60.	Suraj Arjun Shinde	7.6	0.89	0.24	11.52	0.62	1.94	2.51	1.68	0.42
61.	Chndrabhaga Eknath Patil	7.0	0.74	0.27	15.12	0.74	1.11	2.49	1.54	0.41
62.	Nilkand Shravan Patil	7.5	0.74	0.33	18.00	0.58	2.13	3.26	1.88	0.71
63.	Prakash Tukaram Shinde	6.7	0.67	0.38	15.12	0.58	2.50	3.26	1.54	0.67
64.	Ravindra Ashok Patil	7.5	0.75	0.33	11.52	0.44	1.02	3.27	1.18	0.71
65.	Shashikla Dattare Mahajan	6.8	0.55	0.44	14.04	0.60	1.94	1.49	1.46	0.33
66.	Latik Subhas Patil	7.9	0.78	0.29	10.08	0.58	1.67	1.04	1.08	0.49
67.	Subhas Skharam Bavskar	6.8	0.60	0.20	14.04	0.74	1.57	1.15	1.80	0.60
68.	Vasudev Tukaram Patil	6.9	0.78	0.44	10.44	0.56	1.94	2.64	1.28	0.40
69.	Aatmaram Tikaram Patil	7.5	0.80	0.26	9.00	0.45	1.30	3.92	1.80	0.67
70.	Arun Ramdas Patil	7.0	0.65	0.36	18.00	0.53	2.22	3.26	1.56	0.50
71.	Rajkaml Ashok Mahajan	6.6	0.97	0.30	18.00	0.54	2.68	1.63	1.56	0.39
72.	Pravin Suresh Shinde	6.6	0.83	0.30	18.00	0.49	1.57	1.44	1.90	0.82
73.	Soma Suka Patil	7.1	0.54	0.44	18.00	0.70	1.76	3.04	1.92	0.36
74.	Namdev Shankar Patil	7.0	0.64	0.35	12.60	0.51	2.04	1.49	1.18	0.51
75.	Ravindra Eknath Survade	7.9	0.79	0.29	13.68	0.69	1.20	3.04	1.26	0.44
76.	Pandari Kisan Patil	7.4	0.80	0.33	14.04	0.46	1.61	3.09	1.64	0.51
77.	Dttatray Ukhai Patil	7.9	0.78	0.45	18.00	0.73	2.13	1.49	1.45	0.60
78.	Suresh Eknatha Bonde	7.4	0.71	0.23	12.24	0.50	1.30	1.49	1.36	0.62
79.	Hitesh Sanjay Patil	739	0.77	0.32	17.64	0.68	1.02	3.04	1.43	0.32
80.	Pandurang Ramkrushna Patil	6.7	0.73	0.23	11.88	0.72	1.11	3.04	1.28	0.66
81.	DharajRevaji Patil	6.9	0.95	0.32	9.00	0.58	2.04	2.64	0.50	0.53
82.	Badu Mukund Patil	7.8	0.74	0.35	15.84	0.46	1.76	1.49	1.70	0.69
83.	Bharti Suresh Patil	6.9	0.89	0.30	7.92	0.47	2.04	2.50	1.62	0.62
84.	Shamu Ramdas Patil	6.9	0.95	0.33	10.44	0.70	1.76	2.64	1.50	0.40
85.	Uba Tushar Chaudhari	7.1	0.61	0.38	7.56	0.71	1.11	2.42	1.68	0.38
86.	Pramod Murlidhar Patil	7.1	0.65	0.33	11.52	0.49	2.68	1.78	1.90	0.38
87.	Shashikant Vaman Patil	7.9	0.76	0.41	17.28	0.67	2.50	2.84	1.46	0.57
88.	Pradip Liladhar Patil	7.3	0.83	0.29	9.72	0.71	1.67	2.49	1.68	0.44
89.	Vijay Bhanudas Patil	6.7	0.86	0.33	16.92	0.42	2.50	3.26	1.66	0.40
90.	Arun Keshav Patil	7.5	0.80	0.37	14.40	0.60	1.30	0.50	1.74	0.33
91.	Manoj Radhakisan Makeja	7.9	0.78	0.27	14.76	0.56	2.78	2.64	1.64	0.63
92.	Madhukar Shnkar Patil	7.9	0.76	0.30	10.08	0.47	2.31	1.29	1.10	0.80
93.	Dhiraj Ra, Das Patil	7.9	0.75	0.37	15.48	0.57	1.30	2.56	1.18	0.62
94.	Vandana Suresh Shinde	8.1	0.82	0.30	14.76	0.62	1.48	2.56	1.30	0.62
95.	Shalini Madhukar Chudhari	8.0	0.76	0.33	11.88	0.42	2.59	1.68	1.32	0.42
96.	Madhukar Badiram Patil	7.3	0.88	0.30	10.44	0.46	2.04	2.49	1.82	0.52
97.	Ravindra Murlidhar Patil	7.8	0.76	0.33	12.60	0.43	1.02	3.68	1.11	0.46
98.	Sindhubai Shalik Patil	7.9	0.80	0.33	17.28	0.70	1.30	3.68	1.18	0.56
99.	Prmod Murlidhar Patil	7.0	0.72	0.18	12.60	0.71	1.67	0.76	1.70	0.63
100.	Subhash Sakharam Bhavsar	7.8	0.76	0.33	15.48	0.58	1.39	0.64	1.62	0.42

(Soil Health Card Scheme under National Sustainable Farming Scheme in Soil and Water Testing Laboratory at Godavari Foundation's, Dr Ulhas Patil College of Agriculture, Jalgaon)

village. It was reported bymany researchers Shinde (2007), Katkar and Patil (2010); Madavgade *et al.* (2015) that black soils are well supplied with manganese content, which is also observed in the present investigation.

Boron status :

Available boron in soils of all the Tehsil ranged from 0.56to 2.58 mg kg^{-1}. The available boron varied from medium to high. The range of available boron in soils of different states of India varied from traces to 12.2 mg kg^{-1} (Das, 2007).

The present study revealed that there is wide variation in micronutrient status of soils of Velhale Village Bhusawal Tehsil, Jalgaon district Maharashtra. The soils are low in available zinc, iron and boron and high in available sulphur, manganese, copper. Deficient nutrients have to be restored through chemical fertilizers and/or organic manures to maintain soil health. The current status of available sulphur and micronutrients in soils of Velhale village Bhusawal Tehsil, Jalgaon district Maharashtra will be helpful to suggest the efficient ways and methods of balanced nutrient application for enhancing the yields by using recommended quantities of organic manures and inorganic fertilizers in the areas of major and micro-nutrients deficiency.

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