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PHYSICO-CHEMICAL STATUS OF SOIL IN CHANDRAPUR DISTRICT

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Abstract:
The study was conducted in Chandrapur district of Maharashtra State. District is located in the eastern edge of Maharashtra in Nagpur Division and forms the eastern part of Vidarbha region. Of the total 308 lakh hectares land in Maharashtra, two-thirds, i.e. approximately 225.6 lakh hectares of land is under cultivation. In the Chandrapur district, on the basis of climate, proportion of rainfall and the type of soil are Red alluvial soil and Clay Soil. The soil samples were collected from chandrapur for soil analysis. Physio-chemical properties of different soils are pH, moisture content, electrical conductivity, available macronutrient N, P, K, Ca, Mg and micronutrients Fe, Mn, Zn, and Cu. Each macro and micronutrients plays specific role for growth and development of plants. In the experimental field of Withania somnifera, the soil was 18, 38, 4.16 and 7.34 kg/ha Fe, Mn, Zn and Cu, Andrographis paniculata 17, 37, 5.80 and 8.36 Kg/ha Fe, Mn, Zn and Cu.. Soil for Ablemoschus moschatus was 21, 36, 7.80, and 7.39, kg/ha Fe, Mn, Zn and Cu /ha. and for Psoralea corylifolia 20, 40, 8.30 and 9.50 kg/ha Fe, Mn, Zn and Cu..

Keywords: Soil, Physio-chemical properties, Withania somnifera, Andrographis paniculata, Ablemoschus moschatus and Psoralea corylifolia

Introduction:

In Maharashtra, Chandrapur district soils of the farm are clay textured in the surface ranged from 41.36 to 62.13%. The soils of the farm are slightly alkaline in reaction. The $CaCO_3$ ranged from 1.91 to 7.75% which mostly increased with depth. The organic carbon content in surface soil ranged from 0.48 to 0.64% which indicates that the soils are medium to high organic carbon content. The pH, EC, organic carbon and available N, P_2O_5 and K_2O indicate that the soils are neutral to mildly alkaline in soil reaction with low to moderately high in organic carbon content, low to medium in available nitrogen, very low in available P_2O_5 and medium to very high in available K_2O. The most significant discovery was that of the German Chemist Justus Von Leibig, (1840) showed that the growing plants obtain element calcium, potassium, sulphur and phosphorus from soil. For the first time he showed that plants obtain their carbon supply from carbon dioxide in air and not from soil. He also established that certain basic principles of soil management viz i) A cropped soil is restored to fertility only by adding to it all minerals and nitrogen removed by the plants; and ii) The law of minimum in relation to mineral nutrition.

The availability of mineral nutrients is controlled by the chemical and physical properties of the soil. Availability of organic sources of N is dependent upon mineralization of the N to the inorganic forms, ammonium and nitrate. The solubility of most micronutrients is affected by soil, pH and organic matter content to assess the sufficiency of the mineral nutrients for optimum plant growth. For sustained high crop yield, the application of nutrients is required. Efficient use of applied nutrients depends upon the timing and methods of nutrient application. The chemical and physical properties of the soil determine the methods of application and soil management practices are best suited for a given soil (Kamprath and Watson 1980). Soil is a very complex, soil just collection of fine mineral particles. Soil contains air, water, dead organic matter and various type of living organism. The formation of soil is influenced by organisms, climate, topography, parent material, and time. Humus is the primary source of carbon and nitrogen required by plants for their nutrition. It improves soil structure which is necessary for plant growth (Pidwirny, 2006). Soil is one of the great valuable natural resources of a country. To encounter the growing demand of food, fiber, fuel. It is essential that soils are maintained in an excellent state of health. Maintaining soil productivity is a major challenge before this generation. Nearly 50% of the land in India suffers varying types and degree of soil degradation. The current rate of soil degradation is 5-7m ha/yr (Sehgal et al, 1990).

Medicinal plants have good market demand both indigenously and globally. The Medicinal Plants boards have recognized following important herbs to be protected and promoted for medicinal values. Increasing demand of medicinal plants has promoted its commercial cultivation. During the last decade, some systematic efforts have been made to

popularize the cultivation of medicinal plants. It seems that it is much more profitable than many of the traditional crops. Medicinal plant if they are grown under horticultural crops, its cultivation entitles the grower to tax - free returns. Government supports the farmers to make available grants or loan for cultivation of medicinal plants through Banks. However, an endangered species are preferred over the common occurring species for cultivation.

Ablemoschus moschatus (Kasturi bhendi) is a hardy plant and it's a wide range of soils, particularly in sandy loam soils with a pH of 7.0. It also gives a good yield in soil with a pH 6.0 to 8.6. ***Psoralea corylifolia* (Bawachi)** is found growing on variety of soils ranging from sandy medium loam to black-cotton soils however; sandy loam soil with good organic matter is the best for its growth and yield. ***Withania somnifera (Ashwagandha)*** grows successfully in sandy loam or light red soils with good organic matter and drainage. Under such soil condition, it is also easy to dig the roots out without damaging them. A soil pH range of 7.5 to 8 is ideal. ***Andrographis paniculata (Kalmegh)*** is a hardy plant and can be grown on a variety of soils in the native state; it is grown in clay to sandy soils in various locations. However, sandy loamy soil rich in organic matter is good for its growth and yield.

Material and Methods:

Four different types of Soil samples were collected from (Lohara- site - I, Lohara - site - II, Forest soil – site - III and Khairgaon soil - site - IV) Chandrapur. Each soil samples were taken from a depth of 15 – 20 cm in a zigzag manner. The samples were collected for physio-chemical properties and nutritional status of soil. After sampling, the soil samples were spread for air-drying at room temperature. After proper drying, large stones and other similar objects were removed and the soil was ground to break up aggregates and the crumbs. And then samples were passed through 2 mm stainless steel sieve and stored in a clean Polythene bags and labeled properly with necessary information of field (Table: 1).

Result and Observation:

Table 2: Hydrogen ion concentration: pH of soil was slightly alkaline between 7.1 -7.4. *Withania* cultivated in the soil, pH was 7.1. *Andrographis paniculata* the pH 7.2. and pH 7.3 for *Ablemoschus moschatus, Psoralea corylifolia* pH 7.4. **Moisture content:** 0.12 for *Withania somnifera* and 0.13 for *Andrographis paniculata and Ablemoschus moschatus* and *Psoralea corylifolia* 0.14. **Electrical conductivity:** cultivated soil for *Withania somnifera* 0.02 dSm^{-1}. 0.04 dSm^{-1} for *Andrographis paniculata, Ablemoschus moschatus* and *Psoralea corylifolia.* **Macroelements in soil: Available Nitrogen:-** Soil around roots of *Withania somnifera* was 73.5 kg N/ha, *Andrographis paniculata* 96 kg N/ha, *Ablemoschus moschatus* 90.5 kg N/ha, and *Psoralea corylifolia* 153 kg N/ha. **Available phosphorus:-** 38.08 kg P/ha in the soils, for *Withania somnifera,* 35.06 kg P/ha for *Andrographis paniculata,* 37.80 kg P/ha for *Ablemoschus moschatus* and 40.20 kg P/ha for *Psoralea corylifolia.* **Available potassium:-** Available potassium in soil for *Withania somnifera* was 250 kg K/ha, 252.1 kg K/ha for *Andrographis paniculata,* 255.2 kg K/ha for *Ablemoschus moschatus*, and 260.5 kg K/ha for *Psoralea corylifolia.* **Available Calcium and Magnesium:-**Calcium and magnesium are a secondary plant nutrient present in the soil. Soil used for *Withania somnifera* was 34.36 kg Ca/ha and 19 kg Mg/ha, *Andrographis paniculata* 35.08 kg Ca/ha and 18 kg Mg/ha. *Ablemoschus moschatus*, calcium and magnesium was 32.05 kg Ca/ha and 16 kg Mg/ha. *Psoralea corylifolia* was 33.09 kg Ca/ha and 25 kg Mg/ha. **Available Micronutrients:** Most of micronutrients are essential for crop productivity indicate that the micronutrients of medicinal crop growing soils of *Withania somnifera* was 18 kg Fe/ha, 38 kg Mn/ha, 4.16 kg Zn/ha and 7.34 kg Cu/ha and *Andrographis paniculata* 17 kg Fe/ha, 37 kg Mn/ha, 5.80 kg Zn/ha and 8.36 kg Cu/ha. While 21 kg Fe/ha, 36 kg Mn/ha, 7.80 kg Zn/ha and 7.39 kg Cu/ha for *Ablemoschus moschatus. Psoralea corylifolia* was 20 kg Fe/ha, 40 kg Mn/ha, 8.30 kg Zn/ha and 9.50 kg Cu/ha).

Discussion:

The pH, moisture content, electrical conductivity, available macronutrient N, P, K, Ca, Mg and micronutrients Fe, Mn, Zn, and Cu in the soils of different plots, were trials to study their influence of medicinal plants.

The pH of soils was slightly alkaline between 7.1 to 7.4, moisture content 0.12 to 0.14 having electrical conductivity ranges from 0.02 to 0.05 dSm^{1}. Macroelements in soil differentiated into low N and medium to high level of P and K. In *Withania somnifera* the field soil was 73.5, 38.08 and 250 kg N, P and K/ha, a calcium and magnesium was 34.36 and 19 kg/ha. *Andrographis paniculata* crops cultivated in soil having medium level96.0 kg N/ha, 35.06

kg P/ha 252.1 kg K/ha, 35.08 kg Ca/ha and 18 kg Mg/ha. Plot of *Ablemoschus moschatus* 90.5, kg N/ha, 37.80 kg P/ha, 255.2 kg K/ha, 32 .05 kg Ca/ha and 16 kg Mg /ha. Soil of *Psoralea corylifolia* 153 kg N/ha, 40.20 kg P/ha, 260.5 kg K/ha, 33.09 kg Ca/ha and 25 kg Mg/ha. Each micronutrient plays specific roles for the growth and development of plants. In the experimental field of *Withania somnifera*, the soil was 18, 38, 4.16 and 7.34 kg/ha Fe, Mn, Zn and Cu, *Andrographis paniculata* 17, 37, 5.80 and 8.36 Kg/ha Fe, Mn, Zn and Cu. Soil of *Ablemoschus moschatus* was 21, 36, 7.80, and 7.39, kg/ha Fe, Mn, Zn and Cu /ha. and *Psoralea corylifolia* 20, 40, 8.30 and 9.50 kg/ha Fe, Mn, Zn and Cu (Table 2).

From the above results, the essential nutrients of the soil status were known, those helps in maintaining the physical condition of soil and also help in providing proper mineral nutrients. Thus, the recommendation for application of plant nutrients and then dose depends on soil fertility status. Soil testing needs in determination of such requirements, which helps in balanced fertilization for future to avoid deficiency/ toxicity of different plant nutrients and helpful to microbial population in soil (Mishra, 1999). Number of workers and co-workers studies the content of the soil in various regions. The experiments performed on different soils according to their physico-chemical properties. Paudyal and Majid (1992) reported soil of Bikaner district and Jaisalmer in North-western part of Rajasthan, India, soil is loamy sand, alkaline with calcareous layer at 75 to 125 cm depths for *Acacia mangium* crop N 1.82 %, P 0.12%, K 0.71%, Mg 0.07% and Ca 0.66%. The soil in Andaman and Nicobar, Neil, Havelock, Makka Prahar area was slightly alkaline with pH ranging from 7.5 to 8.0, EC ranged 1.0 dSm^{-1} with medium available N (225-550 kg/ha) and low both available P (< 10 kg/ha) and K (<120kg /ha) (Ghoshal et al., 2006). The soil at Munipalle in Gunter district of A. P. was clay loam with pH 7.9, EC 0.7 dSm^{-1}, Available N, P and K, 155 - 66 - 195 kg/ha respectively (Ramani and Pillai, 1992).

Table: 1 Soil Samples were collected from four different sites of Chandrapur districts

Sr.no.	No. of samples	No. of sites	No. of plants
1	Sample-A	Lohara site-Plot I	*Withania somnifera*
2	Sample-B	Lohara site-Plot II	*Andrographis paniculata*
3	Sample-C	Forest soil site-Plot III	*Ablemoschus moschatus*
4	Sample-D	Khairgaon soil-Plot IV	*Psoralea corylifolia*

Table: 2 Representation of pH, moisture content, electrical conductivity, available macro and microelement of soil

Soil samples of crops	pH	Moisture content	Electrical conductivity dSm^{-1}	Available Macronutrient Kg/ha					Available Micronutrient Kg/ha			
				N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
Withania somnifera	7.1	0 .12	0.02	73.5	38.08	250	34.36	19	18	38	4.16	7.34
Andrographis paniculata	7.2	0 .13	0.04	96.0	35.06	252.1	35.08	18	17	37	5.80	8.36
Ablemoschus moschatus	7.3	0 .14	0.04	90.5	37.80	255.2	32.05	16	21	36	7.80	7.39
Psoralea corylifolia	7.4	0 .14	0.04	153	40.20	260.5	33.09	25	20	40	8.30	9.50

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