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Soil Physical Problems in Coimbatore District

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Soil profile studies in Coimbatore District revealed occurrence of physical problems like poor infiltration rate of water and impeded drainage conditicns in Peelamedu, Dasarapatti and Perianaickenpalayam series. Soils of Irugur, Palladam, Syamalakavundanpudur and Vannapatti series showed high infiltration rate and poor aggregate stability. Soils of Peelamedu, Perianaickenpalayam, Pichanur and Tulukkanur series showed high sub-soil bulk density affecting proliferation of roots of crops. Dispersed soils with high alkalinity occurred in Peelamedu series. The soils of Vannapatty, Syamalakavundanpudur and Peelamedu series were low in organic matter content. Soil map indicating the areas of soil physical problems wasprepared and suitable ameliorative measures are discussed.

The physical properties of soil influnce crop growth through their effect on soil moisture, soil air, soil temperature aud impedance of root devolopment. Although a soil may be fertile, the crop yield could be rcduced if the physical conditions of soil are not favourable for infiltration of root penetration or for the germinating seeds to break the crust. Adverse physical and environmental conditions with improper management practices decrease the productivity of soil and yield of crops. Such adverse soil conditions which affect crop growth and yield must be investigated first before adopting ameliorative measures. Soil profile studies were conducted in coimbatore district to investigate the occurrence of physical problems affecting crop growth and a soil map was prepared and suitable ameliorative measures are discussed based on field experiments conducted in problem soils.

MATERIAL AND METHODS

Out of the 26 soil series covering an area of 15.586 Sq. Km. delineated by the Soil Survey and Land Use Organisation of Tamil Nadu Government, 14 soil series occurring in 10046 Sq. Km. were covered in the present investigation and typical profiles representing each series were examined upto one meter depth or up to the parent material. Undisturbed core soil samples were collected and the physical analyses were done in triplicate and mean values reported. The bulk density of soil was estimated as the ratio between the weight of soil to its volume (Dakshinamurthi and Gupta, 1968). Hydraulic conductivity was estimated in core sample using

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constant head and calculated as per Darcy's equation. Yoder's wet sieving technique (1986) was adopted for aggregate stability and stability index were calculated (Dakshinamurthi and Gupta, 1968). Porosity was estimated by buchner funnel method pH and E.C. were estimated in 1:2 soil water suspension (Richards, 1954) and organic carbon was estimated by wet digestion method (Walkley and Black, 1934).

RESULTS AND DISCUSSION

The infiltration rate of Peelamedu, Perianaickenpalayam and Dasarapatti series was low and ranged from 1.0 to 2.6 cm/hr (Table I). The bulk density of the above soils showed increase with depth and ranged from 1.0 to 1.6 g/cc. The hydraulic coductivity of the above soils was low and ranged up to 2.9 cm/hr. In Dasaraparti series, the hydraulic conductivity of sub-soils was very poor which indicates occurrence of impeded drainage conditions as reported in the soil survey report (Anon., 1972). The organic carbon content of the above soils was low and ranged from 0.18 to 0.39 % The pH of the soils ranged from 7.9 to 8.9 which indicates their alkaline nature.

High infiltration rate was observed in soils of Irugur, Palladam, Syamala kavundanpudur and Tannapatti series which ranged from 8.6 to 13.6 cm/hr The hydraulic conductivity of the above soils was also high at surface and ranged from 12.4 to 15.2 cm/hr.

The aggregate stability and stability index of soils of Syamalakvu ndanpudur, Irugur, Palladam, Vannapatti and Tulukkanur series were low throughout the depth of profile while that of surface layer (0-15cm) in Perianaickenpalayam series was low.

The profiles of Palladam, Tulukkanur, Peelamedu, Perianaikkanpalayam and Irugur series showed increase in bulk density with depth. ranging from 1.42 to 1.67 g/cc. High sub-soil bulk density affects the proliferation of roots of crops nutrient mobility and restricts plants growth and yield.

Dispersed soils with alkaline reaction occur in Peelamedu series. If adequate ameoliorative measure to reduce the alkalinity of these soils are not undertaken, adverse soil physical conditions affecting crop growth would intensify.

The organic matter status was poor in profiles of Vannapatti, Syamalakavundanpudur, Peelamedu and Perianaickanpalayam series. The above soils need addition of adequate organic matter to improvetheir structural status.

Soils with high sub-soil bulk densities can be improved by breaking the hard layer with chisel or mould board plough and by incorporation of bulky organic amendments like straw, farmyard manure and compost with disc plough. The field experiment conducted in red soils (Anon. 1978) showed that chiseling upto 20 cm depth with chisel plough and incorporation of FYM, pig manure and

maize straw at 25 t/ha in Pichanur series were found to reduce the high sub-soil bulk bensity from 1.76 to 1.69 g/cc and increased the yield of grain and straw of sorghum (CSH.5) by about 40% over control. Velaytham (1974) found that pressmud, pyrites and gypsum at 10 t/ha were effective in reclaiming saline-sodic soils. Ravikumar (1979) found that application of organic amendments like maize straw FYM, poultry manure and cotton waste at 25 t/ha significantly improved the aggregate stability, hydraulic conductivity and moisture retention characteristics of Periannaickanpalayam series of black soil and improved the yield of ragi (Co 10) by 40% over control.

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TABLE I Physical properties of problem soils in Coimbatore District*

Name of Series	Depth (cm)	Infiltration rate (cm/hr)	Bulk density (g/cc)	Hydraulic conductivity (cm/hr)	Total pore-space (%)	Capillary pore space (%)	Noncapillary pore space (%)	Aggregate stability (%)	Stability index (%)	Organic carbon (%)	pH	E.C. (m. mhos/cm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	((3)
Peelamedu	0– 17	2.6	1.28	2.9	60.5	35.1	25.4	46.7	29.8	0.39	8.1	0.30
	17– 49		1.48	1.2	59.6	38.8	20.8	46.3	41.4	0.18	8.7	1.00
	49– 80		1.60	0.3	57.3	36.2	21.1	56.7	51.8	0.18	8.8	2.20
	80–125		1.42	0.3	57.1	34.2	22.9	52.4	40.3	0.16	8.9	2.20
Perianaickenpalayam	0– 16	1.0	1.27	1.16	64.2	48.99	15.21	29.0	23.5	0.41	8.3	1.10
	16– 36		1.45	0.85	65.1	48.00	17.10	60.9	49.9	0.32	8.1	0.80
	36– 82		1.54	0.46	64.7	44.07	20.63	61.0	49.8	0.26	7.9	0.75
	82–126		1.56	0.31	63.9	53.19	10.71	46.7	12.5	0.21	8.2	1.00
Irugur	0– 17	10.8	1.48	14.1	38.6	20.70	17.9	14.6	12.4	0,69	7.5	0.20
	17– 35		1.51	6.5	48.3	26.20	22.1	34.4	24.2	0.42	7.3	0.20
	35– 56		1.65	5.8	55.5	29.60	25.9	26.7	14.5	0.33	7.6	0.20
Palladam	0– 8	8.6	1.56	12.8	39.4	27.80	11.60	18.6	12.5	0.43	8.0	2.0
	8– 23		1.54	1.8	43.9	29.30	14.60	22 9	18.0	0.28	8.2	2.2
Syamalakavundanpudur	0– 16	10.8	1.52	12.4	42.2	31.2	11.0	22.6	18.8	0.13	8.0	2.2
	16– 45		1.56	6 8	46 6	30.9	15.7	28.4	21.4	0.12	8.0	2.2
Vannapatti	0– 17	13.6	1.55	16.2	47.2	29.2	18.0	16.2	12.8	0.15	7.5	0.2
	17– 38		1.58	8.8	46.9	29.0	17.9	24.5	21.6	0.12	7.0	0.2
Tulukkanur	0– 19	7.8	1.48	9.3	48.8	27.3	21.5	19.6	14.8	0.23	8.5	2.2
	19– 46		1.67	5.7	52.3	34.5	17.8	25.9	21.0	0.26	8.5	2.3
Manupatty	0– 15	6.2	1.48	9.9	48.0	25.6	22.4	24.2	16.8	0.58	7.4	0.2
	15– 43		1.51	3.1	56.3	29.0	27.3	38.8	26.4	0.36	7.8	0.2
Dasarapatty	0– 28	2.6	1.00	12.19	63.0	43.9	19.1	46.8	26.2	0,57	7.8	0.5
	18– 45		1,23	1.14	63.3	40.6	22.7	51.3	31.5	0.54	7.8	0.5
	45– 92		1.29	Traces	63.3	40.3	23.0	51.1	46.5	0.47	7.7	1.0
	92–132		1.41	Traces	61.3	41.4	19 9	46.2	44.4	0.44	7.9	3.0

*: Each value is a mean of three determinations.