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Studies on Some Soil Physical Properties as Influenced by Continuous Cropping Under Intensive Cultivation

K. K. MATHAN[1], K. SANKARAN[2], N. KANAKABUSHINI[3] and K. K. KRISHNAMOORTHY[4]

An assessment of the influence of fertilizer use and pest management under intensive cropping on some of the soil physical properties did not point to any large differences that can be attributed to management practices. Surface soils contained higher percentage of pore space and volume expansion than the sub soils.

The influence of different management practices on the physical properties of the soils have been reported in the past and it varied from soil to soil and from one climatic zone to another (Johnston *et al.*, 1943; Young *et al.*, 1960; Biswas *et al.*, 1967 and 1971 and Adams, 1973). In this paper a study of the assessment of the effects of fertilizer use and pest management under intensive cultivation on the physical properties of the soil is presented.

MATERIAL AND METHODS

The soil of the experimental plot belonging to the Peelamedu series was a typical black soil, clayey loam in texture with a pH of 8.2. The available nitrogen content was low at the start of the experiment. The crop rotation consisted of ragi, cowpea and maize under irrigated condition. The treatments consisted of graded doses of the optimum NPK fertilizers based on soil test values, sulphur free source of NPK fertilizers, farm yard manure, hand weeding and use of weedicides. The details are as follows :

50 per cent NPK plus weedicides
100 per cent NPK plus weedicides
150 per cent NPK plus weedicides
100 per cent NPK plus hand weeding
100 per cent NPK plus weedicides + micronutrients
100 per cent NP + weedicides
100 per cent N + weedicides
100 per cent NPK + weedicides + FYM at 10 tons/ac
100 per cent NPK (sulphur free) + weedicides
Unmanured control

At the start of the experiment in 1972 the pre-planting soil samples were analysed for apparent density, true density and maximum waterholding capacity following the method described by Black (1965). During the course of 3 years, 8 crops were raised in the plots were ploughed under the above mentioned treatments. After the harvest of each crop, the plots were ploughed with country plough twice, levelled and the next crop was raised. At the end of the 8th crop in 1975, post harvest soil samples were collected and analysed again for the

1 - 4 : Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore-3.

afore mentioned physical constants in addition to pore space and volume expansion.

TABLE I. Organic carbon content

T.No.	1972	975	Increase over 1972	Percentage increase over 1972	Percentage value when control of 1975=100
1.	0.304	0.465	0.161	53.70	117.58
2.	0.300	0.508	0.208	69.30	115.98
3.	0.298	0.555	0.257	86.24	126.71
4.	0.300	0.450	0.150	50.50	102.74
5.	0.303	0.545	0.242	79.87	124.43
6.	0.304	0.492	0.183	61.87	135.39
7.	0.300	0.500	0.200	66.67	120.55
8.	0.300	0.638	0.338	112.67	148.66
2.	0.303	0.438	0.138	46.00	100.00
10.	0.300	0.438	0.138	46.03	100.00
Mean	0.292	0.530	0.238	70.22	—

S.E. = 0.0446
D.D. = 0.0915

RESULTS AND DISCUSSION

The data on apparent density and absolute specific gravity are furnished in Table I. Apparent density was influenced by the treatments and the treatments and the values declined on an average from 1.4 to 1.2 (14.02 per cent). The rate of decline of apparent density was more rapid in the plots which received sulphur free source of NPK fertilizers and N alone. Similar trends were observed by Van Bavel and Shaller (1956), Tanchandrphongs and Davidson (1970), Havanagi and Mann (1970) and Hafez (1974). But the treatments did not bring about significant differences of apparent density. Decline in the true density from the initial value was observed in all plots. The rate of decline was maximum in plots which received farm yard manure along with 100 per cent NPK fertilizers.

TABLE II. Apparent density and absolute specific gravity

T.No.	Apparent density				Absolute specific gravity			
	1972	1975	Decrease	% decrease over 1972	1972	1975	Decrease	% decrease over 1972
1.	1.38	1.30	0.08	5.80	2.70	2.64	0.06	2.22
2.	1.37	1.40	+0.03	+2.19	2.70	2.46	0.24	8.89
3.	1.38	1.13	0.25	18.11	2.80	2.61	0.19	6.79
4.	1.40	1.33	0.07	5.00	2.80	2.64	0.16	5.71
5.	1.41	1.12	0.29	20.57	2.80	2.57	0.23	8.21
6.	1.40	1.08	0.32	22.86	2.80	2.63	0.17	6.07
7.	1.40	1.07	0.33	23.57	2.70	2.54	0.16	5.93
8.	1.40	1.22	0.18	12.86	2.70	2.40	0.30	11.11
9.	1.38	1.05	0.33	23.91	2.70	2.31	0.39	14.44
10.	1.38	1.21	0.17	12.32	2.70	2.41	0.29	10.74
Statistical analysis	NS	NS			NS	NS		

TABLE III. Maximum water holding capacity, porepace and volume expansion

T.No.	Maximum water holding capacity				Pore space		Volume expansion	
	1972	1975	Increase	% increase over 1972	Surface sample 1975	Subsoil sample 1975	Surface sample 1975	Subsoil sample 1975
1.	43.30	39.43	3.87	8.94	57.5	40.4	16.1	16.6
2.	43.10	49.20	6.10	14.15	56.9	47.7	18.2	17.5
3.	43.20	49.25	6.05	14.00	46.9	48.9	17.2	17.5
4.	42.80	51.40	8.60	20.09	57.4	50.8	16.2	16.4
5.	43.00	52 00	9.00	20.93	47.4	44.5	17.1	18.4
6.	43.10	48.55	5.45	12.65	44.1	46.4	18.1	18.0
7.	43.10	53.47	10.37	24.06	45.8	46.6	18.3	17.7
8.	42.50	48.47	5.97	14.05	52.4	49.8	17.6	17.2
9.	42.60	50.25	7.55	17.72	43.4	47.2	17.0	19.0
10.	42.60	48.65	6.05	14.20	51.2	46.3	15.0	17.4
Mean	42.93 NS	49.07 NS	6.02	12,27	50.3 NS	47.8 NS	17.1	17.6

A slight decrease in the true density was quite possible because of the fact that the organic matter content as revealed by the organic-carbon (Table III). increased from 46 to 112 per cent during the period of observation and the maximum increase was found in farm yard manure plots. Tiarts *et al.* (1974) reported that the application of cattle manure to a silty clay loam soil decreased the particle density (absolute sp. gravity) and bulk density. Such a decrease in absolute specific gravity was reported by Narayana and Shah (1966), Daji (1974), Kohnke (1974). Clark and McIntyre (1956) reported a decrease which ranged from 8.94 to 24.06 per cent. In 1975, surface and sub soil samples were analysed for those two constants. The percentage pore space was more in the surface layers than in ine subsoil layers. A higher content of organic carbon improves the porepaces as well as the moisture holding capacity of soils. The porespace was not significantly altered by the fertilization. Minimum volume expansion was recorded in the unmanured control plots. The treatmental differences were otherwise not significant.

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