https://doi.org/10.29321/MAJ.10.A02618

Madras agric. J. 70. (5): 304 - 308 May 1983

INFLUENCE OF DIFFERENT SOIL AMENDMENTS ON THE PHYSICAL PROPERTIES OF A HEAVY BLACK SOIL AND YIELD OF GROUNDNUT TMV 7 IN THE PERIYAR-VAIGAI COMMAND AREA

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In a field experiment conducted in a heavy black soil of periyar-Vaigai Command Area of Maduri District, with different soil amendments, the *in-situ* bulk density, infiltration rate, hydraulic conductivity, moisture content in soil (on any day after irrigation) and maximum water holding capacity were all significantly influenced. The plots treated with 20 tonnes of coir waste/ha recorded the highest moisture content at any time after irrigation, maximum water holding capacity, infiltration rate and hydraulic conductivity of soil and lowest *in-situ* bulk density compared to others. The highest yield of groundnut (TMV-7) pods and haulms (with the highest additional profit) was given by coir waster treatment compared to others with pressmud (@ 10 tonnes/ha), farm yard manure (@ 20 tonnes/ha) and Sand (@ 50 tonnes/ha).

In heavy textured black soils, main problems are less aeration, high bulk density, poor drainage and permeability of soil especially for irrigated dry crops Groundnut crop needs good friability and drainage of any soil. With a view to improve the physical condition of heavy black soil and yield of groundnut crop, this investigation was undertaken because groundnut yields are generally low in these soils owing to mainly the physical problem prevelant in them.

MATERIAL AND METHODS

A field experiment with five treatments of soil amendments (Coir waste @ 20 tonnes/ha without treating with any N solution, Pressmud @ 10 tonnes/ha, farm yard manure @ 20 tonnes/ha, sand @ 50 tonnes/ha and control) and 5 replications was laid out in a farmer's holding of a heavy black soil (Peelamedu clay loam A vertisol) near Chellampatty Block (Nathapatty village) of Periyar-Vaigai Command Area of Maduri District, Tamil Nadu. The test crop used was TMV-7 groundnut during the early summer Season of 1981 (January-April). The experimental design followed was randomised block design using 4m x 5m plot size and a spacing of 15 cm x 15 cm (farmer's method). A total number of four uniform irrigation (4 cm) was given and hoeing and weedings were done and earthed up. The manurial schedule followed was 18, 36 and 54 kg of N, P and K/ha respectively.

The moisture content of soil at different depths was determined gravi-

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metrically on the fourth and twentyeth day after irrigation during the crop period (1½ months after sowing). Infiltration rate of water into soil in all experimental plots after about 4 days from sowing date was determined by using double ring infiltrometer (Dakshinamurthi and Gupta 1968). Undisturbed soil core samples were taken from 0-12.5 cm and 12.5-25.0 cm depth of soil after about 2 months from sowing and *in situ* bulk density (Dakshinamurthy and Gupta 1968) and hydraulic conductivity (according to Darsy's equation) weree stimated. Maximum water holding capacity of the soil samples (2 months after sowing) was determined by the method of Keen and Rockzkowski (1921). The major nutrient contents of the amendments tried were analysed as per the procedure of Jackson (1967). The data on yield of dried pods and haulms were recorded.

RESULTS AND DISCUSSION

The texture of sarface soil was clay loam. The E. C. of the surface soil was 0.27 m. mhos/cm and its pH (soil: water = 1 : 2.5) was 8.85.

The ESP of the soil was 12.24. The data on the physical properties of the soil during crop growth and yield are presented in Table 1.

All the amendments have significantly imporved the infiltration rate of water into soil. This is in accordance with the findings of Ravikumar and Thyagarajan, (1980). Statistically the effect of coir waste in improving the infiltrations was the higher under o pressmed and farm yard manure is on par but significantly higher than control *In situ* bluk density of undisturbed soil core has been most reduced by coir waste treatment (1.13 g/cc followed by pressmud (1.13 g/cc) and farm yard manure (1.19/cc). The effect of coir waste, farm yard manure and pressmud on increasing infiltration rate and decreasing bulk density is due to possible increase in aeration, porosity friability and promotion of better aggregation by the carbonaceous matter in them. Their organic matter would have helped to increase microbial activity: better aggregation Hence infiltration rate is hastened and unit volume-weight (bulk density) is reduced.

Hydraulic conductivity of undisturbed soil core also is infiuenced the same way as that of infiltration rate. Coir waste treatment has recorded highest hydraulic conductivity compared to other. In 12.5-25.0 cm layer also there is significant effect due to treatments. Addition of sand increased weight per unit volume making it less fine textured soil and thereby movement of water is increased. The above physical improvements in soil would permit better proliferation of

roots, resulting in better plant growth and yield

Moisture content in soil is strongly influenced by the various treatments. Coir waste treated plots recorded the highest moisture content on fourth and twentyeth day after irrigation compared to other treatments. The amendments have individually influenced moisture content in soil significantly on any day after irrigation. All the amendments tried except sand have increased moisture retention capacity of soil because sand makes the soil coarser in texture. Coir waste, pressmud and farm yard manure have very high moisture retention power because of their highly carbonaceous nature. In addition, these also would serve as soil mulch to prevent evaporational loss of miosture from soil Hence these organic amendments would help to widen the interval period between irrigations in a crop season and economise water use. But sand treated plots would demand one or two more irrigation(s) than control as its addition renders the soil relatively lighter textured causing higher conductivity of water especially from root zone and depleting soil moisture earlier than control as seen from data in Table 1.

Maximum water holding of soil was the highest under coir waste treated plots compared to others in decreesing order. The farm yard manure and pressmud treatments have also significantly increased the water holding capcity of surface soil like the coir waste. But sand treatment has significantly reduced water holding capacity of soil because its dose (50 tonnes/ha) is high enough in making soil relatively coareer textured compared to control. High carbonaceous materials of coir waste, pressmud and farm yard manure have contributed for enhancing moisture holding power of soil. It would help reduce the number of irrigations owing to its high moisture holding ability and hence achieve economy of water use in these soils.

Yield data reveal that coir waste treated plots recorded the highest yield of pods compared to sand, farm yard manure and control in decreasing order. The haulms yield was also the highest under coir waste compared to farm yard manure, pressmud,sand and controt in decreasing order. The amendments have significantly increased yield of both pods and haulms due to the aforesaid improvement of physical condition. Because of luxurient growth in plots treated with coir waste, the yield of haulms happened to be the treated plots recorded pods yield less than that of pressmud, its haulms yield was more than that under pressmud treatment because of probabily higher vegetative growth under farm yard manure treatment than under pressmud and sand treatments. Table 2 reveals the strong correlation of yield of pods and haulms of groundnut TMV 7 crop in this heavy black soil and the established relationship in the form of regression equations. Especially the infiltration rate ($r=0.82$) hydraulic conductivity (0.659) and maximum water holding capacity

Table 1. Mean values of soil physical properties in a heavyblack soil as influenced by various soil amendment and yield of groundnut

Treatments	Soil depth in cm	Infiltration rate (cm/hr)	*In situ* bulk density (g/cc)	Hydraulic conductivity (cm/hr)	Maximum water holding capacity (%)	Moisture content (%) 4 days after irrigation	Moisture content (%) 20 days after irrigation	Yield (kg/ha) Pods	Yield (kg/ha) Haulms
T_1	0-12.5	1.68	1.54	2.3	23.7	21.8	10.7	2496	1820
	12.5-25.0		1.68	1.3	—	23.8	13.8		
T_2	0-12.5	6.75	1.13	25.5	66.9	28.9	15.5	3730	2300
	12.5-25.0		1.44	6.2	—	32.5	20.0		
T_3	0-12.5	4.50	1.13	16.5	56.5	23.7	11.1	3125	2000
	12.5-25.0		1.49	3.5	—	26.7	14.2		
T_4	0-12.5	5.63	1.19	21.5	61.2	27.1	13.9	2844	2228
	12.5-25.0		1.74	3.7	—	31.3	16.6		
T_5	0-12.5	4.75	1.65	6.4	51.2	19.7	9.20	3189	1880
	12.5-25.0		1.74	3.5		21.6	12.4		
CD (5%)	0-12.5	0.70	0.220	0.6	0.25	0.72	0.39	2332	2674
	12.5-25.0		0.023	0.1	—	0.33	0.38		

T_1 = Control; T_2 = Coir waster @ 20 tonnes/ha, T_3 = Pressmud @ 10 tonnes/ha, T_4 = Farm Yard manure @ tonnes/ha
T_6 = Sand — 50 tonnes/ha,

0.707) of this soil were having strong positive influence on the yield of pods. The haulms yields were expressing strong dependance on moisture content in soil 20 days after irrigation (r=0.942), hydraulic conductivity (r= 0.971), inflitration rate (r=0.858) and *in situ* bulk density (r=0.808) owing to the impact of amendments in charging the physical condition of soil desirable.

The additional profit due to amendments was calculated to be the highest (Rs. 2057.00 ha) under coir waste treatment followed by pressmud (Rs. 1249.50/ha) sand (Rs. 1094.00/ha) and farm yard manure (Rs. 331.00/ha) treatments over control at the prevailing rates for amendments and labour.

The auther wishes to wholeshearted thank the Indian Council of Agricultural Research (Co-ordinated Research Project on Water Management) and the Tamil Nadu Agricultural University for financing this research project.

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Table 2 Correlation of the soil physical properties (0-12.5 cm) on yields of pods and haulms of groundnut TMV crop.

Soil properties	Carrelation (*r*) *values* pods yield (Y_1)	haulms yields (Y_2)	Regression equation
Infiltration rate (cm/hr)	0.818	0.853	$Y_1 = 204.80 x + 2132.44$ $Y_2 = 99.00 x + 1589.00$
In situ bulk density (g/cc)	-0.452	-0.808	$Y_1 = -865.22 x + 4220.81$ $Y_2 = -715.21 x + 2991.11$
Moisture condent in soil 20 days after irrigiation %	0.476	0.942	$Y_1 = 85.45 x + 2043.64$ $Y_2 = 77.76 x + 1106.20$
Hydraulic conductivity of soil (cm/hr)	0.659	0.791	$Y_1 = 70.50 x + 26.35.00$ $Y_2 = 20.79 x + 1744.64$
Maximum water holding capacity (%)	0.707	0.414	$Y_1 = 77.96 x + 1856.61$ $Y_2 = 18.89 x + 826.09$