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EFFECT OF COMPACTION OF SANDY SOIL ON SOIL PHYSICAL PROPERTIES AND YIELD OF CROPS UNDER RAINFED CONDITION

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ABSTRACT

Field trails carried out in sandy soils to study the influence of compaction under rainfed conditions on the physical properties of soils and crop yields indicated that by compaction of soil by passing 400 kg roller (1 metre width) ten times 24 hours after rainfall, the bulk density was increased in the subsoil layers upto 40 cm the K (sat) values decreased in the 20-30 cm layer and total porosity decreased by 18.7 per cent in 20-30 cm layer. These changes brought about an yield increase of 18.8 per cent in the first crop. The effect of compaction persisted upto the third crop.

Key words: Compaction, sandy soil, rainfed condition

Light textured soils with 70-90% sand have very poor agricultural production potential because of low water and available nutrient retention capacity and poor mechanical hold for the growing crops. To correct the textural weakness of such soils suitable technologies have been developed (Somani and Gulathi, 1986; Agarwal *et al*., 1987). Compaction of sandy soils by passing 400 kg rollers (1 metre long) was observed to be sufficient in bringing the desirable bulk density to 1.60 g/cc from the initial bulk density of 1.45 g/cc (Yesadian and Gopalswamy, 1984) resulting in yield increase of maize grain by 30% over control . In this study the effect of compaction on the physical properties of sandy soils and yield of crops and the persistence of compaction over a period of time are discussed.

MATERIALS AND METHODS

The trial was laid out in a very sandy soil (90% sand) in an area of one and a half acres under rainfed condition at Veerapandipudur of Coimbatore district. The field was ploughed with a country plough and divided into equal halves. One portion was left as such and the other half was compacted 24 hours after the receipt of rainfall by passing 400 kg stone roller 10 times over the field. Then equal plots (18 x 6m) were formed in both compacted and uncompacted area to constitute the replications. Undisturbed core soil samples were drawn from these plots at different depths *viz*., 0-10, 10-20, 20-30 and 30-40 cm and analysed by standard methods (Gupta and Dakshinamurthi, 1981) for bulk density, hydraulic conductivity, (saturated) and total porosity.

A test crop of groundnut (TMV-3) was sown soon after sufficient rainfall was received. Soil test based fertilizers of NPK at the rates 15, 30, 45 kg/ha respectively were applied. At maturity the crop yield was recorded. The post harvest soil sample cores collected from 0-10, 10-20, 20-30 and 30-40 cm depths were analysed for the physical parameters mentioned above.

In the same field the first residual crop of tomato (Pusa Ruby) was raised followed by a second residual crop of groundnut (TMV.3). At harvest of each residual crop soil core samples were collected and analysed for physical parameters besides recording crop yield.

RESULTS AND DISCUSSION

From surface to 40 cm depth of the control plot the bulk density ranged from 1.40 to 1.48

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g/cc. In the compacted plot, it was 1.48 at the surface (0-10 cm) but increased to 1.65, 1.67 and 1.63 g/cc in the 10-20, 20-30 and 30-40 cm layers respectively (Table 1).

Table 1. Effect of compaction on bulk density, hydraulic conductivity and total porosity of sandy soil (mean of 10 replications).

Treatments	Depth (cm)				
	0-10	10-20	20-30	30-40	Mean
a) Bulk density (g/cc)					
Uncompacted	1.47	1.48	1.45	1.40	1.45
Compacted	1.48	1.65	1.67	1.63	1.61
Mean	1.48	1.57	1.56	1.52	
CD (5%)					
Treatment			0.05		
Depth			0.07		
b) Hydraulic conductivity (cm/hr)					
Uncompacted	52.2	51.3	50.6	51.9	51.50
Compacted	52.4	35.5	17.9	32.1	34.48
Mean	52.3	43.4	34.3	42.0	
CD (5%)					
Treatment			6.15		
Depth			8.92		
c) Total porosity (%)					
Uncompacted	44.4	43.8	43.4	43.9	43.88
Compacted	43.4	38.9	35.3	37.8	38.85
Mean	43.9	41.4	39.4	40.9	
CD (5%)					
Treatment			1.17		
Depth			1.69		

The saturated hydraulic conductivity of the control plots ranged from 50.6 to 52.2 cm/hr. While that of the compacted surface layer was 52.4 cm/hr which was almost the same as the control plot, but the values decreased considerably to 35.5 and 17.9 cm/hr at the lower depths of 10-20 and 20-30 cm respectively. Similar observations were recorded for total porosity also.

The above rearrangement of the soil physical environment namely decreased hydraulic conductivity and total porosity coupled with increased bulk density resulted in retention of higher amounts of moisture and consequently increased the crop yield (Table 2). The yield of first crop of groundnut increased from 2.02 t/ha in the control plots to 2.40 g/ha in the compacted plots. The effect of compaction persisted upto third crop recording an yield increase of 15 per cent in the second crop of tomato and 11.4 per cent in the third crop of groundnut.

Table 2. Effect of compaction on the yield of crops

Treatments	Yield (t/ha)		
	Test crop of Groundnut (TMV.3)	Ist residual crop of Tomato (Pusa Ruby)	IInd residual crop of Groundnut (TMV.3)
Uncompacted	2.02	2.95	2.11
Compacted	2.40	3.40	2.35
CD (5%)	0.28	0.36	NS

The trend of results of post harvest soil analyses indicated that the effect of compaction gradually decreased after each crop. At the end of third crop the bulk density and hydraulic conductivity values were nearing to the original values and the effect of compaction was almost negligible indicating the necessity of compaction of sandy soil once in 2 years under rainfed condition.

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