

**A note on the influence of cultural practices  
on soil structure**

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**INTRODUCTION**

In a previous paper (Vijayalakshmi and Pillai, 1961) data of a few soil physical characters such as pore space, moisture holding capacity, specific conductivity, apparent density etc., as influenced by some cultural practices have been presented and it was concluded that the values were in general high for 'forming mould' treatment. Continuing the studies, the influence of cultural practices on soil aggregation has been examined and the results are embodied in this note.

The importance of maintaining good soil structure in cultivated soils for optimum plant growth and yield is well known. Soil structure is said to be good when the grains of sand, silt and clay are associated in water stable aggregates or crumbs and these in turn are held together in larger units. The soil is said to lack structure when the soil crumbs, if any, disintegrate into their component grains upon submergence in water or when any larger units are lacking.

From time to time the number and size of aggregates in the soil tend to change as a result of natural causes and forces caused by human agency that affect the build up and break down of these structural units. Several factors such as temperature, moisture, soil organisms, disturbances due to tillage and rain drop impact, plant root penetration, traffic, organic matter, lime, fertilisation and different cropping systems affect the number, size and stability of soil aggregates. The effect of some or all of these factors is reflected in the seasonal variability of aggregates of soils (Toth and Alderfer, 1960). These changes in aggregation have been measured in terms of the quantity of water stable aggregates of different sizes. The wet sieving method is usually employed as a technique in evaluating changes in soil structure induced by various soil cultural practices or by addition of soil conditioning chemicals.

## MATERIALS AND METHODS

Over eighty soil samples were collected undisturbed from the top 9 inches soil layer - sixteen from the plots receiving the different cultural operations, namely, ploughing, digging with mamotty, piling mounds, forming basins and control — and were examined for water stable aggregates. The soil belonged to the deep red loam type typical of a very large area under coconuts in this country. Wet sieving analysis was carried out according to the method of Yoder (1936). A nest of sieves of diameter 8 cm. and mesh size 5 mm, 2 mm, 1 mm, 0.5 mm, 0.25 mm. and 0.1 mm. were used. 50 gm. of the soil passing through 8 mm. sieve was placed on the top sieve. The nest of sieves was then lowered into a cylinder of water and raised by mechanical device at the rate of 30 times per minute for half an hour. The nest was then removed, allowed to drain out and then separated. The contents retained on each sieve was dried to constant weight at 105°c. The weight of each of the dried fractions was determined and tabulated.

## RESULTS

The average values of the different water stable aggregate fractions found in the soil samples along with the results of statistical analysis are presented in Table 1. No significant differences in soil structure could be observed

TABLE 1  
Quantity by weight in gms. of soil retained in sieves of different sizes

Sieve size (mm)	Digging	Ploughing	Forming mounds	Forming basins	Control	S. E.	Difference significant or not (P=0.05)
0.10	1.2	0.6	0.9	0.9	0.8	0.406	No
0.25	5.3	4.5	4.5	4.8	6.5	1.026	No
0.50	22.5	17.1	25.1	18.0	17.3	5.459	No
1.00	47.7	50.8	42.5	56.0	53.9	6.859	No
2.00	17.5	21.7	19.4	14.9	16.4	3.888	No
5.00	5.9	5.4	7.6	5.4	5.1	1.575	No
M.W.D.	0.862	0.905	0.925	0.877	0.878	0.064	No

among the different plots receiving the different cultural operations. It is, however, interesting to observe that 5 per cent of the wet sieved soil by weight is retained on the sieve of diameter 5 mm. The percentage of water

stable aggregates varying in size from 2 to 5 mm. is about 15 to 20 per cent. About 50 per cent is retained on the sieve of size 1 mm. and 20 per cent on the 0.5 mm. sieve. Soil aggregates having diameter below 0.25 mm. after wet sieving comes only to 5 per cent. The pattern of distribution of the different water stable aggregates is also the same for all plots studied. Further, about 90 per cent of the grains by weight falls in the range of 0.5 mm. to 2 mm. aggregate size with a high concentration at 1 mm.

Different indices are being made use of as aids in assessing soil structure. Thus Van Bavel (1949) has suggested the mean weight diameter (M. W. D.) of the soil aggregates as a useful statistical index of aggregation. To get the values for the M. W. D., graphs are plotted with cumulated frequency percentage of aggregates against upper limits of size fractions and the area above the curve (shaded) is measured. Fig. 1 serves to illustrate the method adopted. The mean weight diameter gives an estimate of the average size of the soil aggregates and permits the presentation of an aggregate analysis in one figure. Van Bavel has found it to be a sensitive indicator of the condition and treatment of the soil.

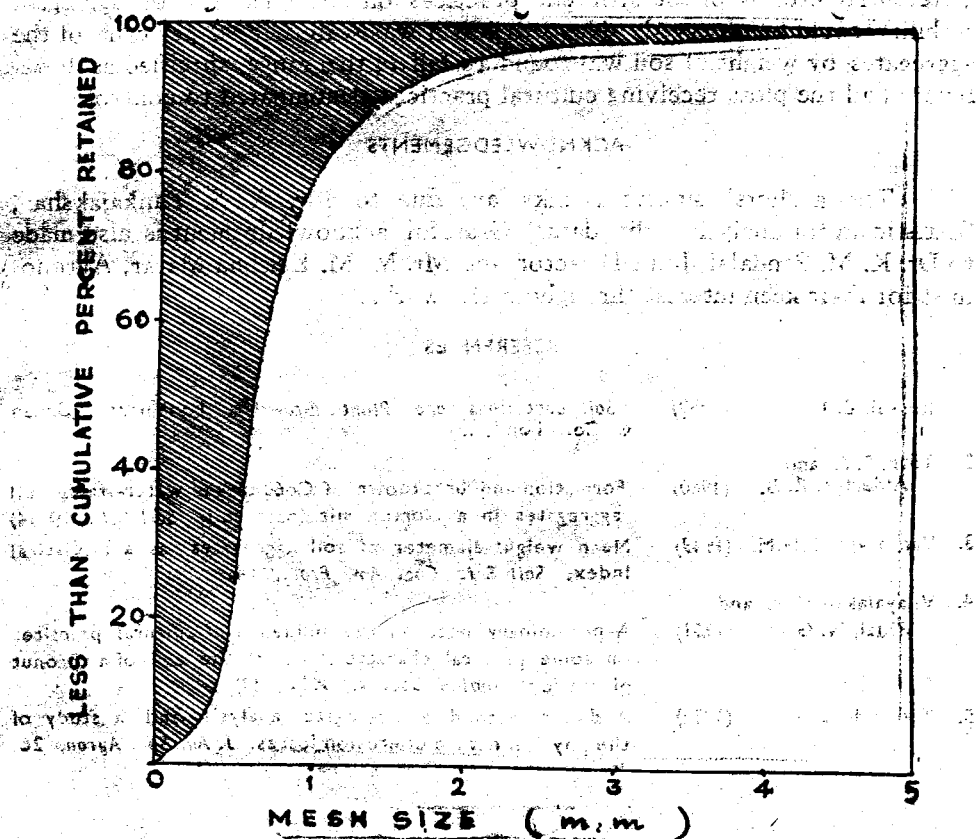


Fig. 1

The mean weight-diameter values were examined statistically, and the results are given in Table 1. No significant difference in the mean weight diameter could also be observed among the different methods of cultivation. Thus the data collected did not give any evidence of differential effects of cultural practices on soil structure or aggregate stability.

Even though no significant difference in aggregate stability due to different cultural operations, is evident from the above study, it was obvious that the soil in general possesses a good aggregation. According to Russel (1950) the most desirable size for optimum plant growth lies in the range 1-5 mm, rather towards the smaller limit in dry conditions. It is thus interesting that the present study conducted during the summer months revealed that about 90 per cent of the aggregates by weight fall in the range specified as beneficial by Russel.

#### SUMMARY

Data on the M. W. D. values of soils, receiving the cultural treatments at this Research Station were statistically examined. No evidence of any differential effects of the different practices on soil structure or aggregate stability could be observed. It was found that 90 per cent of the aggregates by weight of soil was found to fall in the range specified as beneficial in all the plots receiving cultural practices as compared to control.

#### ACKNOWLEDGEMENTS

The authors' sincere thanks are due to Mr. A. S. Pankajakshan, Statistician for analysing the data. Grateful acknowledgement is also made to Dr. K. M. Pandalai, Joint Director and Mr. M. M. Krishna Murar, Agronomist for their keen interest throughout the work.

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