JSST-RL

Journal of Sustainable Science and Transformative Research – Reviews and Letters, Vol 4 (1), 275-277 (2025)

Impact of Organic, Inorganic and Integration System of Crop Cultivation on Soil aggregation and Soil organic carbon

ISSN: 2583-4118
doi:https://doi.org/10.56703/OKGY7002/Fibq8949/Iwjy4033
www.jsst.uk

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Abstract: Soil health today is a global concern among researchers, planners, and farmers. Soil quality is often referred to as "soil health" because of objectives similar to monitoring and maintenance of human health. Hence, there is a scope for improving soil health and the production potential of the crop by the use of organic manures and inorganic fertilizers (Chaudhary et al, 2018). The present study highlighted the impact of different farming practices on soil aggregation, pH, EC, SOC, and available N, P, and K. The soil samples were drawn from the three representative farming systems. Viz. organic farming, integrated farming, and inorganic farming from two villages, i.e., Parwalia and Vaidakhedi of Madhya Pradesh, after harvesting of the soybean crop. The physical and physico-chemical properties of soils were found to be influenced favourably by the organic farming, integrated farming, and inorganic farming practices.

Key Words: Organic, Inorganic, Integration System, Soil aggregate & SOC

1 INTRODUCTION

Soil is an integral component of the environment and the central organizer of the terrestrial ecosystem, which has been in service of mankind since time immemorial. It supports all the vegetation and animal kingdom upon which we human beings are dependent for our survival. However, with the passage of time, the human population increased, and so did the exploitation of this natural source. With the ever-mounting population pressure, the demand for food and fiber supply increased tremendously with the same soil resources available. Consequently, with the onset of intensive agriculture, whereby the only target is higher production to feed the millions of people in the country, the heavy use of chemical fertilizers, high-yielding varieties, pesticides, insecticides, and other agrochemicals is in vogue. Thus, the use of these factory-based chemicals is resulting in deterioration of soil quality, inferior quality of the produce, imbalanced soil health, and disproportionate use of the natural resource. Therefore, a global consensus has evolved about the deteriorating soil health and means to check it. Attempts are being made on a large scale to determine some specific soil quality parameters that can act as indicators of soil health, in order to guide us to ascertain whether a particular cultural practice is improving or degrading the soil health. Thus, in light of the above facts, various integrated plant nutrient supply systems have been suggested by scientists to cater to the problem of deteriorating soil health. Important among them all are integrated farming and organic farming. Integrated farming is a way of balanced fertilization that includes the application of organic manure along with fertilizers. However, organic farming nowadays is seen as a promising soil health-improving practice followed by the farmers in many areas within and outside the country. It is because the addition of organic manure to the soil has many health-improving effects on the soil. Therefore, a project was initiated in farmers' fields in two target districts of MP, viz. Bhopal (Parwalia) and Sehore (Vaidakhedi), in three farming systems: (i) organic farming ;(ii) integrated farming, and (iii) inorganic farming, in order to monitor the soil quality under the prevalent practices under the above farming systems in a participatory way.

2 MATERIAL AND METHODS

Soil samples were drawn from the farmer's field at a depth of 0-20 cm after harvesting of the soybean crop from two villages, viz. Parwalia and Vaidakhedi. 15 farmers were selected from each village, and each farming system had 5 replications. Aggregate stability of soil samples is determined by using a wet sieving method (Yoder, 1936). The MWD is calculated with the help of a procedure outlined by Van Bavel, according to which the mean diameter (di) of each size fraction and the proportion of total sample weight (Wi) are taken as a product and are summed up over all size fractions to give the mean weight diameter (MWD).

$$MWD = \sum_{i=1}^{n} \bar{d}i \quad Wi \qquad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

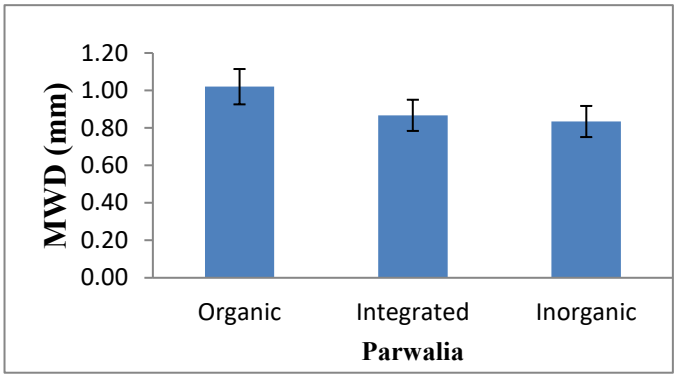
Soil organic carbon(SOC) was determined with the wet digestion method. This method is also known as titrate method and was given by Walkley & Black in 1934.

RESULTS AND DISCUSSION

i) Soil aggregation

a)Mean weight diameter

The mean weight diameter values of the soils of Parwalia and Vaidakhedi villages indicate that the highest value of 1.02mm & 1.04 was recorded in the organic farming system (Figure 1). It was followed by the integrated farming system and inorganic farming system that recorded the mean weight diameter values of 0.87 mm & 0.93 mm and 0.83 & 0.86, respectively it includes that soil aggregation in case of fields supplied with higher amount of organic matter was comparatively better on account of higher microbial activity, secretion of whereas mucilaginous substances and organic acids which might have resulted in larger mean weight diameter in such fields.



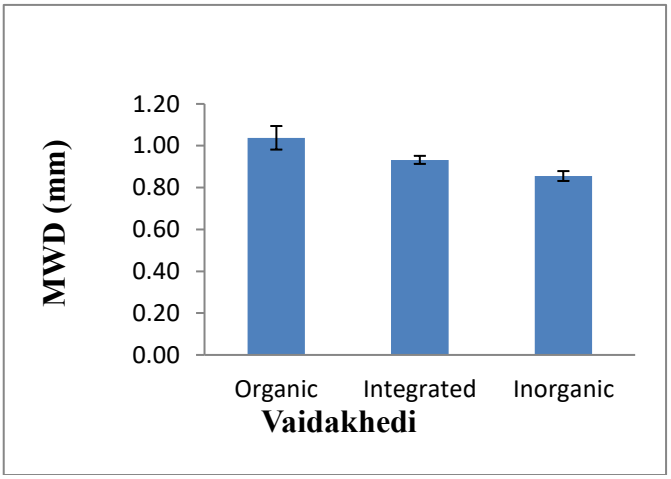
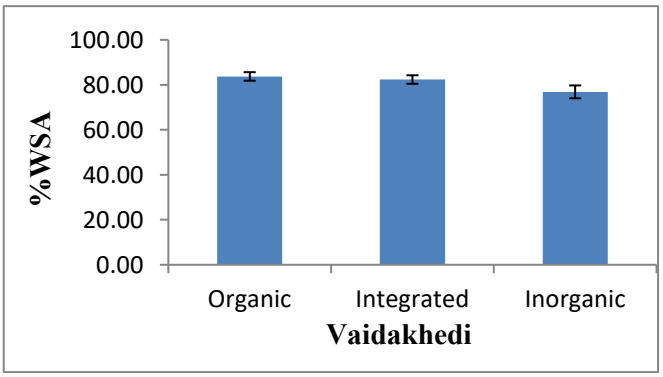


Fig. 1. Impact of different farming systems on the MWD of the soil of Parwalia & Vaidakhedi Villages

b) Water Stable Aggregates

Data on the percentage of water stable aggregates (>0.25 mm) in soils under different cropping systems (Table 2) revealed that soils under organic farming of both villages (86% & 84%) recorded slightly higher values(figure 2) than soils under integrated(85% & 82%) and inorganic (84% & 77%) farming system. The improvement in aggregate stability of soils under organic farming could be attributed to the humic substances released during decomposition of organic manures, which bind the soil particles to form larger-sized aggregates. Formation of larger-sized water-stable aggregates under long-term application of organic manures was also observed by Singh (1964). A considerable increase in the percentage of water-stable aggregates due to the incorporation of organic manure was noticed by Havanagi and Mann (1970). observed a highly significant correlation between per cent aggregate stability and organic carbon in Vertisols of North Karnataka



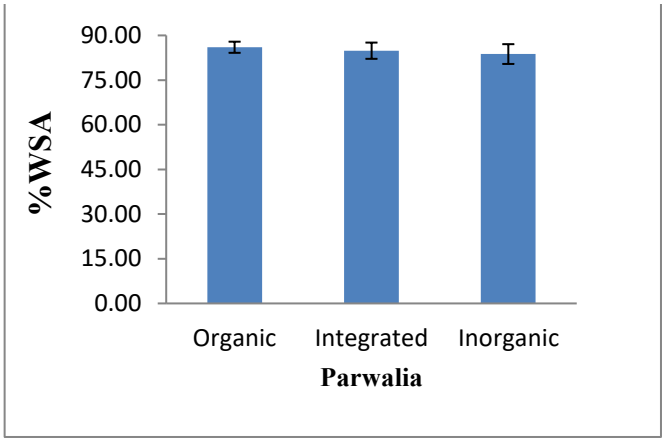
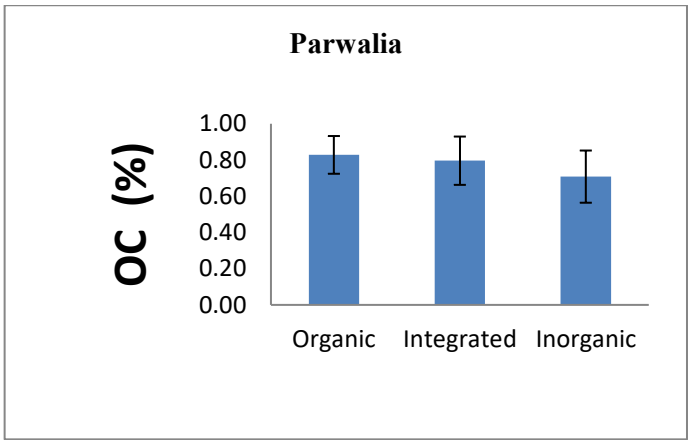


Fig. 2. Impact of different farming systems on water stable aggregate of soil of Parwalia & Vaidakhedi Villages

Soil organic carbon

The results of organic carbon content of surface soils in both villages indicated that it was higher under organic farming (0.83% & 1.01%) than integrated (0.80% & 0.85%) and inorganic (0.71% & 0.75%) systems farming. The increase in organic carbon content of soils under organic farming was quite obvious since the carbonaceous materials contribute to soil organic carbon after their decomposition. These observations are in agreement with the findings of Chaudhary et al.(2019) and Palsaniya et al. (2022).



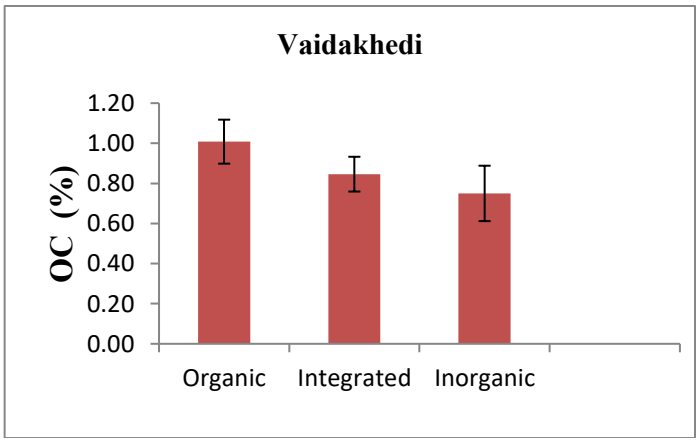


Fig. 3. Impact of different farming systems on soil organic carbon of Parwalia and Vaidakhedi Villages

The graph shows that the MWD in the vertisol is positively and significantly correlated with soil organic carbon (R2 = 0.51*)

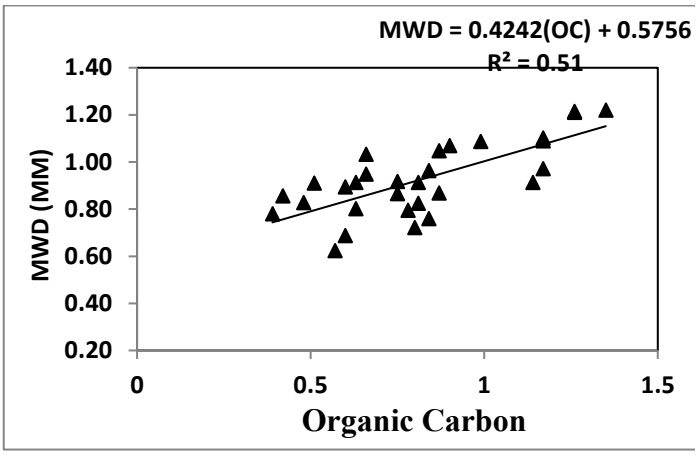


Figure 4. Relationship between MWD and SOC content in the studied vertisol

3 CONCLUSION

The present study highlighted the impact of different farming practices on soil aggregation, pH, EC, SOC, and available N, P, and K. The physical properties of soils were found to be influenced favourably by the organic farming practice. A reduction in bulk density and an increase in water holding capacity and water stable aggregates were noticed in all the soils under organic farming in comparison to integrated and inorganic farming systems. The quality of nutrients added to soil through organics varied widely depending upon the nutrient concentration and quantity of organics applied by the farmer. The nutrient (N, P, and K) concentration was higher in organic farming than in integrated and inorganic farming. The pH and EC are not more influenced by the three farming systems

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