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Effect of organic sources and fertilizer levels on soil aggregate fractions in western Rajasthan

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Abstract
Analyses of aggregate of soil are generally done using aggregate distribution methods, which are based on the presume that the alliance of the soil particles and their specific arrangement play a key bit part in the function of soil organic matter. Two years field experiment was at Agricultural Research Farm, SKRAU, Bikaner during R*abi* 2020-21 and 2021-22. The experiment comprising total 32 treatment combinations; eight sources of organics (M_0-Control, M_1 - FYM @ 20 t ha^{-1}, M_2 - Groundnut husk (GNH) @ 20 t ha^{-1}, M_3 -Wool waste (WW) @ 20 t ha^{-1}, M_4 -FYM @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}, M_5 -WW @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}, M_6 -WW @ 10 t ha^{-1} + FYM @ 10 t ha^{-1}, and M_7 -WW @ 6.67 t ha^{-1} + FYM @ 6.67 t ha^{-1} + GNH @ 6.67 t ha^{-1}) and four fertilizer levels (F_0 -Control, F_1-50% Recommended dose of fertilizer, F_2-75% Recommended dose of fertilizer and F_3-100% Recommended dose of fertilizer). Materials. On the basis of two year studied, result indicated that effect of organic sources and fertilizer levels on soil particle size of soil at harvest of garlic crop found non-significant.

Keywords: Wool waste, FYM, groundnut husk, fertilizer and soil aggregate

Introduction
Soil aggregate stability (SAS) is important for soil fertility, soil erosion resistance, soil aeration, water infiltration and water retention capacity [6], while soil aggregates are an important indicator of soil structure [9]. Soil aggregates further retain organic matter by reducing erosion [11]. Particle size distribution and SAS are affected by internal and external factors such as soil composition, land use, and various physical and chemical processes in different soil systems [3, 15]. According to the hierarchical theory of the whole structure, these features can cause the unevenness of the small difference between soil aggregates, which weakens the SAS [11]. Both the biological and chemical composition of soil affects the SAS of each soil layer [17], including carbon and nitrogen content. It is also said that soil structure (such as agglomeration) is important in stabilizing soil organic carbon (SOC) and total nitrogen (TN) [2]. It has been shown that their distribution varies according to soil composition (Liu, (2015)) and is associated with SAS [14, 7]. Reforestation has been shown to be effective in increasing SOC and TN content in soil while increasing SAS [18, 16] found that although bare land has low SAS, vegetation recovery can increase SOC and TN, thus playing a positive role. Its role in increasing SAS [16, 5]. Found that while reducing the influence of soil during nutrition strategy, SAS, although its direct effect on SAS has been studied worldwide [19], there are some quantitative analyses on the influence of various factors (ecological measures, soil depth, soil depth). Organic carbon of SAS, total nitrogen). The ecological environment of the Loess Plateau is fragile, and the long-term impact has caused local water and soil erosion, making it one of the most damaged areas in China. In 1998, agriculture was converted into forests, pastures, terraces, etc. in order to transform agricultural lands into natural areas or ecological lands. A number of ecological measures were carried out, such as rotation; mountain/ground fences; and cultivation, which has a major impact on soil aggregates. Since then, the vegetation of the Loess Plateau has flourished. The results showed that the forest area increased by 16.5%, the grassland area increased by 7.6%, and the bare land and desert area decreased by 29.0% [15]. After restoration, SOC and TN for different types of land use are important for soil susceptibility to erosion and malnutrition, as small aggregates have greater voluntary losses than large aggregates. Therefore, knowledge of the stability of the whole is useful in evaluating the characteristics of organic soil amendments. Water stability collection helps measure soil susceptibility to erosion, compaction, and other destructive forces.

The impact of rain and water runoff or the importance of energy causes the breakdown of soil aggregates in the field and causes soil erosion. The granularity score gives the average difference between younger (active) and older (intermediate and inactive) SOM populations. Our opinion is that changes in soil aggregate stability over time depend on the biochemical properties of the added organic matter.

Materials and Methods

Experimental site

The experiments were conducted at the SKRAU, Agricultural Research Station farm in Bikaner. Agricultural Research Station is located in the state of Rajasthan, approximately 9 km from the city of Bikaner, on National Highway 15 leading to Sri Ganga Nagar. It is located at 280° 10' north latitude, 730° 18' east longitude, and the average sea level is 223.88 meters. The study area lies in the agro-climatic zone Ic (Hyper arid partially irrigated western plain) of Rajasthan and includes canal-drained areas of northwestern Bikaner, Sri Ganga Nagar, Hanumangarh in the west and Northwest Jaisalmer district. The region has a very hot climate.

Soil of the experimental field

In order to understand the physical and chemical properties of the soil, composite samples were prepared by selecting soil samples from 0 to 15 cm depth from different points in the each treatments field trial. These mixed samples were analyzed to determine the physicochemical properties of the soil.

Table 1: Details of treatments with their symbols

	Treatments	Symbol
	Organic sources (8)	**Main plot**
I.	Control	(M_0)
II.	Farm yard manure @ 20 t ha^{-1}	(M_1)
III.	Groundnut husk @ 20 t ha^{-1}	(M_2)
IV.	Wool waste @ 20 t ha^{-1}	(M_3)
V.	FYM + Groundnut husk @ 20 t ha^{-1} (10 t + 10 t)	(M_4)
VI.	Wool waste + Groundnut husk @ 20 t ha^{-1}(10 t + 10 t)	(M_5)
VII.	FYM + wool waste @ 20 t ha^{-1} (10 t + 10 t)	(M_6)
VIII.	Wool waste + Groundnut husk + FYM@ 20 t ha^{-1} (6.67 t + 6.67 t + 6.67 t)	(M_7)
	Fertilizer levels (4)	Sub plot
I.	Control	(F_0)
II.	50% Recommended dose fertilizer	(F_1)
III.	75% Recommended dose fertilizer	(F_2)
IV.	100% Recommended dose fertilizer	(F_3)

RDF = 50 kg N, 60 kg P_2O_5 and 100 kg K_2O

Table 2: Average elemental composition of FYM, groundnut husk and wool waste

Element	Farm yard manure	Groundnut husk	Wool waste
Carbon (%)	20.42	21.09	18.92
Nitrogen (%)	0.702	0.502	2.248
Phosphorus (%)	0.297	0.471	0.285
Potassium (%)	0.392	0.865	0.712
Sulphur (%)	0.06	0.54	2.28
Iron (ppm)	652.15	524.60	782.11
Copper (ppm)	4.88	5.10	12.68
Zinc (ppm)	43.46	24.04	88.12
Manganese (ppm)	58.12	43.30	48.47

Table 3: Effect of organic sources and fertilizer levels on soil particle size of soil at harvest of garlic crop

Treatments	< 0.1 mm			0.1 mm			0.25 mm		
	(%)								
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Organic Sources									
M_0-Control	12.42	12.02	12.22	80.33	80.75	80.54	4.30	4.32	4.31
M_1 - FYM @ 20 t ha^{-1}	13.25	12.81	13.03	79.43	79.88	79.65	4.51	4.52	4.52
M_2 - Groundnut husk (GNH) @ 20 t ha^{-1}	12.51	12.11	12.31	80.32	80.73	80.53	4.42	4.44	4.43
M_3 -Wool waste (WW) @ 20 t ha^{-1}	12.41	12.00	12.20	80.52	80.92	80.72	4.41	4.42	4.42
M_4 -FYM @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}	12.38	11.98	12.18	80.40	80.81	80.60	4.56	4.57	4.56
M_5 -WW @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}	13.18	12.75	12.96	79.93	80.35	80.14	4.21	4.24	4.23
M_6 -WW @ 10 t ha^{-1} + FYM @ 10 t ha^{-1}	12.63	12.23	12.43	80.42	80.82	80.62	4.37	4.39	4.38
M_7 -WW @ 6.67 t ha^{-1} + FYM @ 6.67 t ha^{-1} + GNH @ 6.67 t ha^{-1}	12.59	12.18	12.38	80.14	80.56	80.35	4.60	4.61	4.61
S.Em±	0.25	0.24	0.17	0.25	0.24	0.18	0.09	0.08	0.06
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fertilizer levels									
F_0 -Control	12.62	12.21	12.42	80.30	80.70	80.50	4.39	4.41	4.40
F_1-50% Recommended dose of fertilizer	12.68	12.27	12.47	80.16	80.57	80.37	4.44	4.45	4.44
F_2-75% Recommended dose of fertilizer	12.69	12.28	12.48	80.14	80.56	80.35	4.42	4.44	4.43
F_3-100% Recommended dose of fertilizer	12.70	12.29	12.49	80.15	80.57	80.36	4.44	4.45	4.44
S.Em±	0.03	0.03	0.02	0.05	0.05	0.04	0.04	0.03	0.03
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 4: Effect of organic sources and fertilizer levels on soil particle size of soil at harvest of garlic crop

Treatments	0.50 mm (%)			2 mm (%)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Organic Sources						
M_0-Control	2.59	2.56	2.58	0.350	0.348	0.349
M_1 - FYM @ 20 t ha^{-1}	2.47	2.45	2.46	0.341	0.340	0.340
M_2 - Groundnut husk (GNH) @ 20 t ha^{-1}	2.38	2.36	2.37	0.368	0.365	0.366
M_3 -Wool waste (WW) @ 20 t ha^{-1}	2.30	2.29	2.30	0.362	0.359	0.360
M_4 -FYM @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}	2.32	2.31	2.31	0.340	0.339	0.339
M_5 -WW @ 10 t ha^{-1} + GNH @ 10 t ha^{-1}	2.32	2.31	2.31	0.362	0.359	0.361
M_6 -WW @ 10 t ha^{-1} + FYM @ 10 t ha^{-1}	2.24	2.24	2.24	0.331	0.331	0.331
M_7 -WW @ 6.67 t ha^{-1} + FYM @ 6.67 t ha^{-1} + GNH @ 6.67 t ha^{-1}	2.33	2.32	2.32	0.338	0.337	0.338
S.Em±	0.15	0.14	0.10	0.010	0.009	0.007
CD at 5%	NS	NS	NS	NS	NS	NS
Fertilizer levels						
F_0 -Control	2.34	2.33	2.33	0.347	0.346	0.347
F_1-50% Recommended dose of fertilizer	2.38	2.36	2.37	0.352	0.350	0.351
F_2-75% Recommended dose of fertilizer	2.40	2.38	2.39	0.348	0.347	0.348
F_3-100% Recommended dose of fertilizer	2.36	2.35	2.35	0.348	0.346	0.347
S.Em±	0.02	0.02	0.01	0.006	0.005	0.004
CD at 5%	NS	NS	NS	NS	NS	NS

Soil sampling
After harvest, soil samples were collected from each treatment using core samplers (7 cm inner diameter) to drill random holes at four locations at 0–15 cm soil depth. The sampled soil was air dried, ground with a wooden mortar and pestle, passed through a 2 mm sieve and stored in cloth bags for later analysis of its different physical, chemical and biological properties. To determine dynamic and biological properties, soil samples taken from each soil depth of each plot were placed in polyethylene bags and stored at 4 °C until used for quantitative analyzes and soil enzyme testing.

Size distribution of aggregates
Soil samples (0-15 cm soil depths) were collected for determination of different aggregate size. Aggregate status of soil was determined by wet sieving method [20]. The soil sample was passed through 8-mm sieve and were retained on 4-mm sieve. Yoder's wet sieving apparatus, comprising of two sieve sets, each having nest of 5 sieves of 12.7 cm diameter and 5 cm height and with hole sizes of 2.0, 0.5, 0.25 and 0.1 mm (with mesh numbers of 8, 16, 32, 64 and 150 respectively), were used for this purpose. The samples were evenly distributed over the top sieve of the set and pre-wetted by capillarity for 10 minutes. The nest of sieves was then allowed to move up and down for 30 minutes. Following this, the sieves were drawn out of water and the oven-dried weight of aggregates retained on each sieve was recorded after drying these in an oven at 105 °C till the constant weight achieved.

Statistical Analysis
Experimental data recorded in various observations were statistically analysed with the help of Fisher's analysis of variance technique [21]. The critical difference (CD) for the treatment comparisons were worked out where ever the variance ratio (F-test) was found significant at 5% level of significance.

Result and Discussion
The particle size distribution of soil of experimental soil was normal and the effect on the particle size distribution of soil with the application of different organic sources and fertilizer levels was non-significant (Table 4) during 2020-21, 2021-22 and under pooled analysis.

Conclusion
On the basis on two-year experiment concluded that organic and inorganic sources do not change the soil aggregates it means for the change soil aggregate required very long time.

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