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A CASE STUDY

Comparison of tank silt and farm yard manures in relation to soil water retention capacity and soil fertility in redgram in alfisol of NSP left canal command area

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Abstract : On farm field experiment on effect of soil amendments in relation to soil water retention capacity and soil fertility in redgram were taken up in *Alfisols* of NSP left canal command area during *Kharif* 2006 and *Kharif* 2007 at pilot area Ganapavaram of Nagarjuna Sagar Project left canal command under A.P. water management project funded by FAO. The trial was carried with the farmers participatory mode to study the impact of application of tank silt and farm yard manure as soil amendments in relation to soil water retention capacity and soil fertility and on crop yield of redgram. The five treatments consisted of 5t FYM/ha, 10t FYM/ha, 20t tank silt/ha, 30t tank silt/ha and RDF. Application of 20 t of tank silt + RDF and 30 t of tank silt + RDF application recorded highest grain yield of 2290 kg ha^{-1} and 2180 kg ha^{-1} during *Kharif*, 2006 and 20 t of tank silt + RDF recorded highest grain yield of 2280 kg/ha followed by application of 30 t of tank silt+ RDF (2130 kg/ha) and application of 10 t of FYM+ RDF (2040 kg/ha) during *Kharif*, 2007, respectively. Post harvest soil analysis revealed that the organic carbon content was high in 10 t FYM + RDF where as the application of increased tank silt recorded increase in water holding capacity during the both the years.

Key Words : Soil amendments, Soil fertility, Redgram, Canal command

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INTRODUCTION

The NSP left canal command spread in Nalgonda, Khammam and Krishna district of Andhra Pradesh with a total command of 3.87 lakhs hectares, mostly consist of red sandy loams locally known as chalka soils followed by mixed sandy loams (dubba soils) together constitutes 75 per cent of the area. The remaining 25 per cent area belongs to clay and clay loam soil (Black cotton soils). In the earlier days the tank silt of an old tank was the only manure and the farmer used in older days, felt that tanks belonged to them and they were proud of them. When the farmer takes silt from the tank, it helps the tank to rejuvenate itself and it increases the water holding capacity. Silt which is present in tank is a combination of sand and clay particles collected from tanks or lakes in the villages or silt can be referred to as a eroded soil accumulated in the tanks and lakes of the villages. It is

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mainly applied to improve soil and moisture conservation, water holding capacity as well as increase the aeration and porosity of the soil for better root growth. Further the farm yard manure application liberate available plant nutrients in the soil in available form and soil physical properties and thereby increasing moisture holding capacity of the soil. In order to provide a base line data on the effect of soil amendments such as tank silt and farm yard manure in relation to soil water retention capacity and soil fertility in redgram, the present study was taken up in Ganapavaram pilot area of N.S.P left canal command area in Nalgonda district of Andhra Pradesh under A.P water management project, a collaborative project between Alterra ILRI, the Netherlands and Acharya N.G Ranga Agricultural University, Hyderabad, India.

MATERIAL AND METHODS

Location and site characteristics of study area :

The Ganapavaram village extending over an area of 1197 ha is bounded between 17° Northern latitude and 80° Eastern longitude. On the East side Yathirajapuram thanda, West side Ganapavaram village; south Mangalkuntathanda and North Thogarrai surround it. The elevation of selected pilot area was 95 m above mean sea level. The major geomorphic units recognized in the pilot area are, *dissected pediments* and *pediplains*. Nearly three fourth of the pilot area is under *pediplains* and characterized by low- lying flat terrain.

The climate of the selected pilot area is semi arid type and temperature begins to rise after February and the hottest month is May with maximum temperatures touching upto 44°C, and the minimum temperatures ranges from 12 to 14°C in the months of December/ January. The southwest monsoon contributes 70 per cent of the annual rainfall from June to September. Occasionally rainfall is also received from November onwards due to cyclonic disturbances in the Bay of Bengal. The natural vegetation includes grasses *Cynodon doctylon*, *Cyprus rotandaus*, neem *(Azadiracta indica*), babul, A*cacia* sp., *Prosofis juliflora*, mango *(Manjifera indica)*, teak *(Tectona grandis) Tamarindus indica*, kalajamun, *Zizyphus jujuba* etc.

The experiment was conducted as on farm trial in farmers' fields during *Kharif* 2005 and *Kharif* 2006 in different fields of the farmers. The initial soil analysis data show that soils were sandy loam in texture and sub angular blocky structure (Table 1) with water holding capacity (39.6 % and 30%) and neutral to slightly alkaline in reaction (pH 8.2 and 7.4) and non-saline (E.C 0.13 and 0.36 dSm^{-1}). The organic carbon content was low (0.42 and 0.49%). The soil available nitrogen (211.0 and 220 kg ha^{-1}), the available phosphorus (8.0 and 12.0 kg ha^{-1}) content was low and the available potassium (190 and 211 kg ha^{-1}) were medium to high (Table 2). The experiment was laid out as non-replicated large plot trials (1000 m^2) with five treatments *viz.*, 5t FYM/ha + recommended dose of fertilizers (T_1), 10 t FYM/ha + RDF (T_2), 20 t tank silt + RDF (T_3), 30 t tank silt + RDF (T_4) and conventional practice *i.e.* only RDF (T_5). The variety studied was LRG-41 at a spacing of 150×20 cm sown during the second fort night of July.

The soil samples before sowing and after harvest of the crop were collected from 0-15 cm depth and analyzed by standard procedures. Particle size analysis was done according to Bouycos hydrometer method (Gee and Bauder, 1986), bulk density (Blake and Hartze, 1986), water holding capacity (Sankaram, 1966). Soil water availability at different soil depths was monitored by determining soil moisture content gravimetrically upto 30 cm soil layer in two depths using core sampler (Michael *et al*., 1977) during different crop vegetative stages. The pH, EC were determined in 1:2.5 soil water solutions (Jackson, 1973) and organic carbon was determined (Walkly and Black, 1934). The available and total nitrogen was determined by kjeldal method, available phosphorus was estimated by spectrophotometer and potassium by flame emission method (Jackson, 1973).

The recommended dose of fertilizer for redgram was 20-50 N and P kg ha^{-1}. The entire dose of fertilizer P was applied as basal dose at the time of sowing. The entire dose of N was applied at 30 days after sowing to boosting the crop growth. The farm yard manures and tank silt were applied at the time of sowing as per the treatments. The crop was harvested at maturity and yield was recorded.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Soil physical characteristics :

The application of increased tank silt recorded increase in water holding capacity, bulk density and pore

Table 1: Initial physical properties of the soil of redgram on farm trial field's *Kharif* 2006 and 2007

Coarse fraction (%)		Particle size distribution (%)						Texture		Structure		WHC (%)		Pore space (%)		BD (Mgm^{-3})	
		Sand		Silt		Clay											
2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
22	28	64.60	66.00	20	14.40	24.60	19.60	sl	sl	sbk	sbk	39.60	30.60	43.30	35.00	1.44	1.50

Table 2: Initial chemical properties of the soil of redgram on farm trial field's *Kharif* 2006 and 2007

pH (1:2.5)		E.C dSm^{-1}		OC (%)		AvN $kgha^{-1}$		AvP $kgha^{-1}$		AvK $kgha^{-1}$	
2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
8.2	7.4	0.13	0.36	0.42	0.49	211	220	8	12	190	211

Table 3: Soil physical properties of redgram experiment plot after harvesting (*Kharif* 2006 and 2007)

Treatments	Bulk density (Mg/m3)		Pore space (%)		Water holding capacity (%)	
	2006	2007	2006	2007	2006	2007
T_1: 5t FYM/ha +RDF	1.45	1.50	42.0	34.0	42.0	36.0
T_2:10 t FYM/ha +RDF	1.42	1.49	44.0	35.6	42.6	38.0
T_3:20 t tank silt+ RDF	1.46	1.50	46.0	38.0	45.0	41.0
T_4:30 t tank silt+ RDF	1.47	1.51	46.5	40.4	45.4	43.4
T_5:RDF	1.43	1.50	43.5	35.0	43.6	37.0

Table 4: Soil moisture content (%) influenced by different treatments in redgram field during *Kharif* 2006 and 2007

Treatments	Depth (cm)	August		September		October		November		December		January	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
T_1:5 t FYM+RDF	0-15	7.9	9.9	5.9	9.5	13.2	13.0	5.7	10.7	7.4	9.6	8.0	9.0
	15-30	8.9	10.9	7.0	10.5	14.3	14.0	7.3	11.3	8.9	10.5	8.6	9.6
T_2:10 t FYM+RDF	0-15	8.9	10	6.3	12	14.3	15.0	8.1	12.1	8.4	10.4	9.0	10.0
	15-30	10.0	12.0	8.9	13	14.8	16.3	9.0	14.0	9.5	11.5	9.9	10.9
T_3:20 t tank silt+ RDF	0-15	10.7	12	10.1	14	16.4	16.4	9.3	14.3	9.6	11.1	11.0	12.0
	15-30	11.0	14	10.9	15	16.9	16.9	13.6	15.6	12.9	14.5	14.0	13.5
T_4:30 t tank silt+ RDF	0-15	11.9	12.5	11.0	14.3	15.0	16.5	14.0	15.0	14.5	16.1	14.0	13.9
	15-30	13.2	15.0	11.1	16.4	17.0	18.0	14.9	15.9	15.0	17.0	15.0	14.0
T_5:RDF	0-15	6.6	7.8	5.7	8.8	12.0	11.5	6.2	9.2	5.8	7.9	6.3	7.0
	15-30	7.8	9.0	7.5	9.8	12.3	12.6	7.3	10.3	7.9	9.8	8.0	9.0

Table 5: Available nutrient status of soils after harvest of redgram at pilot area (*Kharif*, 2006)

Treatments	pH (1:2.5)		E.C dSm^{-1}		OC (%)		AvN $kgha^{-1}$		AvP $kgha^{-1}$		AvK $kgha^{-1}$	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
T_1:5tFYM/ha+ RDF	8.2	7.3	0.16	0.26	0.50	0.54	128	213	20	15	278	229
T_2:10t FYM/ha+ RDF	8.0	7.1	0.19	0.24	0.45	0.58	119	218	25	16	270	240
T_3:20t T.S/ha+RDF	8.2	7.3	0.18	0.28	0.42	0.52	169	201	30	20	308	216
T_4:30tT.S/ha+RDF	8.2	7.5	0.20	0.24	0.44	0.53	175	215	32	22	314	228
T_5:RDF	8.3	7.5	0.22	0.22	0.44	0.44	144	225	10	17	210	215

Table 6: Effect of FYM and tank silt on yield of redgram at pilot area (*Kharif*, 2006 and 2007)

Treatments	Grain yield (kg/ha)	
	2006	2007
T_1: 5t FYM/ha + RDF	1950	1900
T_2: 10 t FYM/ha + RDF	2080	2040
T_3: T4:20 t tank silt + RDF	2290	2280
T_4: T5:30 t tank silt + RDF	2180	2130
T_5: RDF	1740	1630

space with the application of 30 t tank silt fallowed by 20 t tank silt than the farm yard manures applied treatment when compared to the initial soil during the both the year of study period might be due to the presence of large quantity of silt and clay particles in the tank silt which inturn may be due to the plasticity property of tank silt when compared to farm yard manure and inorganic fertilizer applied treatment (Table 3). Percentage of periodical soil moisture content (Table 4) was also high in 30 t tank silt applied treatment fallowed by 20 t tank silt and 10 t farm yard manure applied treatment when compared to the only RDF applied treatment throughout the growing season of the crop. Further, silt application helps to increase the water table of the soil by increasing infiltration during rainy season.

Soil nutrient status :

The available nutrients in the soil were influenced by the application recommended dose of fertilizers, farm yard manures and tank silt and there was slightly decrease in pH in farm yard manure applied treatment when compared to initial soil pH, might be due to the decomposition of organic matter by different micro and macro fauna. The EC was non-saline. The increase in organic carbon content was highest in 10 t FYM/ha + RDF fallowed by 5 t FYM/ha + RDF and 30 t tank silt + RDF when compared to initial soil might be due to decomposition of farm yard manures and more accumulation of root biomass and have the proliferation microbial population's lead to increase in organic carbon (Table 5). The available N content was decreased may due to the higher nitrogen uptake by the legumes and the available P was increased, it might be due to application of silt helps in retention of nutrients which is rich in phosphates and release of soluble inorganic phosphates into soils by phosphorus solubilizing bacteria in the soil and increased the fertility of soil. The available K content was increased in 30 t tank silt + RDF fallowed by 20 t tank silt + RDF, 5 t FYM/ha + RDF and 10 t FYM/ha + RDF when compared to initial soil, it might be due to the tank silt may be rich in potassium .

Crop productivity :

The highest seed yield of redgram recorded in the application of 20 t tank silt with RDF (2280 kg/ha) followed by 30 t tank silt with RDF (2180 kg/ha), 10 t FYM with RDF (2080 kg/ha) and 5 t FYM with RDF (1950 kg/ha) when compared to only application of recommended dose of fertilizers (1740 kg/ha) shown in Table 6 might be due to the redgram crop grown as rainfed with the duration of 180 days and the application of tank silt helps in retention of soil moisture, water holding capacity and nutrients in the soil and increases the fertility of soil which inturn increasing crop yield at the time of flowering and pod formation stage after completion of south west monsoons rainy season.

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