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Effect of Canal Sediments and Mixed Manure on Wheat Performance in El Multaga Area, Northern State, Sudan

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ABSTRACT

A field study was conducted for two successive winter seasons; 2017/18 and 2018/19, at the Research Farm of the National Institute of Desert Studies (RFNIDS), New Hamdab Scheme, Northern State of Sudan. The aim was to study the effect of treatments interactions of canal sediments (0, 20 and 40ton ha^{-1}), application of mixed manure fertilizer (equal weight of farmyard manure and chicken manure) at two levels zero and 4 ton ha^{-1}) on wheat (*Triticum aestivum* L.) growth and yield in the area. The experimental design was a split plot design with four replicates. The main plot was assigned to mixed manure and the sub plot was assigned to canal sediment. The significant differences ($P \leq 0.05$) on plant height, thousand seeds weight, grain yield (Kg ha^{-1}) in both seasons and straw yield (Kg $ha^{-1)}$ in the second season. The combination of application of (40 ton ha^{-1}) canal sediment and (4 ton ha^{-1}) mixed manure showed the highest means values of growth, yield and yield components of wheat (*Triticum aestivum* L.) in both seasons at El Multaga soil series -Northern State of Sudan.

Keywords: Canal sediment, Mixed Manure, ElMultaga Soil Series

1. Introduction

Wheat (*Triticuma estivum* L.) is mainly grown in the Sudan under irrigation, during winter months; its cultivation has recently expanded into latitudes lower than 15° N (Ageeb *et al.,* 1996; Almeu and Hazem, 2011).

Increasing wheat productivity is a national target in Sudan to fill the gap between wheat consumption and production. However, lack of yield stability over seasons and location has remained a great challenge to both research and production management (Babiker and Faki, 1994). Wheat production under semi-arid conditions of Sudan is now a success. Grain yield of over five ton ha^{-1} were obtained with high irrigation, either from river flows or lifted from the River Nile and wells using diesel pumps (Farah *et al.,* 1994).

New Hamdab Scheme (Northern State of Sudan) faces problems of mud accumulation in all irrigation canals. Enormous amounts of sediments are being removed during cleaning of these canals. Disposal of this sediment is a real problem. Sediments accumulated in irrigated canals contain high quantities of clay and might be a useful as a soil conditioner (Mubarak *et al.,* 2014).

Ahmed (2010) stated that application of manure in desert plain soil in the Northern Sudan significantly improved the soil chemical properties and minor increased in organic carbon, nitrogen; available phosphorus and potassium were observed. The soil pH was not affected by the source of organic manure. The poultry manure application on sandy loamy soil in Southwestern Nigeria improved soil chemical properties. It increased soil organic matter, total N, available P, exchangeable Mg, Ca, K and nutrient uptake and lowered exchange acidity (Adeleye *et al.,* 2010).

Chicken manure and sewage sludge application on the poor physical and chemical properties of sand dune soil in Elrawakeeb Dry Land Station, Khartoum State, Sudan resulted in very highly significantly increased soil organic carbon, available P, total nitrogen and mineral nitrogen and decreased soil pH (Elhadi *et al.,* 2016). The aim of this study was to investigate the effect of canal sediment and mixed manure on wheat performance.

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2. Materials and Methods

Field experiments were carried out during two consecutive winter seasons (2017/18 and 2018/19) at the National Institute of Desert Studies Research Farm, New Hamdab Scheme, Northern State of Sudan (latitude 17°55' N and longitude 31°10' E). The climatic zone of the area is described as desert, which is characterized by high temperature in summer, low temperature in winter and low rainfall (Habiballa and Ali, 2010). The soil of the study area belongs to El Multaga soil series which classified as Vertic Haplocambids, fine loamy, mixed, supper active, hyperthermic. The soil structure is moderate sub angular blocky. It is non-saline and non-sodic (see Table 1 below) (LWRC, 1999). Generally, the soil chemical fertility is low and mostly these soils deficient in nitrogen, phosphorus and organic carbon for optimum yield production of different cultivated crops. The physical and chemical properties of the soil are shown in Table 1.

Table1. Some soil properties of the experimental site

Soil properties	Soil depth (cm)				
	0-23	**23-65**	**65-80**	**80 – 105**	**105 - 125**
FS (%)	40	23	22	21	24
CS (%)	37	33	43	42	40
Silt (%)	15	25	11	19	8
Clay (%)	8	19	24	18	28
Texture	LS	SL	SL	SL	SCL
H (paste)	7.5	7.3	8.1	7.8	7.5
Ec_e	0.35	0.37	0.42	1.1	3.2
ESP	3.0	3.0	4.0	5.0	8.0
$CaCO_3$ (%)	0.8	2.6	10.4	0.2	27.5
O.C (%)	0.052	0.066	0.078	0.061	0.052
C/N ratio	4	4	5	5	5

LS = Loamy sand, SL = Sandy loam, SCL= Sandy clay loam

2.1. Treatments and Experimental Design

The treatments were arranged in completely randomized a split-plot design with four replicates. The area of each sub- sub plot was 42 m^2 (6 × 7 m). The experimental units were two meter apart from each other. The main plots were assigned to canal sediments application with two rate (20 and 40 ton ha^{-1}) and sub - plots were assigned to chicken manure with two rates (0 and 4ton ha^{-1}). The experimental procedures were the same for both seasons. Treatments and their abbreviations are illustrated in Table 2.

Table 2: Treatments Application and their Abbreviations.

Treatments	Operation	Abbreviation
Mixed Manure (MM)	0 ton ha^{-1}	MM_1
	4 ton ha^{-1}	MM_2
Canal Sediment (CS)	0 ton ha^{-1}	CS_1
	20 ton ha^{-1}	CS_2
	40 ton ha^{-1}	CS_3

2.2. Cultural practices

Wheat variety WadiElneel was used in this study. Sowing was done manually by digging on 20th of November for both seasons, with seed rate of 120 kg ha^{-1}, at 0.2 m inter-row spacing. Nitrogen and Phosphorus were added as recommended by Agricultural Research Corporation (Sudan). The crop was harvested on 21st of March in both seasons.

2.3. Collection of data

Plant samples were collected randomly from each experimental unit (sub- sub plot) and then growth and yield parameters were determined.

A number of thousand seeds were picked randomly from each plot. The seeds were weighed, and mean 1000-seeds weight (g) was obtained.

Plants of the net area of one meter square (using steel frame of one meter square) were cut at the soil surface at harvest time in three different positions in each plot, tied in bundles and left to dry by air. After drying, they were weighed, then the mean biological yield (kg ha^{-1}) (dry matter plus grain) was determined.

The biological yield samples were manually threshed, and the grain yield as expressed in kg ha^{-1} was obtained. Also, straw yield (kg ha^{-1}) was determined as follows:

$$Straw\ yield\ (kg\ ha^{-1}) = Biological\ yield\ (kg\ ha^{-1}) - Grain\ yield\ (kg\ ha^{-1})$$

2.4. Statistical analysis and interpretation of data

Statistical analysis was carried out using a computer software package (MSTAT). Significance of differences among the various characters under study was compared using Duncan's Multiple Range Test (DMRT). Results were presented in tabular forms.

3. Results and Discussion

Generally, the climate of the study area is classified as arid which is characterized by high temperature in summer, lower in winter and low rainfall (Habiballa and Ali, 2010). Table 3 shows the average min. temperature, max. Temperature, mean temperature and relative humidity in both seasons (National Institute of Desert Studies Meteorological Station). It is cleared that the second season was characterized by lower temperature in December and January and higher relative humidity percentage in all months compared to the first season, and the first season was characterized by higher temperature in February and March compared to the second season.

Table 3: Climatic parameter of experimental site in both seasons

Parameter	Max. temp. (°C)		Min. temp. (°C)		Mean temp. (°C)		Relative humidity (%)	
Month	Season		Season		Season		Season	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
November	29.8	32.1	13.6	16.2	22.1	24.9	40	44
December	30.6	30.2	13.2	12.6	22.0	20.7	46	49
January	27.5	29.0	12.2	9.4	19.7	19.2	44	51
February	33.9	31.0	13.9	12.1	23.9	21.3	35	43
March	35.1	36.4	17.7	16.5	27.3	26.3	25	33

Source: (National Institute of Desert Studies Meteorological Station).

3.1. Yield and Yield Component

3.1.1. Plant Height

Fig.1 shows wheat plant height (Cm) at maturity stage affecting by treatments. As general all values of plant height in the second season were graters than those in the first season, this may be attributed to change in climatic factor especially varies in temperature (low temperature in the second season as shown table 3.

Results indication that tall plant of 77 Cm was obtained when using 40 tons per hectare of canal sediment with 10 tons per hectare of mixed manure compare to that in control 64 cm. This result is in conformity of Ali, (2017) who stated that canal sediment affected significantly in increasing plant height of wheat, also Adeleye *et al.,* 2010 mentioned that manure enhanced wheat yield and its components.

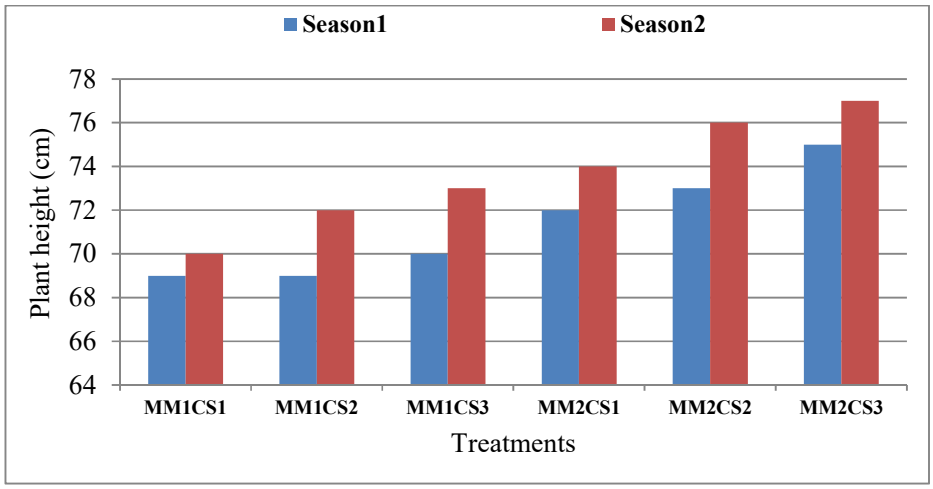

Fig. 1: Illustrated wheat plant height at maturity stage versus treatments for both seasons.

3.1.2. 1000-seeds weight, Biological yield. Grain yield and Straw yield

Table 4 summarize the effect of treatments means on the examined parameters (1000- seed weight, biological yield, grain yield and straw yield of wheat crop in both seasons.

The results of the statistical analysis indicated that mixed manure and canal sediment had significant effects ($P \leq 0.05$) on1000-seeds weight, grain yield in both season and straw yield in the second season, highly significant differences ($P \leq 0.01$) on biological yield (in both season) and straw yield in the first season.

Also results also showed that the application of 4 ton $ha^{-1}$of mixed manure with 40 ton ha^{-1} canal sediment recorded the highest means values of all examined growth and yield attributes in both seasons. Several investigations from different parts of the world reported that addition of manure improved chemical properties of the soil and enhanced growth and yield of wheat (Agdede *et al*.2008: Adeleye *et al*.2010.

Table 4: Interaction effects of canal sediment and mixed manure fertilization on some wheat yield during tow winter seasons

Parameters	1000-seeds weight (g)		Biological yield (Ton ha^{-1})		Grain yield (Ton ha^{-1})		Straw yield (Ton ha^{-1})	
Treatments	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
MM1CS1	27e	29e	6.80d	7.50d	1.50e	1.60f	4.92e	5.60e
MM1CS2	31d	32c	7.50c	7.70d	1.60d	1.80e	5.77d	5.97d
MM1CS3	29c	29d	8.40b	8.80c	1.75d	1.90d	6.40c	6.48c
MM2CS1	32b	34b	8.53b	8.99b	2.10c	2.00c	6.70b	6.80c
MM2CS2	34a	34b	8.80b	9.90b	2.40b	2.50b	6.81b	7.00b
MM2CS3	35a	39a	10.80a	11.75a	2.80a	3.20a	8.80a	7.83a
SE±	2.47	2.60	2.61	2.17	0.48	1.4	1.8	1.6
Sig.	*	*	**	**	*	*	**	*

Means within columns followed by the same letter(s) are not significantly different at P<0.05 level according to Duncan's Multiple Range Test.
* and ** indicate significance at P≤0.05, and 0.01, respectively.

3.1.3. 11000-seeds weight

Table. 4 shows that interaction of 4 tons per hectare with 40 tons of canal sediment produced high seeds weight of wheat (39 g) in the second season compare to control of (27 g) in this result agreed with that of Ali, 2017 who said that canal sediment positively increased seeds weight of wheat, also Elhadi *et al*.2016) stated that manure improved the plant height, number of seeds per spike, number

of spikes per square meter, number of tillers per square meter, 1000- seeds weight, straw yield, biological yield ,grain yield and harvest index of wheat.

3.1.4. Grain yield

The results of this study showed that heights wheat yield of 3.2 tons per hectare obtained for the combination of 4 tons per hectare with 40 tons per hectare canal sediment in the second season compare to control (1.6 tons per hectare) which is mean that the application of manure improved yield of wheat. As mentioned by Rasool *et al.* (2015), who concluded that manure increased wheat growth and yield significantly. Also, the results is in agreement with that of Ali (2017) who stated that, Addition of canal sediment improved and enhanced wheat yield.

3.1.5. Biological yield and Straw yield

Result Table.4 indicated that addition of canal sediment (40 tons per hectare) and mixed manure (4tons per hectare) recorded highest mean values of 11.75 tons per hectare and 8.8 tons per hectare for biological and straw yield of wheat respectively compare to control which produced of 6.8 tons per hectare and 4.92 tons per hectare for the same parameters respectively, this result agreed with Ali,(2017) who reported that canal sediment enhanced biological and straw yield, also Awad Elkarim, (2003) and Awad Elkarim *et al.,* (2005) reported that manure improved mentioned elements .

4. Conclusion

It could be concluded that in the high terrace soil of the Northern State of Sudan, the addition of canal sediment and manure improved and enhanced wheat yield and its components and can be a good solution for reclaiming the infertile sandy soil of the area.

References

Ageeb, O.A., A.B. Elahmadi, M.B. Solh, and M.C. Saxena, (Eds.) 1996. Wheat Production and Improvement in the Sudan. Proceedings of the National Research Review Workshop, 27- 30 August 1995, Wad Medani, Sudan. VIII + 262 .

Almeu, A. and A. Hazem, 2011. Government of Sudan and FAO/WFP Crop and Food Security Assessment Mission to the 15 Northern States of Sudan. Available at: http://www.documents.wfp.org/stellent/groups/public/documents/ena/wfp231348.pdf

Adeleye, E.O., L.S. Ayeni, and S.O. Ojeniyi, 2010. Effect of poultry manure on soil physico-chemical properties, leaf nutrient contents and yield of yam (*Dioscorea rotundata*) on alfisol in Southwestern Nigeria. Journal of American Science 2010;6(10):871-878.

Agbede, T.M., S.O. Ojeniyi and A.J. Adeyemo, 2008. Effect of poultry manure on soil physical and chemical properties, growth and grain. American – Eurasian journal of sustainable agriculture, 2(1) :72-77.

Ahmed, I.A., 2010. Effect of Tillage Methods, Green and Farmyard Manures on Wheat Yield and Properties of Desert Plain Soils, Northern State, Sudan. M.Sc. thesis, National Institute of Desert Studies (NIDS) University of Gezira, Wad Madani, Sudan

Ali, A.M., 2017. Effects of Fertilization with Humate and Canal Sediment and Irrigation Intervals on Soil Properties and Wheat Performance in High Terrace Soils, Northern State, Sudan. Univesity of Gezira, Sudan, Ph.D. thesis, 64-66.

Awad Elkarim, E.E., 2003. Response of wheat to organic and inorganic fertilizers in high terrace soils. Annual report of LWR (2002/2003), ARC, Wad Medani, Sudan.

Awad Elkarim, E.E. and S. Babiker, 2005. Response of wheat to farmyard manure and nitrogen fertilization in high terrace soils. Annual report of LWRC (2004/2005), ARC, Wad Medani, Sudan.

Babiker, E.A. and H. Faki, 1994. Evaluation of Farmers' Attitudes and their Effect on Wheat Productivity and Input Use in Rahad Scheme. ICARDA/ ARC. Wad Medani, Sudan.

Elhadi, E.A., A.R. Mubarak, and F.A.M. Rezig, 2016. Effects of organic amendments on sand dune fixation. Int J Recycl Org Waste Agricult. DOI 10.1007/s40093-015-0111-5.

Farah, S.M., S.H. Ahmed, A.A. Salih, H.M. Ishag, and A.M. BadrEldin, 1994.Effect of Skipping Irrigation at Different Developmental Stages of Wheat.Pages 1-5 in Nile Valley Regional Coordination Meeting, 1-4 October 1994. Cairo, Egypt.

Habiballa, A.M. and A.M. Ali, 2010.Classification of Climates Using AridityIndices.*Sudan J. Des.Res.*, 12: 62-75.

Land and Water Research Centre. 1999. Detailed Soil Survey and Land Suitability Classification of El Multaga Scheme. Agricultural Research Corporation, Wad Medani, Sudan.

Mubarak, A.A., A.A. Hassn, I.A. Ahmed, and A.M.A. Eltilib, 2014. Use of Dry Sewage Sludge and Clay Based Ameliorant for Production of Wheat (*Triticum aestivum* L.) in a Desert Soil II: Effects on Yield and Nutrient Content. Sudan J. Des. Res, 6(1): 67-78.

Rasool, G.H., A.J. Wahla, M. Nawaz, and M. AbdurRehman, 2015. Determination and Evaluation of the Effect of Different Doses of Humic Acid on the Growth and Yield of Wheat (*Triticum aestivum* L.). Journal of Agriculture and Veterinary Science, 8(2): 5- 7.