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Research Application Summary

Effects of chicken and cattle manure on wheat production and soil properties in the high terrace and Karu soils in River Nile State in the Sudan

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Abstract

This study was conducted at Hudeiba Research farm on karu and high terrace soils for two consecutive seasons (2008/09 and 2009/10). Organic manures are traditionally used for supplying plant nutrients. Eight different fertilizer combinations from cattle and chicken manure plus phosphorus and nitrogen were tested to estimate their contribution to wheat grain yield. Changes in growth and yield parameters of wheat relative to inorganically fertilized control were measured. The combined yield analysis of the first season revealed that the treatment consisting of 4 tons Ch/ha + 86 kg N/ha + 43 kg P_2O_5 was the best for wheat production on both the high terrace and Karu soils. This treatment gave the highest wheat grain yield (3375kg/ha). The first season findings of the trial suggested that crop productivity may be improved significantly by the application of various organic manures.

Key words: Cattle manure, chicken manure, grain yield, N mineralization, soil properties, Sudan, wheat

Résumé

Cette étude a été menée à la ferme de recherche de Hudeiba sur les sols de Karu et de haute terrasse pendant deux saisons consécutives (2008/09 et 2009/10). Les engrais organiques sont traditionnellement utilisés pour fournir des éléments nutritifs. Huit combinaisons différentes d'engrais à partir de fumier de bovin et de poulet ainsi que le phosphore et l'azote ont été testés pour évaluer leur contribution au rendement en grain du blé. Les changements dans la croissance et les paramètres de rendement du blé par rapport au contrôle inorganiquement fertilisé ont été mesurés. L'analyse combinée du rendement de la première saison a révélé que le traitement se composant de 4 tonnes Ch/ha + 86 kg N/ha + 43 kgP_2O_5 était le meilleur pour la production du blé à la fois sur la haute terrasse et les sols de Karu. Ce traitement a donné le meilleur rendement en grains du blé (3375 kg/ha). Les résultats de la première saison de l'essai indiquaient que la productivité des cultures peut être

significativement améliorée par l'application de différents engrais organiques.

Mots clés: Fumier des bovins, fumier de poulet, rendement en grain, minéralisation de N, propriétés du sol, Soudan, blé

Background

The growing population in the Sudan in the last few years, and the change of consumption habit necessitate a vital need to increase the production of wheat to cope with the increasing demand of such population. Wheat can grow on a range of soils ranging from sandy loam to montmorillonitic clay but the sandy loam to clay loam textures are nevertheless preferred (Sys *et al*., 1993).

Literature Summary

Chicken manure composition depends on many factors, such as, chicken type, age, type and amount of feed, climatic condition during collection, accumulation and storage management (Elagib, 1997). Both Abdelgani (1997) and Elsheikh (1998) noted that fresh chicken manure is used as a source of nitrogen because of its easy mineralization. Fresh chicken manure is as a source of phosphorus, especially available phosphorus, and increased exchangeable potassium, nitrate nitrogen and organic matter content (Eltilib *et al*., 1994). Additionally chicken manure increased grain yield of wheat (Eltilib *et al*., 1995).

Study Description

The present study was carried out at Hudeiba Research farm (latitude 17 34 N, longitude 33 56, E and altitude 350 meter a.s.l), on karu and high terrace soils for two consecutive seasons (2008/09 and 2009/10). The site is located at Ed Damer River Nile State in the northern region of the Sudan. The soil of the experimental site falls within the karima series and is classified as typic torrisluvents, fine loamy mixed hyperthermic (Soil Taxonomy, 1999). The karu soil and mukabrab series is of Aridisosl order, clay loamy weak fine and medium sub-angular blocky with few fine and medium tubular pores, few white soft CaCo3 patches and concretion and few fine medium and coarse gravels (FAO, 1995). The soil at the study was generally low in organic matter and nitrogen and available phosphorus.

In the first season, the experiments consisted of nine treatments, six treatments from factorial combination of three levels of chicken manure (Ch) (2, 4 and 6 ton/ha) with two levels of nitrogen (0 and 43 kg N/ha) plus the recommended doses of nitrogen alone (86 kg N/ha), nitrogen with cattle manure (Ca) (86kgN/ha + 5 ton cattle manure) and the control. In the second

season, three treatments from a combination of three levels of chicken manure (2, 4 and 6 ton/ha) with one level of nitrogen (43 kg N/ha) were added to twelve treatments. The above treatments were used for the experiment in the karu soil. In the high terrace soil, phosphorus fertilizer at the level of 1P (43 kgP2O5/ha) was used for every treatment containing nitrogen. A randomized complete block design was used with four replication. Each plot area measured 5.4m^2. Chicken manure, plus one seed and phosphorus fertilizer were placed in this some furrow with 30 cm space between furrows. Nitrogen fustier was broad casted in retch treatment. Wheat cultivar "bohain" was used. Sowing for both in first and the second season was during the fourth week of November with a seed rate of 120 kg/ha. The data collected included length of ear (cm), plant height (cm) at maturity stage, 1000- seed weight (g), number of seeds per head and grain yield (kg/ha).

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The result of the first season for both the karu and high terrace soils are shown in Tables 1 and 2. The grain yield was significantly affected by the treatments in both sites. In the karu and high terrace soils the highest yield was obtained from (10 kg/ha tons cattle + 2N), whereas in the high terrace soil the highest grain yield was from (4kg/ha tons Ch + 2N + 1P). In both soils the lowest wheat grain yield was obtained from the control. The highest grain yield in the karu and in the high terrace out-yielded the control by 96% and 76%, respectively.

Table 1. The effect of N,P fertilization , cattle and chicken manure on grain yield and yield components in karu soil in Nile River State season 2008/09.

Treatment	Grain yield (kg/ha)	Straw weight (kg/ha)	No. of spike/m^2	1000-seed (g)	10 head (g)	Plant height(cm)
Control	1603	4644	315	29	11.3	50
2N	2416	6438	365	32	13.9	61
5Ca+2N	2786	7271	348	31	14.3	66
10Ca+2N	3138	7678	418	32	13.4	73
2Ch	1861	5920	318	30	12.5	58
4Ch	2687	6790	378	33	14.0	60
6Ch	2815	7086	385	33	13.9	65
2Ch+2N	2822	6763	367	30	13.6	53
4Ch+2N	3023	7419	421	32	15.0	68
6Ch+2N	2786	7215	374	31	14.6	62
Sig	***	***	Ns	*	ns	***
S.E±	164.03	328.54	29.15	0.853	0.816	0.289
C.V%	12.65	9.78	15.43	5.47	11.95	0.94

Table 2. The effect of N,P fertilization , cattle and chicken manure on grain yield and yield components in high terrace soil in Nile River State season 2008/09.

Treatment	Grain yield (kg/ha)	Straw weight (kg/ha)	No. of spike/m^2	1000-seed (g)	10 head (g)	Plant height(cm)
Control	1552	3966	364	32	9.7	50
2N+1P	2133	5629	412	33	9.8	64
5Ca+2N+1P	2619	6983	473	31	9.9	69
10Ca+2N+1P	2429	6531	399	30	10.8	67
2Ch	2051	5106	347	32	9.0	63
4Ch	2205	5320	377	31	10.6	67
6Ch	2375	5605	400	28	11.4	62
2Ch+2N+1P	2502	6674	442	29	10.6	67
4Ch+2N+1P	2728	7078	435	29	10.6	59
6Ch+2N+1P	2519	6721	439	31	12.0	68
Sig	***	***	ns	**	ns	***
S.E±	131.43	378.89	26.25	0.886	0.639	0.665
C.V%	11.37	12.72	12.84	5.78	12.24	2.10

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