MANAGEMENT OF SUPPLEMENTARY N-ORGANIC SOURCES AS A PARTIAL REPLACEMENT OF N-MINERAL AS RELATED TO AMELIORATION OF SANDY SOIL PROPERTIES AND YIELDS OF A SESAME-WHEAT CROPPING SEQUENCE

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ABSTRACT:

A field experiment was carried out during two successive growing seasons of 2007/2008 and 2008/2009 on a sandy soil at South Tahrir Province, Agricultural Research Station, Agricultural Research Center, Ali Mubarak Village, El-Bostan Region, El-Behiera Governorate, Egypt under a cropping-sequence of sesame-wheat to evaluate the management proper of supplying N-organic manures, *i.e*., composted rice straw and chicken manure wastes, besides N-mineral fertilizer, with special reference to the associated amelioration in soil physio-chemical, fertility status and productivity of the grown plants. The experiment was setup in a randomized complete block design with three replicates. Ten treatments were examined, *i.e.,* control, 100% of N-organic released from either chicken or composted rice straw, 100% of the recommended of N-mineral dose as ammonium sulphate as well as mixture ratios of N-organic : N-mineral of 3:1, 1:1 and 1:3. The application of N-rates of all fertilized plots were kept at 45 kg N/fed for sesame crop at summer season and 100 kg N/fed for wheat at winter one.

The obtained results showed that application of either composted rice straw or chicken manure as solely or combined with N-mineral fertilizer significantly improved the physical properties of the studied sandy soil, *i.e*. bulk density, hydraulic conductivity, infiltration rate, penetration soil resistance and soil moisture constants (field capacity, welting point and available water content). Also, incorporation of both N-mineral and N-organic sources caused substantial increases in soil available N, P, K, Fe, Mn, Zn and Cu. Organic matter content in soil was also increased gradually with increasing the portion of applied N-organic sources in a mixture.

Grain and straw yields of sesame and wheat were progressively increased with raising the applied N-organic portion in the N-mixture sources. Also, N, P and K uptake by both grain and straw followed a trend almost similar to that crop yields. Seed oil content and oil yield of sesame were positively affected by the solely or combined treatments of N-organic and N-mineral. Moreover, a pronounced increase in crude protein content of wheat grain was followed a trend similar as mentioned before. These results are emphasized the importance of partial replacement of N-mineral fertilizers by the use of organic ones. However, applied chicken manure was recorded a better effect as composted to the other treatments for ameliorating soil physico-chemical properties and fertility status as well as its productivity for the grown crops under the prevailing experimental conditions.

Keywords: Chicken manure, management of N-mineral and organic fertilizers, composted rice straw compost, sesame-wheat cropping sequence.

INTRODUCTION:

Organic fertilization is very important not only for providing the plants with their nutritional requirements but also for improving physical and hydrophysical and biological properties. The combination of the organic input and supplementary application of chemical fertilizers has been found as more attractive management option in order to achieve a resource saving and balanced nutrient supply and a high production of different crops **(El-Metwally, 2007 and El-Mancy *et al*., 2008).** Sandy soils deserve special consideration as their physical, bio-chemical characteristics and nutritional status adversely affect to a great extent their irrigation practices and agricultural potentialities. It is worth mentioning that the reclamation of sandy soils in Egypt was dependent upon annual addition of organic manures and crop residuals. Consequently, properties related to soil structure, moisture retention, water movement, water use efficiency and nutritional status were improved, consequently crop yield were increased.

Composting of organic residues results in a final product that can be stored easily handled and uniformly applied to land for beneficial use as a low-analysis fertilizers and soil conditioner. Because most composts contain relatively low levels of nutrients compared to complete fertilizer. So, combining low amendment rates of composts and organic manures with sufficient fertilize to meet crop requirements is an appealing alternative, which utilizes composts at lower rates than those needed to supply all the crop N requirements as well as reduces the accumulation of non-nutrient compost constituents in soil.

Sikare and Enkiri (2001) and Abou El-Enien *et al.* (2008) reported that the compost did not provide sufficient plant available N to increase yields or N uptake. On the other hand, **Fatma *et al.* (2004) and El-Mancy *et al.* (2008)** mentioned that compost may reduce crop yields as compared with N, P and K fertilizer due to limited nutrient availability, but soil reserve of N, P and K as well as other nutrients will be increased after repeated amendment application. Mineralization and/or release of these sorted nutrients should result in improvement of crop yields in subsequent years and the gradual reduction in future application of manure or compost.

Abou El-Enien *et al.* (2008) and Fawy and Ahmed (2009) found that the incorporation of ammonium sulphate and compost of rice straw or fresh chicken manure improved soil organic matter content, available N, P and K content in soil and soil physical properties after maize and wheat harvesting. Also, grain and straw yields were increased by incorporation of inorganic and organic N sources. On the other hand, **Wahba (1997) and Poraas *et al.* (2010)** reported that seed and straw yields of sesame as well as oil yield were increased by application of nitrogen fertilizer with farmyard manures and humic acids compared to the treatments received single application of ammonium sulphate. **Modaihsh *et al.* (2005) and El-Sebaey (2006)** found that application of rice straw, composted plant residues and cotton stalks compost to sandy soil increased and improved the availability of N, P and K in soil compared to mineral fertilizers.

Bashandy (2007) stated that treating sand soils with date palm waste compost increased the total N, available P and K content of post harvest soils as compared to untreated soil or NPK fertilizers. **Taha (2007)** found that application of sesame straw compost to sandy soil significantly increased their available N, P and K in the treated soils after harvesting of two successive crops as compared to control. **Bonde *et al.* (2004)** found that addition of organic resides like wheat straw, sugar cane trash, press mud and compost and farmyard manure to Vertisols were beneficial in enhancing the availability of micronutrients in soil. **Hammad *et al.* (2006)** showed that integration of composted rice straw plus nitrogen fertilizer increased the availability of Fe, Mn, Zn in the tested soil.

The aim of this study was at attaining management proper of supplementary N-organic sources as a partial replacement of N-mineral fertilizers as related to ameliorating sandy soil properties and yields of a sesame-wheat cropping sequence.

MATERIALS AND METHODS:

a. Materials:

To achieve the aforementioned target, a field experiment was carried out during two successive growing season of 2007/2008 and 2008/2009 on a sandy soil at South Tahrir Province, Agricultural Research Station, Agricultural Research Center, Ali Mubarak Village, El-Bostan Region, El-Behiera Governorate, Egypt. Sesame (*Sesame indicum*, variety Giza 32) and the wheat (*Triticum aestivum,* variety Giza 169) were used as a plant indicator. Some characteristics of the experimental soil according to **Black *et al.* (1965**)**, (Klute, 1986) and (Page *et al*., 1982)**, the obtained data are presented in Table (1). The analysis of chicken manure and composted rice straw were determined according to **Brumer and Wasmer (1978)**, and the obtained data are presented in Table (2)

Table (1): Some characteristics of the experimental soil.

a. Soil physical properties			
Particle size distribution %:		Hydraulic conductivity (cm h^{-1})	27.5
Coarse sand	31.15	Infiltration rate (cm h^{-1})	25.6
Fine sand	60.00	Field capacity (% v/v)	6.92
Silt	5.74	Wilting point (% v/v)	2.14
Clay	3.11	Available water (% v/v)	4.78
Texture class	Sand	Bulk density (Mg m^{-3})	1.73
b. Soil chemical properties			
Soil pH (1:2.5)[1]	8.01	Organic matter content %	0.38
ECe (dSm^{-1})[2]	0.63	$CaCO_3$ content %	1.12
Cations (mmolc L^{-1}):		Total porosity %	35.4
Ca^{++}	1.62	***c. Available macro-micronutrients (mg kg^{-1})***	
Mg^{++}	1.45	N	19.80
Na^{+}	2.10	P	3.90
K^{+}	0.54	K	51.80
*Anions (mmolc L^{-1})**		Fe	3.63
HCO_3^-	1.60	Mn	0.78
Cl^-	2.19	Zn	0.62
SO_4^{--}	1.92	Cu	0.35

*No soluble carbonates were detected [1]1:2.5 w/v soil:water suspension [2]Soil paste extract

Table (2): Some characteristics of the used organic manures.

Characteristics	Rice straw (RS)	Chicken manure (CM)
Bulk density (Mg m^{-3})	0.36	0.56
EC in dSm^{-1} (1:5 water extract)	4.83	1.74
pH (1:5 water suspension)	7.49	6.16
Organic matter content %	28.95	50.22
Organic carbon %	16.79	29.13
Total nitrogen %	1.27	2.45
C/N ratio	13.22	11.89
Water holding capacity %	125	140
Total phosphorus %	0.58	1.25
Total potassium %	2.96	2.34
Total micronutrients (mg kg^{-1})		
Fe	2114	2553
Mn	186	296
Zn	167	202
Cu	29	40

Organic matter = Organic carbon x 1.724 (**Waksman, 1952**)

b. Applied treatments:

A randomized complete block design with three replicates was used, with a plot area of 12 m^2 (3 x 4 m), under a sprinkler irrigation system. Three nitrogen sources were used, *i.e.,* chicken manure (CM, 2.45% N), composted rice straw (RS, 1.27% N) as N-organic sources and ammonium sulphate (AS, 20.6% N) as N-mineral source. These N-sources were applied as solely or a mixture at ratios of 3:1, 1:1 and 1:3 for N-mineral fertilizer : each of chicken manure and composted rice straw compost, where the following ten treatments were used:

1 : Control (Without N fertilizer)
2 : 100% N-organic (chicken manure, CM)
3 : 100% N-organic (composted rice straw, RS)
4 : 100% N-mineral (ammonium sulphate, AS)
5 : 75% N-AS + 25% N-RS
6 : 50% N-AS + 50% N-RS
7 : 25% N-AS + 75% N-RS
8 : 75% N-AS + 25% N-CM
9 : 50% N-AS + 50% N-CM
10: 25% N-AS + 75% N-CM

These ratios were calculated based on the N-recommended dose for sesame (45 kg N/fed, *i.e.,* 0.218 Mg/fed as AS, 1.83 Mg/fed as CM and 3.54 Mg/fed as RS) and wheat (100 kg N/fed, *i.e.,* 0.485 Mg/fed as AS, 4.10 Mg/fed as CM and 7.87 Mg/fed as RS), which were calculated according to its total nitrogen content. Organic manure was uniformly spread over soil plot surfaces, and then thoroughly incorporated into the top soil layer of 0-30 cm two weeks before planting. After that, the soil was slightly irrigated to establish good microbial activity for decomposing the applied organic materials in suitable time before sowing sesame at the first season (summer 2007/2008). In order to evaluate its residual effect, wheat was planted on the same plots at the next season (winter 2008/2009).

Ammonium sulphate (AS) was added in two split doses, *i.e.*, before sowing and 40 days after sowing for both tested crops. Both phosphorus as superphospahte (6.7% P) and potassium sulphate (40.2% K) were uniformly applied at the rates of 200 and 100 kg/fed for sesame and wheat crops, respectively.

c. Plant parameters:

All the agricultural recommended practices were followed as common under the tested two crops. Plant samples were collected from each experimental plot at harvest, *i.e.*, 120 days after sowing sesame and 160 days after sowing wheat. The whole plants were threshed into two separates of grains and straw. Plant samples were oven dried at 70 ^{o}C, ground and well digested using H_2SO_4 and H_2O_2. Total nitrogen was determined using the standard procedure of Micro-Kjeldahl as described by **Black *et al.* (1965).** Seed oil content was determined according to **A.O.A.C. (1980).** Crude protein percent in grain was calculated by multiplying N% by 6.15 according to **A.O.A.C. (1980).**

d. Soil samples:

Surface soil samples up to 30cm depth were collected after harvest of both sesame and wheat crops from all experimental plots for determining the studied soil physical and chemical properties for the surface layer of a 0-30cm, *i.e.*, infiltration rate, hydraulic conductivity, bulk density **(Black *et al.*, 1965)**, moisture desorption curves using undisturbed soil samples **(Klute, 1986)**, field capacity, wilting point and available water contents **(Massoud *et al.*, 1971).** Soil organic matter content (Walkley and Black method), pH, EC, available N, P and K were determined according to **(Page *et al*., 1982)**. The available micronutrients of Fe, Mn, Zn and Cu were determined according to **Soltanpour (1985)**. The obtained results were subjected to statistical analysis according to **Snedecor and Cochran (1981)** and the treatments were compared by using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION:

I. Effect of applied different N-organic sources and mineral N-mineral fertilizer on soil physical properties:

Data presented in Table (3) showed that added organic manures individually led to a significant and positive effect on soil bulk density, where its values tended to decrease after harvesting each of sesame and wheat crops as compared to control to applied 100% AS treatment. That was true, since the released organic material from chicken manure and composted rice straw plays an important role soil aggregation, and then increasing soil bulk volume. Moreover, the dilution effect of soil mass resulting from mixing added organic manure with the more denser fraction of sand soil, such results are in agreement with those of **El-Fayoumy and Ramadan (2002) and El-Sodany (2005)**.

On the other hand, the applied organic manures with or without mineral N-mineral fertilizer significantly resulted in increasing the total porosity after harvesting wheat plants as compared to the treatment of 100%N-AS), with a superiority for chicken manure alone or combined with N-mineral fertilizer as compared to composted rice straw compost individually or combined with N-mineral fertilizer.

Table (3): Soil physical properties as affected by the applied different N-sources as an average data for the two growing seasons.

Treatments	Bulk density (Mgm^{-3})	Total porosity %	Hydraulic conductivity ($cm\ h^{-1}$)	Infiltration rate ($cm\ h^{-1}$)	Field capacity %	Wilting point %	Available water %	Penetration resistance ($kg\ cm^{-2}$)
After sesame								
Control	1.70	34.53	24.62	23.49	7.14	2.54	4.60	15.40
100%N-CM	1.51	40.62	21.51	20.52	13.11	4.70	8.41	20.79
100%N-RS	1.53	38.20	23.86	22.74	11.12	4.16	6.96	20.52
100%N-AS	1.69	35.27	25.40	24.83	9.33	4.72	4.61	15.93
75%N-AS + 25%N-RS	1.59	39.15	24.75	23.64	9.17	3.18	5.99	16.58
50% N-AS + 50%N- RS	1.58	40.38	23.94	22.51	8.76	3.19	5.57	18.46
25%N-AS + 75%N-RS	1.57	40.91	22.75	22.51	8.01	2.58	5.43	20.32
75%N-AS + 25%N-CM	1.63	41.30	22.50	22.01	12.11	3.30	8.81	17.71
50%N-AS + 50%N-CM	1.61	42.50	21.18	20.14	13.56	4.24	9.32	19.79
25%N-AS + 75%N-CM	1.56	43.16	20.16	19.30	15.64	6.54	9.10	21.86
L.S.D at 0.05	0.14	0.93	3.61	2.76	1.54	1.10	0.41	3.11
After wheat								
Control	1.69	37.19	23.99	22.25	9.34	2.78	6.56	17.30
100%N-CM	1.51	43.61	19.87	18.10	14.30	4.46	9.84	21.06
100%N-RS	1.52	40.74	21.63	20.53	14.88	4.10	10.8	19.61
100%N-AS	1.65	37.62	23.11	22.19	9.23	2.45	6.78	18.15
75%N-AS + 25%N-RS	1.63	42.16	22.26	21.13	10.61	3.76	6.85	20.14
50% N-AS + 50%N- RS	1.58	43.60	21.53	20.42	9.88	2.71	7.17	21.11
25%N-AS + 75%N-RS	1.57	43.97	20.47	19.61	11.30	2.91	8.39	22.15
75%N-AS + 25%N-CM	1.54	44.71	20.25	19.12	13.71	4.30	9.41	20.19
50%N-AS + 50%N-CM	1.54	46.37	19.16	18.11	15.41	5.49	9.92	22.14
25%N-AS + 75%N-CM	1.54	47.14	19.01	17.50	16.49	4.81	11.7	22.71
L.S.D at 0.05	0.12	2.11	2.60	1.66	1.34	1.15	0.20	2.44

Generally, it could be observed that the reduction pattern in soil total porosity as related to the applied treatments followed the following descending order of (25%N-AS + 75%N-CM) > (50%N-AS + 50%N-CM) > (75%N-AS + 25%N-CM) > (25%N-AS + 75%N-RS) > (100%N-CM) > (50%N-AS + 50%N-RS) > (75%N-AS + 25%N-RS) > (100%N-RS) > (100%N-AS) > control

In respect to soil hydraulic conductivity and infiltration rate, the obtained data in Table (3) showed that, the application of organic manures alone or mixed with N-mineral led to a pronounced decrease in hydraulic conductivity as compared with the control treatment. The data also revealed that, the superior decrease of hydraulic conductivity and infiltration values were recorded under chicken manure followed by composted rice straw. These results could be due the pronounced increment of organic substances, which enhances soil aggregation, and consequently increasing the volume of meso and micro-porosity vs decreasing the volume of macro porosity (< 250 µm). These favourable conditions led to decrease the pathways of water flow in the studied sandy soil. These results are in harmony with those of **El-Hadidi *et al*. (2004) and Fawy and Ahmed (2009)**.

The moisture tension drying data is of practical significance in determining the range of soil moisture available for plant growth and its depletion pattern. The upper is known as field capacity and the lower is known as wilting point.

Data in Table (3) showed that the values of soil moisture constants, *i.e.,* field capacity, wilting point and available water content were positively affected by the combination between N-organic sources and N-mineral fertilizer. These findings are emphasized by the applied N-organic sources caused an increase in the studied soil moisture constants during the tested two seasons under wheat and sesame with or without N-mineral fertilizer as compared with the control. Generally, soil moisture content tended to increase with increasing organic manure portion in the added N-organic : N-inorganic mixtures. Concerning the individual effects of chicken manure, rice straw and mineral nitrogen treatments, results indicate that, the higher values of the studied soil moisture constants were obtained at the end of the second season (after wheat) vs a lowest one was obtained at the end of the first season (after sesame). These results revealed that the highest values of individual N-sources upon soil moisture contents were recorded for (chicken manure, while the lowest one was obtained with N-mineral fertilizer. That means chicken manure was more effective than either composted rice straw or N-mineral fertilizer for increasing the studied soil moisture constants. Also, it could be noticed that the values of soil moisture contents at the end of the second season were higher than those obtained at the end of the first season, these may be due to the decomposition rates of the applied organic manures after wheat harvesting, which were greater than that of the first season (after sesame harvest). Similar results were obtained by **El-Sharaway *et al.* (2003) and Fawy and Ahmed (2009)**.

Furthermore, it could be observed that all the combinations between chicken manure and N-mineral resulted in pronounced increases for soil moisture constants than those obtained between composted rice straw with N-mineral application. These results mean that the residual effects of applied mineral fertilizer and organic manures and their combinations could be categorized in an ascending order of (25%N-AS+75%N-CM) > (100%N-RS) > (50%N-AS+50%N-CM) ≥ (100%N-CM) > (75%N-AS+25%N-CM) > (25%N-AS+75%N-RS) > (50%N-AS+50%N-RS) > (75%N-AS+25%N-RS ≥ (100%N-AS) > Control after wheat harvesting. On the other hand, an ascending order of (50%N-AS+50%N-CM) ≥ (25%N-AS+75%N-CM) ≥ (75%N-AS+25%N-CM) ≥ (100%N-CM) > (100%N-RS) > (75%N-AS+25%N-RS) > (50%N-AS+50%N-RS) ≥ (25%N-AS+75%N-RS) > (100%N-AS) ≥ Control was detected after the first season (after sesame harvesting).

Regarding the penetration resistance, which is one of the useful parameter used as a function of mechanical strength and expressed in kg cm^{-2} as well as this property, was mainly affected by macro pore spaces and bulk density. Data in Table (3) revels that application of the studied organic manures led to a significant increase in penetration resistance value in the studied sand soil. The obtained results indicated that, regardless the types of organic manures, soil penetration resistance values were higher after wheat than those after sesame. This could be due to the repeated application of organic manure in the case of wheat, which reflects an accumulation of the more stable organic compounds that are presented by heavy and humic fraction, which enhancing the formation of stable soil aggregates **(El-Sodany, 2005)**.

Generally the penetration resistance values were increased with chicken manure than composted rice straw for all treatments as compared to the control treatment after the second season (wheat harvesting). These results are in harmony with those of **Anton *et al.* (1995) and El-Naggar *et al.* (2002)**.

II. Effect of N-sources on soil organic matter and available nutrient contents:

Soil organic matter content as affected by the application of organic manure of composted rice straw, chicken manure and N-mineral as ammonium sulphate as well as their combination at the harvest of both successive crops (sesame and wheat), is presented in Table (4). The obtained data showed that soil organic matter content was significantly increased upon the addition of organic manures and progressively increased with increasing the portion of organic manure in the applied mixture of N-organic : N-mineral, however, the treatment received N-mineral alone was un-affected in its organic matter content at the harvest of both seasons and wheat.

Table (4): Soil organic matter and available contents as affected by the applied different N-sources as an average for the two growing seasons.

Treatments	Organic matter %	Soil available nutrient contents (mg kg^{-1} soil)						
		Macronutrient			Micronutrient			
		N	P	K	Fe	Mn	Zn	Cu
After sesame								
Control	0.35	15.21	4.10	55.21	3.55	0.72	0.58	0.31
100%N-CM	0.83	37.15	5.98	71.40	4.11	1.41	1.07	0.96
100%N-RS	0.48	25.98	5.22	72.37	3.98	1.31	0.98	0.84
100%N-AS	0.39	45.20	4.27	59.75	3.81	0.79	0.61	0.41
75%N-AS + 25%N-RS	0.63	39.45	6.71	81.15	5.15	1.84	0.92	0.97
50% N-AS + 50%N- RS	0.68	39.92	6.75	84.75	5.92	2.01	2.03	1.05
25%N-AS + 75%N-RS	0.71	34.58	7.28	85.72	6.07	2.51	1.73	1.14
75%N-AS + 25%N-CM	0.73	38.41	8.26	86.70	6.35	2.97	2.05	1.02
50%N-AS + 50%N-CM	0.69	39.60	9.05	89.25	7.15	3.05	2.26	1.28
25%N-AS + 75%N-CM	0.76	36.70	9.78	90.47	7.95	3.28	2.53	1.17
L.S.D at 0.05	0.09	0.57	0.26	2.54	0.23	0.41	0.45	0.28
After wheat								
Control	0.36	18.32	6.03	61.31	4.15	0.78	0.62	0.39
100%N-CM	0.69	32.95	7.46	88.11	4.94	2.05	1.10	0.85
100%N-RS	0.59	24.75	6.82	90.35	4.70	1.96	0.86	0.72
100%N-AS	0.35	37.97	6.15	63.21	4.25	0.83	0.69	0.41
75%N-AS + 25%N-RS	0.46	38.85	7.91	75.50	5.71	1.35	0.89	0.67
50% N-AS + 50%N- RS	0.48	34.35	8.15	78.86	5.95	2.93	1.47	1.17
25%N-AS + 75%N-RS	0.54	30.15	8.90	81.22	6.30	2.72	1.78	1.09
75%N-AS + 25%N-CM	0.59	32.90	9.30	87.40	6.95	3.13	1.25	1.41
50%N-AS + 50%N-CM	0.61	36.75	9.56	90.75	7.51	3.30	1.56	1.69
25%N-AS + 75%N-CM	0.69	36.25	9.93	87.45	8.45	3.53	1.86	1.99
L.S.D at 0.05	0.07	0.80	0.38	3.03	0.38	0.51	0.11	0.39

The highest value of soil organic matter was recorded at the treatment of 100% chicken manure at the harvest of both successive crops and followed by (25%N-AS+75%N-CM). The values of organic matter content in soil after wheat harvest were lower in magnitude than those obtained after sesame harvest.

That was true, since a hot climate enhances a rapid oxidation and decomposition of organic matter as well as a result of microorganism activity **(El-Sayed *et al*., 2005 and Rehan *et al*., 2004)**. With regard to available N, P, K, Fe, Mn, Zn and Cu in the studied soil (Table 4), results indicated that the incorporation of chicken manure or composted rice straw and N-mineral fertilizer resulted in pronounced increases for soil available N, P, K, Fe, Mn, Zn and Cu as compared to the application of these manures and/or fertilizers solely. It is noteworthy to mention that the applied organic manures are not only considered as a storehouse for plant nutrients but also increasing soil ability for the retention of moisture and available nutrients **(Mahmoud, 1996 and El-Sodany, 2005)**. Moreover, the addition of chicken manure or composted rice straw to soil is one of the mechanisms that more effective to reduce erosion, nutrients losses by leaching or volatilization in sand soil **(Modini *et al.*, 1996)**. Consequently, the combined application of organic with N-mineral fertilizer at mixing with chicken manure (25%N-AS+75%N-CM) was superior for available P, K, Fe, Mn, Zn and Cu as compared to other treatments after the harvest of sesame and wheat, respectively. These results are also demonstrated that available soil N increased gradually with increasing the applied rates of N-mineral as compared to N-organic in their mixtures. This effect was true at the harvest of both subsequent crops. The treatments are ranked as follows: Nitrogen mineral > N-mineral mixture with chicken manure > N-mineral mixture with composted rice straw > N-organic alone > control.

From the abovementioned results, it is quite clear that the combined treatments of N-organic with N-mineral in their mixtures caused a significant increase in available N, P, K, Mn, Zn, Fe and Cu compared to the values obtained when they were added solely. In this connection, **Bakry *et al.* (2009) and Abdel Wareth *et al*. (2010)** reported that application of such organic manures along with mineral fertilizer may be helpful in conversing the fertilizer N and in assuming its continued availability to subsequent crops since microbial biomass is a potentially available N-sources whereas humic compounds may prove to be important source of N supply over an extended period of time. The values of available N, P, K, Fe, Mn, Zn and Cu after wheat harvest were lower to some extent than those obtained after sesame harvest. The depletion in available N, P, K, Fe, Mn, Zn and Cu with continuous cropping is mainly due to uptake by plants in addition nutrients losses through different mechanisms losses below the root zone which actively took place in such coarse textured soils **(Metwally and Khamis, 1998)**.

III. Effect of N-sources on sesame and wheat yields:

Data in Table (5) reveal that the application of organic and/or N-mineral had a significant positive effect on grain and straw yields of sesame and wheat. Increasing the portion of N-mineral in their mixture was accompanied by pronounced increases in the yields of both plant components of sesame and wheat. Among the different treatments, the addition of 75% of entire N requirements of sesame and wheat crops in mineral form and the rest of 25% in organic form as RS-sources (75%N-AS+25%N-RS) produced the greatest grain and straw yields for both sesame and wheat.

Values of the relative increases of both grain and straw yields of sesame due to the treatment of (75%N-AS+25%N-RS) were 85.22 and 88.04%, respectively as compared to the control treatment. The relative increases for wheat were 107.4 and 89.2%, respectively. On the other hand, when addition of 50% of entire N requirements of sesame and wheat crops in mineral form and the rest of 50% in organic form as CM-source (50%N-AS+50%N-CM) produced the greatest grain and straw yields for both sesame and wheat. Values of the relative increases of both grain and straw yields of sesame due to the treatment of (50%N-AS+50%N-CM) were 100.00 and 91.30%, respectively, as compared to the control treatment. The relative increases for wheat were 122.3 and 104.5%, respectively. These findings are in agreement with those obtained by **Hoda *et al*. (2009) and Poraas *et al.* (2010)** who found that the application of mineral nitrogen with organic fertilizer was more pronounced in increasing both grain and straw yields of the studied crops than the addition of N-mineral alone. Also, **Laila (2004) and Bakry and Abd El-Ghani (2005)** mentioned that the combination of N-mineral fertilizer and organic manure in a mixture of them gave the highest grain yields of wheat under coarse textured soils (sandy soil).

Table (5): Sesame and wheat yields as affected by the applied different N-sources as an average for the two growing seasons.

Treatments	Sesame				Wheat			
	Grain		straw		Grain		straw	
	Kg/fed	R.I.	Mg/fed	R.I.	Kg/fed	R.I.	Mg/fed	R.I.
Control	318	--	0.92	--	1180	--	2.46	--
100%N-CM	456	43.40	1.46	58.70	1872	58.64	3.77	53.25
100%N-RS	404	27.04	1.36	47.83	1794	52.03	3.19	29.67
100%N-AS	508	59.75	1.44	52.00	2281	93.30	4.15	68.69
75%N-AS + 25%N-RS	589	85.22	1.73	88.04	2447	107.4	4.65	89.02
50% N-AS + 50%N- RS	561	76.42	1.49	61.95	2331	97.54	4.38	78.04
25%N-AS + 75%N-RS	447	40.57	1.31	42.39	2167	83.64	3.81	54.87
75%N-AS + 25%N-CM	622	95.59	1.69	83.69	2481	110.3	4.81	95.52
50%N-AS + 50%N-CM	636	100.0	1.76	91.30	2623	122.28	5.03	104.47
25%N-AS + 75%N-CM	456	43.40	1.59	72.82	2427	105.67	4.26	73.17
L.S.D at 0.05	29.6	--	0.07	--	63.40	--	0.21	--

R.I. = Relative increase %

IV. Effect of N-sources on N, P and K-uptake by sesame and wheat:

Data presented in Table (6) indicated that N, P and K uptake was significantly increased due to the applied solely or combined treatments (mixture) of N-organic and mineral nitrogen in both grain and straw of sesame and wheat. N uptake by both plant components followed, more or less, the same trend of sesame and wheat yields. The more the rate of the portion of N-mineral fertilizer in the applied mixture more effect. The maximum N uptake by grain and straw of sesame and wheat were recorded under the treatment of (75%N-AS+25%N-CM), followed by (100%N-AS). In this respect, individual application of N-mineral (AS) was superior over organic manure alone. This effect is due to that N-mineral form rapidly available to wheat plants, while N-organic slowly becomes available to plants through microbial activity and the conversion to available N-mineral form, taking more time **(Metwally, 1994).**

Table (6): N, P and K uptake by sesame and wheat as affected by the applied different N-sources as an average for the two growing seasons.

Treatments	Nutrients uptake (kg fed^{-1})					
	N		P		K	
	Grain	Straw	Grain	Straw	Grain	Straw
After sesame						
Control	6.41	5.31	1.24	2.25	3.29	6.74
100%N-CM	10.82	7.45	1.91	3.63	6.52	9.71
100%N-RS	9.77	6.43	1.77	3.16	4.85	8.60
100%N-AS	18.64	10.85	2.44	6.98	7.15	12.65
75%N-AS + 25%N-RS	15.09	13.95	3.10	6.97	7.94	15.63
50% N-AS + 50%N- RS	15.42	10.84	2.66	5.19	7.50	12.84
25%N-AS + 75%N-RS	11.54	7.91	2.05	3.82	5.68	10.10
75%N-AS + 25%N-CM	19.66	15.20	3.37	6.85	9.11	17.24
50%N-AS + 50%N-CM	18.18	12.03	2.97	5.84	8.45	14.35
25%N-AS + 75%N-CM	12.62	8.93	2.37	4.39	6.39	11.42
L.S.D at 0.05	1.24	0.95	0.21	0.37	0.49	1.24
After wheat						
Control	20.24	11.01	31.41	4.15	16.34	19.17
100%N-CM	39.81	21.20	53.06	9.45	43.68	63.40
100%N-RS	36.85	18.04	80.38	7.40	41.73	60.27
100%N-AS	55.16	29.10	91.67	13.10	45.10	90.46
75%N-AS + 25%N-RS	58.06	32.99	98.45	13.80	40.39	94.23
50% N-AS + 50%N- RS	52.50	29.52	103.60	12.10	43.41	87.02
25%N-AS + 75%N-RS	46.31	23.86	105.91	10.20	36.90	77.79
75%N-AS + 25%N-CM	65.02	37.47	100.82	16.10	44.83	104.8
50%N-AS + 50%N-CM	60.41	33.35	110.14	17.40	48.18	97.93
25%N-AS + 75%N-CM	61.15	39.41	101.41	15.81	41.70	85.61
L.S.D at 0.05	4.31	2.23	0.57	0.96	2.56	3.34

Furthermore, results indicated that when organic and N-mineral fertilizers were applied together, N-uptake was higher than with organic or N-mineral alone, and this may be explained on the basis that the combined addition of organic and N-mineral maintains a continuous satisfactory increases in the efficiency of N utilization and reduce N losses.

Concerning P and K uptake, the obtained results followed resembled to that of uptake in the first season (sesame), where the mixing ratio of 3:1 (N-mineral : N-organic) was found to be superior over the other treatments, followed by the treatment of (50%N-AS+50%N-CM). This trend holds true for both grain and straw yields. On the other hand, in the second season (wheat), the treatments were rather different in their effects as compared to the first season, when the entire application of 50%N in the mineral form with 50%N chicken manure found to be superior over the other. Generally, P and K-uptake progressively increased with increasing the applied of N-mineral with N-organic in the first season (sesame crop). Apparently, N encouraged the uptake of P and K with more accumulation in the grains. These findings are emphasized by **El-Sersawy *et al*. (1997) and Abou El-Enein *et al.* (2008)** who pointed out that nitrogen has a positive effect on root growth, the absorbing sites of plant which enhance absorption of nutrients, especially phosphorus that having low mobile action.

On the other hand, the data presented in Table (6) indicated that application of mixing N-mineral with N-organic manure was more effective on increasing P and K-uptake in the second season (under wheat plant) as compared to N-sources alone treatments. Treatment of (50%N-AS+50%N-CM) was superior as compared to the other ones. This effect is due to that N-organic slowly becomes available to plants through microbial activity and the conversion to available N-mineral form, taking more time **(Metwally, 1994).**

V. Effect of N-sources on oil content and yield of sesame:

Seed oil content and yield of sesame were shown in Table (7), data revealed that their values were significantly affected by the individual or mixture application of N-organic sources and mineral nitrogen. The highest oil content (39.6 and 37.8%) were recorded in both treatments of (75%N-AS+25%N-RS) and (100%N-AS) in sesame, respectively. However, the maximum oil yield (233.2 kg fed^{-1}) was obtained under the treatment of (75%N-AS+25%N-RS), followed by the treatments (50%AS+50%CM) and (75%N-AS+25%N-CM). These results are in accordance with those of **Wahba (1997)** who reported that application of ammonium sulphate with organic manure gave a higher seed oil content and yield than N-mineral alone.

Table (7): Sesame oil content and yield as well as grain crude protein of wheat as affected by the applied different N-sources as an average for the two growing seasons.

Treatments	Sesame			Wheat
	Oil content %	Oil yield (kg/fed)	Relative increase %	Crude protein %
Control	29.7	94.4	--	10.55
100%N-CM	30.5	139.1	47.35	13.08
100%N-RS	30.8	124.4	31.78	12.63
100%N-AS	37.8	192.0	103.4	14.87
75%N-AS + 25%N-RS	39.6	233.2	147.0	14.59
50% N-AS + 50%N- RS	32.4	181.8	92.59	13.85
25%N-AS + 75%N-RS	31.6	141.3	49.68	13.14
75%N-AS + 25%N-CM	35.3	219.5	132.5	16.12
50%N-AS + 50%N-CM	35.9	224.7	138.0	14.16
25%N-AS + 75%N-CM	34.0	155.0	64.20	15.50
L.S.D at 0.05	0.76	13.6	--	0.39

VI. Effect of N-sources on crude protein of wheat grain:

As shown in Table (7), crude protein in wheat grains increased considerably upon the combined or single application of both N-organic and N-mineral and the increase progressed with increasing the applied N-mineral as compared to N-organic in their mixtures. Among the different treatments, the application of (75%N-AS+25%N-CM) gave the highest crude protein (%) followed by both treatments of (25%N-AS+75%N-CM) and (100%N-AS). These results are in agreement with those of **Hoda *et al.* (2009) and Abdel Wareth *et al.* (2010)**.

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إدارة الإمداد بمصادر النتروجين العضوي كإحلال جزئى للنتروجين المعدنى وعلاقته بتحسين خواص التربة الرملية وحاصلات تركيب محصولي متتابع سمسم-قمح

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أجريت تجربة حقلية خلال موسمين زراعيين متتاليين ٢٠٠٨/٢٠٠٧ و ٢٠٠٩/٢٠٠٨ على تربة رمليه بمحطه بحوث علي مبارك - شمال مديرية التحرير بمركز البحوث الزراعية - منطقة البستان - محافظه البحيرة –مصر، وبزراعه تركيب محصولي متتابع سمسم-قمح، وذلك بهدف تقييم الادارة السليمة لامداد النتروجين المعدني مع العضوي (مكمورتى قش الارز ومخافات دواجن)، مع إعطاء إهمية خاصة للتحسين المصاحب فى خواص التربة الفيزيوكيميائية، صلاحيه المغذيات، وإنتاجية محصولي السمسم والقمح. وقد صممت التجربه في قطاعات كامله العشوائيه بثلاث مكرارات، كما إشتملت التجربة على ١٠ معاملات (الكنترول، ١٠٠٪ من النتروجين المعدني الموصى به، ١٠٠٪ نتروجين عضوي من مكمورة قش الارز، ١٠٠٪ نتروجين عضوى من مكمورة مخلفات الدواجن، نسب من مخاليط من كل من النتروجين المعدني بكل من قش الارز أو مخلفات الدواجن بنسب ١:٣، ١:١، ٣:١، من الاحتياجات الموصي بها (٤٥، ١٠٠ كجم/فدان لكل من السمسم والقمح علي التوالي).

وقد أظهرت النتائج أن إضافه المكمور العضوى سواء بصورة منفرده أو مشتركة مع النتروجين المعدني قد أدت إلى تحسين الخواص الفيزيائية للتربة (الكثافة الظاهرية، التوصيل الهيدروليكي، معدل الرشح، معامل مقاومة الاختراق، ثوابت الرطوبة كالسعه الحقلية ومعامل الذبول والماء الميسر). كذلك أظهرت النتائج أن المعاملات المشتركة بين مصدرى النتروجين المعدني والعضوي قد حققت زيادة واضحة في تيسر مغذيات N, P, K, Fe, Mn, Zn and Cu فى التربة، مع الزيادة التدريجية فى المحتوي من المادة العضوية بزيادة نسبة المصدر العضوي في مخاليط الأسمدة.

كذلك حدثت زيادة تدريجية فى كل من محصولي الحبوب والقش للسمسم والقمح بزيادة نسبة المصدر العضوي في مخاليط الأسمدة. وأيضا، زاد إمتصاص النتروجين والفوسفور والبوتاسيوم بنفس إتجاه الزيادة في إنتاجية المحصولين. كما وجد ان محتوي بذور السمسم من الزيت ومحصول الزيت قد تأثر إيجابيا باضافة كل من المصدر المعدني والعضوي سواء كان في صورة منفردة أو مشتركة، علاوة على زيادة محتوي حبوب القمح من البروتين متبعا نفس إتجاه الزيادة السابق ذكره. ولذا، تؤكد النتائج أهميه الإحلال الجزئى للأسمدة العضويه محل النتروجين المعدنى، حيث وجد أن إضافة مكمورة مخلفات الدواجن المعالجه كان الأفضل مقارنة بالمعاملات الأخرى من حيث تأثيره على تحسين خواص التربة الفيزيوكيميائية وحالتها الخصوبية، ومن ثم إنتاجيتها تحت الظروف السائدة للتجربة الحالية.