Sandy Soil Management to Secure Yield Productivity, Profitability, Efficiency of Nitrogen & Energy Consumption and Environment

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Abstract: A field experiment has been conducted at Ismailia agriculture research station "Typic Torriorthents, sandy, mixed, hyperthemic" to examine the impact of suggested management practices package; drip & sprinkler irrigation systems, application of slow release N-fertilizer (SRNF) & conventional N-fertilizer, compost and rhizobia inoculation on productivity of wheat-peanut cropping sequence, nitrogen use efficiency, energy consumption efficiency (supplying for such practices) and potentiality of emitting CO_2 gas owing to combustion of used-fossil fuel to obtain such energy and causing global warming or avoiding or mitigating it according to suggested-practices. Also, economic feasibility has been evaluated. The experimental work has been carried out in split split plot design with treatments replicated four times. Treatments have been (a) drip & sprinkler irrigation systems (DIS & SIS) as main plots (b) N-fertilizers as sub-plots. N-fertilizers have been urea in one rate (120Kg Nfed^{-1}) added to soil as 5 allocations & 15Kg N fed^{-1} as an activating dose for N-fixer and ureaform fertilizer (UF) in 3 rates (60,120,180 Kg Nfed^{-1}) added to soil in one dose at planting wheat crop as a N-fertilization for wheat-peanut cropping sequence and (c) compost which have been added in 3 different rates as sub sub-plots. Rhizobia inoculation has been mixed with peanut seeds. The results show that: (1) Yield: wheat grain and straw yields under DIS have been 1.04 and 2.56 ton.fed^{-1} while under SIS, they have been 0.79 and 1.94 ton.fed^{-1} respectively. Peanut seeds and straw yields under DIS have amounted 1.15 and 2.36 ton.fed^{-1} while they have been 1.17and 2.73 ton.fed^{-1}under SIS respectively. The averages of grain and seeds yield of both wheat and peanut crops of UF-treatments have insignificantly increased comparing to those of urea treatment. However, the UF-high rate treatments have given wheat grain & Peanut seeds yields greater than those of urea treatment either under DIS or SIS. Values of the relative increase of compost alone and UF-treatments yield calculated of urea-treatment yield have ranged from -63.3% to 63.29 % for wheat under DIS and from -20.85 to 33.59% under SIS. They have also ranged from -12.67% to 77.05 % for peanut, under DIS and from 0.37% to 129.85%, under SIS. In all treatments, the gradually increasing compost rates have resulted in effective increasing in both wheat and peanuts productivity. (2) NPK concentration: Applying DIS, UF-fertilizer and associated-compost has almost had positive effect on N, P and K% concentration for both wheat and peanut crops comparing to that of SIS and urea fertilizer. (3) N, P and K uptake: such uptake for wheat fertilized with UF-fertilizer under DIS have significantly preferred to SIS. For peanut, no significant difference between DIS and SIS has been seen. However, total N-uptake under DIS has been superior to that under SIS. (4) N-recovery & N-use efficiency: N-recovery values from the used N-fertilizers for wheat have ranged from 9.75 to 32.54 Kg N fed^{-1} under DIS and from 13.31 to 18.76 Kg N fed^{-1} under SIS. These values for peanut have ranged from 11.11 to 32.79 Kg N fed^{-1}under DIS and from 18.17 to 20.33 Kg N fed^{-1} under SIS. Total N-recovery values of the cropping wheat-peanut sequence have amounted 42.98 under DIS and 34.68 Kg N fed^{-1}under SIS. Such values, for sub-treatments have ranged from 10.33 to 81.69 Kg N fed^{-1}under DIS and form 17.33 to 60.23 Kg N fed^{-1}under SIS.N-recovery values of peanut from air have ranged from 10.56 to 66.72 Kg N fed^{-1} under DIS and from 9.95 to 52.45 Kg N fed^{-1}under SIS. N-use efficiency values of DIS have slightly been surpassed to those of SIS. Such values (on average) of UF-treatments have been also surpassed to those of urea treatments under both DIS and SIS. (5) Energy consumption and CO_2 gas emissions evaluation: The data in this section reveal that total consumed energy value under DIS has been less than that under SIS, averaged consumed energy value to operate DIS has been less than that of SIS. Consumed energy value necessitated to irrigate wheat crop has been less than that for peanut crop. The emitted-CO_2 gas values referred to combustion of the used diesel fuel to obtain the previous mentioned energy have amounted 1248.79 Kg CO_2.fed^{-1} under DIS and 1431.92 Kg CO_2.fed^{-1} under SIS. Then, using DIS comparing to SIS has saved 169.08Kg CO_2.fed^{-1}, in relative reduction of 13.55%. For sub-treatments, they have also ranged from 866.68 to 1583.13 Kg CO_2.fed^{-1} under DIS and from 1046.61 to 1763.00 Kg CO_2.fed^{-1} under SIS respectively. The energy values from sun (estimated) required to fixing nitrogen from air (by rhizobia) have amounted 2365.4 MJ.fed^{-1} for DIS and 1672.3 MJ.fed^{-1} for SIS. Also, its values for sub-treatments under DIS have ranged from 991.3 to 2926.5 MJ.fed^{-1} and from 1375.3 to 1869.8 MJ.fed^{-1} under SIS in the same order. These values in diesel fuel form have amounted 57.8 and 45.43 liter fed^{-1} under DIS and SIS respectively. Also for sub- treatments, they have ranged from 16.8 to 106.1 liter fed^{-1} under DIS and from 15.8 to 83.4 liter fed^{-1} under SIS respectively. Therefore, CO_2 emissions which have been already avoided to release and emit to the atmosphere has amounted 154.33 Kg CO_2 fed^{-}

^{1} under DIS and 117.21 Kg CO_2.fed^{-1} under SIS. Also they have ranged from 70.76 to 208.97 Kg CO_2.fed^{-1}for sub-treatments under DIS and from109.38 to133.41 Kg CO_2 fed^{-1} for their corresponding under SIS. Averaged value of energy consumption ability (ECA) for DIS has been less than that for SIS. Its values for sub-treatments have ranged from 3413.4 to 9202.1MJ ton^{-1}dry matter, under DIS and from 4572.4 to 6311.3 MJ ton^{-1}dry matter under SIS. The emitted CO_2 values corresponding to the previous mentioned energy quantities have amounted 389.10 Kg CO_2 ton^{-1}dry matter under DIS and 396.64 Kg CO_2 ton^{-1} dry matter under SIS. Also, they have ranged from 274.43 to 656.93 Kg CO_2 ton^{-1} dry matter for sub-treatments under DIS and from 326.43 to 446.18Kg CO_2 ton^{-1} dry matter for those under SIS. Using UF-fertilizer (on average) comparing to other treatments (on average) has contributed to save 66.51 Kg CO_2.ton^{-1} dry matter. (6) Economic evaluation: the gross return value of DIS has been greater than that of SIS. Gross return value of UF treatments (on average) has been greater than other treatments either under DIS or SIS. The net return (NR) and investment factor (IF) of DIS has been much more than that of SIS. Both UF-fertilizer at N-rate of 120 Kg fed^{-1} under DIS and urea under SIS have had the maximum profitability. The economic optimum rate of compost has mostly been 5 ton fed^{-1} under DIS or SIS. The higher value of the avoided CO_2 revenue has been belonging to DIS and UF-fertilizer.

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1. Introduction

Sandy soil in Egypt comprises most new reclaimed soils (about 2.5 feddans). It is generally poor in plant nutrients and the nutrients applied to it are subject to loss by irrigation water. Also it is often considered as soil with physical properties of no structure, poor water retention and high permeability. Moreover, it is much more sensitive to climatic fluctuation than other soil types, because of the high variance in its status is associated with the fact that it is highly prone to droughts even during the wet season (Philip *et al.,* 1990). It therefore requires proper management to offer optimum productivity of any cultivated crop, especially for the studied cropping sequence here, which has been wheat (*Triticum aestivum* L.) followed by peanut (*Arachis hypogaea* L.). Wheat mainly characterized by high sensitivity to water stress throughout its different growth stages (Abdel-Mawgoud *et al.,* 2007). Peanut can grow in many arid and semiarid regions during dry seasons and needs irrigation to produce economic yield. However, its vegetative preflowering growth stage and the late stage of pod maturation were shown to be sensitive to water stress (Rao *et al.,* 1988; Meisner and Karnok, 1992; Reddy and Reddy, 1993 and *et al.,*2003).

Both wheat and peanut crops need to be fertilized especially, nitrogen fertilization taking into consideration the ability of peanut to associating with some inoculation to fix some atmospheric nitrogen. Therefore, the suggested soil management practices package has included micro irrigation systems, slow & fast-release nitrogen fertilizers, rhizobia inoculation and organic matter application. Drip and sprinkler irrigation systems facilitate delivering irrigation water to plant root zone in slow continuous manner. Drip system is a method to uniformly spread moisture throughout the soil medium which also reduces the amount of drain-off with a peak water utilization rate of 95%. Sprinkler system is designed for crops that require irrigation of an entire area or field. It achieves a water utilization rate of 70%-80% (FAO,2004). Both drip and sprinkler systems offered efficient coverage for small or large areas and were found to be frequently suitable for almost all kinds of crops including vegetables, cotton, soybean, wheat, onion, etc.

Many conventional nitrogen fertilizers have already been available for use on sandy soils. However, any applied N-fertilization program should take into account the environmental considerations related to losses of nitrogen which occur mainly through release of gaseous nitrogen such as nitric oxide (NO) and nitrous oxide (N_2O) through biological denitrification and nitrate (NO^-_3) leaching which has both negative economical and environmental implication (Abbady *et al.,* 1991 and Merchan-Paniagua, 2006).

The used slow release nitrogen fertilizer in this work was ureaform (UF) fertilizer (condensed urea molecules) developed by Abbady *et al.* (1992). It supplies nitrogen in a slowly available form to root zoon depending on microbial activity for two successive growth seasons. This compound is especially effective for crops grown on coarse textured soils (Abbady *et al.,* 2008 and, Abd El-Aal, 2008). Abbady *et al.,* 1997, Hegazy *et al.,* 1998 and Abbady *et al.,* 2003 found that the productivity of UF-fertilizer for many crops, for example sweet, corn, rice, onion, soybean, wheat, was 20-30% more efficient than urea.

The third point in this management practices package has been the application of organic matter to improve the aquatic properties of sandy soil and accelerate UF-molecules breaking down for better nitrogen releasing. Thus in this work, N-nutrient and irrigation water have been slowly and right delivered to plant roots. Moreover, using rhizobia inoculation as a routine work for peanut seeds has been done.

For economical and environmental reasons, it is extremely important to mentioning about consumed energy in N-fertilizers production process as indirect energy in agriculture process. Bhat *et al.,* 1994 stated that nitrogen fertilizer indeed increased crop productivity and subsequently food supply for the world' ever-increasing population. However, the recovery of N-fertilizers is always low. It would reflect on increasing lost-energy which translated to CO_2 emissions. Such emissions are the major causing for global warming. The consumed energy in both micro irrigation systems as direct energy on farm was also taken into consideration.

The main objective, therefore, is to shed the light on the impact of applying previous mentioned soil management practices package on the productivity & profitability of wheat-peanut cropping sequence and the efficiency of nitrogen use & energy consumption.In addition, demonstrating such impact on environment, especially that respecting global worming has been put into account.

2. Materials and Methods

A field experiment has been conducted at Ismailia agricultural Res. Station, Agric. Res. Center "Typic Torriorthents, sandy, mixed, hyperthemic" (USDA, 2006) to study the effect of suggested management practices on growth outputs of wheat-peanut cropping sequence (Wheat, *Triticum aestivum* L., cv Giza 168 and Peanut, *Arachis hypogaea*, L.,cv Giza 5). Some physical and chemical characteristics of the soil have been shown in Table 1. The soil analysis has been performed according to Jackson, 1958.

A split split plots design has been used in this experiment:

(A) Treatments of main plots have been drip and sprinkler irrigation systems.

(B) Treatments of subplots have come as follows:

1- Control (not received N-fertilizer).

2- Urea fertilizer, 120 kg N fed^{-1} at fertilizing first crop and 15 kg N fed^{-1}at fertilizing second crop (activating dose for rhizobia).

3- UF fertilizer, 60 kg N fed^{-1}

4- UF fertilizer, 120 kg N fed^{-1}

5- UF fertilizer, 180 kg N fed^{-1}

(C) Treatments of sub-subplots have come as follows:

1- Compost, 2.5 ton fed^{-1}

2- Compost, 5.0 ton fed^{-1}

3- Compost, 7.5 ton fed^{-1}

Every treatment has been replicated three times. Then the experiment has consisted of 90 treatments.

UF-fertilizer (40%N) (Table,2) has been added as side banding before planting first crop (wheat) in one dose, second crop (peanut) has been planted after harvesting wheat on the same plots without adding any N-fertilizer for those of UF- treatments and adding an activating dose for those of urea treatments. Urea fertilizer (46.5%N) has been applied for wheat (winter season), in rate of 120 kg N fed^{-1}distributed in five equal doses after 2, 4, 6, 8, 10 weeks from planting and for peanuts (summer season) as an activating dose of 15 kg fed^{-1}. Peanut seeds have been mixed with the rhizobia inoculum and allowed to adhere to the seeds by rinsing with a liquid Arabic gum and then left to air drying for one hour.

The produced compost locally in the experimental station and whose chemical analysis presented in table 2 has been incorporated in surface layer of soil (0 -15 cm depth) for two weeks before first crop cultivation (wheat). Its analysis has been carried out according to standard method described by Page 1982. All plots have received P & K fertilizers as follows: Super phosphate (15.5 % P_2O_5) and potassium sulphate (48% K_2O) at rates of 200 and 50 Kg fed^{-1} of P_2O_5 and K_2O, respectively, for wheat-peanut cropping sequence. They have been added before planting wheat crop. In summer season, peanut has been planted after 20 days from wheat harvesting. All fertilizers whether N or P or K have been used as soil application.

Table 1. Some Physical and Chemical Characteristics.

Particle size distribution %	
Coarse sand	76.68
Fine sand	14.89
Silt	6.34
Clay	2.09
Texture class	sand
Chemical properties	
$CaCO_3$ %	1.60
pH (1:2.5 soil- water suspension)	7.74
EC dS/m (at 1:5 soil- water extract)	0.37
Organic matter %	0.50
Cation me. L^{-1}	
Ca^{++}	0.97
Mg^{++}	0.87
Na^{+}	1.51
K^{+}	0.45
Anion me.L^{-1}	
CO_3^{--}	0
HCO_3^{-}	1.42
Cl^{-}	1.02
SO_4^{--}	1.36
Avalable nutrients (mg.kg^{-1}) soil	
N	85
P	25
K	125

Table 2. Chemical Analysis of Compost and Ureaform Fertilizer

Compost		Ureaform	
Character	Value	Character	Value
pH (1:10 water suspension) EC (dS/m, 1:10 "soil: water extract" Organic carbon% Organic matter %	8.7 4.2 16.7 28.8	Nitrogen Content	40%
Available nutrients: NO_3(mg.kg $^{-1}$) NH_4(mg.kg $^{-1}$) P (mg.kg $^{-1}$) K (%)	160 253.5 827 0.76	Activity index	63%
Total nutrients: N (mg.kg $^{-1}$) P (mg.kg $^{-1}$) K (mg.kg $^{-1}$)	5452 4563 6217	Water soluble nitrogen	22.35%

The recommended practices of cultivation have been carried out till wheat-peanut cropping sequence maturity. Plant samples have been taken from each plot at harvesting stage for both wheat and peanut crops. The yield components (grain and straw) of each plot have been recorded. Plant samples of wheat and peanut have been collected from bulk plot weighed, oven dried at 70^{0}C, ground and prepared for digestion using H_2SO_4 and H_2O_2 method described by Page, 1982. The digests have been then subjected to measurement for N, P and K using procedures described by Chapman and Pratt 1961. Obtained results have been subjected to statistical analysis according to Snedecor and Cochran 1980 and the treatments were compared by L.S.D at 0.05 level of probability.

To verify the impact of suggested management practices on the outputs of studied cropping sequence, some appraisement means would be pursued; N-recovery, N-use efficiency, energy consumption ability, emitted carbon dioxide, total cost of energy, Net return and investment factor. They have been calculated using the models: from1 to7.

1-N-recovery fed^{-1} = (N-uptake fed^{-1}for treatment) - (N-uptake fed^{-1} for control).... (1)

2-N-use efficiency = N-recovery fed^{-1}/ N-rate fed^{-1} x100... (2)

3-Energy consumption ability = consumed energy, MJ.Fed^{-1}/yield increased, ton fed^{-1}…. (3)

4-Emitted carbon dioxide = consumed energy in diesel fuel liter x carbon coefficient liter^{-1}… (4)

5-Total cost of energy = total consumed energy x price of energy unit…. (5)

6-Net return = gross return - total cost… (6)

7-Investment factor = gross return / total cost… (7)

Where:

Gross return = yield increase, ton fed^{-1}x sale price of ton crop.

Yield increase, ton fed^{-1}= yield, ton fed^{-1} for treatment- yield, ton fed^{-1} for control

Energy of N fed^{-1}= N-rate fed^{-1} x energy required to manufacture 1 kg of N-fertilizer (59.5MJ)

Energy of compost.fed^{-1}= used compost rate in ton fed^{-1}x 538.56 MJ (energy amount to produce 1 ton)

Energy from sun.fed^{-1}= N-fixed from air fed^{-1} x 59.5MJ

Energy consumed of irrigation system.fed^{-1} calculated according to Shelke, 2010

The energy content of one liter of diesel fuel = 37.4 M Joule

American barrel = 158.984 Liters

Carbon coefficient of one gallon of diesel fuel = 10.0926 kg CO_2

Gallon of diesel fuel = 3.78 liter

Carbon coefficient of one liter of diesel fuel=2.67 kg CO_2

M Joule =10^6 Joule

3. Results and Discussion

This study has devoted to determination the outputs of soil management practices package; ureaform (UF) as a slow release nitrogen fertilizer under micro-irrigation systems in existence of compost comparing to soluble nitrogen form (urea) and with using rhizobia inoculation. The discussion will therefore have the effect of irrigation systems, type & rate of N-Fertilizer and compost application on yield and N, P & K content of successive crops (wheat and peanut).Also, both energetic and economic evaluations as well as environmental impact (CO_2 emissions) have been taken into consideration.

3.1. Yield

Data in Table 3 show that regardless of N-fertilizer form or rate, the drip irrigation system (DIS) has had significant positive effect on grain and straw yield of wheat crop, while it has not significantly affected seeds and straw yield of peanut crop comparing to sprinkler irrigation system (SIS). Also, all fertilization treatments have significantly increased the yield of both crops either under DIS or SIS comparing to control treatment. Such increments have been more clearly under DIS than did under SIS. This result may be attributed to that DIS has an advantage of water distribution uniformity and less percolated water.This result has been in agreement with findings of Abdel-Mawgoud *et al.,* 2007.

As for the effect of fertilizer form, in general, the yield values of all N-fertilizer treatments have been significantly superior to those of compost treatments. Such effect was expected because of poor nitrogen content of used compost (Table 2). This result has been in accordance with findings of Bobby *et al.,* 2006.

Regarding the effect of N-fertilizer form, it is found that: firstly, the averages of grain yield of wheat and seed yield of peanut of UF-treatments have insignificantly increased comparing to those of urea treatments (Table, 3).Moreover, the UF-low rate treatment (60 N-kg) has given grain or seed yield less than that of urea treatments either at DIS or SIS. Secondly, the averages of wheat straw yield of UF-treatments have been significantly inferior to that of urea treatment.

Table 3 Yield and its Components of Both Wheat and Peanut Crops as Affected by Different Treatments

Treatments			Wheat (ton fed^{-1})			Peanut (ton fed^{-1})			
Irrigation (A)	N-form Kg fed^{-1} (B)	Compost ton fed^{-1} (C)	Grains	Straw	Harvest index	Seeds	Pods	Straw	Harvest index
Drip system	0.0	0.0	0.46	1.07	0.43	0.48	1.67	1.00	0.48
		2.5	0.59	1.32	0.45	0.55	1.69	1.51	0.36
		5.0	0.82	1.46	0.56	0.81	1.80	1.60	0.51
		7.5	1.05	2.74	0.38	0.85	1.85	2.00	0.43
	Mean		0.73	1.85	0.39	0.68	1.75	1.53	0.45
	Urea, 120+5	0.0	0.82	2.34	0.35	0.79	1.40	2.13	0.37
		2.5	1.06	3.34	0.32	1.02	1.83	2.60	0.38
		5.0	1.42	3.54	0.40	1.47	2.15	2.68	0.50
		7.5	1.27	2.98	0.43	1.53	2.42	2.89	0.53
	Mean		1.14	3.05	0.37	1.20	1.95	2.65	0.45
	UF, 60	0	0.41	2.00	0.21	0.77	1.64	1.36	0.57
		2.5	0.76	2.20	0.35	0.92	1.85	1.63	0.58
		5.0	1.02	2.57	0.40	1.15	2.02	2.12	0.54
		7.5	1.13	2.91	0.39	1.30	2.09	2.47	0.63
	Mean		0.83	2.42	0.34	1.04	1.90	1.89	0.65
	UF, 120	0	0.62	1.91	0.32	1.35	1.41	1.68	0.73
		2.5	1.29	3.12	0.41	1.53	1.69	2.08	0.74
		5.0	1.43	3.22	0.44	1.60	2.09	2.98	0.54
		7.5	1.08	2.54	0.43	1.75	2.62	3.41	0.51
	Mean		1.08	2.70	0.40	1.56	1.95	2.58	0.63
	UF, 180	0	1.24	2.51	0.49	0.99	1.28	2.94	0.34
		2.5	1.43	2.88	0.50	1.22	1.83	3.12	0.39
		5.0	1.70	3.46	0.49	1.42	2.45	3.30	0.43
		7.5	1.21	3.15	0.38	1.50	2.75	3.32	0.45
	Mean		1.40	3.00	0.47	1.28	2.08	3.17	0.40
Mean			1.04	2.56	0.41	1.15	1.93	2.36	0.49
Sprinkler system	0.0	0	0.42	1.00	0.42	0.40	1.22	1.09	0.37
		2.5	0.44	1.68	0.26	1.17	1.47	1.59	0.74
		5.0	0.45	1.94	0.23	1.40	2.11	2.33	0.60
		7.5	1.47	1.99	0.74	1.45	3.11	2.70	0.54
	Mean		0.70	1.65	0.42	1.11	1.98	1.93	0.56
	Urea 120+15	0	0.63	1.96	0.32	1.00	1.28	1.68	0.60
		2.5	0.81	2.16	0.38	1.09	2.75	2.78	0.39
		5.0	0.92	2.17	0.42	1.38	3.57	3.43	0.40
		7.5	0.65	2.21	0.29	1.46	3.66	3.50	0.42
	Mean		0.75	2.13	0.35	1.23	2.82	2.85	0.45
	UF, 60	0	0.72	1.65	0.44	0.80	1.90	1.89	0.42
		2.5	0.83	1.66	0.50	0.93	2.67	2.75	0.34
		5.0	0.85	1.75	0.49	1.05	3.07	3.50	0.30
		7.5	0.95	2.40	0.40	1.51	3.28	3.73	0.40
	Mean		0.84	1.87	0.45	1.07	2.73	2.97	0.37
	UF, 120	0.0	0.41	1.64	0.25	0.90	1.64	2.19	0.41
		2.5	0.83	1.81	0.46	1.00	2.23	2.34	0.43
		5.0	0.89	1.96	0.45	1.07	2.43	2.85	0.38
		7.5	0.78	1.82	0.43	1.60	2.84	4.01	0.40
	Mean		0.73	1.81	0.40	1.14	2.29	2.85	0.40
	UF, 180	0.0	0.77	2.16	0.36	0.94	1.74	2.22	0.42
		2.5	0.89	2.24	0.40	1.07	1.94	2.68	0.40
		5.0	1.07	2.39	0.45	1.50	2.02	3.02	0.50
		7.5	0.95	2.17	0.44	1.75	2.88	4.41	0.40
	Mean		0.92	2.24	0.41	1.32	2.15	3.08	0.43
Mean			0.79	1.94	0.41	1.17	2.39	2.73	0.44
LSD 0.05%									
A			0.182	0.197		0.025		0.043	
B			0.066	0.204		0.017		0.031	
C			0.121	0.179		0.015		0.026	
AB			0.094	0.289		0.025		0.044	
AC			0.171	0.254		0.026		0.036	
BC			0.242	0.359		0.037		0.052	
ABC			0.342	1.070		0.052		0.073	

An opposite direction for peanut straw yield has been observed (Table, 3). The observed good performance of urea fertilizer in this study despite of coarse texture of soil may be referred to adding it in five equal doses and compost application.

About the effect of fertilizer rate, generally grain & straw yield of wheat and seeds & straw yield of peanut have been increased with increasing N-rate of UF under both irrigation systems. It is important to notice the clear effect of compost application, where with increasing its rates, grain & straw yields of both two crops have been increased. Also, the same effect has been occurred with yield of urea treatment. Such effect may attribute to the known organic matter advantages. Regarding harvest index (HI), data show similar effect for both irrigation systems on HI values either at wheat or peanut crop, there has also been an obvious superiority for HI values belonging to UF-high rates to those of other treatments.

Data given in Table 4 show the values of the relative increase of UF-treatments yield calculated of urea-treatment yield as a standard scale to govern on UF-fertilizer performance.Such performance has varied between negativity and positivity as affected by other studied treatments. For wheat, yield relative increase values ranged from -63.3% to 63.29% under DIS and from -20.85% to 33.59% under SIS. For peanut, such values ranged from -12.67 % to 77.05 % under DIS and from 0.37% to 129.85% under SIS. Here, it must be pointed that the mentioned above negative figures have been related to low rate of UF-fertilizer (60 kg N). In general, UF performance with second crop has frequently been better than that of first one. The authors have tended to think that the action of adaptation between UF-fertilizer and soil medium has been more effective at second crop, and consequently more decomposition and more nitrogen release have been occurred.

It would be mentioned that firstly, the performance of urea has been somewhat improved because of the dividing its rate into 5 doses and compost additions. Secondly, addition of compost alone has frequently given negative relative increase (Table, 4), this effect has been expected and in agreement with the result of Bobby et al, 2006. Thirdly, the effect of application of rhizobia inoculation should not be ignored. It has added nitrogen from air which no doubt being positively affected peanut yield quantity.

3.2. N, P and K-concentration

3.2.1. Wheat:

The data given in Table 5 show that DIS has had significant effect on the concentration of N%, P% and K%, either for grain or straw of wheat crop comparing to SIS. Under DIS, UF fertilizer application (on average) has given N%, P% and K% values for grain yield more than that of urea while in straw yield, the values have been in equality. Under SIS, there has nearly been similarity for the effect of UF and urea on each of N%, P% and K% value in grain and straw. The three levels of used compost either alone or associated with N-fertilizers have had high significant effect on the content of N, P and K. Such effect must be due to its known several benefits (Gellings and Parmenter, 2004).

3.2.2. Peanut:

Insignificant differences have been observed between the values of N% and P% concentrations belonging to DIS and SIS except K% (Table, 6). The different forms of fertilizers and their rates have exhibited insignificant effects on N, P and K concentrations. The compost treatments have had clear significant effect on N, P and K content as occurred in wheat crop.

3.3. Uptake of N, P and K-nutrients

3.3.1. Wheat:

Apparently, effect of DIS has been superior to that of SIS with regard to N, P and K- uptake. However there have been significant differences between DIS and SIS effects on the values of P&K-uptake in grain yield and N&K-uptake in straw yield while no significant differences for N-uptake in grain yield and P-uptake in straw yield have been observed (Table, 7). Regarding fertilizer form, clear superiority for the effect of all N-fertilizers on N, P and K-uptake to that of compost has been marked. This has been attributed to the poverty of compost in such nutrients and its slight obtained yield. However the graded increase of used compost quantities (rates) has resulted in increasing the uptake of those nutrients (Table, 7).

As for N-fertilizer form, it is observed that under DIS: N, P and K-uptake values in grain yield of UF-treatments have been superior to those of urea treatment. An opposite direction has been shown in straw yield. Under SIS: N, P and K-uptake values in grain yield and N&K-uptake in straw yield of UF-treatments have nearly similar to those of urea.

Examination of the effect of fertilizer rate (Table, 7), the result has indicated that with increasing the rate of UF-fertilizer, the N, P and K-uptake values have increased either under DIS or SIS. Also, with increasing compost rate associated with UF-fertilizer treatments, the uptake of such nutrients has increased. However, this uptake at compost rate of 7.5 ton fed^{-1} and UF-rates of 120 and 180 kg fed^{-1} has slightly decreased which could be due to the expected effect of compost on liberation more nitrogen from UF-fertilizer. This effect may lead to obtaining fewer yields and consequently fewer uptakes.

In the matter of total N-uptake, data in Table, 7 show that the average values of total N-uptake (grain +straw) under DIS have been greater than that under SIS. The effect of different treatments on total N-uptake under both irrigation systems could be ranked in the following order: UF, 180 > urea > UF, 120 > UF, 60 > compost.

3.3.2 Peanut:

Peanut crop has grown on the residual part of UF-fertilizer nitrogen on UF-treatments plots or taken activating dose (15 kg N fed^{-1}) from urea fertilizer for that grown on urea treatment plots. Data presented in Table, 8 show that N-uptake average value in seeds yield under DIS has been greater than those under SIS, while P and K-uptake average values have nearly been in resemblance i.e. there has been no significant difference. N, P and K-uptake average values of straw yield under DIS have been greater than those under SIS with clear significant differences.

Table 4 Total Yields of Both Wheat & Peanut Crops and Relative Increase % of Compost &UF-Treatments Yield Calculated of Urea Treatment Yield.

Treatments			Wheat (ton fed^{-1})			Yield relative increase calculated of urea(%)	Peanut (ton fed^{-1})			Yield relative increase calculated of urea yield (%)
Irrigation (A)	N-form Kg fed^{-1}(B)	Compost Ton fed^{-1}(C)	Grain	Straw	Total yield		Seeds	Straw	Total yield	
Drip system	0.0	0.0	0.46	1.07	1.53	-51.58	0.48	1.00	1.48	-49.32
		2.5	0.59	1.32	1.91	-39.56	0.55	1.51	2.06	-29.54
		5.0	0.82	1.46	2.28	-27.5	0.81	1.60	2.41	-17.47
		7.5	1.05	2.74	3.79	19.94	0.85	2.00	2.85	-2.40
	Mean		0.82	1.85	2.66	-15.82	0.74	1.70	2.44	-16.44
	Urea 120+15	0.0	0.82	2.34	3.16	00.00	0.79	2.13	2.92	00.00
		2.5	1.06	3.34	4.4	39.24	1.02	2.60	3.62	23.97
		5.0	1.42	3.54	4.96	56.96	1.47	2.68	4.15	42.12
		7.5	1.27	2.98	4.25	25.65	1.53	2.89	4.42	51.37
	Mean		1.14	3.05	4.19	32.59	1.20	2.65	3.85	31.85
	UF, 60	0.0	0.41	2.00	2.41	-23.73	0.77	1.36	2.13	17.05
		2.5	0.76	2.20	2.96	-63.3	0.92	1.63	2.55	-12.67
		5.0	1.02	2.57	3.59	13.61	1.15	2.12	3.27	11.98
		7.5	1.13	2.91	4.04	27.85	1.30	2.47	3.77	29.11
	Mean		0.83	2.42	3.25	11.40	1.04	1.89	2.93	11.38
	UF, 120	0.0	0.62	1.91	2.53	-19.94	1.35	1.68	3.03	3.77
		2.5	1.29	3.12	4.41	39.56	1.53	2.08	3.61	23.63
		5.0	1.43	3.22	4.65	47.15	1.60	2.98	4.58	56.85
		7.5	1.08	2.54	3.62	14.56	1.75	3.41	5.17	77.05
	Mean		1.08	2.70	3.78	19.62	1.56	2.58	4.11	40.75
	UF, 180	0.0	1.24	2.51	3.75	18.67	0.99	2.94	3.93	34.59
		2.5	1.43	2.88	4.31	36.39	1.22	3.12	4.34	48.63
		5.0	1.70	3.46	5.16	63.29	1.42	3.30	4.72	61.64
		7.5	1.21	3.15	4.36	37.97	1.50	3.32	4.82	65.07
	Mean		1.40	3.00	4.4	39.24	1.28	3.17	4.45	52.39
Mean			1.04	2.56	3.6	14.44	1.15	2.36	3.51	24.07
Sprinkler system	0.0	0.0	0.42	1.00	1.42	-45.17	0.40	1.09	1.49	18.32
		2.5	0.44	1.68	2.12	-18.15	1.17	1.59	3.29	22.76
		5.0	0.45	1.94	2.39	-7.72	1.40	2.33	3.73	39.93
		7.5	1.47	1.99	3.46	33.59	1.45	2.70	4.15	55.22
	Mean		0.79	1.87	2.66	2.70	1.34	2.21	3.72	38.81
	Urea 120+15	0.0	0.63	1.96	2.59	00.00	1.00	1.68	2.68	00.00
		2.5	0.81	2.16	2.97	14.67	1.09	2.78	3.87	44.40
		5.0	0.92	2.17	3.09	19.30	1.38	3.43	4.81	79.48
		7.5	0.65	2.21	2.86	10.43	1.46	3.50	4.96	85.07
	Mean		0.75	2.13	2.88	11.20	1.23	2.85	4.08	52.24
	UF, 60	0.0	0.72	1.65	2.37	-8.49	0.80	1.89	2.69	0.37
		2.5	0.83	1.66	2.49	-3.86	0.93	2.75	3.68	28.36
		5.0	0.85	1.75	2.55	-1.55	1.05	3.50	4.55	69.78
		7.5	0.95	2.40	3.35	29.34	1.51	3.73	5.24	95.52
	Mean		0.84	1.87	2.71	4.63	1.07	2.97	4.04	50.74
	UF, 120	0.0	0.41	1.64	2.05	-20.85	0.90	2.19	3.09	15.3
		2.5	0.83	1.81	2.64	1.93	1.00	2.34	3.34	24.62
		5.0	0.89	1.96	2.85	10.04	1.07	2.85	3.92	46.27
		7.5	0.78	1.82	2.6	0.39	1.60	4.01	5.61	109.33
	Mean		0.73	1.81	2.54	-1.93	1.14	2.85	3.99	48.88
	UF, 180	0.0	0.77	2.16	2.93	13.13	0.94	2.22	3.16	17.91
		2.5	0.89	2.24	3.13	20.85	1.07	2.68	3.75	39.93
		5.0	1.07	2.39	3.46	33.59	1.50	3.02	4.52	68.66
		7.5	0.95	2.17	3.12	20.46	1.75	4.41	6.16	129.85
	Mean		0.92	2.24	3.16	22.01	1.32	3.08	4.37	63.06
Mean			0.79	1.94	2.73	5.45	1.17	2.73	3.9	45.52

Table 5.N, P and K-Concentration (%) of Wheat Crop as Affected by Different Treatments

Treatments			Concentration (%)					
Irrigation (A)	N-form Kg fed^{-1}(B)	Compost ton fed^{-1}(C)	Grain			Straw		
			N	P	K	N	P	K
Drip system	0.0	0.0	1.40	0.49	0.24	0.35	0.13	1.27
		2.5	1.46	0.50	0.26	0.36	0.18	1.33
		5.0	1.52	0.53	0.27	0.39	0.19	1.54
		7.5	1.66	0.55	0.29	0.39	0.20	1.78
	Mean		1.51	0.52	0.27	0.37	0.18	1.48
	Urea 120	0.0	1.46	0.30	0.23	0.36	0.17	1.11
		2.5	1.47	0.38	0.27	0.37	0.25	1.46
		5.0	1.75	0.46	0.29	0.39	0.32	1.58
		7.5	1.52	0.43	0.28	0.34	0.29	1.34
	Mean		1.55	0.39	0.25	0.37	0.26	1.37
	UF, 60	0.0	1.58	0.42	0.22	0.35	0.16	1.01
		2.5	1.68	0.43	0.25	0.36	0.39	1.23
		5.0	2.04	0.55	0.27	0.38	0.29	1.47
		7.5	3.36	0.70	0.32	0.40	0.30	1.48
	Mean		2.17	0.53	0.27	0.37	0.26	1.30
	UF, 120	0.0	1.57	0.42	0.24	0.35	0.14	1.24
		2.5	1.58	0.53	0.27	0.36	0.25	1.35
		5.0	1.68	0.57	0.29	0.40	0.35	1.51
		7.5	1.50	0.50	0.29	0.36	0.30	1.48
	Mean		1.58	0.51	0.27	0.37	0.26	1.40
	UF, 180	0.0	1.31	0.37	0.23	0.34	0.14	1.07
		2.5	1.53	0.43	0.24	0.35	0.38	1.32
		5.0	1.74	0.54	0.31	0.38	0.52	1.50
		7.5	1.60	0.42	0.24	0.36	0.15	1.25
	Mean		1.55	0.44	0.26	0.36	0.30	1.29
Mean			1.67	0.48	0.27	0.37	0.25	1.37
Sprinkler system	0.0	0.0	0.58	0.19	0.20	0.30	0.11	0.50
		2.5	1.50	0.48	0.28	0.31	0.12	0.50
		5.0	1.57	0.48	0.29	0.36	0.13	0.50
		7.5	1.58	0.50	0.29	0.36	0.14	0.70
	Mean		1.31	0.41	0.27	0.33	0.13	0.55
	Urea 120	0.0	1.52	0.30	0.23	0.35	0.10	0.65
		2.5	1.68	0.48	0.24	0.38	0.20	0.57
		5.0	1.91	0.54	0.28	0.38	0.20	0.59
		7.5	1.70	0.53	0.26	0.36	0.16	0.57
	Mean		1.70	0.46	0.25	0.37	0.17	0.60
	UF, 60	0.0	1.16	0.34	0.23	0.35	0.14	0.48
		2.5	1.45	0.35	0.25	0.36	0.16	0.53
		5.0	1.57	0.35	0.26	0.40	0.17	0.64
		7.5	1.67	0.36	0.27	0.40	0.17	0.65
	Mean		1.46	0.35	0.25	0.38	0.16	0.58
	UF, 120	0.0	1.42	0.44	0.25	0.38	0.13	0.64
		2.5	1.57	0.50	0.25	0.38	0.20	0.73
		5.0	1.98	0.51	0.29	0.40	0.23	0.78
		7.5	1.68	0.50	0.27	0.38	0.22	0.74
	Mean		1.66	0.49	0.27	0.39	0.20	0.72
	UF, 180	0.0	1.31	0.39	0.25	0.37	0.15	0.65
		2.5	1.56	0.56	0.28	0.38	0.24	0.67
		5.0	2.02	0.60	0.29	0.38	0.25	0.72
		7.5	1.85	0.43	0.29	0.37	0.17	0.68
	Mean		1.69	0.50	0.28	0.38	0.20	0.68
Mean			1.56	0.44	0.26	0.37	0.17	0.62
LSD0.05%								
A			0.043	0.055	0.025	0.785	0.049	0.025
B			0.0534	0.252	0.031	0.373	0.0178	0.0178
C			0.0729	0.032	0.037	0.018	0.0447	0.0316
AB			0.0755	0.036	0.044	0.062	0.2520	0.0252
AC			0.1032	0.045	0.052	0.026	0.0632	0.0447
BC			0.1459	0.063	0.073	0.036	0.0893	0.0632
ABC			0.2063	0.089	0.103	0.052	0.1263	0.0893

Table 6. N, P and K-Concentration (%) of Peanut Crop as Affected by Different Treatments

Treatments			Concentration (%)					
			Seeds			Straw		
Irrigation (A)	N-form Kgfed[1](B)	Compost tonfed-1(C)	N	P	K	N	P	K
Drip system	0.0	0.0	3.41	0.45	0.29	0.86	0.37	0.17
		2.5	3.64	0.66	0.30	1.53	0.38	0.33
		5.0	3.82	0.67	0.35	1.62	0.40	0.36
		7.5	4.18	0.83	0.43	1.81	0.41	0.38
	Mean		3.76	0.65	0.34	1.46	0.39	0.31
	Urea, 120+15	0.0	3.70	0.64	0.35	1.44	0.31	0.25
		2.5	3.78	0.71	0.36	1.67	0.38	0.30
		5.0	4.25	0.78	0.39	1.79	0.39	0.31
		7.5	4.26	0.78	0.39	2.11	0.41	0.33
	Mean		4.00	0.73	0.37	1.75	0.37	0.30
	UF, 60	0.0	3.78	0.59	0.28	1.00	0.31	0.25
		2.5	3.82	0.67	0.33	1.19	0.38	0.32
		5.0	4.09	0.68	0.35	1.68	0.41	0.35
		7.5	4.12	0.77	0.36	1.72	0.45	0.45
	Mean		3.95	0.68	0.33	1.40	0.39	0.34
	UF, 120	0.0	3.52	0.61	0.32	1.53	0.32	0.28
		2.5	3.98	0.70	0.34	1.64	0.37	0.37
		5.0	4.19	0.77	0.36	1.80	0.46	0.43
		7.5	4.20	0.77	0.36	1.84	0.46	0.44
	Mean		3.97	0.71	0.35	1.70	0.40	0.38
	UF, 180	0.0	3.37	0.56	0.29	1.47	0.33	0.18
		2.5	3.55	0.69	0.30	1.52	0.36	0.28
		5.0	4.09	0.79	0.41	1.95	0.38	0.35
		7.5	4.10	0.79	0.42	1.97	0.38	0.36
	Mean		3.78	0.71	0.36	1.73	0.36	0.29
Mean			3.89	0.70	0.35	1.61	0.38	0.32
Sprinkler system	0.0	0.0	2.01	0.69	0.32	0.80	0.28	0.41
		2.5	2.25	0.71	0.34	0.83	0.29	0.44
		5.0	2.5	0.74	0.34	0.90	0.30	0.44
		7.5	2.45	0.80	0.36	1.10	0.31	0.45
	Mean		2.30	0.74	0.34	0.91	0.30	0.44
	Urea, 120+15	0.0	3.32	0.64	0.33	1.00	0.29	0.41
		2.5	3.78	0.65	0.35	1.04	0.30	0.43
		5.0	4.26	0.65	0.36	1.05	0.30	0.48
		7.5	4.27	0.65	0.37	1.10	0.31	0.49
	Mean		3.91	0.65	0.35	1.05	0.30	0.45
	UF, 60	0.0	3.75	0.64	0.32	0.96	0.28	0.41
		2.5	3.81	0.65	0.33	0.97	0.29	0.42
		5.0	3.90	0.65	0.35	0.98	0.30	0.42
		7.5	4.10	0.67	0.41	1.08	0.30	0.43
	Mean		3.89	0.65	0.35	1.00	0.29	0.42
	UF, 120	0.0	3.79	0.64	0.33	0.93	0.29	0.42
		2.5	4.07	0.65	0.35	0.94	0.30	0.42
		5.0	4.15	0.67	0.39	0.95	0.31	0.42
		7.5	4.22	0.68	0.40	0.95	0.31	0.43
	Mean		4.06	0.66	0.37	0.94	0.30	0.42
	UF, 180	0.0	3.70	0.66	0.33	1.00	0.28	0.42
		2.5	3.90	0.68	0.34	1.03	0.29	0.43
		5.0	4.10	0.70	0.35	1.06	0.30	0.45
		7.5	4.44	0.71	0.35	1.07	0.31	0.45
	Mean		4.04	0.69	0.34	1.04	0.30	0.44
Mean			3.64	0.68	0.35	0.99	0.30	0.43
LSD0.05%								
A			0.136	0.025	0.025	0.049	0.025	0.025
B			0.083	0.018	0.018	0.039	0.040	0.035
C			0.075	0.018	0.018	0.052	0.041	0.018
AB			0.118	0.025	0.025	0.056	0.056	0.025
AC			0.106	0.026	0.026	0.103	0.073	0.026
BC			0.150	0.037	0.036	0.095	0.103	0.037
ABC			0.213	0.052	0.052	0.145	0.146	0.052

Table 7. Uptake of N, P and K (kg fed^{-1}) of Wheat Crop as Affected by Different Treatments

Treatments			Uptake (kg fed^{-1})						Total N-Uptake kg fed^{-1}
			Grain			Straw			
Irrigation (A)	N-form Kg fed^{-1} (B)	Compost Ton fed^{-1} (C)	N	P	K	N	P	K	
Drip system	0.0	0.0	6.44	2.25	1.10	3.36	2.08	16.5	10.19
		2.5	8.61	2.95	1.53	5.10	2.38	17.55	13.37
		5.0	12.46	4.35	2.21	5.75	2.92	25.99	18.16
		7.5	17.60	5.83	3.07	9.65	3.56	34.79	28.28
	Mean		11.28	3.79	1.94	5.97	2.74	23.71	17.20
	Urea, 120+15	0.0	11.97	2.46	1.89	8.41	4.00	34.16	20.40
		2.5	15.58	4.03	2.86	12.9	8.42	37.07	27.94
		5.0	24.85	6.53	4.12	13.14	10.27	55.93	38.66
		7.5	19.30	5.46	3.56	10.12	9.54	39.93	29.44
	Mean		17.93	4.48	3.06	11.15	8.06	41.77	28.84
	UF, 60	0.0	6.48	1.72	0.90	8.00	3.20	20.24	13.48
		2.5	12.77	3.27	1.90	8.36	6.60	27.0	20.69
		5.0	20.81	5.61	2.75	9.25	7.45	38.04	30.57
		7.5	37.97	7.91	3.62	10.19	8.53	42.78	49.61
	Mean		19.51	4.36	2.20	8.95	6.45	32.02	26.98
	UF, 120	0.0	8.16	2.18	1.25	7.64	2.67	25.79	15.8
		2.5	20.38	6.84	3.48	11.23	7.80	38.64	31.61
		5.0	24.02	8.15	4.15	11.59	11.30	47.74	36.90
		7.5	16.20	5.40	3.13	8.84	7.62	38.35	25.34
	Mean		17.1 9	5.45	2.94	9.83	7.34	37.63	27.00
	UF, 180	0.0	16.24	4.59	2.85	9.54	3.51	33.13	24.78
		2.5	21.88	6.15	3.43	10.08	10.9	36.00	31.96
		5.0	29.58	9.18	5.27	11.73	18.1	51.9	42.73
		7.5	19.36	5.08	2.90	11.48	4.84	33.6	30.70
	Mean		21.77	6.14	3.56	10.71	9.34	38.66	32.28
Mean			17.54	4.93	2.75	9.32	6.78	34.76	26.71
Sprinkler system	0.0	0.0	2.436	0.798	0.84	3.00	1.20	7.70	5.44
		2.5	6.60	2.112	1.23	6.07	3.24	8.40	11.81
		5.0	7.065	2.16	1.31	6.09	3.88	9.74	14.05
		7.5	23.23	7.35	4.26	7.12	5.09	9.88	30.39
	Mean		9.83	2.87	1.84	5.57	3.35	8.93	14.58
	Urea, 120+15	0.0	9.576	1.89	1.45	7.45	5.49	11.23	16.44
		2.5	13.608	3.888	1.94	7.50	8.18	12.37	21.82
		5.0	17.572	4.968	2.58	7.83	12.4	12.81	25.82
		7.5	11.05	3.445	1.69	8.46	13.1	14.31	19.01
	Mean		12.95	3.48	1.90	7.81	9.78	12.68	20.62
	UF, 60	0.0	8.352	2.448	1.66	5.83	2.89	8.00	14.13
		2.5	12.035	2.905	2.08	5.97	3.38	10.68	18.01
		5.0	13.345	2.975	2.21	6.97	8.31	11.45	20.35
		7.5	15.865	3.42	2.57	9.60	5.95	12.74	25.47
	Mean		12.40	2.93	2.11	7.09	4.38	10.72	19.29
	UF, 120	0.0	5.822	1.804	1.03	6.56	2.99	10.50	12.05
		2.5	13.031	4.15	2.08	6.80	5.35	13.21	19.91
		5.0	17.622	4.539	2.58	7.38	5.81	14.5	25.46
		7.5	13.104	3.9	2.11	6.84	5.20	10.0	20.02
	Mean		12.40	3.55	1.93	6.90	4.84	13.05	19.05
	UF, 180	0.0	10.087	3.003	1.93	7.95	4.47	14.78	18.08
		2.5	13.884	4.984	2.49	8.54	5.21	15.10	22.40
		5.0	21.614	6.42	3.10	8.84	6.99	17.25	30.70
		7.5	17.575	4.085	2.76	8.35	4.41	14.10	25.60
	Mean		15.79	4.55	2.55	8.42	6.27	15.31	24.20
Mean			12.67	3.47	2.06	7.16	5.63	12.14	19.42
LSD0.05%									
A			5.900	0.623	0.482	0.025	6.840	10.11	
B			1.338	0.339	0.179	0.414	0.457	1.632	
C			1.598	0.340	0.195	0.592	0.473	1.737	
AB			1.962	0.481	0.253	0.587	0.647	2.308	
AC			2.260	0.481	0.277	0.837	0.668	2.456	
BC			3.197	0.680	0.391	1.184	0.946	3.474	
ABC			4.521	0.962	0.553	1.675	1.337	4.913	

As for fertilizer form, clear significant effect for all N-fertilizers on N, P and K-uptake comparing to that of compost treatments either under DIS or SIS has been marked. About N-fertilizer form, there have been significant differences in N, P and K-uptake values among different N-fertilizer treatments; under DIS: N, P-uptake values of seeds and K-uptake of straw belonging to UF- treatments have been superior to those of urea treatments while K-uptake of seeds yield and N, P-uptake of straw yield have come inferior. Under SIS, there has been superiority for N, P and K-uptake of seeds belonging to UF- treatments to those of urea treatments, while inferiority for N, P and K-uptake of straw has been observed (Table 8).

Examination of data presented in Table 8 has illustrated high superiority for DIS effect on the total N-uptake average values to that of SIS as shown at N-uptake of wheat crop (Table7). However, it is obviously noticed that N-uptake of peanut crop has been much more than that of wheat crop although the peanut has grown on the residual part of the nitrogen of UF-fertilizer. This may attribute partially to the nitrogen quantity coming from air and fixed by rhizobia inoculation.

The effect of different treatments on total N-uptake under DIS could be ranked in order of: UF, 120 > UF, 180 > urea > UF, 60 > compost while under SIS, it has been as follows: urea > UF, 180 >UF, 120 > UF, 60 > compost.

3.4. N-recovery and N-use efficiency

3.4.1. Wheat:

N-recovery values of wheat calculated as in model 1 (materials and methods) and presented in Table 9 have ranged from 9.75 Kg N fed^{-1}(on average) with compost treatments to 32.54 Kg N fed^{-1}(on average) with UF,180 treatments under DIS. Under SIS, they have varied from13.31Kg N fed^{-1}(on average) with compost treatments to 18.76 Kg N fed^{-1}(on average) with UF, 180 treatments. Maximum N-recovery has been with the UF-rate of 180 Kg N fed^{-1} under DIS. Generally, it may be ordered the effect of different treatments under DIS as follows: UF, 180 > urea > UF, 60 > UF, 120 > compost and under SIS as follows: UF, 180 > urea > UF, 120 > UF, 60 > compost.

3.4.2. Peanut:

In the light of preceding studies on peanut crop fertilization using N^{15} tracer technique (Danso and Eskew,1981, Zahran,1999 and Adlan, and Mukhtar, 2004), it could be concluded that the N-derived from air (fixed nitrogen by rhizobia inoculation) being represented average figure of 60% of the total nitrogen existing in peanut crop tissue (total N-recovery). Thereon, by subtracting this value from total N-recovery, the value of N-derived from fertilizer can be obtained (Table 9).

In this context, it can be discussed the peanut crop N-recovery as total N-recovery, N-recovery derived from air and N-recovery derived from applied N-fertilizers. Data given in Table 9 show that total N-recovery and N-recovery derived from air average values under DIS have been markedly superior to those under SIS. Their values under DIS have ranged from 27.77 to 81.98 Kg N fed^{-1}and from 16.66 to 49.19 Kg N fed^{-1} respectively while under SIS, these values have ranged from 36.82 to 52.38 Kg N fed^{-1} and from 22.09 to 31.43 Kg N fed^{-1} respectively. The effect of different treatments in this respect can be ordered as follows: UF, 120 > UF, 180 >urea >UF, 60 >compost, under DIS while under SIS, the order has come as follows: urea >UF, 180 >UF, 120 >UF, 60 >compost.

It would be pointed out to the importance of rhizobia inoculation as a proper management practice to provide the plant with some of required nitrogen and protect the environment where it has added an amount of nitrogen ranged from 9.95 to 66.72 Kg N fed^{-1}.

In case of N-recovery derived from applied N-fertilizers, it is observed that its average values under DIS have been also superior to that under SIS. Such values have ranged from 11.11 to 32.79 Kg N fed^{-1} for former and from 18.17 to 20.33 Kg N fed^{-1}for latter. Hence, it can be reported that used different management practices have truly affected N-recovery either for wheat or peanut.

As for total corrected N-recovery of the wheat-peanut cropping sequence (derived only from fertilizer), it is observed that its value has been 42.98 under DIS and 33.75 Kg N fed^{-1} under SIS. For sub-sub-treatments, such values have ranged from10.33 to 81.69 Kg N fed^{-1}under DIS and form 15.48 to 60.23 Kg N fed^{-1}under SIS. Regardless the N-fertilizer form, the associated-compost has had positive effect on such recovery

To discus N-use efficiency, it must calculate: (a) the all inputs of used nitrogen (nitrogen quantity in compost + nitrogen quantity in N-fertilizer of treatment, Kg N fed^{-1}) and (b) total corrected N-recovery in kg N fed^{-1} (wheat N-recovery + peanut N-recovery from only N-synthetic fertilizers). N-use efficiency has been obtained by dividing b/a relative to 100, as in model 2 (materials and methods). Thus, data presented in Table 9 show that N-use efficiency values of DIS have been slightly surpassed to those of SIS. Such values (on average) of UF-treatments have been also surpassed to those of urea treatments under both DIS and SIS. This result has been expected and in agreement with Abbady *et al.,* 2011. Hence UF-fertilizer application as an invented practice for fertilization management can be considered very successful concept. Also, it is observed that N-use efficiency values belonging to compost treatments have been the highest values comparing to other treatments which may due to its few content of nitrogen or to nitrogen fixed from air.

Table 8. Uptake of N, P and K (kg fed^{-1}) of Peanut Crop as Affected by Different Treatments

Treatments			Uptake (kg fed^{-1})						
Irrigation (A)	N-form Kg fed^{-1}(B)	Compost Ton fed^{-1} (C)	Seeds			Straw			Total N-Uptake (kg fed^{-1})
			N	P	K	N	P	K	
Drip system	0.0	0.0	16.37	2.16	1.39	8.60	3.70	1.70	25.0
		2.5	20.02	3.63	1.65	23.10	5.74	4.98	43.1
		5.0	30.94	5.43	2.84	25.92	6.40	5.76	56.9
		7.5	35.95	7.14	3.70	36.20	8.20	7.60	72.1
	Mean		25.82	4.59	2.39	23.46	6.01	5.01	49.28
	Urea, 120+15	0.0	29.23	5.06	2.77	30.67	6.60	5.33	59.9
		2.5	38.56	7.24	3.67	43.42	9.88	7.80	82.0
		5.0	62.48	11.47	5.73	52.98	11.54	9.18	115.5
		7.5	65.18	11.93	5.97	60.98	11.85	9.54	126.2
	Mean		48.86	8.92	4.53	47.01	9.97	7.96	95.87
	UF, 60	0.0	29.11	4.54	2.16	13.50	4.19	3.38	42.6
		2.5	35.14	6.16	3.04	19.40	6.19	5.22	54.5
		5.0	47.04	7.82	4.03	35.62	8.69	7.42	82.7
		7.5	53.56	10.01	4.68	42.48	11.12	11.12	96.0
	Mean		41.21	7.13	3.47	27.75	7.55	6.78	68.96
	UF, 120	0.0	47.52	8.24	4.32	28.46	5.95	5.21	76.0
		2.5	60.89	10.71	5.20	34.11	7.70	7.70	95.0
		5.0	67.04	12.32	5.76	53.64	13.71	12.81	120.7
		7.5	73.50	13.48	6.30	62.74	15.69	15.00	136.2
	Mean		62.24	11.19	5.40	44.74	10.76	10.18	106.98
	UF, 180	0.0	33.36	5.54	2.87	43.22	9.70	5.29	76.6
		2.5	43.31	8.42	3.66	47.42	11.23	8.74	90.7
		5.0	58.08	11.22	5.82	64.35	12.54	11.55	122.4
		7.5	61.50	11.85	6.30	65.40	12.62	11.95	126.9
	Mean		49.06	9.26	4.66	55.10	11.52	9.38	104.16
Mean			45.44	8.22	4.09	39.61	9.16	7.86	85.05
Sprinkler system	0.0	0.0	8.o4	2.76	1.28	8.72	3.05	4.47	16.76
		2.5	26.33	8.31	3.98	13.2	4.61	7.00	39.53
		5.0	35.00	10.36	4.76	20.96	6.99	10.25	55.96
		7.5	35.52	11.60	5.22	29.7	8.37	12.15	65.23
	Mean		26.22	8.26	3.81	18.15	5.76	8.47	58.44
	Urea, 120+15	0.0	33.20	6.40	3.30	16.80	4.87	6.89	50.0
		2.5	41.20	7.09	3.82	28.91	8.34	11.95	70.1
		5.0	58.79	8.97	4.97	36.02	10.29	16.46	94.8
		7.5	62.34	9.49	5.40	38.50	10.85	17.15	100.8
	Mean		48.88	7.99	4.37	30.06	8.59	13.11	78.94
	UF, 60	0.0	30.00	5.12	2.56	18.14	5.29	7.75	48.1
		2.5	35.43	6.05	3.07	26.68	7.98	11.55	62.1
		5.0	40.95	6.83	3.68	34.30	10.50	14.70	75.3
		7.5	61.91	10.12	6.19	40.28	11.19	16.04	102.2
	Mean		42.07	7.03	3.87	29.85	8.74	12.51	71.92
	UF, 120	0.0	34.11	5.76	2.97	20.37	6.35	9.20	54.5
		2.5	40.70	6.50	3.50	22.00	7.02	9.83	62.7
		5.0	44.41	7.17	4.17	27.08	8.84	11.97	71.5
		7.5	67.52	10.88	6.40	38.10	12.43	17.24	105.6
	Mean		46.68	7.58	4.26	26.88	8.66	12.06	73.57
	UF, 180	0.0	34.78	6.20	3.10	8.60	3.70	1.70	43.38
		2.5	41.73	7.28	3.64	23.10	5.74	4.98	64.83
		5.0	61.50	10.50	5.25	25.92	6.40	5.76	87.42
		7.5	77.70	12.43	6.13	36.20	8.20	7.60	113.9
	Mean		53.93	9.10	4.53	23.46	6.01	5.01	77.38
Mean			43.55	7.99	4.17	25.68	6.60	5.33	72.05
LSD0.05%									
A			2.389	0.419	0.214	1.15	1.163	0.145	
B			1.999	0.3667	0.236	1.27	0.265	0.182	
C			1.874	0.419	0.203	1.55	0.178	0.232	
AB			2.827	0.519	0.334	1.79	0.374	0.258	
AC			2.650	0.593	0.287	2.19	0.251	0.329	
BC			3.750	0.838	0.406	3.10	0.355	0.466	
ABC			5.300	1.185	0.574	4.39	0.503	0.659	

Table 9.Total N-Inputs, N-Recovery of Wheat & Peanut Crops, Total Corrected N-Recovery and N-Use Efficiency

Treatment			[1]Total N- Inputs Kg fed^{-1}	[2]N- recovery for wheat Kg fed^{-1}	N-recovery for Peanut			[5]Total corrected N- recovery Kg fed^{-1}	Nitrogen use efficiency %
Irrigation (A)	N-form kg fed^{-1} (B)	Compost Ton fed^{-1} (C)			Total N Kg fed^{-1}	[3]N-from air Kg fed^{-1}	[4]N-from fertilizer Kg fed^{-1}		
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	12.5	3.18	18.1	10.86	7.24	11.04	88.00
		5.0	25.0	7.97	18.1	10.86	7.24	15.21	60.84
		7.5	37.5	18.09	47.1	28.26	18.84	36.93	98.48
	Mean		25.0	9.75	27.77	16.66	11.11	21.06	82.44
	Urea, 120+15	0.0	135.0	10.21	34.9	20.94	13.96	24.17	17.90
		2.5	147.5	17.75	57.0	34.20	22.8	40.55	27.49
		5.0	160.0	28.47	90.5	54.30	36.2	64.67	40.42
		7.5	172.5	19.25	101.2	60.72	40.48	59.73	34.63
	Mean		153.75	18.92	70.9	42.54	28.36	47.28	27.61
	UF, 60	0.0	60.0	3.29	17.6	10.56	7.04	10.33	17.22
		2.5	72.5	10.5	29.5	17.7	11.80	22.3	30.76
		5.0	85.0	20.38	57.7	34.62	23.08	43.46	51.13
		7.5	97.5	39.42	71.0	42.6	28.40	67.82	69.56
	Mean		78.75	18.40	43.95	26.37	17.58	35.98	42.17
	UF, 120	0.0	120.0	5.61	51.0	30.60	20.4	26.01	34.3
		2.5	132.5	21.42	70.0	42.00	28.00	49.42	37.29
		5.0	145.0	26.71	95.7	57.42	38.28	64.99	44.82
		7.5	157.5	15.15	111.2	66.72	44.48	44.48	28.24
	Mean		138.75	16.99	81.98	49.19	32.79	46.23	36.16
	UF, 180	0.0	180.0	24.78	51.6	30.96	20.64	45.42	25.23
		2.5	192.5	31.96	65.7	39.42	26.28	58.76	30.52
		5.0	205.0	42.73	97.4	58.44	38.96	81.69	39.85
		7.5	217.5	30.70	101.9	61.14	40.76	71.46	32.86
	Mean		198.75	32.54	79.15	47.49	31.79	64.33	38.42
Mean				19.32	60.75	36.45	24.33	42.98	45.36
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	12.5	6.37	22.77	13.66	9.11	15.48	123.84
		5.0	25.0	8.61	39.22	23.53	15.69	22.3	89.2
		7.5	37.5	24.95	48.46	29.07	19.39	49.75	118.24
	Mean		25.0	13.31	36.82	22.09	14.73	29.18	110.42
	Urea 120+15	0.0	135.0	11.00	23.5	14.1	9.4	20.4	15.11
		2.5	147.5	16.38	43.6	26.16	17.44	33.82	22.93
		5.0	160.0	20.38	68.1	40.86	27.24	47.62	29.76
		7.5	172.5	13.57	74.3	44.58	29.72	43.29	25.1
	Mean		153.75	15.33	52.38	31.43	20.95	36.28	23.23
	UF, 60	0.0	60.0	8.69	21.6	12.96	8.64	17.33	28.88
		2.5	72.5	9.47	35.6	21.36	14.24	23.71	32.70
		5.0	85.0	14.91	48.8	29.28	19.52	34.43	40.51
		7.5	97.5	20.03	75.7	45.42	30.28	50.31	51.6
	Mean		78.75	13.28	45.43	27.26	18.17	31.45	38.42
	UF, 120	0.0	120.0	6.61	28.0	16.8	11.2	17.81	14.84
		2.5	132.5	14.47	36.2	21.72	14.48	28.95	21.85
		5.0	145.0	20.02	45.0	27.0	18.0	38.02	26.22
		7.5	157.5	14.58	79.1	47.46	31.64	46.22	29.35
	Mean		138.75	13.92	47.08	28.25	18.83	32.75	23.07
	UF, 180	0.0	180.0	12.64	16.58	9.95	6.63	19.27	10.71
		2.5	192.5	16.96	38.33	22.99	15.34	32.3	16.78
		5.0	205.0	25.26	60.92	36.55	24.37	44.53	20.47
		7.5	217.5	20.16	87.4	52.45	34.97	60.23	29.38
	Mean		198.75	18.76	50.81	30.47	20.33	39.08	19.34
Mean				14.92	46.51	27.9	18.60	33.75	42.89

1-total N-input = N-fertilizerfed^{-1}+N-compost fed^{-1} ; 2-N-recovery = N-uptake fed^{-1}for treatment–N-uptake fed^{-1}for control
3-N-from air, kg/fed^{-1} = N-recovery of peanut x 60%, 4-N-from fertilizer, kg/fed^{-1} = total N-recovery of peanuts –N-from air
5-Total corrected N-recovery, kg fed^{-1} = N-recovery of wheat, kg fed^{-1} + N- recovery from fertilizer of peanuts, kg fed^{-1}

3.5. Energy consumption and CO_2 gas emissions evaluation:

One of the most important routes to combat global warming is to enhance efficiency of energy consumption to reduce CO_2 emissions originated from combustion of fossil fuel necessitated to obtain such energy. In agriculture sector, most of this energy has been used either directly (in field) to power mechanization like irrigation systems or indirectly as in the manufacture of goods like fertilizers. Because of importance such inputs to obtain desired yield, this section will be devoted to discuss this issue under the conditions of this study.

Table 10 contains the calculations of consumed energy to manufacture each of compost, N-fertilizers and that required to operate irrigation systems machine as well as that comes from sun; local compost production in farm of the station has spent 538.56 MJ for one ton (soil conditioner development project,2012) and energy required to manufacture one Kg of nitrogen fertilizer ranged from 51 to 68 MJ (Baht *et al.,*1994), consumed energy for operating irrigation systems has been calculated using water requirement, irrigation efficiency & irrigation pump discharge (Shelke, 2010) and that of energy from sun which supplied directly by the sun for creating the organic matter through photosynthesis process nourishing N-fixers for fixing nitrogen from air. To calculate this energy, it is assumed that the fixation of one Kg of nitrogen from air will require the same as figures of Baht *et al.,* 1994.

Thus, total consumed energy data given in Table 10 represent total energetic inputs of this study. Consumed energy value to operate DIS has been less than that of SIS due to the magnitude of irrigation efficiency of former comparing to that of latter. Consumed energy value necessitated for wheat crop has been less than that of peanut crop due to that the water requirement of former is already less than that of latter.Consumed energy of different fertilizers has been the same either under DIS or SIS.

Energy from sun as an invisible energetic input must be well discussed because it has certainly associated in building up plant tissue and consequently, crop yield. The listed values of this energy have shown: firstly, clear superiority for DIS effect comparing to that of SIS. This effect may be attributed to the average obtained N-recovery of former has been greater than that of latter. Secondly, the effect of different sub-treatments has widely varied and can be ranked for DIS as follows: UF, 120 > UF, 180 > urea > UF, 60 > compost and for SIS as follows: urea > UF, 180 > UF, 120 > UF, 60 > compost. This variation has been basically related to obtained yield of each treatment. Thirdly, regardless of N-fertilizer form, addition of compost in gradually increased rates has increased such energy values approximately in the same pattern. It is well-known that the existence of organic matter could encourage plant growth and activate the fixation process (Gellings and Parmenter, 2004).To illustrate the importance of this energy as a clean energy trapped from sun, the percentage of this energy relative to total energy inputs has been calculated. These values have amounted 11.66% for DIS and 8.29% for SIS. Also, they have ranged from 7.59 to 15.47 % and from 7.19 to 8.97% for sub-treatments under DIS and SIS respectively. Hence, it could be deduced the positive effect of pursued management practices on this form of energy. On the other hand, the biological nitrogen fixation could help to ameliorate energy supply problems, offsetting some of energy used to plant production and make more efficient use for energy which would essentially reflect on global warming as an environmental vision and urgent need for energy as a survival vision.

To realize the effect of suggested management practices on energy consumption, energy consumption ability (ECA) has been calculated according to Abbady *et al.,* 2011. It represents the amount of energy consumed to produce one ton plant dry matter (materials and methods). The data presented in Table 10 show that ECA averaged value of DIS has been less than that of SIS i.e. DIS as an irrigation management has been more efficient in consuming energy to produce plant dry matter unit than SIS. Also under DIS, ECA value of UF fertilizer treatments (on average) has been 4378.27 MJ, the same figure for other treatments (compost and urea) has been 6671.2 MJ, then using UF- fertilizer has saved an energy amount of 2292.93 MJ comparing to others in relative reduction of 52.37%. Under SIS, however, an opposite direction has been seen, where the averaged value of such energy of UF-fertilizer treatment and others have amounted 5652.62 and 5411.1 MJ respectively with relative reduction of - 4.27% which would decisively clarify the complexity of soil management practices interference and also the conjugation of DIS with UF-fertilizer as SRNF has represented a successful management.

As for the different individual fertilization treatments, it could be ordered their effect on ECA values in the following rank: under DIS; UF, 120 < UF, 180 < urea < UF, 60 < compost and under SIS; compost < UF, 60 <UF, 180< urea < UF, 120. It is observed that the effect of application of UF-fertilizer on energy saving have been more efficient under DIS than that under SIS due to the better performance of UF-fertilizer under DIS in dry matter production (two successive yields). Also regardless of N-form, it is observed that the addition of compost either under DIS or SIS has positively affected energy saving.

Table 10. Consumed Energy for Manufacturing Compost & N-Fertilizers, Operating Irrigation Systems, Total Energy, Energy from Sun, %Energy from Sun Calculated of Total Energy and Energy Consumption Ability

Treatment			Consumed Energy (MJ fed^{-1})					Energy from sun MJ fed^{-1}	%Energy from sun relative to total energy	Total increased dry matter Ton fed^{-1} Year^{-1}	ECA MJton^{-1} Year^{-1}
Irrigation (A)	N-form kgfed^{-1} (B)	Compost ton fed^{-1} (C)	Compost ton fed^{-1}	N-fert. kg fed^{-1}	Irrigation system: wheat	Irrigation system: peanut	total				
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	1346.4	0.0	3149.1	6298.9	10794.4	646.2	5.99	0.96	11244.2
		5.0	2692.8	0.0	3149.1	6298.9	12140.8	646.2	4.32	0.96	12646.7
		7.5	4039.2	0.0	3149.1	6298.9	13487.2	1681.5	12.47	3.63	3715.5
	Mean		2019.6	0.0			12140.8	991.3	7.59	1.85	9202.1
	Urea, 120+15	0.0	0.0	8032.5	3149.1	6298.9	17480.5	1245.9	7.13	3.07	5693.97
		2.5	1346.4	8032.5	3149.1	6298.9	18826.9	2034.9	10.81	5.01	3757.86
		5.0	2692.8	8032.5	3149.1	6298.9	20173.3	3230.9	16.02	6.1	3307.10
		7.5	4039.2	8032.5	3149.1	6298.9	21519.7	3612.8	16.79	5.66	3802.07
	Mean		2019.6	8032.5			19500.1	2531.1	12.69	4.96	4140.3
	UF, 60	0.0	0.0	3570	3149.1	6298.9	13018.0	628.3	4.83	1.53	8508.5
		2.5	1346.4	3570	3149.1	6298.9	14364.4	1021.6	7.11	1.95	7366.4
		5.0	2692.8	3570	3149.1	6298.9	15710.8	2059.9	13.11	3.85	4080.7
		7.5	4039.2	3570	3149.1	6298.9	17055.2	2534.7	14.86	4.8	3553.2
	Mean		2019.6	3570			15037.1	1561.1	9.98	3.04	5877.2
	UF, 120	0.0	0.0	7140	3149.1	6298.9	16588.0	1820.7	10.98	2.55	6505.1
		2.5	1346.4	7140	3149.1	6298.9	17934.4	2499.0	13.93	5.01	3579.7
		5.0	2692.8	7140	3149.1	6298.9	19280.8	3416.5	17.72	6.22	3099.8
		7.5	4039.2	7140	3149.1	6298.9	20627.2	3969.8	19.25	5.78	3568.7
	Mean		2019.6	7140			18607.6	2926.5	15.47	4.89	3413.4
	UF, 180	0.0	0.0	10710	3149.1	6298.9	20156.0	1842.1	9.14	4.67	4316.1
		2.5	1346.4	10710	3149.1	6298.9	21504.4	2345.5	10.91	5.64	3812.8
		5.0	2692.8	10710	3149.1	6298.9	22850.8	3477.2	15.22	6.87	3326.2
		7.5	4039.2	10710	3149.1	6298.9	24197.2	3637.8	15.03	6.17	3921.8
	Mean		2019.6	10710			22177.1	2825.7	12.58	5.84	3844.2
Mean			2019.6	5890.5			17492.5	2167.14	11.66	4.12	5295.44
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	1346.4	0.0	3988.3	7978.6	13313.3	812.77	6.11	2.50	5325.3
		5.0	2692.8	0.0	3988.3	7978.6	14659.7	1400.04	9.55	2.94	4986.3
		7.5	4039.2	0.0	3988.3	7978.6	16006.1	1729.66	10.81	4.70	3405.6
	Mean		2019.6	0.0			14659.7	1314.15	8.82	3.38	4572.4
	Urea, 120+15	0.0	0.0	8032.5	3988.3	7978.6	19999.4	838.95	4.2	2.36	8474.3
		2.5	1346.4	8032.5	3988.3	7978.6	18345.8	1556.5	8.48	3.93	4668.1
		5.0	2692.8	8032.5	3988.3	7978.6	22692.2	2431.2	10.71	3.26	6960.8
		7.5	4039.2	8032.5	3988.3	7978.6	24038.6	2652.5	11.30	4.91	4895.8
	Mean		2019.6	8032.5			21269.0	1869.8	8.67	3.615	6249.8
	UF, 60	0.0	0.0	3570	3988.3	7978.6	15536.9	771.1	4.96	2.15	7226.5
		2.5	1346.4	3570	3988.3	7978.6	16883.3	1270.9	7.53	3.26	5178.9
		5.0	2692.8	3570	3988.3	7978.6	18229.7	1742.2	9.56	4.19	4350.8
		7.5	4039.2	3570	3988.3	7978.6	19576.1	2702.5	13.81	5.68	3446.5
	Mean		2019.6	3570			17556.5	1621.7	8.97	3.82	5050.7
	UF, 120	0.0	0.0	7140	3988.3	7978.6	19106.9	999.6	5.23	2.23	8568.1
		2.5	1346.4	7140	3988.3	7978.6	20453.3	1292.3	6.32	3.07	6662.3
		5.0	2692.8	7140	3988.3	7978.6	21799.7	1606.5	7.37	3.86	5647.6
		7.5	4039.2	7140	3988.3	7978.6	23146.1	2823.9	12.20	5.30	4367.2
	Mean		2019.6	7140			21126.5	1680.7	7.78	4.94	6311.3
	UF, 180	0.0	0.0	10710	3988.3	7978.6	22686.9	592.0	2.61	3.18	7134.3
		2.5	1346.4	10710	3988.3	7978.6	24023.3	1367.9	5.69	3.97	6051.2
		5.0	2692.8	10710	3988.3	7978.6	25369.7	3120.8	12.3	5.07	5003.9
		7.5	4039.2	10710	3988.3	7978.6	26716.1	2174.7	8.14	6.37	4194.1
	Mean		2019.6	10710			24699.0	1813.9	7.19	4.65	5311.61
Mean				5890.5			19862.1	1660.05	8.29	4.08	5499.16

Energy of N-fertilizer fed^{-1}= N-rate fed^{-1} x energy required to manufacture 1 kg of N-fertilizer (59.5MJ)
Energy of compost fed^{-1}= compost in ton fed^{-1}x 538.56 MJ
Energy from sun fed^{-1}= N-fixed from air fed^{-1} x energy required to manufacture 1 kg of N-fertilizer (59.5MJ)
Energy consumption ability (ECA) = total consumed energy, MJ fed^{-1}/ yield increased, ton.fed^{-1}

To discuss consumed energy cost and CO_2 emissions quantity, the energy in MJ form (Table10) has been calculated in an equivalent diesel fuel form as shown in Table 11, where Goering, 1989 demonstrated that a liter of diesel fuel has an energy content of about 37.4 MJ and U.S. Environmental Protection Agency,2005 stated that carbon coefficient for one liter of diesel fuel amount is 2.67Kg CO_2.Hence,the data show that the averaged quantities of diesel fuel as a consumed energy have ranged from 467.7under DIS to 531.05 liter $fed^{-1}year^{-1}$under SIS respectively, with cost of 514.47 and 584.16 EGP $fed^{-1}year^{-1}$ (price of diesel fuel liter in Egypt = 1.1EGP).Such quantities of diesel fuel represent 2.94 and 3.34 American barrel fed^{-1} $year^{-1}$ respectively (American barrel = 158.984 Liters).

Also, such energy values and its cost have been affected by the sub-treatments which can be ordered as follows: UF, 180>UF, 120>urea>UF, 60>compost either under DIS or SIS due to the increasingly used N-rates. However, it would be mentioned that the rates of UF-fertilizer suggested to fertilize wheat and peanut cropping sequence have been added as a one addition whereas N-fertilization for peanut in urea treatment has depended on the biological N-fertilizer.

To produce such amounts of energy, the emitted-CO_2 values as a result of combustion this fuel (Table11) have amounted 1248.79 KgCO_2 fed^{-1} $year^{-1}$ for DIS and 1417.87 Kg CO_2 fed^{-1} $year^{-1}$for SIS, in other expression 340.58 Kg carbon fed^{-1} $year^{-1}$for former and 386.69 Kg carbon$fed^{-1}year^{-1}$ for latter. They have also ranged for sub-treatments from 866.68 to 1583.13 Kg CO_2 fed^{-1} $year^{-1}$ under DIS and from 1046.61 to 1763.00 Kg CO_2 fed^{-1} $year^{-1}$ under SIS. These values in carbon form have ranged from 236.37 to 431.76 Kg carbon $fed^{-1}year^{-1}$ for former and from 285.44 to 488.82 Kg carbon $fed^{-1}year^{-1}$ for latter. Examination of above data provides that using DIS comparing to SIS has saved 169.08 Kg CO_2 fed^{-1} $year^{-1}$, i. e. 46.11 Kg carbon $fed^{-1}year^{-1}$, with relative reduction of 13.55%.

As regards the effect of sub-treatments, the results have illustrated that the emitted-CO_2 gas quantity related to compost has been less than those of other treatments either under DIS or SIS. The emitted-CO_2 quantity belonging to other treatment has increased with increasing their rates.

As for the energy from sun as a diesel fuel form, the values of this energy have amounted 57.8 and 45.43 liter fed^{-1} $season^{-1}$ under DIS and SIS respectively. Also for sub-treatments, they have ranged from 16.8 to 106.1 liter fed^{-1} $season^{-1}$ under DIS and from 15.8 to 83.4 liter fed^{-1} $season^{-1}$ under SIS respectively. Their cost has been 63.6 and 48.24 EGP fed^{-1} $season^{-1}$ under DIS and SIS respectively. Also, it has ranged from 29.15 to 86.08 EGP fed^{-1} $season^{-1}$for sub-treatments under DIS and from 33.47 to 63.91EGP $fed^{-1}season^{-1}$ under SIS. However this cost will not be paid because such energy as mentioned before has directly trapped from sun. Addition to the unpaid-cost, the most important point in this respect is CO_2 emissions which have been already avoided to release and emit to the atmosphere. Data given in Table 11 also have illustrated that the values of avoided-CO_2 has amounted 154.33 Kg CO2 fed^{-1} $season^{-1}$under DIS and 117.21CO_2 $fed^{-1}season^{-1}$ under SIS. Also they have ranged from 70.76 to 208.97 Kg CO_2.$fed^{-1}season^{-1}$ for sub-treatments under DIS and from 109.38 to 133.41 Kg CO_2.fed^{-1} $season^{-1}$for sub-treatments under SIS. Thus, the use of biologically fixed nitrogen as a partial alternative to chemical N-fertilizer could have great potential for limiting CO_2 emissions and consequently for mitigating global warming.

ECA values as a diesel fuel form presented in Table 11 have amounted 145.73 liter ton^{-1} $year^{-1}$ under DIS and 148.56 liter $ton^{-1}year^{-1}$ under SIS with cost 159.64 EGP $ton^{-1}$for former and 163.39 EGP.$ton^{-1}$for latter respectively. Also ECA values have ranged from 102.77 to 246.03 liter ton^{-1} $year^{-1}$for sub-treatments under DIS and from122.26 to 168.75 liter $ton^{-1}year^{-1}$for sub-treatments under SIS. Their costs have ranged from 113.06 to 267.33 EGP ton^{-1} $year^{-1}$(on average), for sub-treatments under DIS and from134.48 to185.62 EGP ton^{-1} (on average) under SIS respectively.

From the same Table, it is noticed that the emitted CO_2 values to produce one ton of plant dry matter have amounted 389.10 Kg CO_2 ton^{-1} $year^{-1}$under DIS and 396.64 Kg CO_2 $ton^{-1}year^{-1}$ under SIS. Also they have ranged from 274.43 to 656.93 Kg CO_2 ton^{-1} $year^{-1}$ for sub-treatments under DIS and from 326.43 to 446.18 Kg CO_2 $ton^{-1}year^{-1}$for sub-treatments under SIS. These results have illustrated that the application of UF-fertilizer for N- fertilization and DIS for irrigation have been the most efficient management practices comparing to other treatments. The importance of this estimation lies in an economy of cropping productivity in relation to those of CO_2 emissions as a major cause to global warming and which need further studies.

Table 11. Total Consumed Energy &Energy from Sun (liter fed^{-1}) & ECA (liter ton^{-1} yield) as a Diesel Fuel Form, Emitted $CO_2 Kg.ton^{-1}$yield, Emitted & Avoided CO_2 in Kg and Energy Cost, in EGP fed^{-1} or ton^{-1}

Treatment			Total consumed Energy			Energy from sun			ECA(liter. ton^{-1}yield)		
Irrigation (A)	N-form $Kg.fed^{-1}$ (B)	Compost Ton Fed^{-1} (C)	Diesel fuel Liter. fed^{-1}	Emitted CO_2 Kg. fed^{-1}	Cost EGP. Liter fed^{-1}	Diesel fuel Liter fed^{-1} $Seaon^{-1}$	Avoided CO_2 $Kg.fed^{-1}$ $Seaon^{-1}$	Avoided Cost EGP fed^{-1} $Seaon^{-1}$	Diesel fuelLiter fed^{-1} $year^{-1}$	Emitted CO_2 Kg. fed^{-1} $year^{1}$	Cost EGP ton^{-1} $year^{-1}$
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	288.6	770.56	317.46	17.3	46.19	19.03	300.66	802.60	330.66
		5.0	324.6	866.68	357.06	17.3	46.19	19.03	338.15	902.91	371.96
		7.5	360.6	962.80	396.66	44.9	119.88	49.39	99.35	265.26	99.35
	Mean		324.6	866.68	357.06	26.5	70.76	29.15	246.03	656.93	267.33
	Urea, 120+15	0.0	467.4	1247.96	514.14	33.3	88.91	36.63	152.25	406.51	167.47
		2.5	503.4	1344.08	553.74	54.4	145.25	59.84	100.48	268.28	110.52
		5.0	539.4	1440.19	593.34	83.4	222.68	91.74	88.42	236.08	97.26
		7.5	575.4	1536.32	632.94	96.6	257.92	106.26	101.66	271.43	111.82
	Mean		521.4	1392.14	573.54	66.9	178.62	73.61	110.71	295.58	121.77
	UF, 60	0.0	348.1	929.43	382.91	16.8	44.86	18.48	227.5	607.43	250.25
		2.5	384.1	1025.55	422.51	27.3	72.89	30.03	196.96	525.88	216.65
		5.0	420.1	1121.67	462.11	55.1	147.12	61.05	109.11	291.29	120.02
		7.5	456.0	1217.52	501.6	67.8	181.03	74.58	95.00	253.65	104.5
	Mean		402.1	1073.54	442.3	41.8	111.52	46.04	157.14	419.56	172.86
	UF, 120	0.0	443.6	1184.41	487.9	48.7	130.03	53.57	173.93	464.39	191.32
		2.5	479.6	1280.53	527.6	66.8	178.36	73.48	95.71	255.55	105.28
		5.0	515.5	1376.39	567.1	91.4	244.04	100.54	82.88	221.28	91.16
		7.5	551.5	1472.51	606.7	106.1	283.29	116.71	95.41	254.74	104.95
	Mean		497.5	1328.46	547.3	78.3	208.97	86.08	111.98	298.99	123.18
	UF, 180	0.0	538.9	1438.86	592.8	49.3	131.63	54.23	115.40	308.12	126.94
		2.5	574.9	1534.98	632.4	62.7	167.41	68.97	101.94	272.18	112.13
		5.0	610.9	1631.10	672.0	93.0	248.31	102.3	88.94	237.47	97.83
		7.5	647.0	1727.49	711.7	97.3	259.79	107.03	104.86	279.98	115.34
	Mean		592.9	1583.13	652.3	75.6	201.76	83.13	102.77	274.43	113.06
Mean			467.7	1248.79	514.5	57.8	154.33	63.60	145.73	389.10	160.09
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	356.0	950.52	391.6	21.73	58.02	23.90	142.39	380.18	156.62
		5.0	392.0	1046.64	431.2	37.43	99.94	41.17	133.33	355.99	146.66
		7.5	427.97	1142.68	470.77	46.25	123.49	50.88	91.06	243.13	100.16
	Mean		391.99	1046.61	431.19	35.14	93.82	38.65	122.26	326.43	134.48
	Urea, 120+15	0.0	534.7	1427.65	588.2	22.4	59.81	24.64	226.59	604.99	249.24
		2.5	490.5	1309.64	539.6	41.6	111.07	45.76	124.82	333.26	137.30
		5.0	606.7	1619.88	667.4	65.0	173.55	71.5	186.12	496.96	204.73
		7.5	642.7	1716.01	706.9	70.9	189.30	77.99	130.90	349.50	143.99
	Mean		568.65	1518.29	625.5	50.0	133.41	54.97	167.11	446.18	183.82
	UF, 60	0.0	415.43	1109.20	456.97	41.2	110.00	45.32	193.22	515.89	212.3
		2.5	451.4	1205.24	496.5	33.9	90.51	37.29	138.47	369.71	152.31
		5.0	487.4	1301.36	536.1	46.6	124.42	51.26	116.33	310.60	127.96
		7.5	523.4	1397.48	575.7	72.3	193.04	79.53	92.15	246.04	101.36
	Mean		469.41	1253.32	516.32	48.5	129.49	33.47	135.04	360.56	148.48
	UF, 120	0.0	510.9	1364.10	561.9	26.7	71.28	32.31	229.09	611.67	251.99
		2.5	546.9	1460.22	601.5	34.6	92.38	38.06	178.14	475.63	195.95
		5.0	582.9	1556.34	641.2	43.0	114.81	47.30	151.01	403.19	166.11
		7.5	618.8	1652.19	680.7	75.5	201.59	83.05	116.77	311.78	128.44
	Mean		564.8	1508.19	621.3	45.0	119.97	50.18	168.75	450.56	185.62
	UF, 180	0.0	606.6	1619.62	667.3	15.8	42.19	17.38	190.76	509.32	209.83
		2.5	642.3	1714.94	706.5	36.6	97.72	40.26	161.80	432.01	177.98
		5.0	678.3	1811.06	746.1	83.4	222.5	91.74	133.79	357.22	147.16
		7.5	714.3	1907.18	785.7	58.1	155.13	63.91	112.14	299.41	123.35
	Mean		660.4	1763.00	726.2	48.5	129.38	63.91	149.62	399.49	164.58
Mean			531.05	1417.87	584.10	45.43	121.21	48.24	148.56	396.64	163.39

Energy content of a diesel fuel $liter^{-1}$ = 37.4 M J.
Carbon coefficient of one liter diesel fuel = 2.67Kg CO_2
Energy in diesel fuel form (lite fed^{-1}) = energy fed^{-1} in MJ/37.4
Emitted or avoided CO_2 Kg fed^{-1}= Energy in diesel fuel (lite fed^{-1}) x 2.67

3.6. Economic evaluation

To estimate economic response of the two successive cropping yields to suggested management practices, the net return and investment factor (materials and methods) have been employed. The agricultural inputs and outputs have presented in tables 12 and 13. They have been as follows:

(i) Inputs have included costs of irrigation systems application, N-fertilizers and compost:

1-The cost of both drip and sprinkler irrigation systems have been assumed to be the cost of energy required to operate the two systems which being 277.88 EGP for drip system and 351.97 EGP for sprinkler system.

2-the cost of N-fertilizers have included the price of one ton of urea (1800 EGP) and the price of one ton of ureaform (3000 EGP).

3- The cost of compost has represented the price of one ton which being 220 EGP.

The costs of other agriculture operations have not been included because they have been similarly carried out for all treatments and their cost have been the same.

(ii) Outputs have included the price of both wheat and peanut yield which being as follows:

Price of one ton of wheat grain = 2668 EGP (based on the price of one ardab= 400 EGP

Price of one ton of wheat straw = 100 EGP

Price of one ton of peanut seeds = 5000 EGP

Price of one ton of peanut straw = 50 EGP

Data in table 12 show that the gross return value of DIS has been greater than that of SIS. Gross return value of UF treatments (on average) has been greater than other treatments either under DIS or SIS. Data in table 13 reveal that the cost of application of DIS has been less than that of SIS. The net return (NR) and investment factor (IF) of DIS has been much more than that of SIS i.e. application of DIS has been more profitability than that of SIS. This may be attributed to the positive effect of DIS on crop productivity and its higher water consumption efficiency

NR of the treatments under DIS has taken the following rank: UF, 120 > UF, 180> urea> UF, 60 > compost. Under SIS, the rank has been: urea> compost >UF, 180 > UF, 60 > UF, 120. The observed results regarding former rank could be referred to the best agronomic performance of UF under DIS in spite of its higher cost. As for latter rank, urea treatment has headed the rank, this effect has attributed to its lower cost matching its higher yield comparing with other treatments under SIS. Examination of NR and IF results of all treatments given in table 13 has shown that the urea & UF, 120 treatments under DIS and urea & UF, 60 under SIS could be chosen as the most profitable treatments.

To determine the optimum economic UF-treatment, Fig 1 show that UF- rate of 120 Kg N fed^{-1} under DIS has been the optimum rate because of it has met the highest IF (4, 71) and even the best one comparing to all rest treatments (Table 13).Under SIS, the UF, 60 treatment has had highest profitability (highest IF) in spite of the lowering NR (FAO, 2000). This could emphasize that the interferences of different elements of soil management have affected each other.

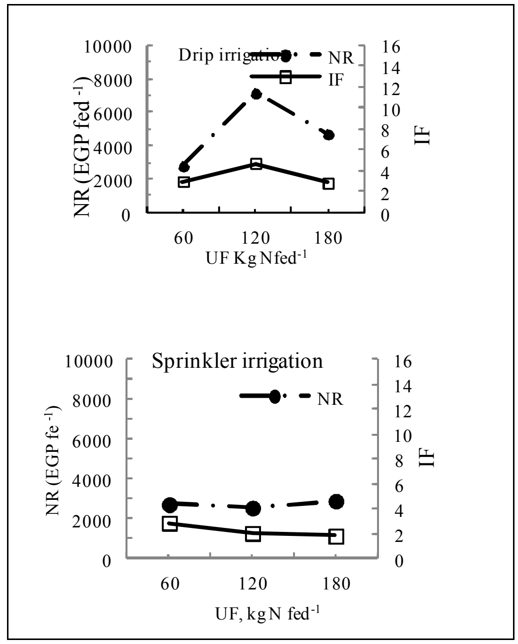

Fig.1 Effect of UF-fertilizer application under drip and sprinkler irrigation systems on NR and IF

To discuss the economic role of compost application

(i) Under DIS, Fig. 2 illustrates that using the compost alone has been unprofitable. However, with increasing the added rates, it has implemented some profitability. Also, with increasing the added rate for every treatment, the NR and IF values have been mostly increased up to the rate of 5 ton fed$^{-1.}$ Such values have been declined at rate of 7.5 ton fed^{-1} for all treatments, i.e. its addition has not been feasible due to its additional cost to the different treatments. Hence, the economic optimum rate of compost has been 5 ton fed^{-1}. (ii) Under SIS, Fig.3 shows that increasing NR and IF values has generally matched the increasing compost levels. They have only recorded higher values with compost alone treatment. In other treatments, no clear trend to select economic optimum compost rate has been observed.However, 5 or 7.5 ton fed^{-1}rates may be rational.In general, the profitability (IF) under this system has mostly been low, where its averaged value has been less than 3 (FAO, 2000).Also, this profitability has been lower than that of drip irrigation system.

Table 12. Yield Increase (Ton fed^{-1}) and Gross Return (EGP fed^{-1}) of Wheat and Peanut Crops as Affected by Different Treatments

treatments			Wheat				peanut				gross return EGPfed^{-1}
Irrigation	N-form Kg fed^{-1}	Compost Ton fed^{-1}	yield increase Ton fed^{-1}		Return EGP fed^{-1}		yield increase Ton fed^{-1}		Return EGP fed^{-1}		
			grain	straw	grain	straw	seeds	straw	seeds	straw	
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	0.13	0.25	346.67	25.0	0.07	0.51	350	25.5	747.17
		5.0	0.36	0.39	960.48	39.0	0.37	0.60	1850	30.0	2879.5
		7.5	0.59	1.67	1574.1	167.0	0.37	1.00	1850	50.0	3641.1
	Mean		0.36	0.77	960.42	77	0.30	0.70	1350	36.17	2422.6
	Urea 120+15	0.0	0.36	1.27	960.48	127	0.31	1.13	1550	56.5	2693.98
		2.5	0.6	2.27	1600.8	227.0	0.54	1.60	2700	80.0	4607.8
		5.0	0.96	2.47	2561.3	247.0	0.99	1.68	4950	84.0	7842.3
		7.5	0.81	1.91	2161.1	191	1.05	1.89	5250	94.5	7696.6
	Mean		0.79	1.98	1820.9	198	0.72	1.58	3612.5	78.75	5710.17
	UF, 60	0.0	0. 0	0.93	0.0	93.0	0.58	0.36	2900	18.0	3011
		2.5	0.3	1.13	800.4	113.0	0.44	0.63	2200	31.5	3144.9
		5.0	0.56	1.5	1494.1	150.0	0.67	1.12	3350	56.0	5050.1
		7.5	0.67	1.84	1787.6	184.0	0.82	1.47	4100	73.5	6145.1
	Mean		0.38	1.35	1020.5	112.5	0.63	1.34	2950	44.75	4337.8
	UF, 120	0.0	0.62	0.84	1654.2	84,0	0.87	0.68	4350	34.0	6122.2
		2.5	1.29	2.05	3441.7	205.0	1.05	1.08	5250	54.0	8950.7
		5.0	1.43	2.15	3815.2	215.0	1.12	1.98	5600	99.0	9729.2
		7.5	1.08	0.84	2881.5	84.0	1.75	2.41	8750	120.5	11836
	Mean		1.11	1.42	2948.2	147	1.27	1.54	5987.5	76.88	9159.53
	UF, 180	0.0	0.78	0.81	2081.0	81.0	0.51	1.94	2550	97.0	4809.0
		2.5	0.97	1.81	2587.9	181.0	0.74	2.12	3700	106.0	6574.9
		5.0	1.24	2.39	3308.3	239.0	0.94	2.30	4700	115.0	8353.3
		7.5	0.75	2.08	2001.0	208.0	1.02	2.32	5100	116.0	7425.0
	Mean		0.94	1.9	2494.6	177.3	0.80	2.17	4012.5	108.5	6790.6
Mean			0.72	1.64	1944.9	142.3	0.74	1.47	3582.4	69.01	5684.14
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	0.02	0.68	53.36	68.0	0.77	0.50	3850	25.0	3996.36
		5.0	0.03	0.94	80.04	94.0	1.0	1.24	5000	62.0	5236.04
		7.5	1.05	0.99	2801.4	99.0	1.05	1.61	5250	80.5	8230.9
	Mean		0. 37	1.1	978.27	87.0	0.94	1.12	4700	55.83	4365.83
	Urea 120+15	0.0	0.21	0.96	560.28	96.0	0.60	0.59	3000	29.5	3685.78
		2.5	0.39	1.16	1040.5	116.0	0.69	1.69	3450	84.5	4691.0
		5.0	0.50	1.17	1334.0	117.0	0.98	2.34	4900	117.0	6468.0
		7.5	0.23	1.21	613.64	121.0	1.06	2.41	5300	120.5	6768.8
	Mean		0.46	1.13	887.11	112.5	0.83	1.76	4162.5	87.88	5403.39
	UF, 60	0.0	0.30	0.65	800.4	65.0	0.4	0.8	2000	40.0	2905.0
		2.5	0.41	0.66	1093.9	66.0	0.53	1.66	2650	83.0	3892.9
		5.0	0.43	0.75	1147.2	75.0	0.65	2.41	3250	120.5	4592.7
		7.5	0.53	1.40	1414.0	140.0	1.11	2.64	5550	132.0	7236.0
	Mean		0.42	0.87	1113.9	86.5	0.67	1.88	3362.5	93.88	4656.65
	UF, 120	0.0	0.0	0.64	0.0	64.0	0.50	1.81	2500	90.5	2654.5
		2.5	0.41	0.81	1093.9	81.0	0.52	1.25	2600	62.5	3837.4
		5.0	0.47	0.96	1253.9	96.0	0.67	1.76	3350	88.0	4787.9
		7.5	0.36	0.82	960.48	82.0	1.2	2.92	6000	146.0	7188.48
	Mean		0.25	0.81	827.07	80.8	0.72	1.94	3612.5	96.75	4617.07
	UF, 180	0.0	0.35	1.16	933.8	116.0	0.54	1.13	1749.6	56.5	2857.1
		2.5	0.47	1.24	1253.9	124.0	0.67	1.59	3350.0	79.5	4807.4
		5.0	0.65	1.39	1734.2	139.0	1.1	1.93	5500.0	96.5	7469.7
		7.5	0.53	1.17	1414.0	117.0	1.35	3.32	6750.0	166.0	7177.0
	Mean		0.50	1.24	1333.9	124.0	0.92	1.99	4337.4	99.63	5577.6
Mean			0.4	1.29	1028.1	98.06	0.82	1.74	4034.9	86.79	4924.11

Table 13. Economic Evaluation of Wheat and Peanut Crops as Affected by Different Treatments

treatments			Fertilizers cost EGP fed^{-1}		Irrigation cost EGP fed^{-1}	Total cost EGP fed^{-1}	Gross return EGP fed^{-1}	Net return EGP fed^{-1}	Invest-ment factor
Irrigation	N-form Kg fed^{-1}	Compost Ton fed^{-1}	N-kg Fed^{-1}	Compost ton fed^{-1}					
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	0.0	550.0	277.882	827.88	747.17	-80.71	0.90
		5.0	0.0	1100.0	277.882	1377.8	2879.5	1501.7	2.09
		7.5	0.0	1650.0	277.882	1927.8	3641.1	1713.3	1.89
	Mean					1377.8	2422.6	1044.76	1.63
	Urea 120+15	0.0	522.6	0.0	277.882	800.48	2693.98	1893.5	3.67
		2.5	522.6	550.0	277.882	1350.5	4607.8	3257.3	3.41
		5.0	522.6	1100.0	277.882	1900.5	7842.3	5941.8	4.13
		7.5	522.6	1650.0	277.882	2450.5	7696.6	4041.3	3.14
	Mean					1625.5	5710.17	3783.5	3.58
	UF, 60	0.0	450	0.0	277.882	727.88	3011.0	2283.12	4.14
		2.5	450	550.0	277.882	1277.8	3144.9	1867.1	2.46
		5.0	450	1100.0	277.882	1827.8	5050.1	3222.3	2.76
		7.5	450	1650.0	277.882	2377.8	6145.1	3767.3	2.58
	Mean					1552.8	4337.8	2784.9	2.98
	UF, 120	0.0	900	0.0	277.882	1177.8	6122.2	4944.4	5.2
		2.5	900	550.0	277.882	1727.8	8950.7	7222.9	5.18
		5.0	900	1100.0	277.882	2277.8	9729.2	7451.4	4.27
		7.5	900	1650.0	277.882	2827.8	11836	9008.2	4.19
	Mean					2002.8	9159.53	7156.73	4.71
	UF, 180	0.0	1350	0.0	277.882	1627.8	4809.0	3181.2	2.95
		2.5	1350	550.0	277.882	2177.8	6574.9	4397.1	3.02
		5.0	1350	1100.0	277.882	2727.8	8353.3	5625.5	3.06
		7.5	1350	1650.0	277.882	3277.8	7425.0	5625.5	2.27
	Mean					2452.8	6790.6	4707.3	2.83
Mean						1802.3	5684.14	3895.43	3.15
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	0.0	550.0	351.97	901.97	3996.36	3094.39	4.43
		5.0	0.0	1100.0	351.97	1451.9	5236.04	3784.14	3.6
		7.5	0.0	1650.0	351.97	2001.9	8230.9	6229.0	4.11
	Mean					1451.9	4365.83	2913.93	3. 01
	Urea 120+15	0.0	522.6	0.0	351.97	874.57	3685.78	2811.21	4.21
		2.5	522.6	550.0	351.97	1423.9	4691.0	3267.10	3.29
		5.0	522.6	1100.0	351.97	1974.5	6468.0	4493.5	3.28
		7.5	522.6	1650.0	351.97	2524.5	6768.8	4244.3	2.68
	Mean					1699.4	5403.39	3703.995	3. 37
	UF, 60	0.0	450	0.0	351.97	801.97	2905.0	2103.03	3.62
		2.5	450	550.0	351.97	1351.9	3892.9	2541.00	2.88
		5.0	450	1100.0	351.97	1901.9	4592.7	2690.80	2.42
		7.5	450	1650.0	351.97	2451.9	7236.0	3514.1	2.43
	Mean					1626.9	4656.65	2712.23	2.86
	UF, 120	0.0	900	0.0	351.97	1251.9	2654.5	1402.6	1.47
		2.5	900	550.0	351.97	1801.9	3837.4	2035.5	2.13
		5.0	900	1100.0	351.97	2351.9	4787.9	2436.00	2.04
		7.5	900	1650.0	351.97	2901.9	7188.48	4286.58	2.48
	Mean					2076.9	4617.07	2540.17	2.03
	UF, 180	0.0	1350	0.0	351.97	1701.9	2857.1	1155.2	1.68
		2.5	1350	550.0	351.97	2901.9	4807.4	1905.5	1.66
		5.0	1350	1100.0	351.97	2801.9	7469.7	4667.8	2.67
		7.5	1350	1650.0	351.97	3351.9	7177.0	3825.1	1.14
	Mean					2689.4	5577.6	2888.40	1.79
Mean						2383.8	4924.11	2540.31	2.07

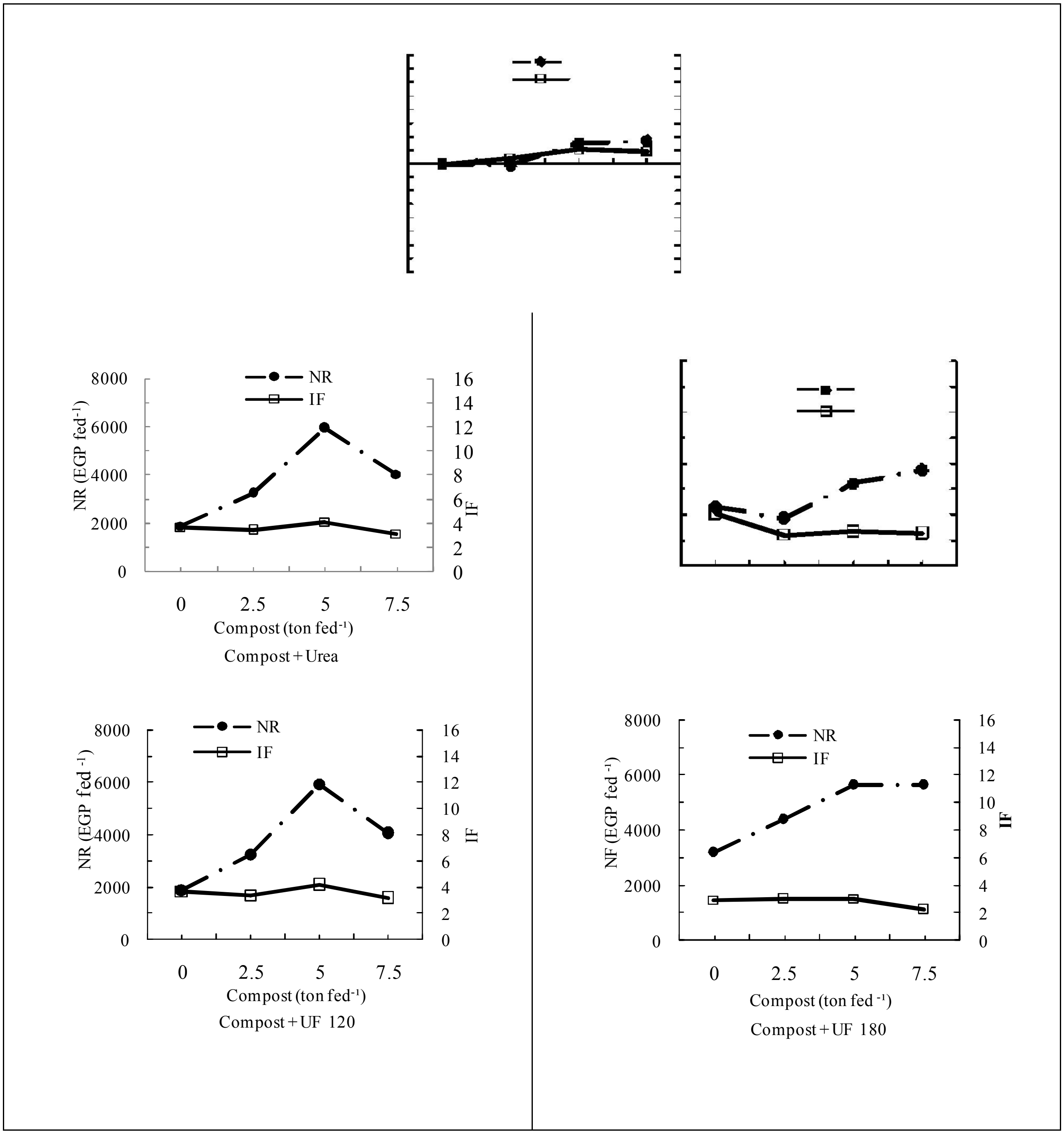

Fig.2 Effect of conjugation of compost and N-fertilizers application under drip irrigation system on NR and IF

Although the actual cost of avoided CO_2 depending on N-fixing process (N-fixed has not had any cost) in this experiment has been estimated at nothing (0.0 EGP fed^{-1}), it could be considered another new income source (Table 14) adding to the traditional primary net return where the policies makers in international agricultural and environmental organizations around the world have legislated some rules to sold the carbon reduction owing to pursuing the sustainable agricultural practices. For example, U.S. Agricultural Sector has offered monetary incentives to farmers adopting management practices which lead to reduce the emitted carbon dioxide (Jan *et al.,* 2004).

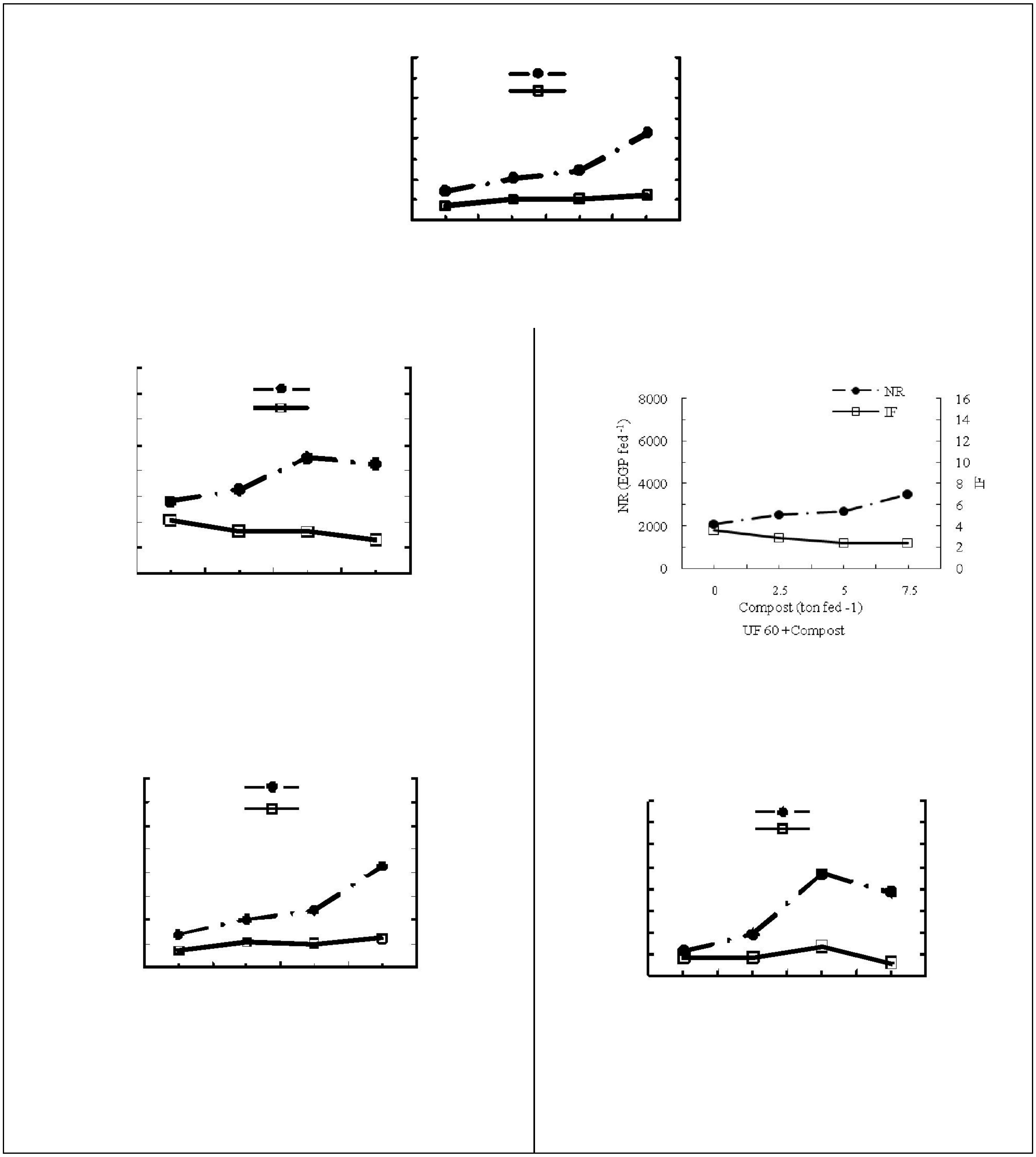

Fig.3 Effect of conjugation of compost and N-fertilizers application under sprinkler irrigation system on NR and IF

On the basis of European Union policy to combat climate change and reducing greenhouse gas emissions, Emissions Trading System of European Commission through its cap and trade schemes (www.CO2prices.eu) has put a price on carbon emissions reduction of € 20 for 1 ton CO_2. Using such price to` evaluate the avoided CO_2 economy in this study, it is found that the revenue of the avoided–CO_2 by using N-fixers (Table 14) has ranged from 24.42 to 19.19 EGP fed^{-1} $season^{-1}$ under DIS and SIS respectively, in relative increase profit has ranged from 1.19 to 0.64% for DIS and SIS respectively. For sub-treatments, it has ranged from 7.31 to 44.83 EGP $fed^{-1}season^{-1}$under DIS while under SIS, it has ranged from 6.68 to 31.90 EGP $fed^{-1}season^{-1}$respectively. The % net return increase values have ranged from 0.06 to 9.08% under DIS and from 0.31 to 0.87% under SIS. Overall, it is importance to observe that the combination among DIS, biological N-fertilizer and UF-fertilizer as management practices has given the higher revenue which would primarily refer to their better effectiveness on yield productivity.

Table 14 Net Return, Avoided CO_2 Emissions, Revenue of Avoided CO_2 Emissions, Total net Return and % Net Return Increase

treatments			Net return EGP fed^{-1}	Avoided CO_2 Kg.fed^{-1} season^{-1}	revenue of Avoided CO_2 EGP fed^{-1} season^{-1}	Total net return EGP fed^{-1}	% net return increase
irrigation	N-form Kg fed^{-1}	Compost Ton fed^{-1}					
Drip system	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	-80.71	46.19	7.31	-73.4	9.08
		5.0	1501.7	46.19	7.31	1509.01	0.49
		7.5	1713.3	119.88	18.97	1732.27	1.11
	Mean		1044.76	70.76	11.20	1055.96	3.56
	Urea, 120+15	0.0	1893.5	88.91	14.07	1907.57	0.74
		2.5	3257.3	145.25	22.99	3280.28	0.71
		5.0	5941.8	222.68	35.24	5977.03	0.06
		7.5	4041.3	257.92	40.82	4082.10	1.01
	Mean		3783.5	178.62	28.28	3811.75	0.63
	UF, 60	0.0	2283.12	44.86	7.10	2290.22	0.31
		2.5	1867.1	72.89	11.54	1878.64	0.62
		5.0	3222.3	147.12	23.28	3245.57	0.72
		7.5	3767.3	181.03	28.65	3795.94	0.76
	Mean		2784.9	111.52	17.64	2802.59	0.62
	UF, 120	0.0	4944.4	130.03	20.58	4964.97	0.42
		2.5	7222.9	178.36	28.23	7251.12	0.39
		5.0	7451.4	244.04	38.62	7490.01	0.52
		7.5	9008.2	283.29	44.83	9053.02	0.50
	Mean		7156.73	208.97	33.07	7189.78	0.46
	UF, 180	0.0	3181.2	131.63	20.83	3202.02	0.66
		2.5	4397.1	167.41	26.49	4423.59	0.60
		5.0	5625.5	248.31	39.30	5664.78	0.70
		7.5	5625.5	259.79	41.11	5666.61	0.73
	Mean		4707.3	201.76	31.93	4739.25	0.67
Mean			3895.43	154.33	24.42	3920.71	1.19
Sprinkler system	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		2.5	3094.39	58.02	9.18	3103.57	0.29
		5.0	3784.14	99.94	15.82	3799.96	0.41
		7.5	6229.0	123.49	19.54	6248.54	0.31
	Mean		4369.17	93.82	14.85	4384.02	0.34
	Urea, 120+15	0.0	2811.21	59.81	9.47	2820.67	0.34
		2.5	3267.10	111.07	17.58	3284.67	0.55
		5.0	4493.5	173.55	27.47	4520.96	0.61
		7.5	4244.3	189.30	29.96	4273.89	0.81
	Mean		3703.99	133.41	21.12	3725.05	0.58
	UF, 60	0.0	2103.03	110.00	17.41	2120.43	0.83
		2.5	2541.00	90.51	14.32	2555.32	0.56
		5.0	2690.80	124.42	19.69	2710.49	0.73
		7.5	3514.1	193.04	30.55	3544.64	0.87
	Mean		2712.23	129.49	20.49	2732.72	0.75
	UF, 120	0.0	1402.6	71.28	11.28	1413.88	0.81
		2.5	2035.5	92.38	14.62	2050.12	0.72
		5.0	2436.00	114.81	18.17	2454.16	0.75
		7.5	4286.58	201.59	31.90	4318.38	0.75
	Mean		2540.17	119.97	18.99	2559.14	0.76
	UF, 180	0.0	1155.2	42.19	6.68	1161.88	0.58
		2.5	1905.5	97.72	15.47	1920.96	0.81
		5.0	4667.8	222.5	35.21	4703.00	075
		7.5	3825.1	155.13	24.55	3849.64	0.64
	Mean		2888.40	129.38	20.48	2908.87	0.70
Mean			2540.31	121.21	19.19	3263.13	0.64

Revenue of avoided CO_2 fed^{-1} = price of ton CO_2 x avoided CO_2 emissions in ton fed^{-1}
Total net return fed^{-1} = net return fed^{-1} + revenue of avoided CO_2 fed^{-1}
Price of ton CO_2 is around € 20 =158.26 EGP and 1 Euro (€) = 7.9131 EGP

4. Conclusion

The results of this study pay attention to reconsider agriculture management practices for sandy soils and chose the proper one or ones which suffice optimal productivity with rational energetic & economic costs and also secure the ecosystem from CO_2 emissions. Also, the results have affirmed that using DIS as irrigation regime, UF-fertilizer as slow release N-fertilizer and rhizobia inoculation as N-fixer has had promised impact to combat global warming.

References

1. Abbady Kh. A., Barakat A. B., El-Mallah M. I. Khatab A. A. The effect of some slow release fertilizers on onion yield and successive sweet corn growth.1-The effect on onion bulb yield, bulb quality and chemical constituents. Egypt J. Appl. Sci. 1997; 12(3):245-261.

2. Abbady Kh.A., Abd El-Aal A.H., Abdel-Mawgoud A.S.A. Awaad M.S. Developed approach for grapevine fertilization. J. Agric. Sci. Mansoura Univ.2008; 33(1):871-886.
3. Abbady Kh. A., Sibak H. A., El-Gayar A. A. A study of ureaform using X-ray technique. Annals of agric. Sci. Moshtohor 1992;30 (4):2072-2079.
4. Abbady Kh. A., Ahmad M. M. M., Elshazly M. A., Amer Kh. A. Yield productivity and Energy-Saving Advantages at Applying Slow-Release Nitrogen Fertilizer in Upper Egypt.Nature and Science 2011;9 (5).
5. Abbady Kh. A., Hegab S.A.M., Awaad M.S., Abdel-Rehim G.H.Salama F.S.A.Ureaform performance as a slow release fertilizer under sprinkler irrigation system. J. Agric. Sci. Mansora Univ. 2003; 28 (11):6969-6979.
6. Abbady Kh. A, Mohamed Z.A., El-Gayar A. A. Dynamic process of ureaformaldehyde hydrolysis. Egypt, J. Appl. Sci.1991; 6 (9) 55-76.
7. Abd El-Aal A.H., Abbady Kh. A., Awaad M.S., Abdel-Mawgoud A.S.A. Yield, quality and profitability of ureaform fertilized apricot trees. J. Agric. Sci. Mansoura Univ. 2008; 23: 1395-1407.
8. Abd El-Mawgoud A.S.A., Gmeh M.A., Abd-Elaziz S.H., El-Sayed M.M.Wheat-Water relations at various irrigation regims with modern irrigation systems under climatic conditions of Assiut Governorate,Upper Egypt. J.Agric. Sci. Mansoura Univ. 2007; 32(7):6051- 6066.
9. Adlan M.A.M., Mukhtar N.O. Quantifying N_2fixed by groundnut (ArachisIshypogaeaL.) as comared to some summer legumes using N^{15} methodology with different reference crops. U.K. J.Agric.Sci.2004; 12: 357-369.
10. Bhat M.G., English B.C., Turhollow A.E, Nyangito H. Energy in synthetic Fertilizers and Pesticides: Revisited,. ORNL/ Sub/ 90-99732/2, National Laboratory, 1994: Oak Ridge, Tennessee.
11. Bobby R. Golden, Nathan A. Slaton, Richard J. Norman, Edward E. Gbur, Jr., Kristofor R. Brye, Russell E. DeLong, Recovery of Nitrogen in fresh and palletized poultry litter by rice. Soil Sci. Soc. Am. J. 2006:70:1359-1369.
12. Chapman H.I., Pratt P.F. Methods Analysis for Soils, Plants and Waters. University of California, Kerkelcy, 1961: 309.
13. Danso S.K.A., Eskew D.L.,Enhancing biological nitrogen fixation.IAEA Bulletin 1981; 26, No.2.
14. Emissions Trading System of European Commission. Cap and Trade Schemes, Analysis of the EU CO2 Market 2012. (www.CO2prices.eu).
15. FAO, Fertilizers and their use.4th Edition. Published FAO and IFA. 2000: Rome.
16. FAO, Fisheries in irrigation systems of arid Asia.Technical paper 2004; Rome.www. Fao.org.
17. Gellings C.W., Parmenter K. E. Energy efficiency in fertilizer production and use, in efficient use and conservation of energy,[Eds.ClarkW.Gellings and Kornelis B.], in Encyclopedia of Life Support Systems.(EOLSS), Developed under the Auspices of the UNESCO Eolss Publishers, Oxford, UK, 2004: [www.eolss.net]
18. Goering C.E Engine and tractor power, St. Joseph. 1989; MI: ASAE.
19. Hegazy M.H., Knany R.E, Abbady Kh,A. Efficiency of ureaform vs. other N-sources for rice-wheat rotation, J.Agric.Mansoura Univ.1998;23(1):485-493.
20. Jackson, M.L. Soil Chemical Analysis, Prentic-Hall Inc. U.S.A. 1958.
21. Jan Lewandrowski, Mark Peters, Carol Jones, Robert House, Mark Sperow, Marlen Eve, Keith Paustian. Economics of sequestering carbon in the U.S. agricultural sector.Technical Bulletin No.(TB-1909) 2004: 69 pp.
22. Meisner C.A., Karnok K.J. Peanut root response to drought stress. Agron. J. 1992; 84:159–165.
23. Merchan-Paniagua S. Use of slow-release N fertilizer to control nitrogen losses due to spatial and climatic differences in soil moisture conditions and drainage in clay pan soils. M.Sc. thesis, Univ. of Missouri, Columbia, MO. 2006.
24. Page, A.L..Methods of Soil Analysis, Agron.9, 2nd ed., Am. Soc. Agron.Madson, WI, USA.1982
25. Philip J. Hughes, Glenn McGregor. Global warming-related effects on agriculture and human health and comfort, Nature, 2009: 121 pages.
26. Rao, R.C.N., Williams J.H., Sivakumar M.V.K., Wadia K.D.R.Effect of water deficit at different growth phases of peanut: II.Response to drought at pre-flowering phase. Agron. J.1988: 80:431–438.
27. Reddy, C.R., Reddy S.R.Scheduling irrigation for peanuts with variable amounts of available water. Agric. Water Manage. 1993: 23:1–9.
28. Reddy,T.Y.,ReddyV.R., Anbumozhi V. Physiological responses of groundnut (Arachishypogaea L.) to drought stress and its amelioration: A critical review. Plant Growth Regul. 2003:41:75–88.
29. Shelke P.P.Selection of Pump set for Irrigation System in griculture.Technology.Articles.2010 www.**water**ight.org
30. Soil Conditioner Development Project, Soils, Water and Environment Research Institute, Agriculture Research Center. Egypt. 2012.
31. Snedecor, G.W, Cochran W.G. Statistical Methods. 7thed. Iowa State Univ. Press. Ames. Iowa, USA, 1980:507.
32. U.S. Environmental Protection Agency, Emission Facts: Average carbon dioxide emissions resulting from gasoline and diesel fuel: 2005 (www.epa.gov).
33. USDA, Keys to Soil Taxonomy, 10th Edition. United State Department of Agriculture (USDA). USA. 2006
34. Zahran, H.H., Rhizobium-Legume symbiosis and Nitrogen fixation under sever conditions and in an arid climate. Microbiol. Mol Biol.Rev.1999:63(4) 968-89.

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