

**RESPONSE OF WHEAT TO VARIOUS  
N-APPLICATIONS UNDER DIFFERENT  
IRRIGATION SYSTEMS IN  
SANDY SOILS**

**Mostafa. M.M\* ; M. N. E. Khalil\* ; A. A. , Sheha\* ;**

**A. M. Selim\*\* and E. S. M. K. , Selim\*\***

**\* Soil science , Faculty of Agriculture, Zagazig university.**

**\*\*Soil science of National Research of Center.**

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**ABSTRACT:** The aim of this work was to study, nitrogen fertilization under different irrigation systems and the consequent effect on the performance and yield of wheat in a newly reclaimed soil. The experiments were conducted at El-Bostan farm, Nobarria where the soil is sandy calcareous in nature and of a poor nutritional quality. Three N-fertilizers were used namely ammonium sulphate (AS), Urea formaldehyde (UF) and chicken manure (Ch.M). Treatments included three rates of nitrogen: 75, 100 and 125 kgN/fed.

Irrigation of the experiment followed once a week through the growing season (20 weeks) using three irrigation systems,(surface, drip and sprinkler). At maturity, yield and yield attributes were assayed.

Straw yield ranged between 1.83 and 5.89 kg / plot. Ammonium sulphate and urea formaldehyde treatments gave more straw yield under drip irrigation than under surface irrigation. Grains yield ranged between 0.54 and 2.62 kg / plot. Surface irrigation gave the lowest grains yield and drip irrigation gave the highest yield of grains.

N-uptake ranged between 17.4 - 36.5 and 27.7 and 81.6 g N/plot for straw and grain yield respectively. Sprinkler irrigation gave the highest N - uptake under all N - rates and sources compared to drip or surface irrigation. Phosphorus uptake by straw ranged between 0.16 and 1.82 g p / plot and by grains between 4.4 and 28 g p/plot.. Urea formaldehyde and chicken manure treatments recorded higher P uptake by both straw and grains than ammonium sulphate treatment. Surface irrigation gave higher P uptake compared to drip or sprinkler irrigation. Amounts of K uptake by wheat straw ranged between 25.5 and 93.6 g / plot and by grains between 6.0 and 17.7 g / plot. .

N-utilization efficiency % ranged between 29 and 35. Urea formaldehyde gave a systematic increase in utilization efficiency by increasing N - dose . The values started with 39% for the first dose and went up to 43 % for the second dose then went down to 34 for the third dose. Under sprinkler irrigation, ammonium sulphate and also urea formaldehyde recorded their best performance in connection to N-use efficiency .

Sprinkler irrigation combined with the high rate of either urea formaldehyde or chicken manure, gave the best water and nitrogen expenditure.

*Key word:* Sandy soils, System irrigation, N-sources, Wheat plant, Chicken Manure.

## INTRODUCTION

In the newly reclaimed sandy soils of Egypt , modern irrigation systems, such as sprinkler and drip, are being widely used and have proved to be more efficient than surface irrigation. The combination of irrigation systems with organic or slow release fertilizers has been tried in order to attain higher

yields. The productivity in such sandy areas is far less than the yielding ability of most cultivars due to poor soil fertility, decreased water and fertilizer use efficiency and also bad management. Metwally and Khamis (1998) indicated that, the N requirements of wheat could not be met by the separate application of any organic source examined. The best mixture

ratio between organic and inorganic N sources was 1:1. The greatest physiological efficiency was noticed, however, where organic N sources were applied alone. Gupta *et al* (2000) reported that, combined application of urea and farmyard manure significantly enhanced available N status over similar N addition through urea alone. They also indicated that, available P and K content of the soil decreased with successive rise in levels of N addition through urea whereas the status of these nutrients increased in plots receiving combined application of urea and manures. Jouffroy and Bouchard (1999) studied the effect of intensity and duration of nitrogen deficiency on wheat grain number in order to develop optimum N fertilizer management strategies. Rates and dates of N fertilizer application were varied in field trials in 1990 – 96 on a sand clay loam soil. They developed a nitrogen deficiency index (NDI), where seven criteria describing the deficiency were estimated for each treatment. Their results indicated that, whatever the grain number component affected (spike number per square meter or grain number per spike), the relative grain number (RGN) appeared to depend

on the history of the deficiency. Also, Nanwai *et al* (1998) reported that, Highest grain yield of wheat (7.04 and 6.05 ton/ha) was recorded with 125% of the recommended dose of inorganic fertilizers (150, 75 and 50 kg N, P<sub>205</sub> and K<sub>20</sub>/ha) integrated with 25 kg ZnSO<sub>4</sub> and organic fertilizer (farmyard manure) at 10 ton/ha. Lotfollahi *et al* (1997) conducted experiments in pots to determine the effects of subsoil nitrogen (N) on grain yield and grain protein concentration (GPC) of wheat, using a sandy soil low in available N. Their results showed that, the subsoil N increased root growth and this resulted in increased water use efficiency. Application of 150 mg N at 60 cm depth, 2 weeks after anthesis, significantly increased grain yield and GPC. It was also shown that, although there was an increase in the rate of N uptake by the roots, the main factor that influenced the utilization of subsoil N was the root length density. Therefore, the aim of this work is to study, in a comparative way, the different aspects of nitrogen fertilization management under different irrigation systems on sources straw and grain yield of wheat in sandy calcareous soil.

## MATERIALS AND METHODS

The experiments were conducted at El-Bostan farm, Nobaria where the soil is sandy calcareous in nature and of a poor nutritional quality. Some physical and chemical characteristics of the soil are shown in Table (1). 100 Kg. / fed. Super phosphate was mixed with the soil. The field was divided into three main blocks one was prepared for surface irrigation, the second and the third were equipped for drip and sprinkler irrigation systems respectively. Plots of 2X3.5m (1/600 Fed.) were established in each block to allow for three replicates for each fertilization treatment.

**Table (1) :** Some physical and chemical properties of the studied soil.

Soil property	Value
Location	El-Bostan
Texture	Sandy
ECdS/m(extraction 1:5)	10
pH ( Suspension 1:2.5 )	8.5
Total N (mg/100g)	65.5
available-N(mgN/100 g)	5.2
Available P (ppm)	22.2
Available K (ppm)	360
Available SO <sub>4</sub> (ppm)	200
O.M %	0.3
Ca(CO <sub>3</sub> )%	17.0

Three N-fertilizers were used namely ammonium sulphate (AS), Urea formaldehyde (UF) and chicken manure (Ch.M). Treatments included three rates of nitrogen: 75, 100 and 125 kgN/fed. Ammonium sulphate was applied in three doses, the first (30%) at planting, the second (40%) at tillering and the third (40%) at spike formation. Whereas urea formaldehyde and chicken manure were added as single dose before seeding.

Wheat seeds ( sakha 69 ) as recommended for this region were treated with an appropriate fungicide and sowed at a rate of 70 kg/fed. on the 15<sup>th</sup> of November 2002. Plant heights were monitored after 6, 12 and 20 weeks from planting.

Irrigation of the experiment followed once a week through the growing season (20 weeks) using the three irrigation systems (surface, drip and sprinkler). Calculations of the discharge of the used pump and time of irrigation revealed the following water utilization along the growing season.

Irrigation System	M <sup>3</sup> /fed./one irrigation	M <sup>3</sup> /fed. / season
Surface	515	10310
Drip	114	2280
Sprinkler	330	6600

After complete maturity, plots were harvested and the yields of straw and grains were estimated. Samples were taken to determine their content of nutritional elements. Water and Nitrogen Use Efficiencies were calculated using water input and N-uptake data for each N- Fertilizer under each irrigation system. Standard methods of determination were followed according to Cottenie *et al.*, (1982) and results were subjected to statistical analysis.

## RESULTS AND DISCUSSION

### *Straw and grain yield:*

Straw yield ranged between 1.83 and 5.89 kg / plot (Table 2). The effect of N- source on the straw yield is evident. Also the rate of N – application seemed to be of special effect within each irrigation system. Under surface irrigation, there was a gradual increase of straw yield as the N- rate increased from 75 to 125 kg. N / fed. High N-rate of ammonium sulphate yielded almost twice as much straw compared to the low rate. This wide difference, however, is not applicable in case of urea formaldehyde or chicken manure where the differences were much narrower. Drip irrigation

treatments gave generally higher straw yield in comparison with surface irrigation. The effect of N-rate is not so much evident as the effect of N – source. Chicken manure again gave the highest straw yield as in the case of surface irrigation. It should be noticed that both ammonium sulphate and urea formaldehyde treatments gave more straw yield under drip irrigation than under surface irrigation.

On the other hand , Sprinkler irrigation gave remarkably higher straw yield in the ammonium sulphate treatment. This observation does not extend, however to the urea formaldehyde or chicken manure treatments. The latter two N- sources gave relatively lower straw yield than similar fertilization treatments under drip or surface irrigation.

Grains yield as shown in Table (2) reflected a rather different trend. Grains yield ranged between 0.54 and 2.66 kg. / plot. Surface irrigation gave the lowest grains yield and drip irrigation gave the highest yield of grains. The effect of N - rate, again, seemed not to be of major impact on grain yield as seen from Table (2), the source of nitrogen played the principal role in grains

Table (2): Straw and grains yield of wheat ( Kg / plot) as effected by adepated irrigation and fertilization regimes

Irrigation	Rate Source	Straw			Mean	Grains			Mean
		75	100	125		75	100	125	
Surface	AS	1.83	2.45	3.37	2.55	0.54	0.99	1.03	0.85
	UF	3.44	4.03	4.27	3.91	0.94	1.63	1.60	1.39
	CM	5.02	5.67	5.00	5.23	1.76	2.40	1.94	2.03
Mean		3.43	4.05	4.21	3.90	1.08	1.67	1.52	1.42
Drip	AS	2.91	3.68	3.86	3.48	1.11	1.05	1.05	1.07
	UF	4.11	5.23	5.30	4.88	1.45	1.83	2.22	1.83
	CM	5.66	5.29	5.89	5.61	2.16	2.03	2.53	2.24
Mean		4.23	4.73	5.02	4.66	1.57	1.64	1.93	1.71
Sprinkler	AS	4.53	4.11	4.31	4.32	1.82	1.87	2.14	1.94
	UF	3.53	4.23	5.86	4.54	1.36	2.66	2.62	2.01
	CM	4.44	2.84	3.70	3.66	1.67	1.97	2.54	2.66
Mean		4.17	3.73	4.62	4.17	1.62	1.97	2.43	2.01
Mean of source		3.09	3.41	3.85	3.45	1.16	1.30	1.41	1.29
		3.69	4.50	5.14	4.44	1.25	1.84	2.15	1.75
		5.04	4.60	4.86	4.83	1.86	2.13	2.34	2.11
Mean of rate		3.94	4.17	4.62		1.42	1.76	1.96	

LSD 0.05 I=0.7330\*\* I X S = 0.7364\* I = 0.7776<sup>ns</sup> I X S = 5.062<sup>ns</sup>  
 S=0.7330\*\* I X R = 0.8269\*\* S = 0.7776<sup>ns</sup> I X R = 4.087<sup>ns</sup>  
 R=0.7330\*\* S X R = 1.432<sup>ns</sup> R = 0.7776\*\* S X R = 4.087<sup>ns</sup>  
 I X S X R = 1.432<sup>ns</sup> I X S X R = 7.079<sup>ns</sup>

production. Slow released N- fertilizer as urea formaldehyde in this case and also organic sources as chicken manure gave relatively higher grain yields. This may be due to the continuous supply of N – along the growing season and especially at the stage of grains formation. Misra and Prasad (2000) affirmed that for sustained production in a rice - wheat cropping system, integrated nutrient management involving both organic manures/ residues and chemical fertilizers was essential. In this connection it should be noted that ammonium sulphate, readily soluble and available, could be a good source of nitrogen at the beginning of plant development but not at the final stages of growth unless added to the soil in several doses.

### ***Nitrogen, phosphorus and potassium:***

#### ***uptake by wheat plants :***

N-uptake (Table3) by wheat straw ranged between 17.4 and 36.5gN/plot. Although the differentiation in straw yield among different treatment was so wide and noticeable, the N-uptake does not reflect a great differences among treatments. This may indicate different N- concentrations

in straw of different treatment. On the contrary, N- Uptake by grains is much more variable among different N- fertilizer and irrigation treatments. N – uptake by grains ranged between 27.7 and 81.6 g N/plot. Sprinkler irrigation gave the highest N – uptake under all N – rates and sources compared to drip or surface irrigation.

Grant *et al* (2001) stressed the importance of N fertilization timing for wheat. Also, Patel *et al* (1994) stated that wheat grain yield was not significantly affected by N source in a field experiment on loamy sand soil. Metwally and Khamis (1998) concluded that, the N requirements of wheat could not be met by the separate application of any organic source examined.

Phosphorus uptake by straw ranged between 0.16 and 2.12 g. p/ plot (Table 4). Grains P ranged between 4.4 and 28.2 g. p / plot.

In general, P uptake by straw was considerably low in comparison with grains P uptake. Organic N- fertilizers seemed to provide more P to the plant in comparison with ammonium sulphate. Urea formaldehyde and chicken manure treatments recorded higher P uptake by both straw and grains than ammonium

Table (3): N – Uptake ( gN / plot) by wheat straw and grains at maturity stage as affected by adapted irrigation and fertilization Treatments

Irrigation	Rate Source	Straw			Mean	Grains			Mean
		75	100	125		75	100	125	
Surface	AS	17.41	20.19	34.30	23.97	27.74	29.08	40.08	32.30
	UF	21.53	23.31	23.24	22.69	28.16	49.04	48.87	42.02
	CM	27.56	31.83	27.45	28.95	56.40	81.65	59.15	65.73
Mean		22.17	25.11	28.33	25.20	37.43	53.26	49.37	46.69
Drip	AS	25.72	30.53	35.19	30.48	38.67	42.06	33.50	38.08
	UF	19.65	23.82	26.62	23.36	42.58	41.32	50.30	44.73
	CM	28.47	23.18	36.49	29.38	58.40	58.63	70.78	62.60
Mean		24.61	25.84	32.77	27.74	46.55	47.34	51.53	48.47
Sprinkler	AS	27.54	32.45	29.51	29.83	70.16	61.24	68.36	66.59
	UF	21.65	22.74	33.56	25.98	39.77	67.44	67.34	58.18
	CM	23.87	15.25	24.21	21.11	45.64	50.09	68.33	54.67
Mean		24.35	23.48	29.09	25.64	51.86	59.59	68.01	59.82
Mean of source		23.56	27.72	33.00	28.04	45.52	44.13	47.31	45.65
		20.94	23.29	27.81	24.01	36.84	52.60	55.50	48.31
		26.63	23.42	29.38	26.48	53.48	63.46	66.09	61.01
Mean of rate		23.71	24.81	30.06		45.28	53.40	56.30	

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LSD 0.05 I = 6.998<sup>ns</sup> I X S = 6.063<sup>ns</sup> I = 7.143\* I X S = 15.67<sup>ns</sup>  
 S = 6.998\* I X R = 6.154\*\* S = 7.143<sup>ns</sup> I X R = 14.03\*  
 R = 6.998<sup>ns</sup> S X R = 6.154<sup>ns</sup> R = 7.143\* S X R = 14.03<sup>ns</sup>  
 I X S X R = 10.66<sup>ns</sup> I X S X R = 24.29<sup>ns</sup>



Table (4): P - Uptake ( gP / plot) by wheat straw and grains at maturity stage as affected by adepated irrigation and fertilization Treatments

Irrigation	Rate Source	Straw			Mean	Grains			Mean
		75	100	125		75	100	125	
Surface	AS	0.16	0.23	0.29	<b>0.23</b>	10.50	9.94	12.44	<b>10.96</b>
	UF	0.26	0.42	0.45	<b>0.38</b>	18.14	18.09	22.70	<b>19.64</b>
	CM	0.69	1.05	0.78	<b>0.84</b>	28.19	25.58	22.98	<b>25.58</b>
<b>Mean</b>		<b>0.37</b>	<b>0.51</b>	<b>0.51</b>	<b>0.48</b>	<b>18.94</b>	<b>17.87</b>	<b>19.37</b>	<b>18.73</b>
Drip	AS	0.93	0.88	0.96	<b>0.92</b>	4.44	4.94	4.87	<b>4.75</b>
	UF	1.02	1.15	1.17	<b>1.11</b>	7.43	8.46	8.47	<b>8.12</b>
	CM	1.81	1.32	2.12	<b>1.75</b>	12.28	11.82	14.12	<b>12.74</b>
<b>Mean</b>		<b>1.25</b>	<b>1.12</b>	<b>1.42</b>	<b>1.26</b>	<b>8.05</b>	<b>8.41</b>	<b>9.15</b>	<b>8.54</b>
Sprinkler	AS	0.68	0.82	0.69	<b>0.73</b>	6.15	5.35	6.47	<b>5.99</b>
	UF	0.63	0.72	0.99	<b>0.78</b>	5.14	6.96	5.42	<b>5.84</b>
	CM	1.82	0.79	1.67	<b>1.23</b>	7.87	9.57	10.90	<b>9.45</b>
<b>Mean</b>		<b>1.04</b>	<b>0.78</b>	<b>0.92</b>	<b>0.91</b>	<b>6.39</b>	<b>7.29</b>	<b>7.60</b>	<b>7.09</b>
Mean of source		0.54	0.64	0.65	<b>0.63</b>	7.03	6.74	7.93	<b>7.23</b>
		0.64	0.79	0.87	<b>0.77</b>	10.24	11.17	12.20	<b>11.20</b>
		1.44	0.05	1.32	<b>1.27</b>	16.11	15.66	16.00	<b>15.92</b>
<b>Mean of rate</b>		<b>0.89</b>	<b>0.82</b>	<b>0.95</b>		<b>11.13</b>	<b>11.19</b>	<b>12.04</b>	

LSD 0.05 I=0.2596\* I X S = 0.1656\*\* I = 1.464\*\* I X S = 3.272<sup>ns</sup>  
 S= 0.2596\* I X R = 0.2159<sup>ns</sup> S = 1.464<sup>ns</sup> I X R = 2.844\*\*  
 R = 0.2596\*\* S X R = 0.2159\*\* R = 1.464\*\* S X R = 2.844<sup>ns</sup>  
 I X S X R = 0.3740\*\* I X S X R = 4.927<sup>ns</sup>



sulphate treatment. In this respect the N - rate also gave an additional effect since higher rates of Urea formaldehyde or chicken manure means higher rates of organic matter which in turn increase the availability of soil phosphorus through the effect on soil pH and on the solubility of phosphates due to produced organic acids in the soil. The effect of the irrigation system on P uptake is evident in this case. . *Ottman and Pope* , (2000) reported similar results on irrigated wheat.

Surface irrigation gave higher P uptake compared to drip or sprinkler irrigation. This might be due to the abundance of water under surface irrigation which helps in the hydrolysis of organic N - fertilizer in the soil .

As seen from Table (5), amounts of K taken up by wheat straw ranged between 25.6 and 113.5 g. / plot. Ammonium sulphate treatments gave lower amounts of K compared to urea formaldehyde and chicken manure treatments , except in the sprinkler irrigation , UF was the lowest.

The lowest N - rate (75 kg./ fed.) gave the lowest K uptake compared to the other two rates (100 and 125 kg N/fed). Uptake of

K by grains ranged between 6.0 and 17.7 g/ plot. Such amounts are extremely low compared to N – uptake or even P uptake by grains. K content in grains seems not to be effected by the different variables like irrigation regime, N - source or N - rate. *Khan et al* (2000) and *Olesen et. al.* (2000) emphathized the positive effect of organic N applications on nutrients absorption.

#### *Nitrogen utilization efficiency :*

The N-utilization efficiency % was calculated using the total N - uptake by straw and grains yield of one unit area (feddan) and dividing by the amount of N applied in each fertilization treatment and multiplying by 100, Table (6). The percentages representing the N- utilization efficiencies (Tables) reflect the combined effect of N - source, N – dose and irrigation system. So, it is easy to compare the utilization efficiency of fertillizer nitrogen under each irrigation system, on one hand, and among the three irrigation systems used, on the other.

From Table (6), it is clearly shown that under surface irrigation, ammonium sulphate gave the lowest values. N rate

**Table (6a): Utilization efficiency of applied N-fertilizers under Surface Irrigation System.**

N-Source	N-Rate Kg/fed.	N-Uptake (Kg/fed.)			N-Utilization Efficiency %
		Straw	Grains	Total	
Ammonium Sulphate	75	10.45	16.64	27.09	36.12
	100	12.11	17.45	29.56	29.56
	125	20.58	24.05	44.63	35.70
Urea Formaldehyde	75	12.92	16.90	29.82	39.76
	100	13.99	29.42	43.41	43.41
	125	13.94	29.32	43.26	34.61
Chicken Manure	75	16.54	33.84	50.38	67.17
	100	19.10	48.99	68.09	68.09
	125	16.47	35.49	51.96	41.57

**Table (6b): N-utilization efficiency of applied N-fertilizers under Drip Irrigation System.**

N-Source	N-Rate Kg/fed.	N-Uptake (Kg/fed.)			N-Utilization Efficiency %
		Straw	Grains	Total	
Ammonium Sulphate	75	15.43	23.20	38.63	51.51
	100	18.32	25.24	43.56	43.56
	125	21.11	20.10	41.21	32.97
Urea Formaldehyde	75	11.79	25.55	37.34	49.79
	100	14.29	24.79	39.08	39.08
	125	15.97	30.18	46.15	36.92
Chicken Manure	75	17.08	35.04	52.12	69.49
	100	13.91	35.18	49.08	49.08
	125	21.89	42.47	64.36	51.49

played a little role since the values ranged between 29 and 35. Urea formaldehyde gave a systematic increase in utilization efficiency by increasing N - dose. The values started with 39% for the first dose and went up to 43 % for the second dose then went down to 34 for the third dose. Here, it is interesting to note that under surface irrigation, a readily soluble and available N - source like ammonium sulphate might be easily lost in drainage water and thus lower efficiency of N- fertilizer could be encountered. On the other hand, urea formaldehyde, being slow released, may take much more time to hydrolyze and to be ready for plant absorption and therefore is less susceptible to loss by leaching.

It is important to note that higher rates of N in this case, did not mean higher utilization efficiency. This observation was repeatedly noticed. Chicken manure treatments recorded the highest efficiency reaching 68% but again dropped down to 41% with the highest N - rate.

Under drip irrigation system, Table (6), a similar trend is noticed

but with slightly different magnitude. The performance of ammonium sulphate is much better under this system giving 51.5% for the first N rate and 43.6% for the second and 33% for the third rate. The increase in N-use efficiency of ammonium sulphate under drip irrigation might be due to diminished possibility of leaching losses of nitrogen. Also, Urea formaldehyde, recorded higher N-use efficiency under this system. Chicken manure, on the other hand, reflected values similar to that under surface irrigation especially under the lowest N-rate (75kg/fed).

In general, N-use efficiency of chicken manure , Table ( 6b) , fluctuated between 49 and 51%.

Under sprinkler irrigation Table (6c), ammonium sulphate and also urea formaldehyde recorded their best performance in connection to N-use efficiency . It is worthy to note that increased N-use efficiency can be related to either higher yield or rather better quality (N%). Therefore, it is important to take the yield into consideration.

**Table (6c): N-utilization efficiency of applied N-fertilizers under Sprinkler Irrigation System.**

N-Source	N-Rate Kg/fed.	N-Uptake (Kg/fed.)			N-Utilization Efficiency %
		Straw	Grains	Total	
Ammonium Sulphate	75	16.52	42.10	58.62	78.16
	100	19.47	36.74	56.21	56.21
	125	17.71	41.02	58.73	46.98
Urea Formaldehyde	75	12.99	23.86	36.85	49.13
	100	13.64	40.46	54.10	54.10
	125	20.14	40.40	60.54	48.43
Chicken Manure	75	14.32	27.38	41.7	55.60
	100	9.15	30.05	39.20	39.20
	125	14.53	41.00	55.53	44.42

**Table (7):** Water and nitrogen expenditure in relation to wheat grains production under different fertilization and irrigation systems.

Irrigation System	N-Fert.	Water expenditure m <sup>3</sup> /kg Grains			N- expenditure kgN/ kg Grains		
		R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>
Surface	AS	32.2	17.3	16.7	0.23	0.17	0.20
	UF	18.1	10.5	10.7	0.13	0.10	0.13
	Ch.M	9.8	7.2	8.9	0.11	0.07	0.07
Drip	AS	3.4	3.6	3.6	0.20	0.16	0.11
	UF	2.6	2.0	1.7	0.09	0.09	0.14
	Ch.M	1.8	1.9	1.5	0.08	0.08	0.06
Sprinkler	AS	6.0	5.9	5.1	0.09	0.09	0.07
	UF	8.1	5.3	4.2	0.08	0.08	0.15
	Ch.M	6.6	5.6	4.3	0.08	0.09	0.08

AS = Am. Sulphate    UF = Urea Formald.    Ch.M = Chicken Manure

R<sub>1</sub> = 75kgN/fed.    R<sub>2</sub> = 100kgN/fed.    R<sub>3</sub> = 125kgN/fed.



**Water and Nitrogen expenditure in relation to grain production:**

Dividing the amounts of water consumed in each irrigation system (as recorded in the materials & methods section) on the grain yield of each corresponding treatment would give an indication of how much water ( $m^3$ ) is needed to produce 1 kg of wheat grains. Also, dividing the consumed amount of fertilizer nitrogen by the yield of grains, would give another indication of how much nitrogen (kg N) is needed to produce 1 kg of wheat grains. Table (7) contains the calculated water and nitrogen expenditure for all studied treatments. It is shown that surface irrigation recorded the highest water expenditure. It is also obvious that increasing the rate of nitrogen might decrease the water expenditure. Differences among N-sources are also evident, chicken manure seems to contribute more positively in this respect than ammonium sulphate. On the other hand, nitrogen consumption does not reveal that much differences either in relation to N-source or N-rate. However, under drip and sprinkler irrigation, the best expenditure of N is noticed. Similar conclusions were

drawn by Sandhu *et. al.* (2000) . Therefore, taking the yield of grains of each treatment into consideration, it could be stated that sprinkler irrigation combined with the high rate of either urea formaldehyde or chicken manure, gave the best water and nitrogen expenditure.

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## استجابة القمح الى معاملات الآزوت

### تحت نظم رى مختلفة فى الاراضى الرملية

مصطفى محمد مصطفى\* محمود نبيل ابراهيم خليل\* - عادل عبد الرحمن شبيحة\*-

- عبد الخالق مراد سليم\*\* \* السيد شبل متولى قاسم سليم\*

\* قسم علوم الأراضى - كلية الزراعة - جامعة الزقازيق

\*\* قسم علوم الأراضى - المركز القومى للبحوث - الجيزة - ج.م.ع

الهدف من هذا العمل هو دراسة التسميد الآزوتى تحت نظم رى مختلفة والتأثير المتعاقب على التفضيل ومحصول القمح فى الأراضى المستصلحة حديثا.

تم اجراء التجارب فى مزرعة البستان بالنوبارية فى قطع تجريبية مساحة كل منها ٣,٥ x ٢ متر (٦٠٠/١) فدان حيث الأرض رملية جيرية فى طبيعتها وفقيرة فى المحتوى الغذائى وقد استخدمت ثلاث اسمدة آزوتية هى:

١- كبريتات الأمونيوم (AS)

٢- اليوريافورمالدهيد (UF)

٣- سبلة الدولجن (Ch.M)

اشتملت المعاملات على ثلاث معدلات من النيتروجين هى (٧٥، ١٠٠، ١٢٥ كجم نيتروجين/فدان) واتبع رى التجربة مرة واحدة كل اسبوع خلال موسم النمو (٢٠ اسبوع) وباستخدام ثلاث نظم للرى (سطحى - تنقيط - رش) وعند النضج تم تقدير المحصول ومكوناته.

تراوح قش القمح بين ١,٨٣ - ٥,٨٩ كجم قش/ قطعة تجريبية أى بمعدل ١٠٩٨ - ٣٥٣٤ كجم قش/فدان.

كما أعطت معاملات كبريتات الأمونيوم واليوريافورمالدهيد محصول قش أعلى تحت نظام الرى بالتنقيط عنه تحت نظام الرى السطحى.

تراوح محصول الحبوب بين ٠,٥٤ - ٢,٦٢ كجم/قطعة تجريبية أى بمعدل ٣٢٤ - ١٥٧٢ كجم حبوب/فدان كان أقلها تحت نظام الري السطحي وأعلىها تحت نظام الري بالتنقيط.

تراوح امتصاص النيتروجين بين ١٧,٤ - ٣٦,٥، ٢٧,٧ - ٨١,٦ جرام نيتروجين/قطعة تجريبية لكل من محصول القش والحبوب على التوالي.

أعطى الري بالرش أعلى امتصاص للنيتروجين تحت كل معدلات النيتروجين ومصادر النيتروجين مقارنة بكل من الري بالتنقيط والسطحي.

تراوح امتصاص الفوسفور بواسطة القش بين ٠,١٦ - ١,٨٢ جرام فوسفور/قطعة تجريبية والحبوب بين ٤,٤ - ٢٨ جرام فوسفور/قطعة تجريبية.

سجلت معاملات اليوريا فورمالدهيد وسماد الدواجن أعلى امتصاص للفوسفور بواسطة كل من القش والحبوب عن معاملة كبريتات الأمونيوم.

أعطى الري السطحي أعلى امتصاص للفوسفور مقارنة بالري بالتنقيط والري بالرش.

كما تراوحت كميات البوتاسيوم الممتصة بواسطة قش الفمخ بين ٢٥,٥ - ٩٢,٦ جرام/قطعة تجريبية والحبوب بين ٦,٠٠ - ١٧,٧ جرام/قطعة تجريبية.

النسبة المئوية لكفاءة الاستفادة من الآزوت تراوحت بين ٢٩ - ٣٥ واعطت اليوريافورمالدهيد زيادة منتظمة في كفاءة الاستفادة بزيادة جرعة النيتروجين.

القيم بدأت بـ ٣٩% للدفعة الأولى وزادت الى ٤٣% للدفعة الثانية ثم انخفضت الى ٣٤% للدفعة الثالثة.

وقد سجلت المعاملة التي ارتبط فيها الري بالرش مع المستوى العالى لأى من كبريتات الأمونيوم، واليوريا فورمالدهيد أفضل استجابة فيما يتعلق بكفاءة استخدام الآزوت.

كما تبين أن الري بالرش مع المعدل العالى من أنى من اليوريافورمالدهيد وسماد سبنة الدواجن أعطت أفضل انفاق للمياه والنيتروجين.