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Influence of Nitrogen, Biofertilizer, Compost Addition and Sowing Dates on Wheat Grown in Upper Egypt

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ABSTRACT

Response of wheat yield to nitrogen fertilization is differing according to soil, fertilizer, application method, weather conditions, and sowing dates. Two field experiments were carried out during the two successive winter growing seasons of 2014/2015 and 2015/2016 at Kom Ompo Agriculture Research Station, Aswan Governorate, Egypt (24° 28' 38.604" N and 32° 56' 50.671" E) to evaluate the influence of three sowing dates (November 1st and 20th and December 10th) and five treatments of nitrogen fertilization (75 kg N fed^{-1}, 56.25 kg N+ inoculation with biofertilizer, 56.25 kg N + 10 m^3 compost, 37.5 kg N +biofertilizer+ twice N foliar spray and 37.5 kg N+ 10 m^3 compost + twice N foliar spray) on wheat yield. Treatments were distributed in a Split Plot Design with three replicates; sowing dates in the main plots and nitrogen fertilization treatments in the sub plots. Results revealed that N-fertilization treatments 56.25 kg N fed^{-1}+ biofertilizer inoculation and 37.5 kg N fed^{-1}+ biofertilizer+ twice foliar spray of 1%N had superior effect on wheat yield, its components, protein content the uptake of NPK in grain and straw without signicant differences between them, and with the treatment of 37.5 kg N+ 10 m^3 compost+ twice N foliar spray which recorded the highest yield. Sowing dates of wheat had significant effects on grain and straw yields, its components and the uptake of NPK; since the rank for their superior effects was as follows: 20Nov>1Nov>10Dec. Grain and straw yields increased with sowing wheat at November 20th by 10.68 and 14.70 % as compared with sowing at November 1 and by 40.52 and 29.26 % as compared with sowing at December 10th, respectively. For the economical return, N fertilization at a rate of 37.5 kg N+ biofertilizer inculation+ twice 1% N foliar spray recorded the highest net return (14017 L.E) per feddan as compared with other treatments. So, it could be concluded that and N fertilization at 37.5 kg N+ biofertilizer+ twice N foliar spray is the optimum treatment under these conditions with sowing wheat on November 20th, not only because it could rotaionlize mineral N fertilizer by 45% approximately, but also safeguard environment agaisnt pollution.

Keywords: wheat yield, Upper Egypt, nitrogen, biofertilizer, compost and sowing dates.

INTRODUCTION

Wheat (*Triticum aestivum,* L.) is one of the main strategic crops in Egypt. Increase the agricultural land area of wheat and maximizing its production are of the main government target. There are many factors that affect wheat production among them soil type, quantity and quality of irrigation water, fertilization especially nitrogen, weather conditions, management and etc.

Aswan is one of the Egyptian Governorates which lie at the southernmost of Upper Egypt. It is one of the promising areas for horizontal expansion in wheat production. Adjusting the suitable date of wheat sowing plays an important role on the yield attributes. Early or late sowing dates reduces wheat yield, since some studies demonstrated that earlier sowing could increase chances of disease and insect problems, however late sowing reduces chance of survival; delays maturity, increases disease chances and reduces yield potential (Qasim *et al.,* 2008; El-Gizawy, 2009 and Hassanein *et al.,* 2012).

The meteorological report concerning Egypt climate indicated that the averages of maximum (Max) and minimum (Min) daily temperature increased by 0.2-4.4°C and 0.2-2.5°C than known measurements through winter seasons of period from 1981-2014, respectively. As for Aswan climate, the report illustrated that average of Max T increased by 3.2 more than the normal rate (24.1°C), whereas the average of Min T increased by 0.2°C more than the known rate (10.5°C). The highest average of Max T (28.2 °C) and of Min T (13.6°C) was at 2010. However, the climate in Aswan is extremely dry year-round, from zero to less than 1 mm to average annual precipitation (Abd El-Hamed and Abd El-Aal 2015).

Nitrogen fertilization is a key important factor that affects wheat production. Response of wheat yield to nitrogen fertilization is differ according to wheat varieties, soil type, fertilizer type and method of application as well as the climate conditions (Mekail *et al.,* 2005; Morsy *et al.,* 2007 *and* Ewais *et al.,* 2010). In Nile Delta region, grain yield significantly responded to mineral N fertilizer up to 75 kg N fed^{-1}, while the response of straw yield was up to 90 kg N fed^{-1} (El-Guibali *et al.,* 2005; Abomarzoka and Hamadny 2017 and El-Dissoky *et al.,* 2017). In Middle Egypt, wheat straw and grain yields responses to N fertilizer level ranged from 75-100 kg N fed^{-1} according to wheat varieties (Mekail *et al.,* 2005 and Hemeid and Ali, 2010).

Biological inoculation of wheat by biofertilizer which contain microbial strains of free-living–N_2- fixing bacteria (i.e. Azotobacter and Azospirrilum) with mineral N fertilization at the rate of 56-60 kg N fed^{-1} maximize the yield and net return (Morsy *et al.,* 2007; Badr *et al.,* 2009; Mosaad *et al.,* 2013 and Abd El-Lattief 2013). The combined use of inorganic, organic and bio fertilizers had beneficial effect on reducing the use of chemical fertilizers, keep balance among nutrient supply, and maintains soil ability for sustainable agriculture (Datta *et al.,* 2009; Khalil *et al.,* 2010; Ewais *et al.,* 2010 and El-Gizawy, 2010).

Earlier, studies showed that application of organic manures along with mineral nitrogen fertilizer was the best for soil fertility conservation, saving mineral N fertilization. In Sohage Governorate- Egypt, Khalil and Aly (2004) stated that application of 30 m^3 FYM fed^{-1} (0.49 %N) at sowing wheat with application of two equal doses of mineral N fertilizer (dose=23 kg N fed^{-1}) after sowing gained the highest grain and straw yields (21.5 ardab and 6.46 t. fed^{-1}). In Middle Egypt, Hemeid and Ali (2010) reported that application of 2 ton compost of crop residues fed^{-1} (1.85 % N) together with inorganic fertilizer 60 kg N fed^{-1} had an integrated effect on wheat yield and recorded the highest grain yield 3.221 and straw yield 5.92 ton fed^{-1}.

Also, it was reported earlier that foliar spray of fertilizers along with soil application increases the efficiency of fertilization and reduces the losses of fertilizer as well increases the yield. Furthermore, studies demonstrated that foliar spray of nitrogen can be supplemented with soil-applied fertilizers but can't replace soil fertilization. Sarhan *et al.,* (2004); Jamal, *et al.,* (2006); Khan, *et al.,* (2009); Gul *et al*., (2011) and El-Dissoky (2013) found that application of N at the rate of 1-3 % N with soil activated dose of N gave a high increase in wheat grain and straw yields and in their contents of N and P in comparison with soil application only ().

The objective of the present study is to assess response of wheat yield to nitrogen fertilization, organic and biofertilizer application which grown at different sowing dates in Upper Egypt (Aswan Governorate).

MATERIALS AND METHODS

Field experiments were conducted under the environmental conditions of Upper Egypt at the Farm of Kom Ompo Agricultural Research Station, Aswan Governorate (Latitude 24° 28' 38.604" N and Longitude 32° 56' 50.671" E), during the two successive winter growing seasons of 2014/2015 and 2015/2016 to evaluate the effect of nitrogen fertilization (rates, methods of application), addition of biofertilizer, compost and sowing dates on wheat yield (*cv.* Miser 1) grown under these conditions.

Experimental Design and Treatments:

Split Plot Design with three replicates was utilized. Each experiment included 15 treatments, and the plot area was 10.5 m^2. The main plots were arranged for three dates of sowing: November 1 (D_1), November 20 (D_2) and December 10 (D_3), and the sub plots were divided into five treatments of nitrogen fertilization as follows:

1) 75 kg N fed^{-1} (100% N: control).
2) 56.25 kg N fed^{-1} + biofertilizer (75%N+bio).
3) 56.25 kg N fed^{-1} + 10 m^3 compost fed^{-1} (75%N+org).
4) 37.5 kg N fed^{-1}+ biofertilizer+ twice foliar spray of 1% N (50%N+bio+F).
5) 37.5 kg N fed^{-1}+ 10 m^3 compost+ twice foliar spray of 1% N (50%N+org+F).

Samples of soil were randomly taken from the field experiments before sowing dates (D_1, D_2, and D_3), and then analyzed for some soil physical and chemical characteristics according to the methods outlined by Hesse (1971) and Page (1982); Table (1).

Table 1. Some physical and chemical properties of the experiment soil before sowing (Average of the two seasons).

Properties	Particle size distribution				OM	$CaCO_3$	SP	pH*	EC**
Soil samples	Sand %	Silt %	Clay %	Texture class	%	%	%	(1:2.5)	dSm^{-1}
D_1	59.70	17.98	22.32	Sandy clay loam	0.72	1.58	53.5	7.90	1.04
D_2	59.20	19.12	21.68	Sandy clay loam	0.68	1.73	50.0	7.88	1.04
D_3	60.10	18.00	21.90	Sandy clay loam	0.57	1.60	49.50	7.82	0.89

Properties	Soluble Cations and anions (meq/100 g soil)							Available NPK (mg kg^{-1})		
Soil samples	Ca^{++}	Mg^{++}	Na^+	K^+	CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	N	P	K
D_1	3.80	1.95	4.09	0.55	N.D.	1.92	6.02	2.45	40	19	172
D_2	3.14	2.70	4.13	0.45	N.D	2.02	7.11	1.29	45	21	250
D_3	2.88	1.58	3.92	0.52	N.D	1.88	6.00	1.02	50	19	208

***pH in 1:2.5 soil: water suspension, ** EC in soil paste extract.**

Compost was applied at the rate of 10 m^3 fed^{-1} with soil preparation. Some physical chemical properties of the applied compost were tested according to Page, (1982) and given in Table 2.

Table 2. Some properties of the applied compost.

Properties	pH*	EC** dSm^{-1}	Moisture %	Weight (kg m^{-3})	O.M. %	C:N Ratio	%			
							C	N	P	K
Values	7.52	6.18	15.5	550	25.29	18.3 : 1	14.67	0.80	0.16	0.86

***pH in 1:10 water suspension **EC in 1:10 water extract.**

Wheat seeds (*cv.* Miser 1) were sown at 1^{st} and 20^{th} November and 10^{th} December at both seasons. Phosphorus was applied at a rate of 100 kg fed^{-1} as single calcium superphosphate fertilizer (15.5% P_2O_5) with soil preparation. However, 50 kg fed^{-1} of potassium sulfate fertilizer (48% K_2O) as one dose was administered just before sowing. Soil application of mineral N fertilizer as ammonium nitrate fertilizer (33.5% N) was applied at two equal doses for all the nitrogen fertilization treatments with 1^{st} and 2^{nd} irrigations after sowing. Twice foliar spray of 1 % N (as urea 46.5% N) was excuted at tillering stage (after 45 days) and at booting stage (after 70 days) from sowing at the rate of 400 L fed^{-1}.

Wheat seeds were inoculated before sowing with biofertilizer SWERI-N (biological inoculant containing strains of *Azorizobium coulinodals, Herbspirellum sp.* and *Azotobacter chrococcum*) "$\approx 10^7$ CFU/ml", provided by the Unit of Bio-fertilizers Production- Microbiology Res. Department- Soils, Water and Environment Res. Institute- Agric. Res. Center, Giza, Egypt.

Monthly averages of agro-meteorological data recorded by Egyptian Meteorological Authority 2014, 2015, 2016 (E.M.A., 2017) at the experimental site (Aswan Governorate) for the two growing seasons are exhibited in Table 3.

Harvesting, sampling and nutrients status: -

Grain and straw yields, spikes number m^{-2} and 1000-grain weights were recorded. Nitrogen, phosphorus, and potassium concentrations were determined at the wet digested of plant samples (grain and straw) using sulphuric and perchloric acids. Testing nutrients status followed the methods outlined by Chapman and Pratt (1982) and Page et al., (1982); N was determined using Kjeldahl method; P was determined using spectrophotometer at wave length 640 by ammonium molybedate; K was determined using flamephotometer. Protein content in grain was calculated by multiplying N % by 5.75 factor. The economic return for each nitrogen fertilization treatment was calculated according to the cost and the total gross return of grain and straw yields per faddan as Egyptian pound (L.E).

Table 3. Mean agro-meteorological of Aswan Governorate (Latitude 23.58; Longitude 32.47- Elevation: 200 met.) during the two seasons 2014/2015 and 2015/2016 (E.M.A., 2017).

Month		Temperature (°C)			Relative Humidity (%)	Possible sunshine duration (hr)	Temperature (°C)			Relative Humidity (%)	Possible sunshine duration (hr)
		Max.	Min.	Average			Max.	Min.	Average		
		Season 2014/2015 October 2014 - May 2015					Season 2015/2016 October 2015 - May 2016				
Oct-		35.2	21.9	28.5	24.0	11.5	38.3	24.1	31.1	27.7	11.5
Nov-	1	32.3	17.8	25.0	29.0	11.0	29.9	17.2	23.3	55.0	11.0
	2	31.0	17.3	23.8	32.0	10.9	29.6	16.7	22.9	59.0	10.6
	3	25.4	13.1	19.1	58.0	10.6	25.7	11.3	18.2	39.0	10.7
Ave. Nov.		29.6	16.1	22.6	39.7	10.8	28.4	15.1	21.5	51.0	10.8
Dec-	1	30.8	16.6	23.4	42.0	10.6	24.4	11.6	17.5	39	15.6
	2	22.3	9.2	12.1	44.0	10.5	21.8	10.3	15.9	44	15.5
	3	24.3	11.2	17.4	40.0	10.5	23.5	10.2	16.5	43	10.5
Ave. Dec.		25.8	12.3	17.6	42.0	10.5	23.2	10.7	16.6	42.0	13.9
Jan-		23.4	10.0	16.4	37.7	10.7	15.6	8.9	15.4	37.3	10.7
Feb-		27.5	13.0	20.0	27.0	11.2	28.2	12.3	20.2	29.0	11.2
Mar-		31.6	16.7	24.2	19.3	11.9	33.7	17.7	25.0	22.3	11.9
Apr-		33.5	17.9	25.8	21.3	12.6	38.1	21.7	30.1	14.3	12.4
May-		39.4	24.5	32.1	14.3	13.2	40.5	24.8	32.8	13.0	13.2

The statistical analysis was tested according to Gomez and Gomez (1984) and means values were compared against least significant differences test (L.S.D.) at 5% level.

RESULTS AND DISCUSSION

1-Grain and Straw Yields and Harvest Index:

Nitrogen fertilization impact:

Data in Table 4 show that wheat grain and straw yields responded well to the treatments of nitrogen fertilization associated with biofertilizer and compost additions in both seasons. The highest grain yield was obtained with N-fertilization of 50%N+org+F (37.5 kg N fed^{-1} with compost and twice N foliar spray), but without a significant difference with grain yield that recorded with 100%N (75 kg N fed^{-1}), 75%N+org (56.25 kg N+ 10 m^3 compost) and 50%N+bio+F (37.5 kg N+ biofertilizer+ twice N foliar spray). Straw yield was rremarkably higher due to combined application of mineral N fertilizer at 37.5 kg N associated with 10 m^3 compost and twice N foliar spray (50%N+org+F) as compared with 75 kg N (100%N), without significant differences with 75% N+org and/or 50% N+bio+F.

Concerning harvest index (HI), the highest percent of HI was obtained when soil N fertilization was added at 75 kg N fed^{-1} (100% N). However, the differences among other treatments were not noticeable. So, it can be concluded from the above mentioned results that N fertilization as a combined application of mineral N fertilizer and compost or biofertilizer with twice N foliar spray (as treatments of 75% N+bio, 50% N+bio+F and 75% N+org, 50% N+org+F) had immense effect on grain and straw yields.

Furthermore, the current study showed that N-fertilization at a rate of 56.25 kg N fed^{-1} (75% N) with biofertilizer inoculation or 37.5 kg N fed^{-1} (50% N) + biofertilizer+ twice foliar spray of 1%N had positive effect on yield without signicant differences between them, yet the highest yield was recorded with 50%N+org+F. These results clarify the importance of biofertilizer inoculation which had its beneficial effects in N-fixation and production of plant growth promoting substances probably such as indol acetic acids, gibberellins, pyridoxine and others. These results are in accordance with those obtained by Morsy *et al.,* (2007); Badr *et al.,* (2009) and Abd El-Lattief (2013) who stated that inoculation of wheat seeds with biofertilizers containing strains of *Azotobacter* and *Azospirrilum* with mineral N fertilization at the rate of 56-60 kg N fed^{-1} could maximize its yield. Furthermore, the present study revealed that twice foliar spray of 1%N (20 g urea L^{-1}) along with soil application of 50% N (37.5 kg N) and addition of organic fertilizer or biofertilizer increased wheat yield and maximized fertilization efficiency. Our results are in agreement with those obtained by Sarhan, *et al.,* (2004); Jamal *et al.,* (2006) and Khan *et al.,* (2009) who reported the foliar spray of fertilizers along with soil application increased the efficiency of fertilization, reduced the fertilizers losses and increased the yield.

Sowing dates impact:

Data in Table 4 show that sowing dates significantly affected wheat grain and straw yields and HI. The rank of sowing dates for their effects on grain and straw yields was D_2>D_1>D_3, and for HI the superiority was obtained at sowing dates D_1 and D_2 without significant difference between them. The highest grain and straw yields were obtained at sowing wheat on November 20 (D_2) in both seasons. The mean Grain and straw yields increased with sowing wheat at November 20 as compared with sowing at November 1 by 10.68 and 14.70 % and increased as compared with sowing at December 10 by 40.52 and 29.26 %, respectively. The highest mean of HI was recorded with sowing at November 20. These results illustrate that the optimum time for wheat sowing under these conditions is November 20, and this may be attributed to suitable weather conditions at this period for sowing wheat and plant growth (as shown in Table 3) since the temperatures were as follow: maximum 31.0°C, minimum 17.3°C, and average 23.8°C. Porter and Gawith (1999) stated that the optimum temperatures for wheat ranged from 24-28°C for sowing and germination, 20-25°C accelerated growth, 15-22°C heading, 18-24°C pollination and grain filling and for 20-25°C maturity. In this regard at different environmental conditions in Egypt (Sakha, Qalubia, Minia, Sids and

Shandaweel locations), Qasim *et al.,* (2008); El-Gizawy, (2009) and Hassanein *et al.,* (2012) found that the highest values for plant height, No. of tillers m^{-2}, spike length, No. of grain $spike^{-1}$, 1000-grain weight, biological and grain yields and NPK uptake were obtained when wheat was sown at 15th November, but the highest No. of non-effective tillers m^{-2} and the highest straw yield were recorded from sowing wheat on 30th November.

Interaction between different studied treatments and sowing dates showed some significant effect on grain and straw yields and HI (Table 4 and Figs. 1 and 2). The highest mean of grain yield (3778 kg fed^{-1}) was obtained at the interaction of 50%N+bio+F*D_2, while the highest mean of straw yield (8911 kg fed^{-1}) was obtained at the interaction of 75%N+org*D_2. However, the highest percent of HI (32.53) was recorded at the interaction of 100% N*D_1. These results are in agreement with that obtained by Badr *et al.,* (2009); El-Gizaey (2009) and Hassanein *et al.,* (2012).

Table 4. Impact of nitrogen fertilization, biofertilizer and compost addition, sowing dates and their interactions on grain and straw yields and harvest index.

Characters		Grain yield (Kg fed^{-1})			Straw yield (Kg fed^{-1})			Harvest index (%)		
Treatments		1st	2nd	Mean	1st	2nd	Mean	1st	2nd	Mean
Sowing dates (D)										
D_1		3300^b	3387^b	3343^b	7851^b	7370^b	7610^b	29.66^a	31.50^a	30.58^a
D_2		3441^a	3959^a	3700^a	8676^a	8781^a	8729^a	28.42^a	31.09^a	29.76^b
D_3		2769^c	2496^c	2633^c	6551^c	6956^c	6753^c	29.77^a	26.44^b	28.11^c
LSD at 5%:		93.6	62.8	33.2	512	347	296	NS	0.97	0.66
Nitrogen fertilization treatments (N)										
100%N (75 kg N)		3167^a	3266^{ab}	3217^b	7404^b	7332^c	7368^c	30.17^a	30.57^a	30.37^a
75%N+bio		3044^b	3206^b	3125^c	7488^b	7500^{bc}	7494^{bc}	29.02^{bc}	29.85^a	29.44^b
75%N+org		3224^a	3209^b	3216^b	7795^{ab}	8038^a	7916^a	29.37^{ab}	28.45^b	28.91^b
50%N+bio+F		3171^a	3333^{ab}	3252^{ab}	7722^{ab}	7743^{abc}	7732^{ab}	29.13^{abc}	29.75^a	29.44^b
50%N+org+F		3244^a	3388^a	3316^a	8053^a	7899^{ab}	7976^a	28.73^{bcd}	29.78^a	29.26^b
LSD at 5%:		77.7	132.6	71.2	392	404	266	NS	0.93	0.81
Interaction of N*D										
D_1	100%N	3315	3339	3327	7204	6625	6914	31.54	33.51	32.53
	75%N+bio	3171	3118	3144	7690	7002	7346	29.29	30.81	30.05
	75%N+org	3326	3206	3266	8526	7467	7997	28.08	30.03	29.05
	50%N+bio+F	3302	3513	3408	7851	7767	7809	29.61	31.15	30.38
	50%N+org+F	3385	3760	3572	7984	7988	7986	29.79	32.00	30.90
D_2	100%N	3420	4085	3753	8836	8503	8670	28.01	32.45	30.23
	75%N+bio	3307	3843	3575	8540	8632	8586	27.91	30.81	29.36
	75%N+org	3537	3881	3709	8481	9341	8911	29.44	29.37	29.41
	50%N+bio+F	3440	4116	3778	8618	8707	8663	28.52	32.10	30.31
	50%N+org+F	3500	3868	3684	9905	8721	8813	28.23	30.72	29.48
D_3	100%N	2767	2376	2571	6173	6869	6521	30.97	25.73	28.35
	75%N+bio	2653	2658	2656	6234	6867	6551	29.85	27.93	28.89
	75%N+org	2810	2538	2674	6377	7305	6841	30.60	25.93	28.27
	50%N+bio+F	2771	2369	2570	6698	6753	6725	29.27	25.99	27.63
	50%N+org+F	2846	2537	2692	7271	6987	7129	28.17	26.62	27.40
LSD at 5%:		NS	229.7	123.4	679	NS	NS	1.95	1.62	1.40

100%N (75 kg N fed^{-1}), 75%N+bio (56.25 kg N+ biofertilizer), 75%N+org (56.25 kg N + 10 m^3 compost), 50%N+bio+F (37.5 kg N +biofertilizer+ twice N foliar spray) and 50%N+org+F (37.5 kg N+ 10 m^3 compost + twice N foliar spray).

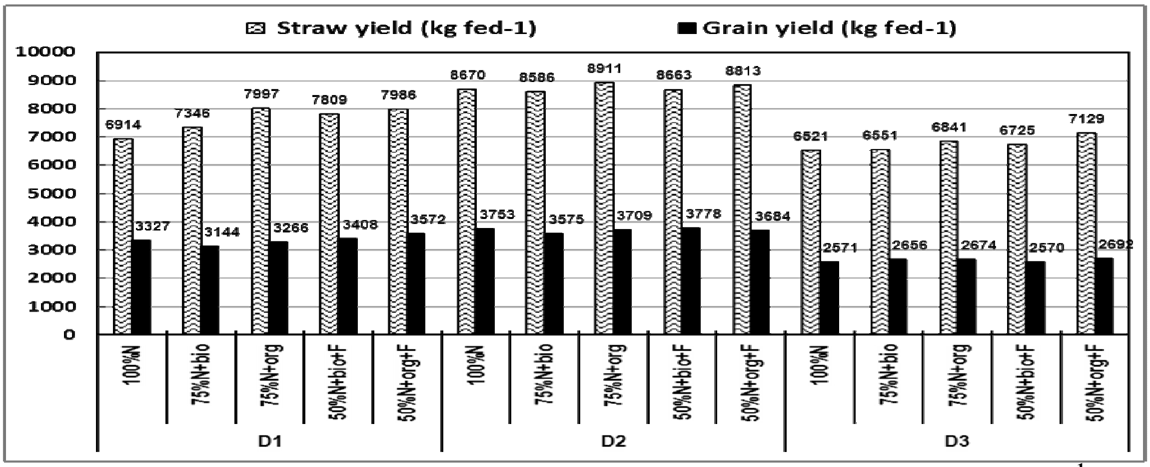

Fig. 1. Impacts of nitrogen fertilization and sowing dates on grain and straw yields (kg fed^{-1}).

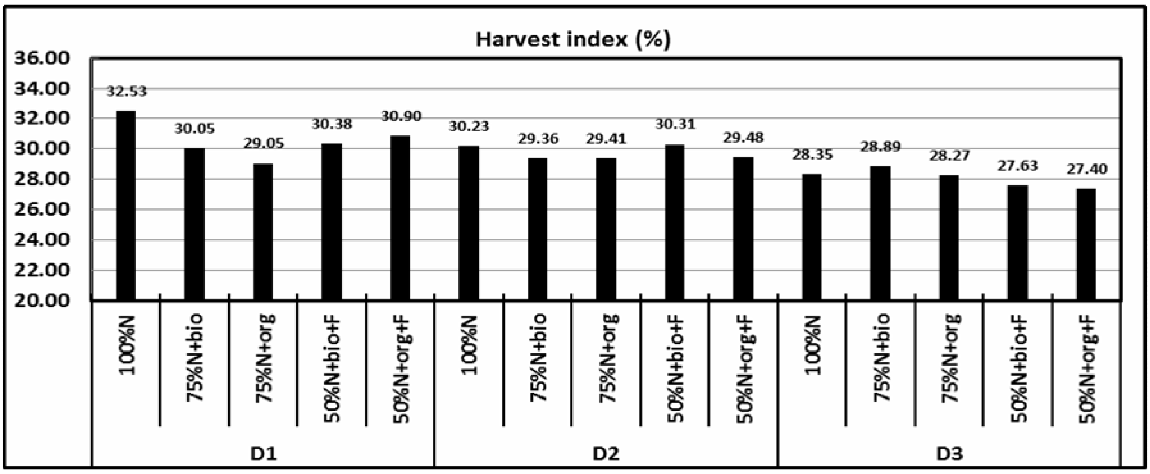

Fig. 2. Impacts of nitrogen fertilization and sowing dates on harvest index (%).

2-Yield components:

Data in Table 5 show that spikes No. m^{-2} was affected by variation of N fertilization treatments. The highest value of spikes No. m^{-2} (413) was obtained with N fertilization as 50%N+org+F, but this value was insignificant with that obtained with 75%N+org and 50%N+bio+F. Also, spikes No. m^{-2} significantly affected by sowing dates. The highest value of spikes No. m^{-2} (462) was obtained with sowing wheat on November 20 (D_2). This result may be related to elevating plant tillering rate which increased with sowing on November 20 but decreased with sowing on December 10 as compared with sowing at November 1. In this respect, Qasim *et al.,* (2008) stated that plant height, No. of tillers m^{-2}, spike length biological and grain yields decreased with delayed wheat seeding. In the current study the interaction between treatments of N fertilization and sowing dates significantly affected spikes No. m^{-2}. The highest mean of spikes No. m-^{2} (480) was obtained with the interaction between 75%N+org and D_2, but without a significant difference with that recorded (470) with the interaction between 50%N+org+F and D_2.

Table 5. Impact of nitrogen fertilization, biofertilizer and compost addition, sowing dates and their interactions on spikes number m^{-1}, 1000-grain weight and protein content.

Characters		Spikes No. m^{-2}			1000-Grain weight (g)			Protein %		
Treatments		1st	2nd	Mean	1st	2nd	Mean	1st	2nd	Mean
Sowing dates (D)										
D_1		390	408	399	46.67	39.80	43.23	13.17	12.68	12.92
D_2		450	474	462	51.60	43.90	47.75	13.40	13.17	13.28
D_3		367	308	338	49.20	47.00	48.10	13.29	12.59	12.94
LSD at 5%:		17.4	5.3	9.2	NS	1.48	2.23	NS	0.40	NS
Nitrogen fertilization treatments (N)										
100%N (75 kg N)		393^{b}	381^{c}	387^{b}	50.00	44.03	47.02	12.87	12.46	12.67
75%N+bio		392^{b}	376^{c}	384^{b}	49.11	44.44	46.78	13.53	13.39	13.46
75%N+org		408^{ab}	408^{b}	408^{a}	48.66	43.92	46.30	13.04	13.05	13.05
50%N+bio+F		412^{a}	400^{b}	406^{a}	49.55	42.31	45.93	13.73	12.68	13.20
50%N+org+F		406^{ab}	419^{a}	413a	48.44	43.12	45.78	13.26	12.47	12.87
LSD at 5%:		15.3	11.3	9.2	NS	NS	NS	0.51	0.48	0.38
Interaction of N*D										
D_1	100%N	366	388	377	47.66	40.60	44.13	12.46	11.61	12.03
	75%N+bio	377	381	379	46.66	39.83	43.25	13.09	13.12	13.11
	75%N+org	379	406	392	46.00	40.76	43.39	12.90	12.96	12.93
	50%N+bio+F	408	424	416	48.00	39.43	43.71	13.66	12.93	13.29
	50%N+org+F	420	442	431	46.66	38.36	41.68	13.76	12.76	13.26
D_2	100%N	446	466	456	51.00	45.00	49.00	12.83	12.81	12.82
	75%N+bio	451	432	441	51.00	43.00	47.25	13.92	13.37	13.65
	75%N+org	457	503	480	50.33	45.00	48.00	12.72	13.29	13.01
	50%N+bio+F	444	481	462	52.33	43.00	47.67	14.40	12.99	13.70
	50%N+org+F	453	488	470	50.66	43.00	46.83	13.11	13.37	13.24
D_3	100%N	368	290	329	49.33	46.50	47.92	13.32	12.98	13.15
	75%N+bio	348	314	331	49.66	50.00	49.83	13.57	13.67	13.62
	75%N+org	387	314	350	49.00	46.00	47.50	13.51	12.92	13.22
	50%N+bio+F	385	296	341	48.33	44.50	46.42	13.13	12.11	12.62
	50%N+org+F	346	328	337	49.66	48.00	48.83	12.92	11.27	12.09
LSD at 5%:		*26.5*	*19.5*	*15.9*	*NS*	*2.71*	*NS*	*0.88*	*0.83*	*0.66*

100%N (75 kg N fed^{-1}), 75%N+bio (56.25 kg N+ biofertilizer), 75%N+org (56.25 kg N + 10 m^3 compost), 50%N+bio+F (37.5 kg N +biofertilizer+ twice N foliar spray) and 50%N+org+F (37.5 kg N+ 10 m^3 compost + twice N foliar spray).

Data in Table 5 show that the variations among N fertilization treatments for 1000-grain weight were insignificant. However, 1000-grain weight significantly affected by sowing dates, as the rank of sowing dates followed the order D_3>D_2>D_1. The interaction of N fertilization treatments with sowing dates had significant effect on 1000-grain weight in the 2^{nd} season only, but insignificant for the mean of the two seasons. These results are in accordance with that obtained by Qasim *et al.,* (2008) and El-Gizawy (2009).

Data in Table 5 illustrate that grain content of protein significantly affected by treatments of N fertilization, whereas the highest mean of protein content (13.46%) was obtained with N fertilization treatment 75%N+bio (56.25 kg N + biofertilizer). Sowing dates had significant effect on protein content in 2^{nd} season only, with superior the content at sowing date November 20^{th}. The interaction between N-fertilization treatments and sowing dates had a significant effect on grain content of protein. The highest protein content (13.70%) was recorded with the interaction of 50%N+bio+F*D_2. The obtained results showed that N treatments having biofertilizer inoculation exhibited in general higher protein in the grain produced. These results are in accordance with that obtained by Ewais *et al.,* (2010) and Abd El-Lattief (2013) who found that inoculation with the mixture of Azospirillum+ Azotobacter resulted in significant increases in 1000-grain weight, grain and straw yields and protein content of grain.

3-NPK-Uptake (Kg fed^{-1}):

A-NPK-uptake in grain yield:

Data in Table 6 show the effects of N fertilization treatments and sowing dates and their interactions on the grain yield uptake of NPK (kg fed^{-1}). The results indicated that variations among N fertilization treatments for the grain uptake of NPK were obvious combared with 100% N. The superiority for the grain yield uptake of NPK was recorded for N fertilization treatments; 75% N+ org, 50%N+bio+F and 50%N+org+F, without significant differences among them.

Data in Table 6 and Figs. 3, 4 and 5 show that the grain yield uptakes of NPK, were significantly affected by sowing dates in both seasons. The highest grain content of NPK was recorded of wheat that sowing on November 20^{th} (D_2). The rank of sowing dates for its superiority impacts was D_2>D_1>D_3. The interactions of N fertilization treatments with sowing dates significantly affected the grain uptake of N in 2^{nd} season but insignificant in 1^{st} season. However, the interaction had insignificant effect on grin uptake of P and K in 2^{nd} season. The highest grain uptake for both N (89.5 kg fed^{-1}) and P (16.1 kg fed^{-1}) were recorded with the interaction of 50%N+bio+F*D_2. For K-uptake the interaction of 75%N+org*D_2 had the highest uptake (17.1 kg fed^{-1}) without significant difference with that recorded at the interaction of 50%N+bio+F*D_2.

Table 6. Impact of nitrogen fertilization, biofertilizer and compost addition, sowing dates and their interactions on NPK-uptakes in grain yield (Kg fed^{-1}).

Characters		N			P			K		
Treatments		1^{st}	2^{nd}	Mean	1^{st}	2^{nd}	Mean	1^{st}	2^{nd}	Mean
Sowing dates (D)										
D_1		75.6	74.7	75.1	16.1	12.9	14.5	16.8	13.9	15.3
D_2		80.1	90.6	85.3	15.0	14.5	14.7	16.1	16.5	16.3
D_3		64.0	54.7	59.4	11.7	9.2	10.5	12.1	10.6	11.4
LSD at 5%:		3.69	1.27	1.83	2.19	0.71	1.30	0.43	1.21	0.44
Nitrogen fertilization treatments (N)										
100%N (75 kg N)		70.7	70.6	70.7	13.9	11.8	12.8	15.2	13.5	14.4
75%N+bio		71.6	74.6	73.1	13.0	12.0	12.5	13.5	13.3	13.4
75%N+org		73.0	73.0	73.0	14.8	11.8	13.3	15.6	13.5	14.5
50%N+bio+F		75.9	74.0	75.0	15.2	12.2	13.7	16.1	13.6	14.9
50%N+org+F		74.9	74.4	74.6	14.5	13.1	13.8	14.5	14.5	14.5
LSD at 5%:		3.49	NS	2.66	1.22	NS	0.99	1.21	NS	0.78
Interaction of N*D										
D_1	100%N	71.8	67.4	69.6	15.1	13.0	14.0	16.5	14.2	15.4
	75%N+bio	72.2	71.2	71.7	15.0	12.1	13.6	16.1	11.9	14.0
	75%N+org	74.6	72.2	73.4	16.3	11.4	13.9	15.9	13.4	14.6
	50%N+bio+F	78.5	79.0	78.8	16.7	13.1	14.9	18.8	14.0	16.4
	50%N+org+F	81.0	83.4	82.2	17.2	15.0	16.1	16.5	16.0	16.3
D_2	100%N	76.3	90.8	83.6	14.3	14.2	14.2	15.2	16.0	15.6
	75%N+bio	80.1	89.4	84.8	13.4	14.0	13.7	14.3	16.7	15.5
	75%N+org	78.3	89.7	84.0	15.6	14.3	14.9	18.1	16.1	17.1
	50%N+bio+F	86.1	93.0	89.5	16.5	15.5	16.0	16.4	17.1	16.8
	50%N+org+F	79.8	89.9	84.9	15.2	14.4	14.8	16.3	16.6	16.5
D_3	100%N	64.1	53.7	58.9	12.2	8.3	10.3	13.9	10.3	12.1
	75%N+bio	62.6	63.2	62.9	10.4	9.8	10.1	10.1	11.4	10.7
	75%N+org	66.0	57.1	61.5	12.4	9.7	11.1	12.8	11.0	11.9
	50%N+bio+F	63.3	49.9	56.6	12.4	8.1	10.2	13.2	9.6	11.4
	50%N+org+F	64.0	49.7	56.8	11.1	10.0	10.6	10.7	10.9	10.8
LSD at 5%:		NS	6.85	4.61	NS	NS	NS	2.09	NS	1.36

100%N (75 kg N fed^{-1}), 75%N+bio (56.25 kg N+ biofertilizer), 75%N+org (56.25 kg N + 10 m^3 compost), 50%N+bio+F (37.5 kg N +biofertilizer+ twice N foliar spray) and 50%N+org+F (37.5 kg N+ 10 m^3 compost + twice N foliar spray).

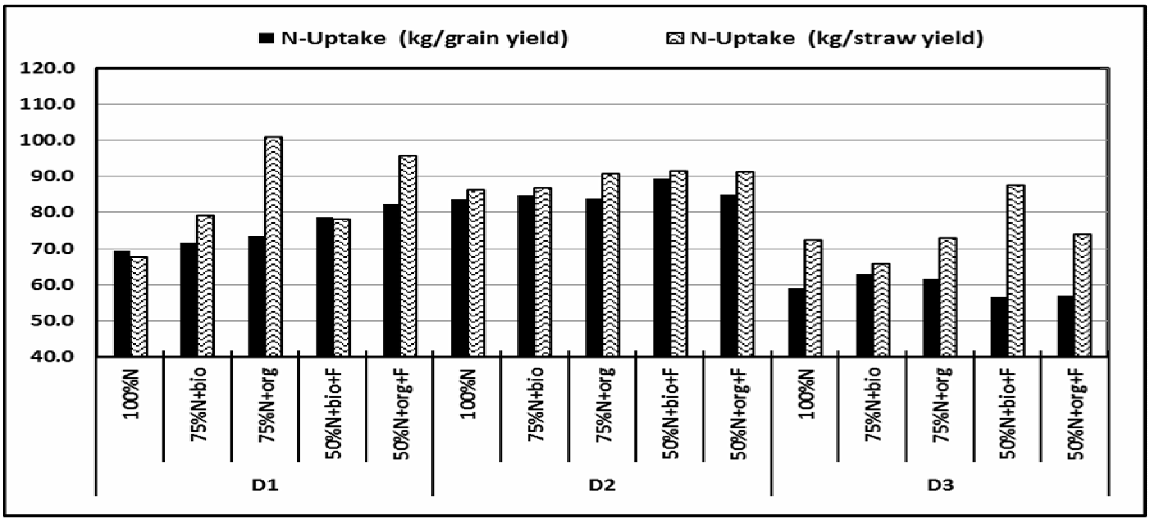

Fig. 3. Impacts of interactions among nitrogen fertilization treatments and sowing dates on the uptake of N in straw and grain yields.

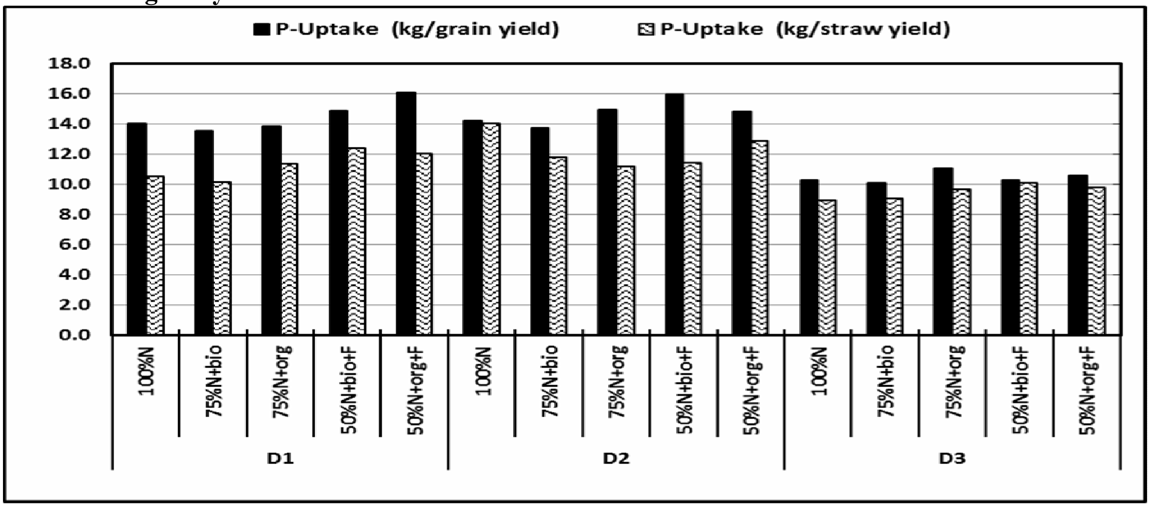

Fig. 4. Impacts of interactions among nitrogen fertilization treatments and sowing dates on the uptake of P in straw and grain yields.

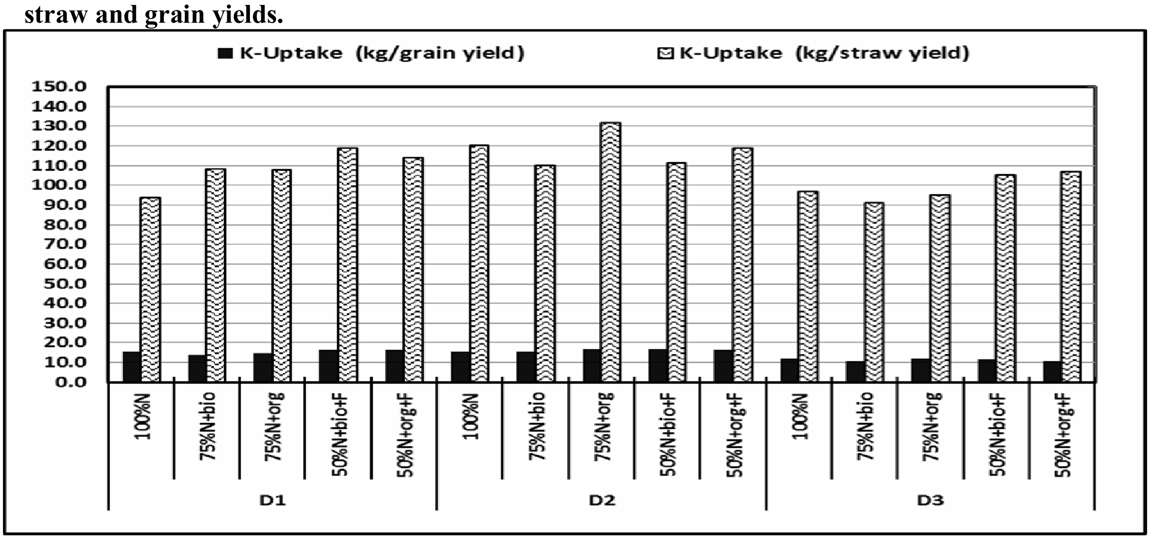

Fig. 5. Impacts of interactions among nitrogen fertilization treatments and sowing dates on the uptake of K in straw and grain yields.

B- NPK-uptake in straw yield:

Data in Table 7 reveal that various N fertilization treatments, significantly affected the uptake of N in straw in both seasons, but insignificantly affected the uptake of P and K. The highest N-uptake in straw was obtained with 75%N+org (56.2 kg N + 10 m^3 compost), but without significant differences with treatments of 50%N+bio+F (37.5 kg N+ biofertilizer+ twice N foliar spray) and 50%N+org+F (37.5 kg N+ 10 m^3 compost+ twice N foliar spray).

Table 7. Impact of nitrogen fertilization, biofertilizer and compost addition, sowing dates and their interactions on NPK uptakes in straw yield (Kg fed^{-1}).

Characters		N			P			K		
Treatments		1st	2nd	Mean	1st	2nd	Mean	1st	2nd	Mean
Sowing dates (D)										
D_1		92.8	75.9	84.3	9.7	12.9	11.3	125.7	91.2	108.5
D_2		95.4	83.4	89.4	10.0	14.5	12.3	128.1	108.9	118.5
D_3		77.7	71.5	74.6	7.5	11.5	9.5	106.0	92.3	99.1
LSD at 5%:		3.85	6.90	4.59	1.21	1.78	1.46	10.15	9.03	8.18
Nitrogen fertilization treatments (N)										
100%N (75 kg N)		81.1	69.8	75.5	9.4	13.0	11.2	114.9	92.5	103.7
75%N+bio		82.9	71.7	77.3	8.4	12.2	10.3	113.6	92.5	103.1
75%N+org		93.4	83.1	88.3	8.6	12.8	10.7	122.0	101.1	111.5
50%N+bio+F		91.9	79.8	85.8	9.4	13.3	11.3	122.7	100.9	111.8
50%N+org+F		93.8	80.2	87.0	9.7	13.5	11.6	126.4	100.3	113.3
LSD at 5%:		7.55	6.27	6.08	NS	NS	NS	NS	NS	NS
Interaction of N*D										
D_1	100%N	75.6	59.7	67.6	9.2	11.8	10.5	107.4	79.8	93.6
	75%N+bio	88.4	70.0	79.2	8.8	11.5	10.1	126.5	89.8	108.1
	75%N+org	113.8	88.3	101.1	10.1	12.6	11.4	130.4	85.0	107.7
	50%N+bio+F	84.4	71.9	78.2	10.5	14.3	12.4	134.5	102.9	118.7
	50%N+org+F	101.5	89.7	95.6	10.0	14.0	12.0	129.6	98.6	114.1
D_2	100%N	94.3	78.3	86.3	12.1	16.0	14.0	135.0	105.8	120.4
	75%N+bio	92.8	80.9	86.8	9.6	14.0	11.8	119.3	100.8	110.1
	75%N+org	93.1	88.5	90.8	8.5	13.9	11.2	137.2	126.5	131.9
	50%N+bio+F	97.7	85.6	91.7	9.2	13.6	11.4	119.0	103.8	111.4
	50%N+org+F	98.9	83.8	91.3	10.8	14.9	12.9	129.9	107.5	118.7
D_3	100%N	73.4	71.5	72.5	6.8	11.1	8.9	102.2	91.9	97.0
	75%N+bio	67.5	64.3	65.9	7.0	11.1	9.0	95.1	87.0	91.1
	75%N+org	73.1	72.6	72.9	7.3	12.0	9.7	98.4	91.7	95.1
	50%N+bio+F	93.4	82.0	87.7	8.3	11.8	10.1	114.5	95.9	105.2
	50%N+org+F	81.0	67.0	74.0	8.2	11.4	9.8	119.5	94.9	107.2
LSD at 5%:		13.09	10.87	10.54	1.86	NS	1.75	NS	NS	NS

The uptake of NPK in straw, significantly affected by sowing dates, whereas the uptake of NPK was decreased with sowing at D_1 and D_3 as compared with D_2. The highest NPK uptake in straw yield was obtained at sowing wheat at November 20th.

Additionally, it is obvious from Table 7 and Figs. 3, 4 and 5 that interaction between N fertilization and sowing dates had a significant effect on the uptake of N and P in straw yield, but had insignificant effect on the uptake of K.

Also, Fig. 6 illustrate that the total uptake of NPK in grain and straw yields clearly affected by sowing dates, whereas it decreased with sowing wheat at December 10th as compared with sowing at November 1and 20th. The highest total uptake of NPK was obtained at sowing wheat on November 20th with N fertilization as 50% N+org+F (37.5 kg N+ 10 m^3 compost+ twice 1% N foliar spray). Furthermore, N fertilization as 75%N+org (56.25 kg N+ 10m^3 compost fed^{-1}) and 50% N+bio+F (37.5 kg N+ biofertilizer+ twice N foliar spray) had superior impacts on the total uptake of NPK as compared with 100% N (75 kg N fed^{-1}). These previous results illustrate that application of compost or inoculation by biofertilizer along with mieral N fertilization at 50% or 75% N and foliar spray of N had integrated effect on the totat uptake of NPK (Fig. 6), as well as increased N fertilization efficiency. Furthermore, these results are positively correlated with above-mentioned results of wheat yield and its componts (Tables 4 and 5).

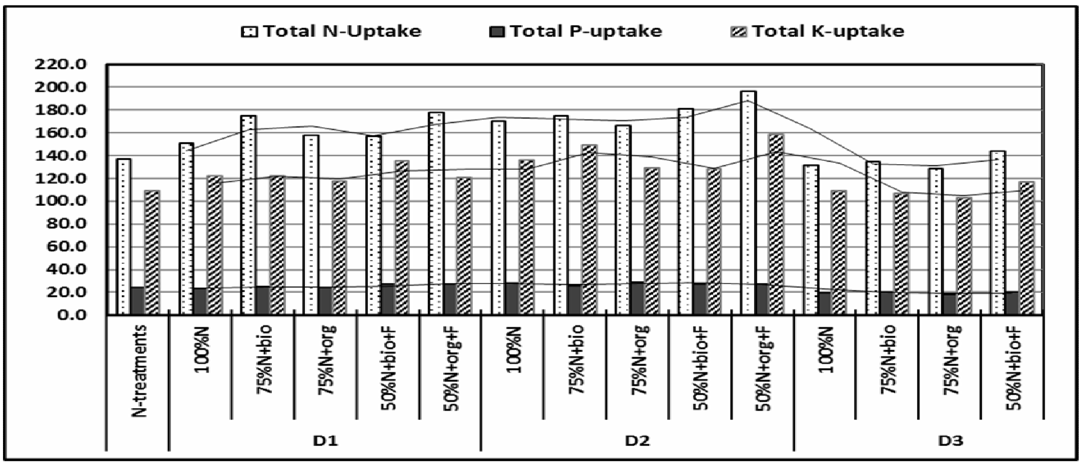

Fig. 6. Impacts of interactions among nitrogen fertilization treatments and sowing dates on the total uptake of NPK in straw and grain yields.

4-Economical evaluation:

Data in Table 8 show the economical evaluation of wheat yields (grain and straw) as affected by N-fertilization treatments. The inputs were; 200 L.E/50 kg ammonium nitrate fertilizer, 250 L.E/50 kg urea fertilizer, 200 L.E/ twice N foliar spray, 30 L.E/biofertilizer and 200 L.E/m^3 compost. The outputs were; 3.33 L.E/kg grain (500 L.E/ardab) and 500 L.E/1000 kg straw. Data illustrate that treatment of 75% N+org (56.25 kg N+ 10 m^3 compost fed^{-1}) had the highest cost (2672 L.E), while the treatment of 50% N+bio+F (37.5 kg N+ biofertilizer+ twice N foliar spray) had the lowest cost (678 L.E). For the total gross return per feddan, N fertilization as 37.5 kg N fed^{-1}+ compost+ foliar (50% N+org+F) recorded the highest value (15030 L.E) of grain and straw yields. However, for the net return (total gross return - total cost), N-fertilization as 37.5 kg N + biofertilizer+ twice N foliar spray (50% N+bio+F) recorded the highest net return (14017 L.E). These result illustrate that N fertilization at a rate of 37.5 kg N (50% N) + inoculation with biofertilizer and twice N foliar spray was maximmized grain and straw yields and the net return per feddan as compared with mineral fertilization at 75 kgN fed^{-1} (100%N) and other treatments which due to its lower cost. Moreover, the differences between the yield of 37.5 kg N fed^{-1}+bio+ foliar and 37.5 kg N fed^{-1}+org+ foliar were insignificant. So, it could be concluded that N fertilization at 37.5 kg N+ biofertilizer+ twice N foliar spray (50% N+bio+F) is the optimum treatment for N fertilization under these conditions, not only because it could rotaionlize mineral N fertilizer by 45%, approximately, but also safeguard environment againist pollution.

It is worth mentioning that the combined applications of 10 m^3 compost fed^{-1} along with 37.5 kg N fed^{-1} (50% N) and twice N foliar spray gave lower net return as compare with the treatments of 100% N and/or 37.5 kg N+biofertilizer+foliar, due to higher cost of compost (2000 L.E). Nonetheless, application of compost would have a positive effect on the next crops (as a residual effect) and on the sustainablity of soil productivity, therefore one might consider it is justified. The combined application of organic fertilizers with inorganic fertilizers is reccomended for saving chemical fertilizers; improving soil properties; support soil fertility maintenance; keep balance among fertilizers and reducing environmental pollution (El-Gizawy 2010 and Khalil *et al.,* 2010).

Table 8. Economical evaluation of wheat yield as affected by N fertilization treatments (average of two seasons).

Treatments ↓	Total cost of N-fertilization (L.E)	Wheat yield (kg fed^{-1})		Gross Return (L.E)			Net return (L.E)
		Grain	Straw	Grain yield	Straw yield	Total	
75 kg N fed^{-1}	896	3217	7368	10713	3684	14397	13500
56.25 kg N+ bio	(672+30)= 702	3125	7494	10406	3747	14153	13451
56.25 kg N+ org	(672+2000)= 2672	3216	7916	10709	3958	14667	11995
37.5 kg N+ bio+ foliar	(448+30+200)= 678	3252	7732	10829	3866	14695	14017
37.5 kg N+ org+ foliar	(448+2000+200)= 2648	3316	7976	11042	3988	15030	12382

CONCLUSION

Under the ecological conditions prevailing at Aswan Governorate (Upper Egypt), it can be concluded that sowing wheat on November 20th and fertilized with nitrogen at a rate of 37.5 Kg N fed^{-1} (as ammonium nitrate fertilizer) administered with twice foliar spray of 1%N (20g urea L^{-1}) and integrated with biofertilizer inoculation (SWERI-N) gives the optimum yield with the highest net return.

REFERENCES

Abd El-Hamed H. and A. Abd El-Aal (2015). The climate report for winter season 2013/2014 and seasons of 1981-2014. Meteorological J., No. (40):36-55.

Abd El-Lattief E. A. (2013). Impact of integrated use of bio and mineral nitrogen fertilizers on productivity and profitability of wheat (*Triticum aestivum* L.) under Upper Egypt conditions. Int. J. of Agronomy and Agric. Res. (IJAAR), 3(12):67-73.

Abomarzoka, E. A. and M. K. A. Hamadny (2017). Effect of the previous summer crops and different levels of nitrogen, phosphorus and potassium on wheat crop productivity and its components. 1st Int. Conf. Fac. Agric. Alex. Univ. 22-23 Feb., 2017; Alex. J. Agric. Sci. 61(6):1-11 (Special Issue).

Badr A.; E. O. M. Ibrahim and M. F. El-Kramany (2009). Interaction effect of biological and organic fertilizers on yield and yield components of two wheat cultivars. Egyptian J. of Agronomy 31, 17-27.

Chapman H. D. and P. F. Pratt (1982). "Methods of Plant Analysis, I. Methods of Analysis for Soil, Plant and Water". Chapman Publishers, Riverside, California, USA.

Data, J. K.; A. Banerjee; M. Sahs Sikdar; S. Gupta and N. K. Mondal (2009). Impact of combined exposure of chemical fertilizer, bio-fertilizer and compost on growth, physiology and productivity of *Brassica campestries* in old alluvial soil. J. of Environmental Biology (India), 30(5):797-800.

E. M. A., (2017). Egyptain Meteorological Authority-General Management for Surface Stations- Giza Agro-Meteorological Station.

El-Dissoky, R. A. (2013). Effect of nitrogen, phosphorus and potassium application as soil and foliar on wheat productivity at soil salinity conditions. J. Soil Sci. and Agric. Eng., Mansoura Univ., 4 (8):647– 660.

El-Dissoky, R. A.; R. A. Ramadan and I. A. A. Hegab (2017). Balanced fertilization of nitrogen and micronutrients for wheat grown in salt affected soils. Menoufia J. Soil Sci., Vol. 2 April: 119–134.

El-Gizawy, N. K. B. (2009). Effect of planting date and fertilizer application on yield of wheat under no till system. World J. Agric. Sci., 5 (6): 777-783.

El-Gizawy, N. K. B. (2010). Effect of nitrogen, biogas sludge manure and biofertilizer on grain nitrogen uptake and yield of wheat (*Triticum aestivum*, L.). The International Conference of Agronomy, 20-22 Sept., 2010, ELArish, 1-13.

El-Guibali A. H.; S. H. Omran and S. F. El-Fiki (2005). Response of Gemmiza 7 wheat cultivar to different levels of nitrogen and zinc fertilization. Minufiya J. Agric. Res., 30(2):791-799.

Ewais M. A.; A. A. Mahmoud and S. A. El-Shikhah (2010). Influence of organic, N-mineral and biofertilization on growth, yield and chemical composition of wheat plants. Minufiya J. Agric. Res., 35(3):1125-1146.

Gomez, K. A. and A. A. Gomez (1984). "Statistical Procedures for Agriculture Research". 2nd Ed., John Wiley and Sons.

Gul H.; A. Said; B. Saeed; F. Mohammad and I. Ahmad (2011). Effect of foliar application of nitrogen, potassium and zinc on wheat growth. ARPN J. of Agric. and Biological Sci., 6(4):56-58.

Hassanein M. K.; M. Elsayed and A.A. Khalil (2012). Impacts of sowing date, cultivar, irrigation regimes and location on bread wheat production in Egypt under climate change conditions. Nature and Science, 10(12):141-150.

Hemeid N. M. and A. M. A. Ali (2010). Response of some wheat varieties to applying composted crop residues and mineral nitrogen fertilization. Egypt. J. Appl. Sci., 25(6B):422-441.

Hesse, P.R. (1971). A Text Book of Soil Chemical Analysis. John Murry Publishers, Ltd, 50 Albemarle Street, London.

Jamal, Z.; M. Hamayun; N. Ahmad and M. F. Chaudhary (2006). Effects of soil and foliar application of different concentrations of NPK and foliar application of $(NH_4)_2SO_4$ on different yield parameters on wheat. J. Agron., 5(2):251-256.

Khalil F. A. and S. A. Aly (2004). Effect of organic fertilizers as substitutions of mineral nitrogen fertilizer applied at planting on yield and quality of wheat. Minufiya J. Agric. Res., 29(2):435-449.

Khalil, H. M.; M. A. Khaled and L. W. Antoun (2010). The combined use of inorganic and organic fertilizers with bio-fertilizer for wheat crop and soil fertility. Egypt J. of Appl. Sci., 25(3):181-196.

Khan, P.; M. Y. Memon; M. Imtiaz and M. Aslam (2009). Response of wheat to foliar and soil application of urea at different growth stages. *Pak. J. Bot.*, 41(3): 1197-1204.

Mekail M. M.; A. M. Ahmed and M. R. Mohamed (2005). Effect of nitrogen fertilizer levels and seeding rates on yield and yield components of some wheat varieties. Minia J. of Agric. Res. & Develop., 25(3):437-460.

Morsy M. A.; A. A. Omran and M. M. Foaad (2007). Wheat yield and NPK uptake as affected by nitrogen fertilization in combination with Rhizobacterin inoculation. Fayoum J. Agric. Res. and Dev., 21(1):16-27.

Mosaad, I. S. M.; E. E. E. Khafagy and R. A. El-Dissoky (2013). Effect of mineral, bio and organic nitrogen fertilization on wheat yield and nitrogen utilization efficiency and uptake at northern delta of Egypt. J. Soil Sci. and Agric. Eng., Mansoura Univ., 4(10): 1101 – 1116.

Page, A. L. (ED) (1982). "Methods of Soil Analysis". Part2: Chemical and microbiological properties, (2nd Ed). Am. Soc. At Agron. Inc. Soil Sci. Soc. Of Am. Inc., Madison, Wisconsin, VSA.

Porter J. R. and M. Gawith (1999). Temperatures and the growth and development of wheat: a review. Elsevier Science, European J. of Agronomy 10, pp. 23–36.

Qasim, M.; M.Q. Faridullah and M. Alam (2008). Sowing dates effect on yield and yield components of different wheat varieties. J. Agric. Res., 46(2):135-140.

Sarhan, S. H.; A. M. Abd Elhameed and H. Z. Abd Elsalam (2004). Effect of nitrogen application methods on growth, yield and some nutrient contents of wheat. Zagazig J. Agric. Res., 31(4B):1717-1726.

تأثير النتروجين والسماد الحيوي والكمبوست ومواعيد الزراعة على القمح المزروع بمصر العليا

رمضان عوض الدسوقي و عوض الله محمد عطية
معهد بحوث الأراضي والمياه والبيئة - مركز البحوث الزراعية – الجيزة - مصر

تختلف استجابة محصول القمح للتسميد النتروجيني تبعا لنوع التربة، السماد وطريقة إضافته، الظروف المناخية ومواعيد الزراعة؛ لذا أجريت تجربتان حقليتان خلال موسمي الزراعة الشتويين 2015/2014 و 2016/2015 بمحطة بحوث كوم امبو الزراعية- محافظة أسوان-مصر N "38.604 ′28 °24) (E "50.671 '56 °32 and لتقييم تأثير ثلاثة مواعيد من الزراعة (1 و20 نوفمبر و10 ديسمبر) وخمس معاملات من التسميد النتروجيني: 75 كجم ن للفدان؛ 56,25كجم ن +تسميد حيوي؛ 56,25كجم ن +10م3 كمبوست للفدان؛ 37,5كجم ن + تسميد حيوي+ الرش الورقي مرتين 1% ن و 37,5كجم ن +10 م3 كمبوست+ رش الورقي مرتين 1%ن وذلك على محصول القمح، وزعت المعاملات في تصميم قطع منشقة في ثلاث مكررات، حيث تمثلت مواعيد الزراعة في القطع الرئيسية ومعاملات التسميد النتروجيني فى القطع الشقية. هذا وقد أوضحت النتائج تفوق تأثير معاملاتي التسميد النتروجيني 56,25كجم ن+السماد الحيوى و 37,5كجم ن + الحيوي+ الرش مرتين 1%ن بالنسبة لمحصول القمح ومكوناته ومحتوى الحبوب من النتروجين والفوسفور والبوتاسيوم والبروتين وذلك بدون فارق معنوى بينهم وبين معاملة التسميد 37,5كجم ن +10 م3 كمبوست+ الرش الورقي مرتين 1%ن التي حققت أعلى محصول حبوب. هذا وقد أثرت مواعيد الزراعة معنويا على محصولي الحبوب والقش ومكونات المحصول والممتص من النتروجين والفوسفور والبوتاسيوم، حيث كان ترتيب مواعيد الزراعة تبعا لتفوق تأثيرها كالتالي: 20نوفمبر ثم 1نوفمبر ثم 10 ديسمبر، هذا وقد زاد محصولي الحبوب والقش مع الزراعة في 20 نوفمبر بمعدل 10.68 و14.70 % بالمقارنة بالزراعة في 1 نوفمبر وبمعدل 40.52 و 29.26 % بالمقارنة بالزراعة في 10 ديسمبر على التوالي؛ بالنسبة للعائد الأقتصادى سجل أعلى عائد فعلى للفدان (14017 جنيهاً) مع التسميد النتروجيني بمعدل 37,5كجم ن+ مع التلقيح بالسماد الحيوي+ والرش مر تين بي 1% نتروجين وذلك بالمقارنة بالمعاملات الأخرى، لذا يمكن ان تخلص الدراسة الى ان زراعة القمح في 20 نوفمبر مع التسميد النتروجيني عند معدل 37,5 كجم نتروجين للفدان والتلقيح بالسماد الحيوي مع الرش مرتين بي 1% نتروجين هي المعاملة المثلى للتسميد تحت هذه الظروف فضلا عن إمكانية ترشيد السماد النتروجين المعدني بنسبة 45% تقريبا وحماية البيئة أيضا من التلوث.