J. Plant Production, Mansoura Univ., Vol. 8(3):425 -434, 2017

Effect of Urea and Anhydrous Ammonia Fertilizer on Yield and Yield Component of Rice Plants.

Abd El-Megeed, T. M.
Rice Research& Training Center, Field Crops Research Institute, Agriculture Research center, 33717 Sakha-Kafrelsheikh.

ABSTRACT

Two field experiments were conducted in 2015 and 2016 growing seasons at the farm of Agricultural Research Station, Sakha, Kafrelsheikh, Egypt, consisted of three cultivars(Sakha106, Giza179 and Egyptian hybrid rice one) as well as seven nitrogen (N) fertilizer treatments were added at the rate of 165 kg N/ha. Anhydrous ammonia (82% N) was injected directly into the dry soil at the depth of 20 cm before plant, while, urea (46% N) was applied according to the recommended of RRTC. Results revealed that application of nitrogen at 165 kg N/ha as anhydrous ammonia recorded the highest chlorophyll content, LAI, dry matter/m^2, plant height (cm), no. of tiller/m^2, panicle number/m^2, panicle weight(g), panicle length (cm) and filled grains resulted in a highest grain yield. Also, economic analysis was done. Data shows that the highest profit was recorded when full dose of Anhydrous Ammonia was applied with all varieties.

INTRODUCTION

Rice (Oryza sativa L.,) is considered one of the most important summer crops in Egypt. The productivity of rice is affected by many factors such as seed germination, N fertilization, and quality of the fertilizer techniques. Several studies reveal that judicious and proper use of fertilizers can markedly increase the yield and improve the quality of rice Place, *et al*., (1970).Panicles with a low percentage of sterile flowers permit the application of higher doses of nitrogen and produce better yields Yoshida, (1981). Modern production agriculture requires efficient, sustainable, and environmentally sound management practices. Nitrogen is normally a key factor in achieving optimum lowland rice grain yields Fageria, *et al*., (1997).

Nitrogen (N) fertilizer is one of the limiting factor of rice production, but is subject to loss under wet conditions. Fertilizer Must be used with compatible N formulations to be effective.Nitrogen (N) is essential for rice, and usually it is the most yield limiting nutrient in irrigated rice production around the world Samonte. *et al*., (2006).Fageria, (2003)and Tayefe, *et al*., (2011) concluded that in cereals crop such as rice, N accumulation is associated with dry matter production and yield of shoot and grain. The nitrogen fertilizer rates were strongly linearly the number of grain per panicle and the grain yield. The yields always increase with the addition of nitrogen fertilizer. This Clearfield that nitrogen is very important in the rice system Bagayoko., (2012).

The kind of nitrogenous fertilizer may also affect the yield and quality of the grain Gately and Kelly (1987). Some of these fertilizers, are anhydrous ammonia (82%N) and urea (46 %N). In Egypt, urea is the dominant fertilized used in flooded rice soils because it is very cheapest compared to ammonium sulfate and other nitrogen sources. Anhydrous ammonia is a liquid under high pressure and must be injected at least six inches deep into a moist soil because it becomes a gas once it is released from the tank. In soil, ammonia reacts with water to form the ammonium ($NH4^+$) ion, which is held on clay and organic matter. Anhydrous ammonia is generally the cheapest source of nitrogen fertilizer.

Anhydrous Ammonia, NH3, is the most basic form of nitrogen fertilizer, and the most widely used source of nitrogen for corn production in North America, due to lower cost, high N content, and relative stability in soils. Most of the kind of N fertilizers are derivatives of ammonia transformed by additional processing, which increases cost. Anhydrous ammonia (AA) uses, has increased rapidly during last decade as an alternative effective N-material (El-Mneasy, 2002) and inexpensive N fertilizer than other commercial ones (Abdel Kader-Mona, 2002). Therefore, it is widely used effectively for fertilizing different crops such as cereal, fiber and field crops as well as vegetable crops grown in soils widely different in their physical and chemical features even those planted in salt affected soils (Ali-Nadia, *et al*.,2002; kineber, *et al*., 2004 and El-Masry *et al*., 2006).

Anhydrous ammonia is injected 15 to 20 inches below the soil surface to minimize escape of gaseous NH3 into the air. It reacts with soil water to form ammonium (NH_4^+) ions. Positively charged NH_4^+ ions react and bind strongly with negatively charged soil constituents, including clay and organic matter. As such, they are held on the soil exchange complex and not subject to movement with water.

There have been no studies evaluating the effect of application anhydrous ammonia (AA) injection and their effects on soil and rice plant characteristics. Therefore, the objectives of the current work were to highlight the relative impact of different sources of nitrogen such as anhydrous ammonia and urea on the response yield and its attributes of some different rice cultivars under normal soils conditions.

MATERIALS AND METHODS

Two field experiments were conducted at the farm of Agricultural Research Station, Sakha, Kafrelsheikh, Egypt, during 2015 and 2016 seasons. Representative soil sample was taken and subjected to chemical analysis followed the standard procedures by Cottenie *et al*, (1979) and page *et al*., (1982) and the results showed that this soil texture was clayey with 1.5% and 1.6 % organic matter, pH 8.2 and 8.26, EC 1.8 and 1.45 dS/m, 12.5 and 12.6 mg.kg^{-1}NH_4^+ and 10 and 11.8 mg.kg^{-1} NO_3^-during the year 2015 and 2016 respectively.

Two sets of treatments included in the experiment are follows: Cultivars {V_1: Sakha106, V_2: Giza 179 and V_3: Egyptian Hybrid rice one (EHR1)} and two different nitrogen sources namely, urea and anhydrous ammonia.

The different sources of nitrogen fertilization was applied at the rate of 165 kg N/ha. Anhydrous ammonia (82% N) was injected directly into the dry soil at a depth of 20 cm preplant by a blade applicator then soil leveling was done, while, urea (46% N) were applied two times; one before transplanting and the other 30 days after transplanting. The nitrogen sources and its combination applied in seven different treatments as shown in Table (1). Split plot design in a randomized complete block arrangement was used with three replications. Rice cultivars was assigned to the main plots and fertilizer doses in the sub-plot. The previous crop was wheat; a common procedure was followed in raising of seedling in seedbed. Seedlings of 30 days old were uprooted from the nursery beds carefully. Seedlings were transplanted in the well puddled experimental plots. Spacing's were given 20 X 20 cm.

Table 1. The different treatments of nitrogen sources.

Treatments	N kg/ha	Form of nitrogen	Methods and time of application
T_1	165	Urea	---
T_2	165	Anhydrous ammonia	Injected into soil before flooding
T_3	165	Anhydrous ammonia + Urea	3/4 N injected into soil before flooding + 1/4 N as urea at PI
T_4	165	Anhydrous ammonia + Urea	3/4 N injected into soil before flooding + 1/4 N as urea at late booting (LB)
T_5	165	Anhydrous ammonia + Urea	1/2 N injected into soil before flooding + 1/2 N as urea at P.I
T_6	165	Anhydrous ammonia + Urea	1/2 N injected into soil before flooding + 1/2 N as urea at late booting (LB)
T_7	0 (control)	---	---

PI: Before panicle initiation& LB: Late Booting.

Full dose of phosphorus 36.89 kg P2O5. ha-1as a super phosphate (15%) was applied as a basal dose at the time of final land preparation and incorporated well into the soil. All intercultural operations were done carefully. From transplanting to twice weeks before harvesting, a thin layer of water (3-5cm) was kept on the plots. Water was cut off from the plots two weeks before harvesting 20 days after complete heading. The yield of each plot was harvested separately at full maturity. Plant sample were collected from each plot for collection of data on plant characters and yield components. The grain and straw yield weight for each plot were recorded after proper sun drying and then converter into t. ha-1. The grain yield was adjusted at 14% moisture level. The differences among the treatment were compared by multiple comparison tests using Duncan's Multiple Range Test (DMRT) (Duncan, 1955).

RESULTS AND DISCUSSION

Chlorophyll content of flag leaf:

Data cited in Table (2) show that significant varietals differences were observed in Chlorophyll content of flag leaf in two seasons. It is evident from the data that Hybrid1 and Giza179 produced significantly nearly values of chlorophyll content followed by Sakha106 which gave the lowest value of chlorophyll content in both seasons of study. Application of full dose of Anhydrous ammonia injection into dry soil before flooding introduce the highest value of chlorophyll content. Plant grown without nitrogen fertilizer had the lowest chlorophyll content. Significant variation of nitrogen fertilizer and variety were observed (Table 3).

Table 2. Growth characteristics at harvest as affected by rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Treatments	Chlorophyll content (uE)		LAI		Dry matter /g / m^2	
	2015	2016	2015	2016	2015	2016
Cultivars						
Sakha106 (V_1)	0.6958b	0.7078b	3.091b	3.891b	411.2b	429.2b
Giza179 (V_2)	0.7570a	0.7690a	4.539b	5.339b	431.5b	449.5b
Hybrid 1 (V3)	0.7604a	0.7724a	6.369a	7.169a	539.7a	557.7a
F. test	*	*	*	*	*	*
Nitrogen Treatment						
T_1	0.6828d	0.6948d	3.946e	4.746e	420.1e	438.1e
T_2	0.8560a	0.8680a	7.403a	8.203a	646.6a	664.6a
T_3	0.8137b	0.8257b	6.298b	7.098b	533.3b	551.3b
T_4	0.7603c	0.7723c	5.310c	6.110c	499.6c	517.6c
T_5	0.7348c	0.7468c	4.556d	5.356d	459.3d	477.3d
T_6	0.7032d	0.7152d	2.904f	3.704f	353.3f	371.3f
T_7	0.6132e	0.6252e	2.247g	3.047g	313.4g	331.4g
F. test	**	**	**	**	**	**
Interaction	*	*	*	*	*	*

Whereas:

T_1: Recommended dose of N as urea (165 kg N/ha), T_2: Recommended dose of N as Anhydrous Ammonia (165 kg N/ha), T_3:3/4 dose of Anhydrous Ammonia +1/4 N as urea at panicle initiation., T_4:3/4 dose of Anhydrous Ammonia +1/4 dose of N as urea at late booting, T_5:1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at panicle initiation, T_6: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at late booting, T_7: Control (Zero Fertilizer).

Among the treatment combination (V_3T_2) gave the highest value of chlorophyll content and the lowest value was from V_1T_7. Increase in chlorophyll content increased significantly due to nitrogen application could be attributed mainly to the role of nitrogen in the stimulation of cell division. Also, anhydrous ammonia increased the availability of nitrogen that increase the absorption of nitrogen that increase chlorophyll formation. These results are supported by the findings of Chaturvedi, (2005), who concluded that, the urea fertilizer showed significant reductions in growth and yields in most of the experiments compared with ammonium nitrogen fertilizer form. Similar finding was achieved by Osman, *et al*., (2013) and Ismail, *et al*., (2013). which they reported that the application of N-fertilizers may be attributed to the fact that these nutrients being important constituents of chlorophyll and enzymes that have direct impact on vegetative and reproductive phases of plants. Debiprasad, *et al*., (2010), concluded that the grain and straw of rice yield were increased significantly by adding nitrogen fertilizer. Grain yield was increased significantly when N fertilizer at 220 kg/ha was added, while the lowest value was recorded by control treatment (without addition of N fertilizer).

Table 3. Chlorophyll content of flag leaf as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	0.6420ij	0.7185d-g	0.6880f-i	0.6540j	0.7305e-g	0.7000g-i
T_2	0.7705cd	0.8740b	0.9235a	0.7825cd	0.8860b	0.9355a
T_3	0.7605c-e	0.8380b	0.8425b	0.7725cde	0.8500b	0.8545b
T_4	0.7530c-e	0.7820c	0.7460c-e	0.7650c-f	0.7940c	0.7580c-f
T_5	0.7145e-h	0.7535c-e	0.7365c-f	0.7265f-h	0.7655c-f	0.7485d-f
T_6	0.6625hi	0.7365c-f	0.7105e-h	0.6745ij	0.7485d-f	0.7225f-h
T_7	0.5675k	0.5965jk	0.6755g-i	0.5795k	0.6085k	0.6875h-j

Leaf area index:

Data in Table (2) reveal that the highest value of leaf area index was observed with EHR1 followed by Giza 179. Nitrogen application Injection into dry soil before flooding significantly affected leaf area index. Maximum value of leaf area index was recorded when nitrogen application was applied as a full dose of anhydrous ammonia injected into dry soil before flooding at the rate of 165 kg N/ha^{-1}, while the lowest value was observed with control treatment. This mainly due to the role of nitrogen in physiological process. The interaction between three rice cultivars and different sources of nitrogen had significant effect on LAI during both seasons. Data in Table (4) showed that, Egyptian Hybrid rice1 gave the highest LAI values when they treated by anhydrous ammonia (T_2 treatment)followed by anhydrous ammonia+ urea (T_3 treatment) in 2015 and 2016, respectively. While, Sakha106 with T_7 treatment (control) gave the lowest values of LAI at late booting stage in 2015 and 2016, respectively. Similar finding was achieved by Osman, *et al*., (2013),Chaturvedi, (2005)and Ismail, *et al*., (2013). which they reported that the increase in growth and yield owing to the application of N-fertilizers may be attributed to the fact that these nutrients being important constituents of nucleotides, proteins, chlorophyll and enzymes, involve in various metabolic processes which have direct impact on vegetative and reproductive phases of plants.

Table 4. Leaf area index as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	2.877lm	3.920ij	5.040gh	3.677k	4.720gh	5.840f
T_2	5.397fg	6.383cd	10.430a	6.197f	7.183d	11.230a
T_3	3.783i-k	6.080d-f	9.030b	4.583ghi	6.880de	9.830b
T_4	3.440j-l	5.570e-g	6.920c	4.240h-k	6.370ef	7.720c
T_5	3.007kl	4.310hi	6.350cde	3.807jk	5.110g	7.150d
T_6	1.787no	3.340jkl	3.587i-l	2.587lm	4.140h-k	4.387h-j
T_7	1.347o	2.167mn	3.227j-l	2.147m	2.967l	4.027i-k

Dry matter (g.m^{-2}):

Hybrid rice 1 registered the highest numerical value of dry matter yield and the lowest value was recorded by Sakha106 at late booting stage in both seasons as shown in Table 5. Concerning the dry matter yield at late booting stage in both seasons, significant differences were detected among the different sources treatments. T_2 treatment (anhydrous ammonia) was superior to all other treatments in dry matter yield while, the lowest value was recorded by T_7 treatment (control) in both seasons. Rice cultivars and different sources of nitrogen application interaction was highly significant in season 2015and 2016 as cleared in Table 6. Egyptian Hybrid rice1 had the highest dry matter yield under T_2 treatment, while Sakah106 recorded the lowest value under T_7 treatment in both seasons. The increases of such parameters in response to application of N fertilizers is probably due to enhancing availability of nitrogen which enhanced leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation. These findings confirm those of Alim, (2012), Chaturvedi, (2005)and Debiprasad, *et al*., (2010).

Plant height (cm) at harvest:

Significant differences in plant height were observed among the cultivars (Table 6). Egyptian Hybrid rice1show the maximum plant height followed by Giza179. Plant height of rice cultivars also varied significant due to nitrogen fertilizer application (Table 6). Application full dose of anhydrous ammonia (T2) produced the highest plant height. Plant grown without nitrogen fertilizer had the lowest plant height. Significant variation of different treatments of nitrogen fertilizer and varieties were observed (Table 7). Among the treatments combination (V3T2) gave the highest value of plant height and lowest from V3T7. Increase in plant height due to nitrogen application could be attributed mainly to the role of nitrogen in the stimulation of cell division. The results are in conformity with those of Osman, *et al*., (2013), and Ismail, *et al*., (2013), who observed a significant effect of nitrogen on plant height.

Table 5. dry matter as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
T_1	340.0i	400.1gh	520.1d	358.0i	418.1gh	538.1d
T_2	619.9bc	600.0bc	720.0a	637.9bc	618.0bc	738.0a
T_3	480.0d-f	480.0d-f	640.0b	498.0de	498.0de	658.0b
T_4	458.6e-g	460.0e-g	580.1c	476.6ef	478.0ef	598.1c
T_5	420.0fg	460.0e-g	497.8de	438.0fg	478.0ef	515.8de
T_6	280.0j	360.0hi	420.0fg	298.0j	378.0hi	438.0fg
T_7	280.0j	260.1j	400.1gh	298.0j	278.1j	418.1gh

Table 6. Plant height/cm, No. of tiller/m^2, No. of panicle/m^2 at harvest as affected by rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Treatments	Plant height /cm at harvest		No. of tiller/m2		No. of panicle/m2	
	2015	2016	2015	2016	2015	2016
Cultivars:						
Sakha106 (V_1)	91.85c	94.85e	616.8c	625.8c	521.2c	530.2c
Giza179 (V_2)	98.05b	101.05b	643.5b	652.5b	570.3b	579.3b
Hybrid 1 (V3)	106.69a	109.69a	669.5a	678.5a	649.9a	658.9a
F. test	**	**	**	**	**	**
Nitrogen Treatment:						
T_1	97.32d	100.32d	613.8d	622.8d	562.6d	571.6d
T_2	106.33a	109.33a	765.4a	774.4a	702.7a	711.7a
T_3	101.83b	104.83b	688.1b	697.1b	625.3b	634.3b
T_4	100.93bc	103.93bc	674.7b	683.7b	614.7b	623.7b
T_5	99.50c	102.50c	636.0c	645.0c	585.3c	594.3c
T_6	95.52d	98.52d	577.0e	586.0e	523.1e	532.1e
T_7	90.61e	93.61e	548.0f	557.0f	449.3f	458.3f
F. test	**	**	**	**	**	**
Interaction	*	*	*	*	*	*

Whereas:

T_1: Recommended dose of N as urea (165 kg N/ha), T_2: Recommended dose of N as Anhydrous Ammonia (165 kg N/ha), T_3:3/4 dose of Anhydrous Ammonia +1/4 N as urea at panicle initiation., T_4:3/4 dose of Anhydrous Ammonia +1/4 dose of N as urea at late booting, T_5: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at panicle initiation, T_6: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at late booting, T_7: Control (Zero Fertilizer).

Table 7. Plant height/cm at harvest as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106(V1)	Giza 179 (V2)	Hybrid1(V3)
	2015			2016		
T_1	90.29fg	94.84e	106.83b	93.29hi	97.84f	109.83bc
T_2	100.84d	105.33bc	112.84a	103.84e	108.33bc	115.84a
T_3	93.67ef	104.50bc	107.34b	96.67fg	107.50cd	110.34b
T_4	93.17ef	102.50cd	107.11b	96.17fg	105.50de	110.11bc
T_5	91.17efg	100.34d	107.00b	94.17gh	103.34e	110.00bc
T_6	88.17gh	93.00ef	105.40bc	91.17ij	96.00fg	108.40bc
T_7	85.67h	85.83h	100.33d	88.67j	88.83j	103.33e

Number of tiller /m^2 at harvest:

Number of tillers.m^{-2} varied significantly among by the cultivars (Table6). Data in Table 6 indicated that nitrogen fertilizer affected significantly number of tillers m^{-2}. Number of tillers significantly increased in case of EHR1. Application of full dose of anhydrous ammonia (T_2) produced the highest number of tillers.m^{-2}followed by the treatments (T_3&T_4). Control treatment plant grown without nitrogen fertilizer had the lowest effective tillers. Similar results of applied N fertilizer were reported by Matsuo *et al*, 1995;who, reported that it is necessary to apply much N fertilizers to help rice plants to accelerate the phosphate absorption for increased tillering. Alim, 2012found that the differences in the number of tillers among the different type and compatible N were mainly due to their variations in the availability of N and other nutrients. Adequacy of nitrogen probably favored the cellular activities during panicle formation and development that led to increased number of tillers. hill^{-1}, consequently in the number of tillers.m^{-2}. Regarding the interaction effect of rice cultivars and different sources of nitrogen fertilizers (Table 8), it is obviously clear that, the application of full dose of anhydrous ammonia (T_2) produced the highest number of tillrs.m^{-2}with Egyptian hybrid rice 1, followed by Giza 179 which gave the highest number of tillers under the same treatment of nitrogen application in this study.

Number of panicle /m^2 at harvest:

The highest value of number of panicle /m2 at harvest was observed with EHR1 followed by Giza 179.Nitrogen application significantly affected the number of panicles. Maximum value of number of panicles was recorded when recommended dose of nitrogen as anhydrous ammonia was applied (T2)while, the lowest value was observed when nitrogen was not applied. This mainly due to the role of nitrogen in physiological process. These results are supported by the findings of Chaturvedi, 2005, who concluded that, the urea fertilizer show significant reductions in growth and yields in most of the experiments compared with ammonium nitrogen fertilizer form.

Table 8. No. of tiller at harvest/m^2 as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106(V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106(V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	589.3gh	628.1ef	624.0ef	598.3ij	637.1fgh	633.0gh
T_2	716.1bc	748.0b	832.0a	725.1c	757.0b	841.0a
T_3	652.1de	684.0cd	728.1b	661.1efg	693.0de	737.1bc
T_4	644.1ef	660.0de	720.0b	653.1efg	669.0e-h	729.0bc
T_5	612.0fg	640.1ef	655.9de	621.0hi	649.1ij	664.9def
T_6	572.1hi	584.1ghi	574.7hi	581.1jk	593.1jkl	583.7jk
T_7	532.1j	559.9hij	552.0ij	541.1l	568.9kl	561.0kl

Regarding the interaction effect of rice cultivars and different sources of nitrogen fertilizers (Table 9), it is obviously clear that the application of full dose of anhydrous ammonia (T_2) produced the highest number of panicles.$m^{-2}$with Egyptian hybrid rice1, followed by Giza 179 which gave the highest number of panicles under the same treatment of nitrogen application under this study.

Table 9. No. of panicle at harvest/m^2 as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106(V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106(V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
T_1	520.0h	563.9efg	604.0cde	529.0g	572.9ef	613.0cd
T_2	620.1cd	676.0b	811.9a	629.1cd	685.0b	820.9a
T_3	559.9fgh	612.0cd	704.1b	568.9ef	621.0cd	713.1b
T_4	552.0fgh	604.0cde	688.0b	561.0eg	613.0cd	697.0b
T_5	536.1gh	587.9def	631.9e	545.1fg	596.9de	640.9c
T_6	476.1i	528.0gh	565.4efg	485.1h	537.0fg	574.4ef
T_7	384.0j	420.0j	544.0gh	393.0j	429.0i	553.0fg

Panicle weight (g):

Panicle weight differed significantly in all cultivars (Table 10). The maximum panicle weight was observed with EHR1 followed by Giza179. There were a significant differences in panicle weight among different nitrogen sources treatments. Where, T_2 treatment (anhydrous ammonia) produced the heaviest panicle weight, while T_7 treatment (control) produced the lowest value of panicle weight in both seasons.

The interaction between rice cultivars and different sources of nitrogen was highly significant in both seasons of study 2015 and 2016. Data in Table (11) recorded that, under T_2 treatment, EHR1 produced the heaviest panicle weight, while the lowest value of panicle weight was recorded under T_7 treatment. Thus, the increase in growth and yield owing to the application of N-fertilizers may be attributed to the fact that these nutrients being important constituents of nucleotides, proteins, chlorophyll and enzymes, involve in various metabolic processes which have direct impact on vegetative and reproductive phases of plants. These findings confirm those of Chaturvedi,2005who concluded that, without fertilizer gave the lowest grain N content in experiments. Thus,it may be concluded that nitrogen fertilizer was found to be optimum for rice production.

Table 10. Panicle weight (g) and panicle length (cm) as affected by rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Treatments	Panicle weight (g)		Panicle length (cm)	
	2015	2016	2015	2016
Cultivars:				
Sakha106 (V_1)	3.133b	3.173b	20.279b	20.389b
Giza179 (V_2)	3.364a	3.404a	20.836ab	20.946ab
Hybrid 1 (V3)	3.477a	3.517a	21.364a	21.474a
F. test	*	*	*	*
Nitrogen Treatment:				
T_1	3.362c	3.402c	20.433c	20.543c
T_2	3.957a	3.997a	22.700a	22.810a
T_3	3.660b	3.700b	22.117b	22.227b
T_4	3.546bc	3.586bc	21.817b	21.927b
T_5	3.330c	3.370c	20.800c	20.910c
T_6	2.907d	2.947d	19.817d	19.927d
T_7	2.510e	2.550e	18.100e	18.210e
F. test	**	**	**	**
Interaction	*	*	*	*

Whereas:

T_1: Recommended dose of N as urea (165 kg N/ha), T_2: Recommended dose of N as Anhydrous Ammonia (165 kg N/ha), T_3:3/4 dose of Anhydrous Ammonia +1/4 N as urea at panicle initiation., T_4:3/4 dose of Anhydrous Ammonia +1/4 dose of N as urea at late booting, T_5: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at panicle initiation, T_6: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at late booting, T_7: Control (Zero Fertilizer).

Table 11. Panicle weight (g) as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	3.000f-i	3.747bc	3.340c-f	3.040ghi	3.787bc	3.380def
T_2	3.740bc	3.830b	4.300a	3.780bc	3.870b	4.340a
T_3	3.420b-f	3.730bc	3.830b	3.460cde	3.770bc	3.870b
T_4	3.220e-g	3.620b-e	3.797b	3.260efg	3.660bcd	3.837b
T_5	3.040f-i	3.280def	3.670b-d	3.080fgh	3.320efg	3.710bc
T_6	2.810g-j	2.770hij	3.140fgh	2.850hij	2.810hij	3.180efg
T_7	2.700ij	2.570jk	2.260k	2.740ij	2.610j	2.300k

Panicle length (cm):

Cultivars show significant variation in respect of panicle length (Table 10). The longest panicle was observed from EHR1 and the shortest from Sakha106. Nitrogen had significant role in increasing the panicle length (Table 10). Concerning the panicle length there was a significant difference were detected among different sources of treatments in both seasons. T_2 treatment (anhydrous ammonia) produced the longest panicle, while T_7 treatment (control) produced the shortest panicle length in both seasons. Similar results were reported for lowland rice by Sahar and Burbey (2003), Osman, *et al.*, (2013) and Chaturvedi, (2005). Data in Table 12 showed that a significant interaction between rice cultivars and different nitrogen sources in panicle length (cm) in both seasons of study. Data revealed that EHR1produced the highest panicles length (cm) in both seasons when treated with application recommended dose of anhydrous ammonia (T_2). On the other hand, Giza179 gave nearly the lowest panicles length which non-treated with any nitrogen treatment under this study.

Table 12. Panicle length (cm) as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
T_1	19.900ef	20.400de	21.000cd	20.010hi	20.510fgh	21.110def
T_2	21.500c	23.150ab	23.450a	21.610d	23.260ab	23.560a
T_3	21.200cd	22.550b	22.600b	21.310de	22.660c	22.710bc
T_4	20.700cde	22.350b	22.400b	20.810efg	22.460c	22.510c
T_5	20.350de	21.000cd	21.050cd	20.460gh	21.110def	21.160de
T_6	19.550f	19.250fg	20.650cde	19.660ij	19.360jk	20.760efg
T_7	18.750gh	17.150i	18.400h	18.860kl	17.260m	18.510l

Filled grain and unfilled grains/ panicle:

Filled grain and unfilled grain per panicle variations exerted significant influence on the filled grain. panicle^{-1} (Table 13). Cultivar EHR1 produced the maximum number of filled grains panicle^{-1}followed by Giza179. The lowest number of filled grain panicle^{-1} was observed from Sakha106. Also, data showed that the highest number of unfilled grain was observed with EHR1 while the lowest unfilled grain/ panicle was recorded by Sakha106. Filled as well as unfilled grains panicle^{-1} was also significantly affected by different treatments in both seasons (Table 13). Full dose of anhydrous ammonia before flooded (T_2) introduced the highest number of filled grain panicle^{-1}followed by the treatment of 3/4 anhydrous ammonia +1/4 urea at P.I (T_3). Control treatment produced the lowest number of filled grains. In this study, it was observed that the highest number of unfilled grain was produced with 1/2 anhydrous ammonia +1/2 urea at late booting(T_6) due to applied half dose of urea at late booting which produced highest number of unfilled grain/panicle.The findings are in agreement with those of Chaturvedi, (2005)and Debiprasad, *et al.*, (2010).

Table 13. No. of filled grain/panicle, No. of unfilled grain/panicle, 1000-grain weight as affected by rice cultivars and different treatments of nitrogenapplication in 2015 and 2016 seasons.

Treatments	No. of filled grain/panicle		No. of unfilled grain/panicle		1000-grain weight (g)	
	2015	2016	2015	2016	2015	2016
Cultivars:						
Sakha106 (V_1)	105.99c	108.99c	3.300c	5.300c	27.619a	28.619a
Giza179 (V_2)	117.10b	120.10b	4.600b	6.600b	24.286c	25.286c
Hybrid 1 (V3)	136.00a	139.00a	5.943a	7.943a	23.857b	24.918b
F. test	**	**	**	**	**	**
Nitrogen Treatment:						
T_1	110.27d	113.27d	3.433e	5.433e	26.278bc	27.278bc
T_2	145.74a	148.74a	5.667b	7.667b	23.000f	24.000f
T_3	134.60b	137.60b	4.600c	6.600c	24.667e	25.667e
T_4	132.13b	135.13b	4.167cd	6.167cd	25.333d	26.333d
T_5	122.97c	125.97c	3.833de	5.833de	25.833cd	26.833cd
T_6	103.70e	106.70e	8.167a	10.167a	26.833ab	27.833ab
T_7	88.47f	91.47f	2.433f	4.433f	27.170a	28.140a
F. test	**	**	**	**	**	**
Interaction	*	*	*	*	*	*

Whereas:

T_1: Recommended dose of N as urea (165 kg N/ha), T_2: Recommended dose of N as Anhydrous Ammonia (165 kg N/ha), T_3:3/4 dose of Anhydrous Ammonia +1/4 N as urea at panicle initiation., T_4:3/4 dose of Anhydrous Ammonia +1/4 dose of N as urea at late booting, T_5: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at panicle initiation, T_6: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at late booting, T_7: Control (Zero Fertilizer).

Interaction between cultivars and nitrogen treatments significantly affected the number of filled and unfilled grains panicle^{-1} (Table14 and 15). The cultivarEHR1coupled with application full dose of anhydrous ammonia before flooded (T_2) introduced the highest number of filled grains panicle^{-1}. The lowest number of filled grain, however produced by the treatment V_3T_7. This is might be due to larger panicle size and translocation of photosynthesis to the respiration organs for setting grains. The highest unfilled grains panicle^{-1} was found in with the combination of V_3T_6 with no any significantly with V_2T_6. This was mainly due to the lack of nitrogen's as it is a limiting nutrient factor for grain filling.

Table 14. No. of filled grain/panicle as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
N_1	100.50jk	105.50ij	124.80efg	103.50ij	108.50hi	127.80de
N_2	128.50ef	143.20d	165.53a	131.50d	146.20c	168.53a
N_3	115.00ghi	132.50e	156.30ab	118.00fg	135.50d	159.30b
N_4	111.80hi	129.60ef	155.00bc	114.80gh	132.60d	158.00b
N_5	105.60ij	117.10gh	146.20cd	108.60hi	120.10efg	149.20c
N_6	92.00klm	98.50jkl	120.60fgh	95.00kl	101.50ijk	123.60ef
N_7	88.50lm	93.30klm	83.60m	91.50lm	96.30jkl	86.60m

Table 15. No. of unfilled grain/panicle as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
N_1	2.500hi	3.500fgh	4.300efg	4.500ghi	5.500efg	6.300e
N_2	4.000fg	5.500cde	7.500b	6.000ef	7.500cd	9.500b
N_3	3.500fgh	4.500def	5.800cd	5.500efg	6.500de	7.800c
N_4	3.000gh	4.000fg	5.500cde	5.000fgh	6.000ef	7.500cd
N_5	2.500hi	3.500fgh	5.500cde	4.500ghi	5.500efg	7.500cd
N_6	6.000c	9.000a	9.500a	8.000c	11.00a	11.500a
N_7	1.600i	2.200hi	3.500fgh	3.600i	4.200hi	5.500efg

1000-grain weight:

Cultivars showed significant response on 1000-grain weight (Table 13). The highest 1000-grain weight was observed with Sakha106 which was significantly higher than other cultivars. EHR1 showed the lowest 1000-grain weight. Nitrogen sources treatments influenced significantly the thousand grain weight. Maximum 1000-grain weight was recorded without application of nitrogen (T_7) and it was statistically at par with application 1/2 of nitrogen as anhydrous ammonia + 1/2 of nitrogen as urea at late booting (T_6).Which was superior over rest of the treatments. Mehla and Panwar (2001) also, observed differences in yield components and yield of different basmati rice cultivars. Similar results were reported earlier by Boli *et al*., (1995). Increase in 1000-grain weight with application full dose of anhydrous ammonia before flooded might be primarily due to higher photosynthetic rate and ultimately plenty of photosynthesis available during grain development (Kausar *et al*., 1993).Data in Table 16revealed that a significant difference on the interaction between rice cultivars and different nitrogen sources were recorded in both seasons. Data indicate that Sakha 106 gave the maximum 1000-grain weight which recorded without application of nitrogen (T_7) and it was statistically at par with application 1/2 of nitrogen as anhydrous ammonia + 1/2 of nitrogen as urea at late booting (T_6).

Table 16. 1000-grain weight as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	27.833b	26.500cde	24.500ghi	28.833b	27.500cde	25.500ghi
T_2	25.500efg	21.500l	22.000kl	26.500efg	22.500l	23.000kl
T_3	27.000bcd	24.000hij	23.000jk	28.000bcd	25.000hij	24.000jk
T_4	27.500bc	25.000fgh	23.500ij	28.500bc	26.000fgh	24.500ij
T_5	27.500bc	26.000def	24.000hij	28.500bc	27.000def	25.000hij
T_6	29.000a	26.500cde	25.000fgh	30.000a	27.500cde	26.000fgh
T_7	29.000a	27.000bcd	25.500efg	30.000a	28.000bcd	26.430efg

Grain and straw yield:

The rice cultivars different significantly in respect of grain and straw yield ha-1 (Table 17). The hybrid rice cultivar produced the highest grain and straw yield followed by Giza179. The results were in conformity with the observation of Mariam, (2007) and Bijesh Maharjan and Rodney T. Venterea (2014). Grain and straw yield t. ha^{-1} increased with applying nitrogen as full dose in the form of anhydrous ammonia injection into soil before flooded. Application of anhydrous ammonia injection in soil before flooded (T_2) gave the maximum grain and straw yield followed by (T_3)3/4 of nitrogen as anhydrous ammonia + 1/4 nitrogen as urea at panicle initiation (P.I) which was statistically at par with(T_4) 3/4 of nitrogen as anhydrous ammonia + 1/4 nitrogen as urea at late booting (LB) in the two seasons. High yield of application anhydrous ammonia injection in soil before flooded (T_2)might be primarily due to more filled grains and high value of the panicle weight. The interaction effect of rice cultivars and nitrogen sources exerted significant influence on the grain and straw yield (Table 18 and19) combination of V_3T_2 produced the highest grain and straw yield and it was statistically identical with V_3T_3, V_3T_4, V_2T_2 and V_2T_3 in both seasons of study. It was observed that the lowest values of grain yield were produced with T_7 (without N) application with all cultivars. This may be due to low soil nitrogen contents that would delay root growth and ultimately crop establishment. Andrews. (1956), Chaturvedi, (2005), Debiprasad, *et al*., (2010)and Osman, *et al*., (2013) concluded that the grain and straw of rice yield were increased significantly by adding nitrogen fertilizer. Yield ofrice grain was increased significantly when N fertilizer at 220 kg/ha was added, while the lowest value was recorded by control treatment (without addition of N fertilizer).

Table 17. Grain yield and straw yield t/ha as affected by rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Treatments	Grain yield t/ha		Straw yield t/ha	
	2015	2016	2015	2016
Cultivars:				
Sakha106 (V_1)	10.850c	11.080c	11.810b	12.040b
Giza179 (V_2)	11.310b	11.540b	12.233b	12.463b
Hybrid 1 (V3)	11.678a	11.908a	13.303a	13.533a
F. test	**	**	**	**
Nitrogen Treatment:				
T_1	11.436d	11.703d	12.193d	12.423d
T_2	12.472a	12.437a	13.760a	13.990a
T_3	12.161b	12.387b	13.357b	13.587b
T_4	12.003bc	12.211bc	13.106bc	13.336b
T_5	11.752c	12.073c	12.783c	13.013c
T_6	11.221d	11.413d	12.078d	12.308d
T_7	7.910e	8.140e	9.864e	10.094e
F. test	**	**	**	**
Interaction	**	**	**	**

Whereas:
T_1: Recommended dose of N as urea (165 kg N/ha), T_2: Recommended dose of N as Anhydrous Ammonia (165 kg N/ha), T_3:3/4 dose of Anhydrous Ammonia +1/4 N as urea at panicle initiation., T_4:3/4 dose of Anhydrous Ammonia +1/4 dose of N as urea at late booting, T_5: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at panicle initiation, T_6: 1/2 dose of N as Anhydrous Ammonia +1/2 N as urea at late booting, T_7: Control (Zero Fertilizer).

Table 18. Grain yield t/ha as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)	Sakha106 (V1)	Giza 179 (V2)	Hybrid 1(V3)
	2015			2016		
T_1	11.133hi	11.497gh	11.677e-h	11.363i	11.727g-i	12.020efg
T_2	12.053c-f	12.617ab	12.747a	12.283de	12.847ab	12.977a
T_3	11.647e-h	12.350abc	12.487a-c	11.877fg	12.580bcd	12.717abc
T_4	11.533f-h	12.180b-e	12.297a-d	11.763gh	12.410cd	12.527bcd
T_5	11.233h-i	12.023c-g	12.000c-g	11.463hi	12.253def	12.230def
T_6	10.723i	11.150hi	11.790d-g	10.953j	11.380i	11.907efg
T_7	7.630k	7.353k	8.747j	7.860l	7.583L	8.977k

Table 19. Straw yield t/ha as affected by the interaction between rice cultivars and different treatments of nitrogen application in 2015 and 2016 seasons.

Nitrogen Treatment	Cultivars					
	Sakha106(V1)	Giza 179 (V2)	Hybrid 1 (V3)	Sakha106(V1)	Giza 179 (V2)	Hybrid 1 (V3)
	2015			2016		
T_1	11.653ij	11.957hi	12.970def	11.883lm	12.187kl	13.200f-h
T_2	13.233de	13.473cd	14.573a	13.463ef	13.703de	14.803a
T_3	12.633efg	13.123de	14.313ab	12.863hi	13.353e-g	14.543ab
T_4	12.453fgh	12.760ef	14.103ab	12.683ij	12.990g-i	14.333bc
T_5	12.103ghi	12.400fgh	13.847bc	12.333jk	12.630ij	14.077cd
T_6	11.310j	11.927hi	12.997def	11.540m	12.157kl	13.227f-h
T_7	9.280l	9.993k	10.320k	9.510o	10.223n	10.550n

Finally, it can be concluded that application of Anhydrous Ammonia is better than urea alone and in case of the application of the half dose of Anhydrous Ammonia, it is better to apply the rest amount of nitrogen at PI.

Economic Study:

An economic analysis on the combined result using the partial budget technique is appropriate. The results of the partial budget are given in Tables 20,21,22,23,24 and 25.Data show that the highest profit was recorded when full dose of Anhydrous Ammonia was applied with all varieties. As well as hybrid 1 recorded the more profit followed by Giza 179 than other varieties.

Table 20. Effect of different nitrogen treatments for Sakha 106 cultivaron farmer profit by LEin 2015 season.

Treatments	Season 2015						
	Sakha 106	Price of rice	Total price for rice/pound	urea price	Amonia price	Labor	Income
T1	11.133	2500	27832.5	833	0	200	26799.5
T2	12.053	2500	30132.5	0	1201.66	0	28930.84
T3	11.647	2500	29117.5	178.5	901.2	100	27937.8
T4	11.533	2500	28832.5	178.5	901.2	100	27652.8
T5	11.233	2500	28082.5	357	600.83	100	27024.67
T6	10.723	2500	26807.5	357	600.83	100	25749.67
T7	7.63	2500	19075	0	0	0	19075

Table 21. Effect of different nitrogen treatments for Giza179cultivaron farmer profit by LE in 2015 season.

Treatments	Season 2015						
	Giza 179	Price of rice	Total price for rice/pound	urea price	Amonia price	Labor	Income
T1	11.497	2500	28742.5	833	0	200	27709.5
T2	12.617	2500	31542.5	0	1201.66	0	30340.84
T3	12.35	2500	30875	178.5	901.2	100	29695.3
T4	12.18	2500	30450	178.5	901.2	100	29270.3
T5	12.023	2500	30057.5	357	600.83	100	28999.67
T6	11.15	2500	27875	357	600.83	100	26817.17
T7	7.353	2500	18382.5	0	0	0	18382.5

Table 22. Effect of different nitrogen treatments for Hybrid1 cultivar on farmer profit by LE in 2015 season.

Treatments	Season 2015						
	Hybrid 1	Price of rice	Total price for rice/pound	Urea price	Amonia price	Labor	Income
T1	11.677	2500	29192.5	833	0	200	28159.5
T2	12.747	2500	31867.5	0	1201.66	0	30665.84
T3	12.487	2500	31217.5	178.5	901.2	100	30037.8
T4	12.297	2500	30742.5	178.5	901.2	100	29562.8
T5	12	2500	30000	357	600.83	100	28942.17
T6	11.79	2500	29475	357	600.83	100	28417.17
T7	8.747	2500	21867.5	0	0	0	21867.5

Table 23. Effect of different nitrogen treatments for Sakha106 cultivar on farmer profit by LEin 2016 season.

Treatments	Season 2016						
	Sahka 106	Price of rice	Total price for rice/pound	urea price	Amonia price	Labor	Income
T1	11.363	2500	28407.5	833	0	200	27374.5
T2	12.283	2500	30707.5	0	1201.66	0	29505.84
T3	11.877	2500	29692.5	178.5	901.2	100	28512.8
T4	11.763	2500	29407.5	178.5	901.2	100	28227.8
T5	11.463	2500	28657.5	357	600.83	100	27599.67
T6	10.953	2500	27382.5	357	600.83	100	26324.67
T7	7.86	2500	19650	0	0	0	19650

Table 24. Effect of different nitrogen treatments for Giza179 cultivar on farmer profit by LE in 2016 season.

Treatments	Season 2016						
	Giza 179	Price of rice	Total price for rice/pound	Urea price	Amonia price	Labor	Income
T1	11.727	2500	29317.5	833	0	200	28284.5
T2	12.847	2500	32117.5	0	1201.66	0	30915.84
T3	12.58	2500	31450	178.5	901.2	100	30270.3
T4	12.41	2500	31025	178.5	901.2	100	29845.3
T5	12.253	2500	30632.5	357	600.83	100	29574.67
T6	11.38	2500	28450	357	600.83	100	27392.17
T7	7.583	2500	18957.5	0	0	0	18957.5

Table 25. Effect of different nitrogen treatments for Hybrid1 cultivar on farmer profitby LE in 2016 season.

Treatments	Season 2016						
	Hybrid 1	Price of rice	Total price for rice/pound	Urea price	Amonia price	Labor	Income
T1	12.02	2500	30050	833	0	200	29017
T2	12.977	2500	32442.5	0	1201.66	0	31240.84
T3	12.717	2500	31792.5	178.5	901.2	100	30612.8
T4	12.527	2500	31317.5	178.5	901.2	100	30137.8
T5	12.23	2500	30575	357	600.83	100	29517.17
T6	11.907	2500	29767.5	357	600.83	100	28709.67
T7	8.977	2500	22442.5	0	0	0	22442.5

CONCLUSION

Based on the results, it can be concluded that nitrogen should be applied as Anhydrous Ammonia for obtaining the highest grain yield and increase the farmer's income.

REFERENCES

Abdel Kader-Mona G. (2002). Response of growth and yield of wheat "cv Seds 7" to Fe and Zn application under ammonia injection. Ph. D. Thesis, Fac. of Agric. Moshtohor, Zagazig, Univ.

Alim,M. A. 2012. J. Environ. Sci. & Natural Resources, 5: 273- 282,

Ali-Nadia A. A., Darwish, D S. and Mansour, M. M. (2002). Effect of Azotobacterchroococcum and Azospirillumbarsilence inoculation and anhydrous ammonia on root colonization, plant growth and wheat plant under saline –Alkline conditions. J. Agric Sci. Mansoura Univ. 27 (8) 5575-5591.

Bagayoko, M., 2012. Journal of Agricultural and Biological Science. 7:620-632.

BijeshMaharjan and Rodney T. Venterea (2014). Anhydrous Ammonia Injection Depth Does Not Affect Nitrous Oxide Emissions in a Silt Loam over Two Growing Seasons. Journal of Environmental Quality. Published August 15, 2014.

Boli, A., Siddique, S. M., Ganai, B. A., Khan, H. V., Singh, K. N. and Bali, A.S. 1995. Response of rice genotypes to nitrogen levels under transplanted condition in Kashmir valley. Indian J. Agron., 40 (1): 35-37.

Chaturvedi, I.,2005. J. Cent. Eur. Agric. 6: 611-618.

Cottenia, A.; R. Camerbynek; M. Verioo and A. Dhaere, 1979. Fractionation and determination on of trace elements in plants. Soils and Sediments pure Appl. Chem. 52: 145 – 153.

Duncan, D. B. (1955). Multiple range and multiple F-tests. Biometrics 11: 1-42.

Debiprasad D, Hrusikesh P, Ramesh C. Tiwari and Mohammad S, J. 2010.Adv. Appl. Sci. Res. 2010 1, 36-49.

El-Masry, A. A. Gohar, M. N. and El-Akabawy, M. A. (2006). The influence of nitrogenous fertilizer sources and some soil amendments on Hull-less Barley under alkli soil. Egypt J.Appl. Sci.21 (11): 247-256.

El-Mneasy, A. I. A. (2002). Increasing the efficiency of some fertilizers. Ph. D. Thesis, Fac. of Agric. Zagazig Univ. Egypt.

Fageria, N. K. 2003. Communications in Soil Science and Plant Analysis 34: 259–270.

Fageria, N.K., Baligar, V.C., Jones, C.A., 1997. Growth and Mineral Nutrition of Field Crops; 2nd Ed; Marcel Dekker: New York.

Gately, T.F. and Kelly, D., 1987. Sources of nitrogen for spring barley. Soils and Grassland Production Research Report, pp 27–8. Dublin. An ForasTaluntais

Ismail, A. O. A.*; F. A. Farag; A. H. A. Hassanein and A. H. Abd-Elrahman (2013). Effect of Soil Amendments and Anhydrous Ammonia Application and Their Interactions on Some Soil Properties And Wheat Productivity Under Salt Affected Soil conditions. J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 4 (10): 1085 - 1100, 2013.

Kausor, K., Akbar, M., Rasal, E. and Ahmed, A. N. 1993. Physiological response of nitrogen, phosphorus and potassium on growth and yield of wheat. Pakistan J. Agric. Re. 14: 2-3.

Mariam T.W.G. 2007. Productivity of some rice cultivars fertilized with different nitrogen sources. M. Sc. Thesis, Fac. of Agric., Kafrelsheikh. Univ., Egypt.

Matsuo, T. K. Kumazawa, R. Ihii, K. Ishihara and H. Hirate, 1995. Science of the plant. Volume two physiology. Food and Agriculture Policy Research Center, Tokyo, Japan, PP: 1240.

Mehla, D.S and Panwar, D.V.S. 2001. Effect of fertility levels on field and yield components of semi-dwarf and tall scented rices. Indian J. Ecol. 28 (1) :7-12.

Osman E. A. M., A. A. EL- Masry and K. A. Khatab (2013). Effect of nitrogen fertilizer sources and foliar spray of humic and/or fluvic acids on yield and quality of rice plants. Pelagia Research Library Advances in Applied Science Research, 2013, 4(4):174-183.

Page, A. L.; R. H. Miller and Dr. Keeney. 1982. Methods of soil Analysis. Part 2. Amer. Sco. Agric. Inc. Madison.

Place, G.A., Sims J.L. and Hall, U.L., 1970. Agron. J., 62: 239–41.

Sahar, A. and N. Burbly, 2003. Effect of nitrogen, phosphorus and potassium (NPK) compound dosages on the growth and yield of lowland rice. J. Stigma (Indonesia), 11 (1): 26 -29.

Samonte, S. O. P. B., L. T. Wilson, J. C. Medley, S. R. M. Pinson, A. M. Mc- Clung, and J. S. Lales. 2006. Agronomy Journal 98: 168–176.

Tayefe, M., A. Gerayzade, E. amiri1 and A. NasrollahZade, 2011. International Conference on Biology, Environment and Chemistry. IPCBEE vol.24 (2011) © (2011) IACSIT Press, Singapoore.

Yoshida S., 1981. Fundamentals of rice Crop Science. International Rice Research Institute, 269 p.

تأثير إستخدام اليوريا واالتسميد الأمونيا اللامائية على محصول ومكونات المحصول لنبات الأرز

طاهر محمد عبد المجيد

قسم بحوث الأرز، معهد بحوث المحاصيل الحقلية، مركز البحوث الزراعية.

أجريت دراسة وذلك لتقييم بعض أصناف الأرز المصرية تحت طرق ومواعيد مختلفة من إضافة السماد الأزوتى والتى أجريت بمركز بحوث الأرز بسخا خلال موسمى 2015، 2016، وذلك فى ارض طينية منخفضة المادة العضوية والنيتروجين وذلك لدراسة تأثير مصادر مختلفة من التسميد النيتروجينى على محصول الأرز ومكوناتة، وكانت المعاملات المستخدمة ثلاثة أصناف أرز مصرية هي، هجين مصرى واحد، جيزة179، سخا106 كما إستخدم سبعة معاملات من النيتروجين المختلفة وذلك طبقاُ للمعدل الموصى بة من اليوريا وهو 165 كجم نيتروجين /هكتار، الأمونيا الغازية وهى 82% نيتروجين، وتم حقن الأمونيا الغازية بالتربة الجافة على عمق20 سم قبل الزراعة واليوريا طبقاً للتوصيات قسم بحوث الأرز بسخا. أشارت النتائج إلى أن إضافة النيتروجين بمعدل 165 كجم نيتروجين /هكتار كأمونيا غازية أعطت اعلى محتوى كلورفيل ومساحة ورقية ، وزن مادة جافة (م2)، طول نبات (سم)، عدد فروع والسنابل (م2)، وزن السنبلة (جم)، طول السنبلة (سم)، عدد الحبوب الممتلئة والتى أدت إلى زيادة معنوية فى المحصول وتم تاكيد ذلك بعمل تقييم إقتصادى للكل المعاملات تحت الدراسة.