

EFFECT OF DIFFERENT NITROGEN LEVELS AND TIME OF APPLICATION ON THE GRAIN QUALITY CHARACTERS OF DIFFERENT RICE VARIETIES.

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Abstract

Two field experiments were conducted during the two seasons 1988 and 1989 at El-Khadmia, Kafr El-Sheikh to study the effect of timing and levels of nitrogen fertilization on the grain quality characters of two rice cultivars, Giza 175 and Giza 181. The main results obtained can be summarized as follows:-

In both seasons Giza 181 surpassed Giza 175 in most of the grain quality characters. Time of N-application had a significant effect on the studied traits.

Crude protein content and head rice% increased, while hulling% and milling% tended to decrease by increasing N-levels. On the other hand, the different interactions were significant with respect to the studied traits.

INTRODUCTION

Increasing nitrogen efficiency through the use of an optimum N-level at an optimum time of application, is one of the most important factors that limits productivity of rice varieties. Ismail (1989) found that the modern high tillering and short-stature rice cultivar, Giza 181 was the highest yielder compared with the tall tradi-

tional one, Giza 172 which was the lowest yielder. Leilah and El-Kalla (1989) and Ismail (1989) found that increasing N-level up to 60 kg N/fed. significantly increased rice grain yield and most of its components.

The present investigation aimed to study the effect of rice varieties, time of N-application and N-levels on the grain quality characters.

MATERIALS AND METHODS

Two field experiments were carried out at El-Khadmia, Kafr El-Sheikh during two summer seasons (1988 and 1989) to study the effect of 3 times of N-application ($1/2$ of N in dry soil before transplanting "BT" + $1/2$ of N at 20 days after transplanting "AT", $1/2$ of N at "AT" + $1/2$ of N at panicle initiation "PI" and $1/3$ of N at "AT" + $2/3$ of N at "PI") and 5 N-levels (0, 20, 40, 60 and 80 kg N/fed.) on grain quality characters of two rice varieties namely Giza 181 and Giza 175. The calcium monphosphate (15.0% P_2O_5) was added before the flooding, immediatly at the rate of 100 kg/fed. Nitrogen as urea (46% N) was added according to the previously mentioned timing and levels of N-application. Irrigation and other culture operation were given whenever necessary. Some soil physical and chemical properties are given in Table 1. The experiment was laid out in a split-split design with 4 replicates. At the time of harvest the following characters were measured:-

- 1- Hulling percentage
- 2- Milling percentage
- 3- Grain crude protein
- 4- Head rice percentage

Data were subjected to analysis of variance according to the procedure outlined by Gomez and Gomez (1984). Treatment means were compared by the New L.S.D. of Waller and Duncan (1969).

Table1. Some soil chemical and physical properties of the experimental soil.

Properties	Seasons	
	1988	1989
Mechanical analysis		
Sand %	12.50	12.20
Silt %	31.20	31.50
Clay %	56.30	55.30
Soil texture	Heavy clay	
Chemical analysis		
E. C. mmoh/cm at 25°C	1.80	1.70
Organic matter content	1.52	1.53
Calcium carbonate %	1.32	1.34
Soil pH (1:2.5)	8.30	8.10
Total N ppm	360.00	434.00
Available NH ₄ ppm	1.90	2.10
Available NO ₃ ppm	18.30	17.20
Available P ppm	19.10	18.60
Available K	310.00	350.00

RESULTS AND DISCUSSION

Data in Table 2 reveal that hulling % significantly differed by the two rice varieties, this variation may be due to the difference between the hull weight of the two varieties. On the other hand, the highest hulling % was obtained by adding 1/3 of N at 20 days "AT" + 2/3 of N at "PI", while application of 1/2 N at 20 days "AT"+ 1/2 of N at "PI" recorded the lowest one in both seasons. Data also show that, raising nitrogen levels up to 80 kg N/fed. significantly reduced hulling%. These results agree with those obtained by Badawi (1982) and Ismail (1989).

Table 2. Average of hulling%, milling %, protein content% and head rice% as affected by rice varieties, time of N-application and N-levels.

Characters	Hulling %		Milling %		Protein %		Head rice %	
	1988	1989	1988	1989	1988	1989	1988	1989
Treatments								
A-Rice varieties								
Giza 175	73.89	74.61	65.93	66.00	7.80	7.81	53.55	53.02
Giza 181	75.47	76.24	66.39	66.46	7.91	7.94	53.30	52.80
F - test	N.S.	**	N.S.	N.S.	**	**	N.S.	N.S.
B-Time of N-appl.								
T ₁	74.87	75.63	67.43	67.56	7.53	7.57	52.49	51.98
T ₂	74.11	74.86	65.06	65.13	7.92	7.79	52.99	52.99
T ₃	75.06	75.78	66.01	66.00	8.09	8.16	54.82	54.28
L.S.D. 5 %	0.52	0.53	0.78	0.77	0.02	0.02	0.21	0.21
L.S.D. 1 %	0.75	0.76	1.13	1.12	0.03	0.03	0.31	0.30
C- N-Levels								
00 kg N/fed.	76.08	76.85	67.09	67.16	6.42	6.49	49.32	48.85
20 kg N/fed.	75.44	76.21	66.83	66.90	7.79	7.80	51.76	51.23
40 kg N/fed.	73.83	74.85	66.43	66.50	8.20	8.21	54.22	53.69
60 kg N/fed.	74.71	74.47	66.08	66.15	8.46	8.44	55.74	55.19
80 kg N/fed.	74.31	74.02	64.37	64.44	8.58	8.57	56.13	55.58
L.S.D. 5 %	0.91	0.92	1.21	1.20	0.03	0.03	0.28	0.27
L.S.D. 1 %	1.23	1.21	1.56	1.58	0.04	0.04	0.36	0.35

T₁ = 1/2 of N in dry soil + 1/2 of N at 20 days "AT".

T₂ = 1/2 of N at 20 days "AT" + 1/2 of N at "PI".

T₃ = 1/3 of N at 20 days "AT" + 2/3 of N at "PI".

The interaction between rice varieties and time of N-application had a significant effect on hulling%, over both seasons, adding 1/3 of N at 20 days "AT"+ 2/3 of N at "PI" to Giza 181 recorded the highest hulling % values, while the lowest ones were obtained with applying 1/2 of N at 20 days "AT" + 1/2 of N at " PI" for Giza 175, Table 3. Also, data in Table 4. show that, hulling % was significantly affected by the interaction between rice varieties and N-levels. Applying 80 Kg N/fed. to Giza 181 recorded the highest hulling %, while the lowest one was obtained from applying 40 kg N/fed. to Giza 175.

Data in Table 5 reveal that, hulling percentage was significantly affected by the interaction between N-levels and time of N-application.

Adding 80 kg N/fed. as 1/2 of N in dry soil+1/2 of N at 20 days "AT" recorded the lowest hulling % values in both seasons.

Data in Table 2 reveal that, milling % was not affected by the two rice varieties, on the other hand it was significantly affected by time of N-application. The highest milling % values were obtained by adding nitrogen as 1/2 of N in dry soil + 1/2 of N at 20 days "AT", while adding nitrogen as 1/2 of N at 20 days "AT"+ 1/2 of N at "PI" produced the lowest ones over both seasons. Data in Table 2 also show that, milling % value was significantly decreased by increasing N-levels, these results are in harmony with those obtained by Badawi (1982).

Milling % was significantly affected by the interaction between rice varieties and either time of N-application or N-levels. The highest milling % was obtained with treatment of N-application as (1/2 of N in dry soil + 1/2 of N at 20 days "AT"), while the lowest one was recorded with treatment of N-application as (1/2 of N at 20 days "AT" + 1/2 of N at " PI") over both seasons. On the other hand, the highest milling % was obtained from unfertilized Giza 175 rice plants, while the lowest one was obtained from Giza 175 rice plants when treated with 80 kg N/fed. (Tables 3&4).

Data in Table 5 show that, the milling % values were significantly affected by the interaction between time of N-application and N-levels, the lowest milling% was obtained 80 kg N/fed. as (1/2 of N at 20 days "AT" + 1/2 of N at " PI".

Regarding the grain protein content, data in Table 2 indicate that, the two rice varieties, Giza 181 and Giza 175 significantly differed in grain protein content, Giza 181 recorded the higher grain protein content than Giza 175 over both seasons. On

Table 3. Average of hulling%, milling %, and head rice as affected by the interaction between rice varieties and time of nitrogen application.

Characters	Hulling %				Milling %				Head rice %			
	1988		1989		1988		1989		1988		1989	
	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181
Season												
Rice varieties												
Time of N-application												
T ₁	74.30	75.43	75.06	76.20	67.53	67.45	67.60	67.52	53.44	51.53	52.93	51.02
T ₂	72.91	75.31	73.65	76.08	65.00	65.12	65.07	65.19	53.16	52.82	52.64	52.30
T ₃	74.37	75.67	75.13	76.44	65.27	66.60	65.34	66.67	54.01	55.62	53.48	55.07
L.S.D. at 5%	1.05		1.08		0.24		0.23		0.26		0.29	
L.S.D. at 1%	1.50		1.05		0.36		0.34		0.40		0.24	

Table 4. Average of hulling%, milling %, and head rice% as affected by the interaction between rice varieties and nitrogen levels.

Characters	Hulling %				Milling %				Head rice %			
	1988		1989		1988		1989		1988		1989	
	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181	Giza 175	Giza 181
Season												
Rice varieties												
N-application												
00 kg N/fed.	76.52	75.64	77.30	76.41	67.25	66.94	67.32	67.01	49.90	48.77	49.41	48.29
20 kg N/fed.	75.76	75.12	76.33	75.88	66.84	66.81	66.91	66.88	51.88	51.60	51.37	51.09
40 kg N/fed.	72.64	75.01	73.38	75.77	66.70	66.16	66.77	66.23	53.23	52.21	52.71	52.67
60 kg N/fed.	73.79	75.63	74.54	76.40	65.96	66.20	66.03	66.27	55.25	56.30	54.44	55.95
80 kg N/fed.	70.61	75.95	71.33	76.72	62.91	65.83	62.89	65.90	55.61	55.65	55.06	55.10
L.S.D. 5 %	1.77		1.78		1.34		1.36		0.39		0.40	
L.S.D. 1 %	2.25		2.28		1.76		1.74		0.51		0.51	

Table 5. Average of hulling%, milling %, and head rice% as affected by the interaction between time of nitrogen application and nitrogen levels.

Time of N-application	Hulling %						Milling %						Head rice %					
	1988			1989			1988			1989			1988			1989		
	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
N-levels																		
00 kg N/fed.	76.11	76.04	76.09	76.88	76.81	76.86	76.44	67.19	66.64	67.51	67.26	66.71	49.23	49.41	49.36	48.75	48.93	48.88
20 kg N/fed.	76.21	75.05	76.98	75.81	75.84	67.99	66.91	65.58	68.06	66.98	65.65	50.80	51.01	53.39	50.30	50.51	50.51	52.87
40 kg N/fed.	75.28	70.70	74.80	76.75	71.42	75.56	68.93	64.08	66.29	69.20	64.15	66.36	52.70	52.74	57.23	52.18	52.22	56.67
60 kg N/fed.	75.02	73.38	75.73	75.78	74.13	76.50	67.88	63.78	66.59	67.95	63.85	66.66	54.28	55.08	57.86	53.75	54.54	57.29
80 kg N/fed.	71.04	75.38	73.41	71.76	76.15	74.16	65.21	63.34	64.56	65.28	63.41	64.63	55.45	51.66	58.23	54.91	51.15	55.68
L.S.D. 5 %	2.16			2.18			1.64			1.66				0.48			0.49	
L.S.D. 1 %	2.77			2.79			2.11			2.13				0.65			0.63	

the other hand, the highest protein content was obtained by applying N as (1/3 of N at 20 days "AT" + 2/3 of N at "PI"), while the lowest one was recorded with (1/2 of N in dry soil + 1/2 of N at 20 days "AT" treatment. On the other hand, grain protein content significantly increased by increasing N-levels. These results are in agreement with the findings obtained by El-Kalla *et al* (1988), Ismail (1989) and Singh *et al* (1989).

Data in Table 2 also reveal that there are no significant differences between the two rice varieties in head rice%, in spite of the differences between them in grain length. Head rice % was significantly affected by the time of N-application, 1/3 of N at 20 days "AT" + 2/3 of N at "PI" treatment recorded the highest head rice %, while when nitrogen was applied as 1/2 of N in dry soil + 1/2 of N at 20 days "AT" recorded the lowest one.

Head rice % was significantly affected by N-levels. Head rice% increased by increasing N-levels. This may be attributed to the resistance to breakage of the grain resulting from the increase in protein content. These results are in good agreement with those obtained by Badawi (1982).

Data in Table 3 show that the head rice % was significantly affected by the interaction between rice varieties and time of N-application. The highest head rice% was recorded from Giza 181 when nitrogen was applied as 1/3 of N at 20 days "AT" + 2/3 of N at "PI", while nitrogen added as 1/2 of N in dry soil + 1/2 of N at 20 days "AT" gave the lowest one over both seasons. Moreover, the increasing N-levels was associated with the increase in head rice% for Giza 181 and Giza 175 (Table 4). The highest head rice % was obtained from Giza 181 when fertilized by 60 kg N/fed.

On the other hand, head rice% was significantly affected by the interaction between time of N-application and N-levels, (Table 5). Adding 60 kg N/fed. as 1/3 of N at 20 days "AT" + 2/3 of N at "PI" (T₃) gave the highest head rice % in 1989 season while 80 kg N/fed added at T₃ gave the highest value in 1988.

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تأثير مستويات مختلفه من النيتروجين وميعاد إضافتها على صفات جودة حبوب أصناف أرز مختلفه

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أقيمت تجربتان حقليتان فى موسم ١٩٨٨ و ١٩٨٩ فى مزرعة الخادمية بكفر الشيخ لدراسة تأثير خمسة معدلات تسميد نيتروجين (صفر و ٢٠ و ٤٠ و ٦٠ و ٨٠ كجم نيتروجين / للفدان وثلاث مواعيد اضافة كالتالى ٢/١ كمية النيتروجين مختلطة بالأرض الجافه قبل الشتل ٢/١+ الكمية بعد ٢٠ يوم من الشتل ، ٢/١ كمية النيتروجين بعد ٢٠ يوم من الشتل + ٢/١ الكمية عند بداية تكوين الداليات ، ٢/١ كمية النيتروجين بعد ٢٠ يوم من الشتل + ٢/٢ الكمية عند بداية تكوين الداليات على صفات جودة حبوب صنفى أرز جيزه ١٧٥ و ١٨١ والنسبه المئويه للحبوب السليمه .

ويمكن تلخيص النتائج المتحصل عليها كالتالى :-

١ - تفوق الصنف جيزه ١٨١ على الصنف جيزه ١٧٥ فى النسبه المئويه للبروتين فى الحبوب والنسبه المئويه للتقشير.

٢ - كان لمواعيد اضافة سماد النيتروجين أثراً معنوياً على معظم الصفات تحت الدراسة حيث سجلت معاملة اضافة النيتروجين (٢/١) كمية النيتروجين بعد ٢٠ يوم من الشتل + ٢/٢ الكمية عند بداية تكوين الداليات (زيادة النسبه المئويه للتقشير والنسبه المئويه للبروتين فى الحبوب على مدى الموسمين.

٣ - أدت زيادة معدلات التسميد النيتروجينى حتى ٨٠ كجم نيتروجين / للفدان الى زيادة كل من النسبه المئويه للبروتين فى الحبوب السليمه والنسبه المئويه للحبوب السليمه ونقص كل من النسبه المئويه للتقشير والنسبه المئويه للتبييض وذلك خلال موسمى الدراسه.

٤ - كان للتفاعل بين الأصناف ومواعيد اضافة النيتروجين تأثيراً معنوياً على النسبه المئويه للتقشير والنسبه المئويه للتبييض والنسبه المئويه للحبوب السليمه حيث سجلت المعامله التى تحتوى على صنف جيزه ١٨١ عند اضافة ٢/١ كمية النيتروجين بعد ٢٠ يوم من الشتل + ٢/٢ الكمية عند بداية تكوين الداليات زيادة النسبه المئويه للتقشير والنسبه المئويه للحبوب السليمه خلال موسمى الزراعه.

٥ - أثر التفاعل بين الأصناف ومستويات النيتروجين معنوياً على النسبه المئويه للحبوب السليمه حيث أدى اضافة ٨٠ كجم نيتروجين / للفدان الى صنف جيزه ١٨١ الى زيادة النسبه المئويه للحبوب السليمه.

٦ - أثر التفاعل بين مواعيد الإضافة ومعدلات التسميد بالنيتروجين معنوياً على النسبه المئويه للحبوب السليمه حيث أدى اضافة ٦٠ كجم نيتروجين / للفدان على دفتين ٢/١ كمية النيتروجين بعد ٢٠ يوم من الشتل + ٢/٢ الكمية عند بداية تكوين الداليات للحصول على أعلى نسبة مئويه من الحبوب السليمه