

EFFECT OF NITROGEN FERTILIZATION SOURCES AND RATES ON SOME RICE DISEASES IN EGYPT

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Abstract

Split plot design experiments were conducted to evaluate the effect of nitrogen fertilizer sources as farmyard manure (FYM) and/or urea at different rates on brown spot and false smut infection on five rice cultivars. The main treatments were assigned for the rice cvs. i.e. Giza 171, Giza 177, Giza 178, Sakha 101 and Sakha 104, while sub plots were used for nitrogen sources and rates. The experiments were conducted at Sakha experimental farm at Rice Research & Training Center (RRTC) in 2002 and 2003 seasons.

Results showed that infection with brown spot varied according to different tested cultivars. The infection was higher on Giza 177 and Giza 171 rice cultivars as compared with the other tested cultivars while the least infected cultivar in both seasons was Sakha 104. It was found also that the lower nitrogen rate the higher infection with brown spot disease as a mean of the five tested cvs. The severity of infection increased in case of incorporating FYM into the soil prior to the last plough as compared with urea.

The severity of false smut infection was higher on the late maturing cultivar Giza 171 than on the early maturing ones, Giza 177, G.178, Sakha101, and Sakha 104. The severity of infection increased as the nitrogen fertilization rates increased. As for yield, it was shown that the yield increased by increasing nitrogen fertilization compared with the untreated plots.

INTRODUCTION

Soil organic matter plays an important role in soil fertility. It is considered the major source of nutrients, especially in rice nutrition (Chu *et al.*, 1978).

Brown spot disease caused by *Helminthosporium oryzae* has been known for some time to be associated with abnormal soil deficient in nutrient elements (Ou, 1985). It was reported that nitrogen deficiency was more conducive to brown spot disease, while an excess of nitrogen reduces susceptibility (Ismunadji, *et al.* 1973, Kauraw, & Samantary 1982 and Osman, 1985). Mohanty & Chakrabart (1982) reported that supply of nitrogen in slow release form was associated with lower incidence of the disease. Chakrabarti & Chaudhure (1992) mentioned that brown spot development increases with either deficiency or excess of nitrogen.

Some researches have investigated the false smut infection *Ustilaginoidea virens* as influenced by nitrogen fertilization. Singh *et al.* (1987) reported that incidence of false smut was lowest at the zero N level with a four fold increase on plants receiving the highest dose (240 kg N/ha as urea). The same conclusion was reported by other investigators (Singh, 1974, Singh *et al.* 1987 and Bhardwaj *et al.* 1989). Thakur *et al.* (1995) also found that maximum dose of N (125 kg/ha) enhanced disease severity. However, the higher dose of K application with N reduced disease intensity.

The incidence and severity of both brown spot and false smut differ from cultivar to another either under artificial or natural inoculation. A lot of researchers evaluated many promising lines and cultivars for both diseases, they found different reactions among these tested lines and cultivars (Ou, 1985, Ansari *et al.* 1988, Patil & Moghe 1990, Bhagat *et al.* 1993, and Ding-Kejian, *et al.* 1997).

Chakraborty *et al.* (1988) used farmyard manure in combination with urea and found that yield of rice and apparent nitrogen use efficiency were highest in sole urea treatment and almost similar in farmyard manure + urea. Budhar *et al.* (1991) reported that grain yield of rice was significantly influenced by farmyard manure and green manures over control. Rajput and Warsi (1991) reported that application of organic materials with or without inorganic nitrogen significantly increased grain and straw yields over control. Application of N in combination with organic materials proved to be better than application of N alone.

Sharma and Mitra (1988 & 1991) found that the application of farmyard manure at the rate of 10 t/ha at transplanting increased grain yield as much as the application of 30 K N/ha. They found also that increasing the rate of farmyard manure application up to 15 t / ha increased grain yield significantly. Thakur *et al.* (1995) reported that yields of grain and straw of rice increased significantly due to the application of organic manures.

The current study aimed to find out the effect of farmyard manure either alone or in combination with urea on brown spot and false smut diseases of rice.

MATERIALS AND METHODS

Field experiments were conducted at Sakha experimental farm at Rice Research and training center (RRTC) in 2002 and 2003 season. Split plot design experiment with four replicates were conducted. The main plots had five rice cvs. i.e. Giza 171, Giza 177, Giza 178, Sakha 101 and Sakha 104, while sub plots were used for nitrogen applications (Table 1). Urea (46.5% N) was used at rates of 40, 60 and 80 units of nitrogen per feddan. Half of the

dose was incorporated into the soil just before puddling, while the other half was added 30 days after transplanting. The rates of farmyard manure (FYM) were 20 and 30 m³ /fed incorporated and plowed into the soil in each treatment prior to the last plough. The rest of the treatments was 20 kg N + 10 m³ FYM/fed. The organic manure was incorporated into the soil during land preparation while 20 kg N/fed was added half with FYM and the other 30 days after transplanting. The plot size was 2 × m, comprising 10 rows with 20 × 20 cm spacing between rows and hills. Twenty-eight-day old seedlings were transplanted. The experiments were left for natural infection in both diseases.

Estimation of brown spot:

Samples of rice leaves were randomly taken four times at 15-day intervals, beginning after thirty days of transplanting. Total number of brown spot lesions was recorded for each hundred leaves per plot (El-Wahsh, 1997 and Osman, 1985).

Estimation of false smut:

Number of infected panicles /m² was counted to express the disease incidence. While number of smut balls/m² were counted to show the disease severity (Sehly *et al.*2004).

Grain yield:

Two rows from each side of plots were discarded to avoid the border effect, rice plants of remaining rows were harvested. The weight of the grain yield was recorded at harvest, and then adjusted to 14% moisture content (El-Wahsh, 1997 and Osman, 1985).

Statistical analysis:

All the collected data were subjected to statistical analysis following the standard methods by Gomez and Gomez (1976), using IRRISTAT Computer program. Data were presented in tables.

RESULTS AND DISCUSSION

The severity of brown spot as influenced by nitrogen fertilization as farmyard manure and / or urea in 2002 season is recorded in Table (1). The obtained data revealed that the highest infected cultivar was Giza 177 (101.29 spots /100 leaves) followed by Giza 171 (78.14 spots), while the lowest infected one was Sakha 104(32.43) and Sakha 101 (29.0). These results coincide with the findings of EL-Wahsh 1997 who found that Giza 171 and Giza 177 were the highest infected cultivars. It was shown also that the lowest mean number of spots was observed at 80 kg N of urea (35.80), followed by 60 kg N of urea (36.60) and 10 m³20 kg N+ FYM (42.80). While

the highest number of spot was shown at 40Kg N/F (59.00) and 30 m³ FYM (55.00) as compared with the untreated one (128.0 spots). The brown spot infection decreased with the increase of nitrogen levels in soils and vice-versa. Several researchers came to the same conclusion (Ismunadji, *et al.*, 1973, Kauraw & Samantaray, 1982 and Osman, 1985). The obtained results revealed that the severity of brown spot decreased by increasing of nitrogen levels in soil as compared with control. While the severity increased in case of adding FYM in contrast with adding urea alone. This might be due to incorporating FYM into the soil prior the last plough at the same season, so the available nitrogen was not high enough to decrease the brown spot severity.

Table 1. Effect of nitrogen fertilization as Farmyard manure (FYM) and urea on severity of leaf brown spot disease of five rice cultivars (Sakha – 2002 season)

Treatments	No. of spots / 100 leaves					S. Means
	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	
30 m ³ FYM /fed	75	85	57	28	30	55.00
80 Kg N/fed	48	79	13	17	22	35.80
20m ³ FYM/fed	74	92	49	23	33	54.00
60 Kg N /fed	49	57	33	25	19.3	36.60
20 kg N+10m ³ FYM/fed	71	75	35	16	17.3	42.80
40 kg N/fed	83	82	70	28	32.7	59.00
Control without	147	239	112	69	74.7	128.00
M. Mean**	78.14	101.29	52.71	29.0	32.43	-

L.S.D. 5%

Main ** (5.63)

Sub ** (10.81) Interaction* (29.7)

Concerning the severity of false smut, data in Table (2) show that the highest number of smut balls /m² was observed on Giza 171 (49.13), whereas the other tested cultivars ranged from 2.49 balls on Sakha 104 to 6.20 balls on Giza 177. Data also showed that the percentage of infection increased by increasing nitrogen fertilization. In spite of no significant differences between treatments, it ranged from 11.40 to 17.61 balls /m² as compared with the check (14.86). Singh & Dube (1978) , Anand *et al.* (1985), Bhardwaj *et al* (1987) and Narinder-Singh *et al* (1987) found that higher N levels in split application gave a higher number of smutted florets/m².

As for yield, data presented in Table (3) show that Sakha 101 gave the highest yield (3.817 T/fed) followed by Sakha 104 (3.704) and Giza 178 (3.344). All the treatments increased yield significantly compared with the untreated plots. The same experiment was repeated in season 2003. Data was recorded in Tables 4,5 and 6. The obtained data from Table (4) show that the highest severity of brown spot was noticed on Giza 177 (156.57)

flowed by Giza 171 (109.71) while the lowest number of spots was shown on Giza 178 (37.71). The highest infection severity was obtained from 40Kg N (115.60) followed by 20 m³ FYM (84.60) while the lowest infection was shown from 80Kg N (57.80) followed by 60Kg N/fed (73.00) as compared with the check one (230.00). Almost the same trend as the previous season.

Table 2. Effect of nitrogen fertilization as FYM and urea on percentage of false smut balls/m² of five rice cultivars (Sakha – 2002 season)

Treatments	No. of spots / 100 leaves					S. Means
	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	
30 m ³ FYM /fed	53.7	5.0	1.7	10.33	3.0	14.75
80 Kg N/fed	36.3	7.0	6.0	5.0	4.0	11.66
20m ³ FYM/fed	66.3	9.0	1.4	9.33	2.0	17.61
60 Kg N /fed	38.3	6.7	4.3	5.67	2.03	11.40
20 kg N+10m ³ FYM/fed	45.3	6.7	2.7	4.0	0.37	11.81
40 kg N/fed	45.0	2.7	3.7	4.67	3.33	11.88
Control without	59.0	6.3	3.0	3.33	2.67	14.86
M. Mean**	49.13	6.20	3.26	6.05	2.49	-

L.S.D. 5%

Main **(7.38)

Sub ns

Interaction*(10.92)

Concerning false smut, the data driven from Table (5) revealed that the highest false smut was shown on Giza 171 (38.99), followed by Giza 177 (12.24), while the lowest one was Sakha 101 (0.63). These results are in agreement with the findings of many investigators who mentioned that, incidence and severity of both brown spot and false smut differed from cultivar to another, either under artificial or natural inoculation, (Ou 1985 Ansari *et al* 1988, Patil and Moghar 1990, Bhagat *et al* 1993, and Ding-kejian *et al* 1997). The Infection trend was similar to that of the previous season. The severity of smut infection increased by increasing nitrogen fertilization applied either as urea and / or FYM, since it ranged from 8.99 to 21.47 balls/m² as compared with the control (3.33 balls /m²). The same conclusion was obtained by other researchers who mentioned that increasing nitrogen level predispose plants to false smut infection (Singh *et al* 1987, Bhagat *et al* 1993 and Ding-kejian *et al.* 1997).

The yield from the recorded data in Table (6) revealed that Giza 178 gave the highest yield followed by, Sakha 101 and Sakha 104. While Giza 177 and Giza 171 gave lower yield compared with the previous cultivars. Also the yield was increased by increasing nitrogen application compared with the untreated one (2.5) t/fed). The highest yield was obtained from 30m³ FYM /fed (3.70 t/fed.) followed by 10 m³ FYM + 20 kg N (3.65 t/fed). These results are in line with the findings of some investigators specially Rejput &

Wasi (1991) who reported that application of nitrogen in combination with organic materials proved better in grain and straw yields than application of nitrogen alone.

Table 3. Effect of nitrogen fertilization as FYM and urea on grain yield ton/fed of five rice cultivars (Sakha – 2002 season)

Treatments	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	S. Means
30 m ³ FYM /fed	3.526	3.547	3.637	4.068	3.913	3.738
80 Kg N/fed	3.388	3.273	3.451	3.760	3.564	3.487
20m ³ FYM/fed	3.487	3.444	3.445	3.880	3.740	3.599
60 Kg N /fed	3.369	3.494	3.448	3.871	3.660	3.568
20 kg N+10m ³ FYM/fed	3.492	3.406	3.510	4.240	4.290	3.788
40 kg N/fed	3.242	3.238	3.217	3.900	3.720	3.463
Control without	3.371	2.682	2.701	3.000	3.040	2.959
M. Mean**	3.411	3.298	3.344	3.817	3.704	-

L.S.D. 5%

Main * (0.32)

Sub ** Interaction<1

Table 4. Effect of nitrogen fertilization as FYM and urea on severity of leaf Brown spot disease of five rice cultivars (Sakha – 2003 season)

Treatments	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	S. Means
30 m ³ FYM /fed	73.0	104.0	43.0	63.0	60.0	68.60
80 Kg N/fed	85.0	89.0	17.0	69.0	29.0	57.80
20m ³ FYM/fed	95.0	100.0	33.0	108.0	87.0	84.60
60 Kg N /fed	68.0	113.0	23.0	89.0	72.0	73.00
20 kg N+10m ³ FYM/fed	101.0	132.0	26.0	63.0	91.0	82.60
40 kg N/fed	108.0	187.0	34.0	116.0	133.0	115.60
Control without	238.0	371.0	88.0	256.0	197.0	230.00
M. Mean**	109.71	156.57	37.71	109.14	95.57	-

L.S.D. 5%

Main **(17.46)

Sub **(17.58)

Interaction**(39.33)

Table 5. Effect of nitrogen fertilization as FYM and urea on severity of false smut disease of five rice cultivars (Sakha – 2003 season)

Cultivars Treatment	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	S. mean**
30 m ³ FYM /fed	64.3	37.0	4.70	0.67	0.67	21.47
80 Kg N/fed	37.3	13.67	5.0	1.0	0.67	11.53
20m ³ FYM/fed	50.7	2.0	1.0	0.13	1.67	11.10
60 Kg N /fed	36.3	3.3	2.7	1.0	1.67	8.99
20 kg N+10m ³ FYM/fed	32.0	17.3	1.3	0.13	1.0	10.35
40 kg N/fed	39.0	10.7	1.0	0.13	2.33	10.63
Control without	13.3	1.7	0.1	1.33	0.23	3.33
M. Mean**	38.99	12.24	2.26	0.63	1.18	-

L.S.D. 5%

Main **(8.87)

Sub **(8.6)

Interaction ns

Table 6. Effect of nitrogen fertilization as FYM and urea on Grain yield of five rice cultivars (Sakha – 2003 season)

Cultivars Treatment	Giza 171	Giza 177	Giza 178	Sakha 101	Sakha 104	S. mean**
30 m ³ FYM /fed	2.857	3.410	3.820	3.680	3.700	3.700
80 Kg N/fed	3.033	3.033	3.520	3.560	3.370	3.360
20m ³ FYM/fed	3.337	3.440	3.850	3.750	3.670	3.610
60 Kg N /fed	3.300	3.480	3.770	3.850	3.570	3.590
20 kg N+10m ³ FYM/fed	3.270	3.460	4.040	3.820	3.680	3.650
40 kg N/fed	2.960	3.030	3.197	3.140	3.960	3.060
Control without	2.422	2.177	2.590	2.670	2.620	2.500
M. Mean**	3.026	3.147	3.541	3.496	3.370	3.322

L.S.D. 5%

Main **(3.29)

Sub **(0.15)

Interaction ns

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تأثير مصادر و معدلات التسميد النيتروجيني المختلفة على بعض أمراض الأرز في مصر

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تم إجراء تجربة في قطاعات منشقة لدراسة تأثير التسميد النيتروجيني سواء عضوي (ناتج حيواني) أو سماء معدني (يوريا ٤٦,٥ %) أو الاثنين معا بمعدلات مختلفة لكل منهما، علي كلا مرضى التبقع البني و التفحم الكاذب على خمسة أصناف من الأرز بحيث كانت المعاملات الرئيسية عبارة عن أصناف الأرز التالية : جيزة ١٧١، جيزة ١٧٧، جيزة ١٧٨، سخا ١٠١ و سخا ١٠٤، بينما كانت المعاملات المنشقة عبارة عن مصادر و معدلات النيتروجين المختلفة. تم تنفيذ التجربة بمزرعة محطة البحوث الزراعية بسخا موسمي ٢٠٠٢، ٢٠٠٣. أظهرت النتائج أن الإصابة بمرض التبقع البني اختلفت باختلاف الأصناف المختبرة حيث كانت الإصابة عالية على الصنفان جيزة ١٧١، جيزة ١٧٧ عنها في بقية الأصناف تحت الدراسة . وكان أقل الأصناف إصابة في موسمي الزراعة هو الصنف سخا ١٠٤.

وجدت علاقة عكسية بين الإصابة بالمرض و التسميد الأزوتي حيث تزداد الإصابة بنقص التسميد الأزوتي و العكس على كل الأصناف تحت الاختبار .

أوضحت الدراسة أيضا أن الإصابة ازدادت في المعاملات التي تم إضافة السماد العضوي لها خلطا بالتربة قبل الحرثة الأخيرة في نفس موسم الزراعة وذلك و بالمقارنة بإضافة اليوريا فقط كسماد معدني.

بخصوص مرض التفحم الكاذب أوضحت النتائج أن شدة الإصابة كانت عالية على الصنف جيزة ١٧١ المتأخر في النضج عنة في بقية الأصناف مثل جيزة ١٧٧ ، جيزة ١٧٨ ، سخا ١٠١ ، و سخا ١٠٤ . وجد أيضا إن شدة الإصابة تزداد بزيادة التسميد النيتروجيني .
أظهرت الدراسة أن المحصول يزيد بزيادة التسميد الأزوتي بالمقارنة بالمعاملات التي لم يتم فيها إضافة أي سماد نيتروجيني.