

EFFECT OF FOLIAR APPLICATION OF UREA ON YIELD AND SEED QUALITY OF SOME RICE VARIETIES GROWN IN SALINITY SOILS.

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ABSTRACT

Two field experiments were carried out in salinity soils at Tag El-Eiz, Agricultural Research Station, Dakahlia Governorate, Egypt, during the two successive growing seasons 2000 and 2001. This investigation aimed to study the effect of time of foliar application of urea 20% (at panicle, at panicle+10 days and at panicle+ 20 days) on yield and seed quality of some rice varieties (Giza 177, Giza178 and Sakha 101) in salinity soils conditions. The results indicated that rice variety Giza 178 gave the highest value of panicle length, no. of panicles/m², panicle weight, no. and weight of grains/panicle, germination percentage and plumule length(cm) in the first season and no. of panicles/m², no. of grains/panicle, grain yield and germination percentage in the second season. While Sakha 101 gave the highest value of 1000-grain weight, grain yield, protein percentage, root length and seedling dry weight in the first season and plant height, panicle length and weight, grain weight/panicle, 1000-grain weight, straw yield, germination percentage, plumule length and seedling dry weight in the second season. On the other hand, Giza 177 gave the lowest value in all characters except carbohydrate percentage and seedling dry weight in the first season and carbohydrate percentage and plumule length in the second one. Foliar application of urea at panicle gave the highest value of grain yield, germination percentage and seedling dry weight in both seasons. The interaction between rice varieties x application time of urea spraying 20 % was not significant in all characters except of grain weight/panicle, straw yield and carbohydrate percentage in the first season.

INTRODUCTION

Rice (*Oryza sativa*, L.) is one of the most important cereal crops in Egypt. There is great need to improve its yield and quality. In this connection, El-Mowafy (1994) found that significant differences among cultivars regarding to Na, K uptake and Na/K ratio. Abd Alla (1996) observed that some rice varieties produced higher grain yield and number of panicles/m² than other varieties grown in the same field. Abd El-Rahman *et al* (1996) and Zayed (1997) investigated the productivity of some rice cultivars under saline soils. They observed highly significant differences among these cultivars in plant height, number of panicles/hill, panicle length and weight, 1000-grain weight, grain and straw yields. Some cultivars were salt tolerant while, other cultivars were salt sensitive. El-Kady and Abd El-Wahab (1999) evaluated three rice cultivars. They found that Giza 178 gave the highest values as to number of panicles/m², number of grains/panicle, and head rice. While Giza181 gave the highest values of leaf area index, dry matter content, N uptake and grain yield. Sakha 101 produced the tallest plants and heavier 1000-grain weight. Sehly *et al.* (2001) evaluated some rice cultivars. They reported highly significant differences among the studied cultivars in grain yield and K and N contents. Proper fertilizer is recognized as one of the effective factors. Nitrogen is an essential element for plant growth and a constituent of all proteins and protoplasm. Frank (1967) found that urea improves the

permeability of the cuticle which, turn favours mineral diffusion applied to the foliar. De et al. (1971), applied 17.8 kg N/ha as 20% urea spraying solution and obtained an increase of 15% in paddy yield over the un-sprayed control. Gupta et al. (1975) reported that applied 120 kg N/ha to rice cultivar IR 28 either fully through soil or as 50% through soil and the rest as successive foliar sprays of 5% urea solution. The latter treatment gave higher grain number/panicle, productive tillers/ plant and greater paddy yield. Fanyan and Yakovlev (1977) found that the foliar application of 20% of the rate of nitrogen to rice at the milk to wax ripe stage increased paddy yields by about 800 kg/ha and improved grain quality. Stefan and Stefan (1990) revealed that the rice yield increased with increasing liquid N fertilizer through foliar. Mandal *et al.* (1991) applied up to 200 kg N/ha as 100% soil application, 50% soil + 50% foliar application or 75% soil +25% foliar. They reported that plant height, number of panicles/m², straw yield and grain yield were greatest when 75% of N was applied to soil and the rest through foliar. Taha *et al.* (1992) found that foliar nitrogen of urea significantly increased rice grain and straw yield as well as their attributes as compared with the control. Badole and Narkhede (1999) found that the growth and yield of rice increased significantly with the application of 50, 50 and 50 kg/ha (N:P:K) as a basal rate and foliar spray of urea (2%) at grain filling growth stage.

The present work was designed to investigate the effect of urea spraying at different times of application on yield and seed quality of some rice varieties grown in salinity soils.

MATERIALS AND METHODS

These experiments were carried out during the two growing seasons of 2000 and 2001 at Tag El-Eiz Agricultural Research Station, Dakahlia Governorate to study the effect of foliar application of urea on yield and seed quality of some rice varieties in salinity soils conductions. Each experiment includes twelve treatments and a split-plot design with four replicates was used. The rice varieties (Giza177, Giza178 and Sakha 101) were randomly distributed in the main plots, while time of foliar application of urea at panicle stage (65 days after sowing) , at panicle+10 days and at panicle + 20 days) distributed in the sub-plots. The concentration of liquid urea was 20 %. The soil texture of the experimental farm was loam soils. Mechanical and chemical analysis of the two soils are presented in Table (1). The field was ploughed and calcium super phosphate (15.5 %P₂O₅) was incorporated in the soil during tillage operation at the rate of 30 kgP₂O₅/ fad. Nitrogen fertilizer in the form of urea 46.5 % was added at a rate of 25 kg N/fad after 15 days from sowing. Each sub-plot was 5 m long and 3 m wide. Rice seeds were sown on 12th June in both seasons at the rate of 60kg/fad. Weeds were chemically controlled by using satern with the rate of 1.500 litter/ fad, was incorporate in 10 kg sand and sowing after seven days from seed sown. At harvest, ten plants were chosen at random from the center of each plot to study the following characters, plant height (cm), panicle length (cm), panicle weight (g) number of grains/panicle, grain weight/panicle (g) and 1000-grain weight (g). From center each plot, tillers of one square meter were calculated to determine number of panicle/m². Plants of each plot were harvested and

threshed; grain and straw yield were weighted in kilogram and converted to ton/fad. Grain crude protein: N-content was determined according to Kjeldahl methods of A. O. A. C. (1970). The nitrogen content then multiplied by the factor of 5.95 to estimate the crude protein in the milled grains. Carbohydrate was estimated according to Dubious and Gilles methods (1956). Standard germination test (SGT): Four replicates (100 seed) were germinated on moistened paper towels at 25 C for 10 days (AOSA.1981). The plumule and root length of 10 randomly selected normal seedlings was measured and mean seedling dry weight was determined (AOSA.1983). All data were statistically analysed according to Gomez and Gomez (1983).

Table (1) : Mechanical and chemical analysis of soils used in 2000 and 2001 seasons

| Variables | Seasons | |
|------------------------------|---------|------|
| | 2000 | 2001 |
| Mechanical analysis : | | |
| Sand % | 48.2 | 46.2 |
| Silt % | 42.6 | 43.6 |
| Clay % | 9.2 | 10.2 |
| CaCO ₃ | 3.90 | 2.60 |
| Soil texture | Loam | Loam |
| Chemical analysis : | | |
| Organic matter | 3.51 | 1.73 |
| Available N (PPM) | 21 | 17.5 |
| Available P (PPM) | 61.9 | 36.9 |
| Available K (PPM) | 256 | 300 |
| Soil reaction pH (1:2.5) | 7.5 | 7.6 |
| EC Ds/m1 | 5.2 | 4.8 |

RESULTS AND DISCUSSION

1-Rice varieties:

Data presented in Tables (2), (3) and (4) show that the three varieties were differ significantly in all characters except for grain yield in the first season. The variety Giza 178 gave the highest value of panicle length (cm), no. of panicles/m², panicle weight (g), no. and weight of grains/panicle, germination percentage and plumule length (cm) in the first season and no. of panicles/m², no. of grains/panicle, grain yield (ton/fad.) and germination percentage in the second season, while Sakha 101 gave the highest value of plant height (cm), 1000-grain weight (g), grain yield (ton/fad.), protein percentage, root length and seedling dry weight (g) in the first season as well as plant height (cm), panicle length (cm), panicle weight (g), grain weight (g)/ panicle, 1000-grain weight (g), straw yield (ton/fad), germination percentage, plumule length (cm) and seedling dry weight (g) in the second season. On the other hand, variety Giza 177 gave the lowest value in all characters except carbohydrate percentage and seedling dry weight (g) in the first season and carbohydrate percentage and plumule length (cm) in the second season. The differences between the three rice varieties may be due to the differences in genetic make up of these varieties. These results are in harmony with those obtained by El-Mowafy(1994), Abd Alla (1996) and Abd El-Rahman *et al.* (1996).

Table (2): Effect of time of urea foliar application on growth and yield of some rice varieties in 2000 and 2001 seasons.

| Treatments | Plant height (cm) | | Panicle length (cm) | | No. of panicles/m ² | | Panicle weight(g) | | Grain weight/panicle | |
|-------------------------------|-------------------|-------|---------------------|-------|--------------------------------|--------|-------------------|------|----------------------|------|
| | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| A- Rice varieties : | | | | | | | | | | |
| 1-Giza 177 | 79.71 | 73.04 | 18.16 | 18.28 | 518.25 | 539.37 | 2.58 | 1.95 | 2.43 | 1.84 |
| 2-Giza178 | 76.09 | 72.49 | 21.05 | 19.46 | 604.50 | 695.06 | 2.87 | 2.23 | 2.73 | 2.04 |
| 3-Sakha 101 | 81.26 | 78.82 | 19.75 | 20.84 | 485.87 | 560.30 | 2.69 | 2.96 | 2.58 | 2.76 |
| L. S. D at 5% | 5.54 | 9.26 | 0.53 | 0.31 | 138.08 | 107.63 | 0.42 | 0.56 | 0.45 | 0.27 |
| B-Time of foliar spray | | | | | | | | | | |
| 1- Control | 75.95 | 71.13 | 18.92 | 18.64 | 480.17 | 479.58 | 2.39 | 2.22 | 2.38 | 2.06 |
| 2-At panicle | 81.17 | 77.23 | 20.42 | 20.00 | 588.83 | 665.42 | 3.17 | 2.56 | 2.81 | 2.32 |
| 3-At panicle+10days | 79.68 | 75.45 | 19.79 | 19.90 | 560.83 | 646.67 | 2.71 | 2.38 | 2.57 | 2.24 |
| 4-At panicle+20days | 79.28 | 75.32 | 19.48 | 19.56 | 515.00 | 602.08 | 2.57 | 2.36 | 2.55 | 2.24 |
| L. S. D at 5 % | 2.87 | 2.58 | 0.83 | 0.80 | 57.42 | 74.26 | 0.31 | 0.25 | 0.22 | 0.23 |
| C- The interaction: | | | | | | | | | | |
| A X B | N. S | N. S | N. S | N. S | N. S | N. S | N. S | N. S | * | N. S |

Table (3): Effect of time of urea foliar application on growth, yield and seed quality of some rice varieties in 2000 and 2001 seasons.

| Treatments | No. of grain/panicle | | 1000-grain weight(g) | | Grain yield (ton/fad) | | Straw yield ton/fad | | Protein percentage | |
|-------------------------------|----------------------|--------|----------------------|-------|-----------------------|-------|---------------------|-------|--------------------|------|
| | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| A- Rice varieties : | | | | | | | | | | |
| 1-Giza 177 | 102.47 | 71.40 | 26.54 | 25.73 | 2.940 | 2.171 | 3.052 | 2.766 | 5.07 | 4.00 |
| 2-Giza178 | 140.87 | 109.16 | 20.16 | 18.70 | 3.090 | 3.468 | 4.123 | 3.803 | 4.60 | 3.93 |
| 3-Sakha 101 | 108.87 | 108.25 | 27.99 | 25.56 | 3.113 | 3.239 | 3.565 | 4.898 | 4.46 | 5.65 |
| L. S. D. at 5% | 22.30 | 26.36 | 2.20 | 0.84 | N. S | 0.98 | 1.41 | 1.53 | N. S | 2.86 |
| B-Time of foliar spray | | | | | | | | | | |
| 1- Control | 109.20 | 86.30 | 24.02 | 22.90 | 2.817 | 2.767 | 3.234 | 3.270 | 3.65 | 3.45 |
| 2-At panicle | 124.67 | 104.54 | 26.02 | 23.43 | 3.556 | 3.101 | 3.653 | 4.406 | 4.99 | 4.78 |
| 3-At panicle+10days | 123.46 | 99.80 | 25.32 | 23.47 | 2.966 | 3.040 | 3.857 | 3.892 | 4.80 | 5.10 |
| 4-At panicle+20days | 112.30 | 94.45 | 24.23 | 23.52 | 2.851 | 2.929 | 3.575 | 3.722 | 5.45 | 4.78 |
| L. S. D at 5% | 17.87 | 4.87 | 1.34 | N. S | 0.34 | N. S | 0.67 | 0.53 | 1.63 | N. S |
| C- The interaction: | | | | | | | | | | |
| A X B | N. S | N. S | N.S | N.S | N.S | N.S | * | N.S | N.S | N.S |

Table (4): Effect of time of urea foliar application on yield and seed quality of some rice varieties in 2000 and 2001 seasons.

| Treatments | Protein Percentage | | Carbohydrate percentage | | Germination percentage | | Plumule Length | | Root length | | Seedling dry weight(g) | |
|-------------------------------|--------------------|------|-------------------------|-------|------------------------|-------|----------------|------|-------------|------|------------------------|-------|
| | 2000 | 2001 | 2000 | 2001 | 2000 | 2000 | 2001 | 2001 | 2000 | 2001 | 2000 | 2001 |
| A- Rice varieties : | | | | | | | | | | | | |
| 1-Giza 177 | 5.07 | 4.00 | 62.21 | 62.09 | 97.17 | 94.58 | 4.58 | 4.26 | 6.14 | 3.77 | 0.021 | 0.020 |
| 2-Giza178 | 4.60 | 3.93 | 60.58 | 60.65 | 98.00 | 96.67 | 4.74 | 4.16 | 7.12 | 3.96 | 0.015 | 0.015 |
| 3-Sakha 101 | 4.46 | 5.65 | 58.67 | 58.69 | 94.50 | 94.17 | 3.57 | 3.55 | 7.78 | 6.88 | 0.021 | 0.021 |
| L. S. D. at 5% | N. S | 2.86 | 3.67 | 4.57 | 6.30 | 3.69 | 1.27 | 0.95 | N.S | 2.22 | 0.004 | 0.004 |
| B-Time of foliar spray | | | | | | | | | | | | |
| 1- Control | 3.65 | 3.45 | 68.68 | 65.84 | 94.22 | 91.56 | 4.03 | 3.86 | 6.43 | 4.51 | 0.019 | 0.018 |
| 2-At panicle | 4.99 | 4.78 | 53.39 | 56.20 | 98.89 | 98.44 | 4.63 | 4.02 | 7.92 | 5.01 | 0.019 | 0.019 |
| 3-At panicle+10days | 4.80 | 5.10 | 60.30 | 60.34 | 97.33 | 96.22 | 4.22 | 4.03 | 7.06 | 5.14 | 0.019 | 0.019 |
| 4-At panicle+20days | 5.45 | 4.78 | 59.57 | 59.54 | 95.78 | 94.33 | 4.31 | 4.04 | 6.65 | 4.83 | 0.019 | 0.018 |
| L. S. D at 5% | 1.63 | N. S | 1.85 | 9.31 | 2.71 | 4.37 | N.S | N.S | N.S | N.S | N.S | N.S |
| C- The interaction : | | | | | | | | | | | | |
| A X B | N.S | N.S | ** | N. S | N.S | N.S | N.S | N.S | N.S | N.S | N.S | N.S |

2-Time of foliar application:

Data in Tables (2), (3) and (4) show that the effect of time of urea foliar application (20%) was significantly affected on all characters in both seasons. Non foliar (control) gave the highest value of carbohydrate percentage in both seasons and root length (cm) in the first season. while foliar spray of urea at panicle stage gave the highest value of plant height (cm), panicle length (cm), no. of panicles/m², panicle weight (g), grain weight (g)/panicle, no. of grains/panicle, grain yield (ton/fad), germination percentage and seedling dry weight (g) in both seasons. As well as 1000-grain weight (g) and plumule length (cm) in the first season and straw yield (ton/fad) in the second one as compared with other treatments. On the other hand foliar application of urea (20%) at panicle + 10 days gave the highest value of straw yield (ton/fad) in the first season and 1000-grain weight (g), protein percentage and root length (cm) in the second season. The last foliar spray of urea at panicle +20 days gave the highest value of protein percentage in the first season and plumule length (cm) in the second season. These results may be due to urea foliar spray increases cell permeability and the effect of urea on the metabolic activity in the leaves of plants. Similar results were obtained by De *et al.* (1971), Fanyan and Yakovley (1977) and Taha *et al.* (1992).

3-The interactions:

Data in Tables (5),(6)and(7) revealed that the interaction between rice varieties X time of application of urea spraying (20%) show no significant effect on all characters in this study except of grain weight (g)/panicle, straw yield (ton/fad) and carbohydrate percentage in the first season. Similar results were obtained by El-Kady and Abd El-Wahab (1999) and Sehly *et al.* (2001).

Table (5): The interaction effect between rice varieties and time of urea foliar application on grain weight/ panicle (g) in 2000 season.

| Rice varieties | Time of foliar application | | | |
|----------------|----------------------------|------------|----------------------|----------------------|
| | Control | At panicle | At panicle + 10 days | At panicle + 20 days |
| 1-Giza 177 | 2.15 | 2.52 | 2.54 | 2.50 |
| 2-Giza178 | 2.41 | 2.08 | 2.64 | 2.77 |
| 3-Sakha 101 | 2.58 | 2.82 | 2.52 | 2.37 |
| L. S. D. at 5% | 0.32 | | | |

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Table (6): The interaction effect between rice varieties and time of urea foliar application on straw yield (ton/fad) in 2000 season.

| Rice varieties | Time of foliar application | | | |
|----------------|----------------------------|------------|----------------------|----------------------|
| | Control | At panicle | At panicle + 10 days | At panicle + 20 days |
| 1-Giza 177 | 2.65 | 3.09 | 3.64 | 2.82 |
| 2-Giza178 | 3.67 | 3.97 | 3.95 | 4.90 |
| 3-Sakha 101 | 3.38 | 3.90 | 3.97 | 3.00 |
| L. S. D. at 5% | 0.97 | | | |

Table (7): The interaction effect between rice varieties and time of urea foliar application on carbohydrate % in 2000 season.

| Rice varieties | Time of foliar application | | | |
|----------------|----------------------------|------------|----------------------|----------------------|
| | Control | At panicle | At panicle + 10 days | At panicle + 20 days |
| 1-Giza 177 | 66.14 | 57.13 | 63.47 | 62.09 |
| 2-Giza178 | 69.20 | 56.07 | 59.60 | 57.45 |
| 3-Sakha 101 | 70.69 | 46.98 | 57.84 | 59.17 |
| L. S. D. at 5% | 2.70 | | | |

RECOMMENDATION

It can be recommended that sowing Giza 178 or Sakha 101 and foliar application of urea at panicle stage gave the highest values for yield and yield quality under saline soil conditions.

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تأثير الرش باليوريا على المحصول وجوده حبوب بعض أصناف الارز فى الاراضى الملحية

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أجريت تجربتان حقليتان بمزرعة محطة البحوث الزراعيه بتاج المز - محافظة الدقهليه خلال موسم الزراعه ٢٠٠٠، ٢٠٠١ وذلك لدراسة تأثير ميعاد الرش باليوريا على المحصول وجوده حبوب بعض أصناف الارز (جيزه ١٧٧ و١٧٨ وسخا ١٠١) فى الاراضى الملحيه وكانت اهم النتائج المتحصل عليها مايلي:-

١-تفوق الصنف جيزه ١٧٨ معنوياً على باقي الاصناف فى طول الداليات وعدد الداليات فى المتر المربع ووزن الداليات وعدد ووزن حبوب الداليه ونسبه اتياب الحبوب وطول الريشه فى الموسم الاول وايضا عدد الداليات فى المتر المربع وعدد الحبوب للداليه ومحصول الحبوب(طن / فدان)، النسبه المئويه لاتياب الحبوب فى الموسم الثانى. بينما تفوق الصنف سخا ١٠١ فى طول النباتات ووزن ١٠٠٠ حبه ومحصول الحبوب والنسبه المئويه للبروتين فى الحبوب وطول الجزير للبادره والوزن الجاف للبادره فى الموسم الاول وكذلك طول النبات وطول الداليه ووزن الداليات ووزن حبوب الداليه ووزن ١٠٠٠ حبه ومحصول القش (طن/ فدان) والنسبه المئويه لاتياب الحبوب وطول الريشه والوزن الجاف للبادره فى الموسم الثانى بينما اعطى الصنف جيزه ١٧٧ اعلى نسبة مئويه من الكربوهيدرات فى الحبوب واعلى قيمه من الوزن الجاف للبادره فى الموسم الاول وكذلك اعلى نسبة مئويه للكربوهيدرات وزياده فى طول الريشه فى الموسم الثانى.

٢-اعطت معامله الكنتترول (بدون رش) اعلى نسبة مئويه من الكربوهيدرات فى الحبوب فى كلا الموسمين واعلى قيمه لطول جزير البادرات فى الموسم الاول. بينما اعطى الرش باليوريا فى وقت تكوين الداليات (٦٥ يوم من الزراعه تقريبا) اعلى قيمه لكل من طول النبات وطول الداليه وعدد الداليات فى المتر المربع ووزن الداليه ووزن حبوب الداليه وعدد حبوب الداليه ومحصول الحبوب (طن/ فدان) والنسبه المئويه لاتياب الحبوب والوزن الجاف للبادرات فى كلا الموسمين وكذلك وزن ١٠٠٠ حبه و طول الريشه فى الموسم الاول ووزن القش (طن/ فدان) فى الموسم الثانى بالمقارنه بباقي المعاملات. بينما اعطى الرش باليوريا فى ميعاد تكوين الداليات + ١٠ يوم اعلى محصول من القش (طن / فدان) فى الموسم الاول واعلى قيمه من وزن ١٠٠٠ حبه والنسبه المئويه للبروتين فى الحبوب وطول الجزير للبادرات فى الموسم الثانى. وقد اعطى الرش باليوريا عند ميعاد تكوين الداليات + ٢٠ يوم اعلى نسبة مئويه من البروتين فى الموسم الاول وزياده فى طول الريشه فى الموسم الثانى.

٣- سجل التفاعل بين اصناف الارز وميعاد الرش باليوريا تأثيرا غير معنوياً فى جميع الصفات ما عدا وزن حبوب الداليه ومحصول القش (طن / فدان) والنسبه المئويه للكربوهيدرات فى الموسم الاول فقط.

٤- اوضحت الدرسة ان هناك تفوقا فى المحصول وجوده الحبوب لكل من الصنفين جيزه ١٧٨ وسخا ١٠١ فى كلا الموسمين كما سجل الرش باليوريا فى ميعاد تكوين الداليات اعلى محصول وجوده للحبوب وذلك فى الاراضى الملحيه تحت ظروف محافظه الدقهليه.

ويمكن التوصية بزراعة صنفى الأرز جيزه ١٧٨ أو سخا ١٠١ مع رش اليوريا فى مرحلة تكوين الداليات للحصول على أعلى قيم للمحصول وانجودة تحت ظروف الأراضى الملحيه.