SUMMARY

Two field experiments for transplanted and broadcast-seeded rice system were conducted at Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt, during 1996 and 1997 seasons to investigate the effect of time and method of nitrogen application on grain yield and grain quality of transplanting and broadcasting methods on rice cultivars; (Giza 181, Giza 177, Giza 178, Sakha 101 and Sakha 102). Four times of N application viz. (T_1) two splits ($^2/_3$ as basal and incorporated into dry soil + $^1/_3$ as top-dressing at panicle initiation), (T_2) three splits ($^1/_3$ as basal and incorporated into dry soil + $^1/_3$ as top-dressing at maximum tillering stage + $^1/_3$ as top-dressing at panicle initiation), (T_3) three splits ($^1/_2$ as basal and incorporated into dry soil + $^1/_4$ as top-dressing at panicle initiation + $^1/_4$ as top-dressing after complete flowering, and (T_4) all amount was incorporated into dry soil were used in this study.

The split -plot design was used, and the main plots were devoted to five rice cultivars and subplots were allocated for the time of nitrogen application.

Studied Characters :

A. Growth characters :

1- Number of tillers at different stages of growth/m^2

2- Heading date (days)

3- Plant height at harvest (cm)

4- Panicle length (cm)

B. Yield and yield attributes :

1- Number of panicles/m^2
2- Panicle weight (g)
3- Filled grains/panicle
4- Unfilled grains/panicle
5- 1000-grain weight (g)
6- Straw yield (t/ha)
7- Grain yield (t/ha)
8- Harvest index

C- Grain quality characters :

1- Grain length (mm)
2- Grain width (mm)
3- Grain shape
4- Hulling %
5- Milling %
6- Head rice %
7- Protein %
8- Amylose %

The most important results obtained from this study could be summarized as follows :

I- Broadcasting Method :

1. Growth measurements :

a) Number of tillers/m^2, plant height, heading date (in days) and panicle length were significantly different from 1996 to 1997. Higher values for number of tillers/m^2 at all growth stages, and heading date (in days) were detected in 1996, but the situation was reversed for plant height and panicle length which were higher in the second season than in the first one.

b) Time of nitrogen application had significant effects on all studied characters except for number of tillers/m^2 at the 3rd growth stage. When nitrogen was applied as $^2/_3$ basal and $^1/_3$ at panicle initiation (PI), T_1 gave higher values of

number of tillers/m^2 and longest rice plants. The highest value of heading date (in days) was obtained at T_3 ($^1/_2$ basal + $^1/_4$ at PI + $^1/_4$ at complete flowering) whileT_2 (3 equal splits) gave the longest panicle length.

c) Giza 178 produced the highest number of tillers at 1st, 2nd and 3rd stages, while Giza 177 had significantly lower values of tillers and earliest heading. Sakha 102 appeared as the longest variety and significantly differed from all varieties, while Giza 181 gave the longest panicles compared with the other varieties.

d) The interaction between cultivars and seasons differed significantly for all measurements except for number of tillers/m^2 in both 1st and 4th growth stages and panicle length.

e) Numbers of tillers/m^2 at different growth stages, heading date, plant height and panicle length were significantly affected by the interaction between rice cultivars and times of N application as combined data for 1996 and 1997 rice seasons. The highest number of tillers was obtained with Giza 178 under T_1 treatment, at the 1st and 4th growth stages. Sakha 101 under T_3 treatment gave the highest number of tillers at the 2nd growth stage, while the same variety gave the highest tillers in case of T_3 treatment at the 3rd growth stage. On the other hand, Giza 177 was the earliest for heading date in T_2 treatment and the tallest plants were observed in T_2 treatmet with Sakha 102, while the highest value of panicle length was obtained by Giza 181 by T_2 treatment.

f) The interactions between time of N application and season were significant at first and second growth stages and for heading date.

g) Plant height and panicle length were significantly affected by the interaction among cultivars, time of N application and seasons.

2. Yield and its components :

a) Higher values for number of panicles/m^2, panicle weight and 1000-grain weight were detected in the first season, while values of filled and unfilled grains/panicle, straw and grain yield and harvest index were higher in the second season.

b) Grain yield and yield components were significantly affected by nitrogen fertilizer application. Adding nitrogen in three split doses; $^1/_2$ basal, $^1/_4$ at panicle initiation and $^1/_4$ at complete flowering (T_3) gave the highest number of panicles/m^2, panicle weight, number of unfilled grains/panicle and grain yield. The highest values of filled grains/panicle and 1000-grain weight were obtained when nitrogen was split as; $^1/_3$ basal, $^1/_3$ at maximum tillering and $^1/_3$ at panicle initiation (T_2) with no significant difference over T_1 for number of filled grains/panicle and T_1 and T_4 for 1000-grain weight. Splitting nitrogen in T_3 or T_2 treatment gave the highest harvest index.

c) Highly significant differences were observed among the five cultivars in all studied characters. Giza 178 cultivar had the highest number of panicle/m^2 and harvest index, while Sakha 101 had the highest panicle weight. The highest values of straw yield were obtained by Giza 181 and Sakha 101. The highest 1000-grain was produced by Sakha 102. However, Giza 181 produced the highest number of filled and unfilled grains/panicle. As for the grain yield, Giza 178 cultivar produced the highest value (8.25 t/ha), but without significant superiority over Sakha 101 (8.05 t/ha).

d) The effects of interaction between cultivars and seasons were highly significant for all parameters, but only significant for grain yield.

e) Panicle weight, filled grains/panicle, unfilled grains/panicle and straw yield were significantly affected by the interaction between nitrogen application and seasons.

f) The interaction between rice cultivars and nitrogen application significantly influenced yield and yield components. Adding nitrogen in three split doses (T_3); $^1/_2$ basal, $^1/_4$ at panicle initiation and $^1/_4$ at complete flowering with Giza 178 cultivar gave the highest value for number of panicles/m^2 and grain yield. The same N application resulted in the highest panicle weight and harvest index with Sakha 101 cultivar as well as unfilled grains/panicle and straw yield with Giza 181 cultivar. However, Giza 178 had the highest value for filled grains/panicle under T_1 treatment, while the highest 1000-grain weight under T_2 treatment was obtained with Sakha 102.

g) The interaction between cultivars, nitrogen application and seasons had significant effect on number of panicles/m^2, panicle weight, filled grains/panicle and unfilled grains/panicle.

3. <u>Quality characters</u> :

a) Higher hulling and protein percentages were detected in the first season, but values of milling and head rice percentages were higher in the second one.

b) Milling, head rice and protein percentages responded significantly to time of nitrogen application, while the other attributes were statistically the same with different nitrogen application times.

When nitrogen was applied as two split doses; $^2/_3$ basal and $^1/_3$ at panicle initiation (T_1), the highest significant values of milling and head rice were obtained.

c) Giza 181 cultivar gave the highest values of grain length, grain shape and amylose content. The highest hulling, milling, head rice and protein percentages were recorded for Giza 177 cultivar.

d) Significant interactions between cultivars and seasons were calculated for milling, head rice, protein and amylose percentages.

e) Giza 177 cultivar had the highest values for hulling and head rice under T_2 treatment, protein under T_1 treatment as well as milling under T_3. On the other hand, Giza 181 cultivar had the highest values for grain length, grain shape and amylose content under T_2, T_4 and T_1 treatments, respectively. For grain width, the highest mean value was obtained by Sakha 101 with T_2 treatment.

f) Significant effects were found for milling, head rice and protein percentages which means that the effect of time of nitrogen application on some grain quality attributes was not constant in both years of study.

g) With the exception of grain length, grain width and grain shape, all attributes showed significant differences due to the interaction effect between cultivars, nitrogen application and seasons.

II- Transplanting Method :

1. Growth attributes :

a) Number of tillers/m^2 in the first, second and third stages were significantly higher in the first season than in the second one. However, plant height and heading date gave significantly higher values in the second season than in the first one.

b) N-application gave significant effect on number of tillers/m^2 in the third and fourth stages, heading date, plant height and panicle length. The highest values of number of tillers/m^2 in the third and fourth stages, heading date and plant height were obtained by T_1 ($^2/_3$ basal + $^1/_3$ at panicle initiation).

c) Giza 178 produced the highest number of tillers in the first and second growth stages. Giza 177 was superior in the third stage, while Giza 181 gave the highest number of tillers in stage four. Giza 177 was the earliest cultivar and gave the shortest panicles, while Sakha 102 gave the highest value of plant height.

d) The interaction between cultivars and seasons was statistically significant for all attributes.

e) Giza 178 produced the highest number of tillers at the first growth stage with T_3, and at the second stage with T_1 and T_2 and at the fourth growth stage with T_1. However, Giza 177 produced the highest number of tillers with T_3. The earliest heading occurred with Sakha 102 at T_4, while the longest plants were always recorded for the same cultivar at all times of nitrogen application.

f) The interaction between times of nitrogen application and seasons of study were significant for all growth attributes.

g) With the exception of heading date, all growth attributes showed highly significant differences due to the effect of interaction among cultivars, N-applications and seasons.

2. <u>Yield and yield components</u> :

a) Higher mean values for panicle weight, filled grains/panicle, 1000-grain weight and harvest index were detected in the first season compared to the second one. However, number of

panicles/m^2, unfilled grains and straw yield were found to be higher in 1997 rice season than in 1996. However, grain yields for both seasons were very close.

b) Yield and its components were affected by time of nitrogen application. Highest number of panicles/m^2, panicle weight, straw and grain yields and harvest index were obtained by plants received nitrogen as $^2/_3$ basal and $^1/_3$ at panicle initiation (T_1). The same N-fertilizer treatment resulted in the lowest mean value for unfilled grains/panicle.

c) Giza 181 gave the highest values for panicle weight and unfilled grains/panicle. While, Giza 178 had the highest values for number of panicles/m^2 filled grains/panicle and straw yield. Sakha 101 produced the highest values for panicle weight, 1000-grain weight, grain yield (8.63 t/ha) and harvest index.

d) The interaction between cultivars and seasons was statistically highly significant for all traits under study.

e) T_1 with all cultivars gave the highest mean values for yield (with Sakha 101) and most of yield components, number of panicles/m^2 with Giza 178 and panicle weight with sakha 101.

f) The interaction between time of nitrogen application and seasons was statistically significant for panicle weight, filled grains/panicle, grain yield and harvest index, revealing that this effect differed from one season to another.

g) The interaction effect of cultivars, N-application and seasons was significant for yield and yield components except for panicle weight.

3. Quality characters :

a) Higher mean values for hulling and protein percentages were detected in the first season, but the situation was reversed in the second season.

b) Grain length, milling and head rice percentages reached its maximum values by T_2 (3 equal splits), while the highest grain width and protein percentage were recorded for T_4 and T_2, respectively.

c) Giza 181 had the highest grain length, while Sakha 102 gave the highest values for grain width and amylose content. The highest values of hulling, milling, head rice and protein content were recorded for Giza 177.

d) The interaction between cultivars and seasons was statistically significant for all properties except for grain width and grain shape.

e) Highest values of grain length and shape were obtained by Giza 181 with T_2 and T_1, respectively. For grain width, the highest values were recorded by T_2 with Sakha 101 and Sakha 102, while the highest values of hulling percentage were recorded by T_1 and T_2 with Giza 177 and the highest milling and head rice percentages were recorded for the same cultivar with both T_2 and T_3. Both Giza 177 and Giza 181 produced the highest levels of grain protein as a result to T_1. However, for amylose percentage, the highest values were obtained by T_3 with Sakha 102.

f) The interaction between nitrogen fertilizer and seasons was statistically significant for all quality attributes except for hulling percentage.

g) With the exception of grain width, grain shape and hulling percentage and all quality traits showed significant differences due to the effect of interaction between cultivars, N-applications and seasons.

As a conclusion, transplanting gave higher significant grain yield and head rice compared to broadcasting method.

It could be recommended to obtain high yield and quality to grow Giza 178 and Sakha 101 and to split nitrogen in three splits ($^1/_2$ as basal + $^1/_4$ at panicle initiation + $^1/_4$ at complete flowering) for broadcasting and transplanting methods under conditions similar to the present experiments.

However, T_2 ($^1/_3$ basal + $^1/_3$ at maximum tillering + $^1/_3$ at panicle initiation) and T_1 ($^2/_3$ basal + $^1/_3$ at panicle initiation) were efficient for broadcasting and transplanting methods, respectively.