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SUMMARY

Two field experiments were carried-out at the experimental farm of El-Kharga Research, Station, New Valley, Egypt, during the two successive growing seasons of 2006/07 and 2007/08. The experiments were carried out to study the effects of irrigation and nitrogen fertilization on two promising barley cultivars under New Valley conditions.

The treatments used were as follows:

A- Irrigation treatments:

Three irrigation intervals were applied as follows:

- 1- Irrigation every 14 day.
- 2- Irrigation every 21 day.
- 3- Irrigation every 28 day.

B- Barley cultivars

The tested two barley cultivars were Giza 123 and 129.

C- Nitrogen fertilizer rates were applied as follows:

- 1- Zero kg N/fed.
- 2- 15 kg N/fed.
- 3- 30 kg N/fed.
- 4- 45 kg N/fed.

The experimental design was split-split - plot in three replications.

The obtained results could be summarized as follows:

1. Vegetative growth:

1.1. Heading date to 50%:

Average number of day from sowing to heading date of barley cultivars significantly affected by irrigation intervals in both seasons. Irrigation each 14 day gave the highest number of days from sowing to

50% heading (72.00) and (71.63) days as compared with all the other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was significant differences among barley cultivars of number of days from sowing to 50% heading in the first season (2006/07). Giza, 123 gave the highest number of days from sowing to heading date 71.08 and 69.86 days as compared with Giza, 129 studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there were a significant differences between nitrogen fertilizer levels on number of days from sowing to 50% heading in 2006/07 and 2007/08 seasons. Application nitrogen fertilizer at the rate of 45kg/fed gave the highest number of days from sowing to 50% heading 70.67 days and 71.56 days as compared with all other nitrogen levels in 2006/07 and 2007/08 seasons, respectively.

1.2. Number of days until maturity

Average of number of days until maturity of barley cultivars significantly affected by irrigation intervals in both seasons. Irrigation each 14 days gave the highest number of days until maturity (112.04) and (112.25) days as compared with all the other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was significant differences among barley cultivars of number of days until maturity in both seasons, Giza, 123 gave the highest number of days until maturity 111.33 and 111.97 days as compared with Giza, 129 studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there were a significant differences between nitrogen fertilizer levels on number of days until maturity in 2006/07 and 2007/08 seasons.

1.3. Plant height (cm):

Plant height significantly affected by irrigation intervals in both seasons. Plants irrigated each 14 day gave the tallest plants (91.74 cm and 92.12 cm) as compared with all other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly those barley cultivars significantly different in plant height in both seasons.

1.4. Number of tillers/m²:

Results show clearly that number of tillers/m² significantly decreased with increasing irrigation water intervals in both seasons. Irrigated plants each 14 day gave the highest number of tillers/m² 457.71 and 420.13 as compared with all other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that the effect of nitrogen fertilizer levels on number of tillers/m² was significant in both seasons. Results indicated that number of tillers/m² significantly increased with increasing nitrogen fertilizer rate in both seasons.

1.5. Number of no effective tillers/m²:

Data show that number of no effective tillers/m² was significantly affected by barley cultivars in 1st season only. Giza, 123 cultivar gave the highly value (11.00) in comparison to Giza, 129.

1.6. Leaf area (cm²)

Leaf area (cm²) of barley cultivars significantly affected by irrigation intervals in both seasons. Plants irrigated each 14 day gave the greatest leaf area (cm²) 3.96 cm² and 3.53 cm² as compared with all other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly those barley cultivars significantly different in leaf area (cm²) in the second season only. Giza, 123 cultivars gave the

highest leaf area (3.31 cm^2) in 2006/07 season and 3.94 cm^2 in 2007/08 season.

Results show clearly that there was a significant effect of nitrogen fertilizer levels on leaf area (cm^2) in 2006/07 and 2007/08 seasons. Application nitrogen fertilizer at the rate of 45 kg N/fed gave the highest leaf area (cm^2) 3.60 cm^2 and 4.01 cm^2 as compared with all other nitrogen levels in 2006/07 and 2007/08 seasons, respectively.

2. Yield and its components

2.1. Number of spikes/ m^2 :

Result show clearly that number of spikes/ m^2 significantly decreased with increasing irrigation intervals in both seasons.

Results show clearly that there was significant differences among barley cultivar in number of spikes/ m^2 in both seasons. Giza, 129 gave the highest number of spikes/ m^2 423.39 in 2006/07 season.

Results show clearly that the effect of nitrogen fertilizer levels on number of spikes/ m^2 was significant in both seasons. Results indicated that number of spikes/ m^2 significantly increased with increasing nitrogen fertilizer levels in both seasons.

2.2. Spike length:

Spike length (cm) of barley cultivars significantly affected by irrigation intervals in both seasons. Plants irrigated each 14 day gave the longest spikes 5.34 cm and 5.89 cm as compared with all other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly those barley cultivars significantly different in spike length in both seasons. Giza 129 cultivar gave the longest spikes 5.25 cm in 2006/07 season, but Giza 123 cultivar gave the longest spikes in the second season and 5.37 cm in 2007/08 season.

Results show clearly that there was a significant effect of nitrogen fertilizer levels on spike length (cm) in 2006/07 and 2007/08 seasons.

2.3. Number of grains/spike

Number of grains/spike of barley cultivars significantly affected by irrigation intervals in both seasons. Plants irrigated each 14 day gave the greatest number of grains/spike 31.82 and 35.38 as compared with all other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that barley cultivars significantly different in number of grains/spike in both seasons. Giza, 123 cultivar gave the highest number of grains/spike 31.3 in 2006/07 season and 32.4 in 2007/08 season.

Results show clearly that there was a significant effect of nitrogen fertilizer levels on number of grains/spike in 2006/07 and 2007/08 seasons.

2.4. Spike weight (gm):

Results show that the effect of irrigation intervals on weight per spike was significant in both seasons. Irrigated plants each 14 day gave the heaviest spike weight 1.56 and 1.57 gm as compared with all other irrigation treatments in two growing seasons, respectively.

Results show clearly that barley cultivars differed significantly in spike weight in both seasons. Giza, 123 cultivars gave the highest spike weight 1.62 and 1.58 gm as compared with other cultivar studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was a significant effect of nitrogen fertilizer levels on spike weight in 2006/2007 and 2007/2008 seasons.

2.5. 1000-grain weight (gm):

1000-grain weight (gm) of barley plants significantly decreased with increasing irrigation water intervals in both seasons. Plants irrigated each 14 day interval during growth seasons gave the heaviest 1000-grain weight 39.37 and 43.95 (gm) as compared with all other irrigation intervals in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that barley cultivars significantly differed in 1000-grain weight (gm) in 2007/08 season only.

Results show clearly that 1000-grain weight significantly increased with increasing nitrogen fertilizer levels in 2006/07 and 2007/08 seasons.

2.6. Biological yield (ton)/fed

Biological yield (ton/fed) of barley cultivars significantly affected by irrigation intervals in both seasons. Irrigation each 14 day gave the highest biological yield/fed (4.06 ton) and (4.38 ton) as compared with all the other irrigation treatments in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was significant differences among barley cultivars of biological yield (ton/fed) in both seasons, Giza, 123 gave the highest biological yield/fed (4.13 and 4.42 ton/fed) as compared with Giza, 129 studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there were a significant differences between nitrogen fertilizer levels on biological yield (ton/fed) in both seasons.

2.7. Grain yield (ardeb/feddan):

Grain yield per feddan of barley cultivars significantly decreased with increasing irrigation interval in both seasons. Plants irrigated each 14 day interval gave the highest grain yield per feddan (10.63 and 11.84 ardeb) as compared with all other irrigation interval in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that barley cultivars significantly differed of grain yield per feddan in both seasons Giza, 123 cultivar gave the highest grain yield per feddan (9.91 and 10.87 ardeb) as compared with Giza, 129 cultivar (7.32 and 9.36 ardeb/fed) studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was significant differences among nitrogen fertilizer rates on grain yield ardeb/feddan in 2006/07 and 2007/08 seasons. Grain yield per feddan significantly increased with increasing nitrogen fertilizer rate in both seasons.

2.8. Straw yield (ton/feddan):

Straw yield ton/feddan of barley plants significantly decreased with increasing irrigation water intervals in both seasons.

Results show clearly that barley cultivars significantly differed of straw yield ton/feddan in both seasons. Giza,123 cultivar gave the highest straw yield ton/feddan 2.97 and 2.90 ton as compared with the other barley cultivar studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that the effect of nitrogen fertilizer levels on straw yield ton/feddan of barley cultivars was significant in 2006/07 and 2007/08 seasons. Straw yield ton/feddan significantly increased with increasing nitrogen fertilizer rate in both seasons.

2.9. Harvest index:

Harvest index of barley significantly affected by irrigation intervals treatments in the first season (2006/07) and insignificant in the second season (2007/08). Plants irrigated each 14 day gave the highest harvest index 29.74 as compared with all other irrigation treatments in this season.

Results show clearly those significant differences among barley cultivars in harvest index in the second season only.

Results show clearly that the effect of nitrogen fertilizer levels on harvest index of barley was significant in 2006/07 and 2007/08 seasons.

3. Protein (%) and grain protein yield (kg/fed)

3.1. Protein %

Protein % of barley cultivars significantly decreased with decreasing irrigation intervals in both seasons. Plants irrigated each 14 day interval gave the highest Protein % (9.64 and 9.66 %) as compared

with all other irrigation interval in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that barley cultivars significantly differed of Protein% in both seasons. Giza 129 cultivars gave the highest Protein % (9.81 and 9.81) as compared with Giza123 cultivar studied in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that there was significant differences among nitrogen fertilizer rates on protein% in 2006/07 and 2007/08 seasons. Protein% significantly increased with increasing nitrogen fertilizer rate in both seasons.

3.2. Grain protein yield (kg/feddan):

Grain protein yield per feddan of barley cultivars significantly decreased with increasing irrigation intervals in both seasons. Plants irrigated each 14 day interval gave the highest grain protein yield per feddan 130.59 and 145.08 kg/fed, as compared with all other irrigation interval in 2006/07 and 2007/08 seasons, respectively.

Results show clearly that barley cultivars insignificantly differed of grain protein yield per feddan in both seasons. Giza, 123 cultivar gave the highest protein yield per feddan in the first season (105.48 kg/fed.), while, Giza, 129 cultivar gave the highest value of grain protein (118.99) in the second season.

Results show clearly that there was significant differences among nitrogen fertilizer rates on grain protein yield kg/feddan in 2006/07 and 2007/08 seasons.

4. Irrigation water-plant relationships:

4.1. Water use efficiency (kg grain/m³):

Water use efficiency (WUE) of barley significantly affected by irrigation intervals in both seasons. Average of WUE significantly decreased with increasing water irrigation intervals from 21 to 28 day in 2006/07 and 2007/08 seasons.

Results show clearly that there was significant differences among barley cultivars in water use efficiency in both seasons. Giza, 123 cultivar gave the highest water use efficiency 1.60 and 1.82 kg/m³ as compared with Giza, 129 cultivar studied in this season.

Results show clearly that the effect of nitrogen fertilizer levels on WUE of barley cultivars was significant in 2006/07 and 2007/08 seasons.

4.2. Water-crop relationships

Testing the correlation between seed yield and total amount of irrigation water showed that the polynomial equations were best fit the data and gave the highest significant correlation coefficient of 0.3142 and 0.2336 for Giza 123 and Giza 129 cultivars, respectively. It could be extrapolated that using irrigation water at a rate 814.03 m³/fed produced a maximum of 1813.58 kg/fed grain yield (15.11 aradeb/fed) of Giza 123 cultivar. In the cases of Giza 129 cultivar using 839.57 m³/fed irrigation water gave 1362.16 kg grain yield/fed (11.35 aradeb/fed), respectively. It is quite clear that there is remarkable variation in the amount of irrigation water that could be used for growing of each of these cultivars.

5. Nitrogen use efficiency (kg grain/kg N):

Nitrogen use efficiency (NUE) of barley significantly affected by irrigation intervals in both seasons.

Results show clearly that there was a insignificant differences between barley cultivars in nitrogen use efficiency in both growing seasons.

Giza 123 cultivar gave the highest nitrogen use efficiency 22.14 and 22.60 kg/kg nitrogen as compared with Giza 129 cultivar in both growing seasons.

Results show clearly that the effect of nitrogen fertilizer levels on nitrogen use efficiency of barley cultivars was significant in 2006/07 and 2007/08 seasons.

As a recommendation under these conditions and the resembling conditions, irrigation every 14 day with N fertilization at rate 45 get the highest seed yield of Giza 123 or Giza 129 as barley cultivars.