

CHAPTER 5

SUMMARY

The present thesis was designed to evaluate the growth, yield, yield components, water use efficiency and some chemical compositions of Giza 126 barley cultivar under rainfed conditions. Two field experiments were carried out in flood plain of Wadi Hashim, Raas El-Hekma Region, East Mersa Matrouh, Matrouh Governorate, North Western Coast of Egypt, during two winter growing successive seasons (2011/2012 and 2012/2013) to study the effect of size strip of water harvesting (catchment): cultivated area and (mineral nitrogen and biofertilization) on growth, yield, yield components, water use efficiency, some chemical compositions and economic evaluation of winter barley.

The study included 30 treatments, which were the combination of five of strip water harvesting system and six (mineral nitrogen and biofertilization) treatments.

5.1. Strip Water Harvesting System (Catchment): Cultivated Area:

Five treatments according to the relationship between cultivated area and catchment area i.e., without leaving catchment area, 1 : 1, 2 : 1, 3 : 1 and 4 : 1. The cultivated area of the experimental unit was 6 m × 6 m (i.e., 36 m²) and the catchment area was different according to the different treatment i.e. without catchment area, 36 m², 72 m², 108 m² and 144 m².

5.2. Mineral Nitrogen and Biofertilization.

Six nitrogen with or without biofertilization treatments i.e. without mineral nitrogen and uninoculation, 10 kg N as NH₄NO₃ (33.5 % N)/fed., 20 kg N as NH₄NO₃ (33.5 % N)/fed., Biofertilization, 10 kg N as NH₄NO₃ (33.5 % N)/fed. with biofertilization and 20 kg N as NH₄NO₃ (33.5 % N)/fed. with biofertilization.

Grains were soaked in water for 24 hour in tap water, and then the half quantity of grains was inoculated with microbein. The treatments were arranged in a strip plot design in four replications.

The results obtained in this respect could be summarized as follows:

5.3. Growth Characters:

1. Strip water harvesting system had a significant effect on plant height (cm), leaf area/m², leaf area index and total chlorophyll with the two growth stages (56 and 70 DAS) and specific leaf weight (mg/cm²) only, at (70 DAS) for both growing seasons, whereas the maximum values were obtained by using the largest catchment area 4: 1 ratio (four times of cultivated area), while the minimum values were obtained by control treatment (without leaving catchment area).
2. Strip water harvesting system had not a significant effect on specific leaf weight (mg/cm²) at (56 DAS) through both successive seasons.
3. Relative growth rate (gm/gm/day) had not significantly affected by strip water harvesting system at all growth stages (56-63 and 63-70 days) for both seasons.

4. Mineral nitrogen and biofertilization had a markedly significant effect on plant height, leaf area/m², leaf area index and total chlorophyll overall growth stages during the two growing seasons.
5. Maximum mean values were obtained by using 20 kg N/fed. with biofertilization while, low mean values were obtained by without mineral nitrogen and biofertilization (control treatment).
6. Specific leaf weight (mg/cm²) had significantly affected by mineral nitrogen and biofertilization treatments only at (70 DAS), through the two seasons.
7. Mineral nitrogen and biofertilization significantly effected on relative growth rate (gm/gm/day) at (56-63 and 63-70 days) through the second season, while for the first season, with the same stages, this character had not affected by mineral and bio-fertilizer treatments.
8. The interaction between size strip of water harvesting system and (mineral nitrogen and biofertilization) had significantly affected on plant height, leaf area/m², leaf area index and total chlorophyll overall growth stages for both growing seasons whereas, maximum mean values were recorded by the interaction treatment ((4: 1 ratio + 20 kg N/fed. with biofertilization).
9. Specific leaf weight (mg/cm²) significantly affected by the interaction between studied factors at (56 and 70 DAS) through the second season and at (70 DAS) for first season, while, at (56 DAS) through first season, this character had not significantly affected by this interaction.
10. Relative growth rate (gm/gm/day) with the two growth stages (56-63 and 63-70 days) through the two seasons, had not significantly affected by the interaction between size strip of water harvesting system and (mineral nitrogen and biofertilization).
11. The maximum values of plant height, leaf area/m², leaf area index and total chlorophyll were recorded by the interaction treatment ((4: 1 ratio + 20 kg N/fed. with biofertilization) overall growth stages through two successive seasons.

5.4. Grain Yield, Yield Components and Water Use Efficiency:

1. Increasing the ratio between catchment area to cultivated area caused an increase in yield, yield components and water use efficiency for both growing seasons.
2. The size of strip water harvesting system had markedly significant effect on spike length (cm), number of spikes/m², number of grains/spike, 1000 grain weight (g), grain yield (kg/fed.), biological yield (kg /fed.), straw yield (kg/fed.), harvest index, tillering index and water use efficiency (kg/m³) through the two growing seasons.
3. Maximum mean values were obtained by (4: 1) ratio while, minimum mean values were detected by without leaving catchment area treatment.
4. Size of strip water harvesting system had affected on number of tillers/m² only for the second season, on the other hand, through the first season, this character had not affected by this factor.
5. Number of spikelets/spike had not been affected by size of strip water harvesting system treatments through first and second seasons.
6. Mineral nitrogen and biofertilization had a markedly significant effect on number of tillers/m², spike length (cm), number of spike/m², number of grains/spike, 1000 grain weight (g), grain yield (kg/fed.), biological yield (kg /fed.), straw yield (kg/fed.), harvest index, tillering index and water use efficiency (kg /m³) through both successive seasons.

7. Maximum mean values of grain yield, yield components and water use efficiency were obtained by applying 20 kg N/fed. with biofertilization, while on the other hand, minimum mean values were recorded by without mineral nitrogen and biofertilization (control treatment) through the two seasons.
8. Number of spikelets/spike had not been affected significantly by mineral and biofertilizer treatments during first and second seasons.
9. The interaction between size strip of water harvesting system and (mineral nitrogen and biofertilization) had significantly affected on grain yield, yield components and water use efficiency through the two successive seasons.
10. Highest mean values for number of tillers/m², spike length (cm), number of spikes/m², number of spikelets/spike, number of grains/spike, 1000 grain weight (g), grain yield (kg/fed.), biological yield (kg /fed.), straw yield (kg/fed.), harvest index (%) and water use efficiency (kg /m³) were obtained by the interaction treatment ((4: 1) ratio with 20 kg N/fed. + biofertilization), while the lowest mean values were recorded by without leaving catchment area in without mineral nitrogen and biofertilization (control treatment) for both growing seasons.
11. Maximum mean value of tillering index were obtained by using the interaction treatment ((4: 1) ratio + 20 kg N/fed. with biofertilization) for first season, and interaction treatment ((4: 1) ratio + 10 kg N/fed. with biofertilization) for second one, while minimum values were detected by the interaction treatment (without leaving catchment area in without mineral nitrogen and biofertilization) during the two seasons.

5.5. Chemical Compositions:

1. Size of strip water harvesting system had significantly affected on percentage of phosphorus, crude protein percentage and protein yield kg/fed. through the first and second successive seasons.
2. Maximum mean values of phosphorus percentage and protein yield kg/fed. were obtained by (4: 1) treatment while, minimum mean values were recorded by without leaving catchment area for both seasons.
3. For two seasons, the highest mean value of crude protein percentage were recorded by without leaving catchment area, on the other hand lowest value were obtained by using the percentage ratio between catchment area to cultivated area (4: 1). In this respect, crude protein percentage increased by decreasing the ratio between catchment area and cultivated area, also by increasing moisture stress.
4. Potassium percentage had not significantly affected by size of strip water harvesting system during both seasons.
5. Mineral nitrogen and biofertilization had a markedly significant effect on percentage of phosphorus, crude protein percentage and protein yield kg/fed. for the two successive seasons.
6. Highest mean value of phosphorus percentage were detected by using biofertilization treatment only, without nitrogen fertilizer, while lowest mean value were recorded by (without mineral nitrogen and biofertilization) for first and second seasons.
7. Maximum mean values of crude protein percentage and protein yield kg/fed. were obtained by applying 20 kg N/fed. with biofertilization, on the other side, minimum mean values were achieved by (without mineral nitrogen and biofertilization) through the two successive seasons.
8. Through both seasons, potassium percentage had not significantly affected by mineral nitrogen and biofertilization treatments.

9. The interaction between size strip of water harvesting system and (mineral nitrogen and biofertilization) had a significant effect on phosphorus percentage, crude protein percentage and protein yield kg/fed. for both successive seasons.
10. For the two successive seasons, the highest mean values of phosphorus percentage were obtained by using the interaction treatment ((4: 1) ratio + biofertilization without mineral nitrogen). Highest mean values of crude protein percentage were recorded by the interaction treatment (without leaving catchment area + 20 kg N/fed. with biofertilization). Highest mean value of protein yield kg/fed. were detected by using the interaction treatment ((4: 1) ratio + 20 kg N/fed. with biofertilization).
11. Potassium percentage had not significantly affected by the interaction between size strip of water harvesting system and (mineral nitrogen and biofertilization) during first and second growing seasons.

All growth characters, yield, yield components and water use efficiency for the first season expressed higher mean values than those obtained through the second season this might be due to:

1. The high quantity and regular distribution of precipitations during winter season also, it was early through the first season that affected early cultivation and plant adaptation as well as growth stages, adaptation of barley plants to metrological factors which were suitable to physiological process and increasing plant life period.
2. Up to 60 % of precipitation was concentrated in January month (54.8 mm) of the second season whereas, it was useless for vegetation.

5.6. Economic Evaluation:

1. Improvement of barley production through water harvesting techniques and (mineral nitrogen and biofertilization) showed attractive return to investment and attractive return to use the cube meter of rain water irrigation.
2. The economic impact of water harvesting methods varies significantly, and therefore costs benefit analysis should be carried out to determine the best ones to be used.

Generally, data showed that, adding the strip size of strip water harvesting system (catchment): cultivated area "4: 1" (four times of cultivated area) and applying 20 kg N/fed. with inoculating barley grains by microbein as a biofertilization sores gave the highest grain yield for both seasons and enhanced the most of growth characters, yield components, water use efficiency and some chemical compositions of Giza 126 barley cultivar under rainfed conditions.