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### **SUMMARY**

A field experiment was carried out at Shandaweel Research Station (Sohag Governorate), Agricultural Research Centre, Ministry of Agriculture, Egypt during the two successive seasons of 2014/2015 and 2015/2016 to study the effect of intercropping Egyptian clover variety fahl with wheat on yield and its components under some agricultural treatments.

The experiment was laid out using randomized complete blocks design using split-split plot arrangement with three replications. Three planting methods (drill on beds, drill and broadcasting) arranged in the main plots, Three weed control method i.e., spraying with bazegrn, hand weeding and without weed control were arranged in sub-plots and seeding rates of fahl-berseem i.e., 15, 25 and 35% of its recommended rate (20 kg/fed.) were arranged in sub-sub plots.

#### **1- Wheat characters:**

##### **A. Vegetative traits:**

##### **1. Plant height (cm.)**

plant height at harvest was significantly affected by planting method, weed control method and seeding rates of fahl-berseem in both seasons of this study. Drill on beds, without weed control and 35% of recommended rate (20 kg/fed.) produced the tallest wheat plants. The second order interaction was significant in both growing seasons. The maximum mean values of plant height were obtained from drill on beds planting method, without weed control and 35% rate of recommended rate of fahl berseem in the first and second seasons.

##### **2- Spike length (cm):**

Planting methods, weed control method and seeding rates of fahl-berseem affected significantly on spike length in both seasons. The data show that the maximum spike length was obtained from drill on beds planting method. Also,

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spray with bazegran produced the tallest spike length. Here too, 15% of recommended rate of fahl-berseem produced the tallest spike length. The second order interaction was significant in the two growing seasons . The highest mean values in this respect were obtained from drill on beds under sole wheat planting method and spray with bazegran.

### **B. Yield and its components:**

#### **1- Number of spikes m<sup>-2</sup>:**

Planting method had highly significant effect on number of spikes m<sup>-2</sup> in both seasons. The maximum number of spikes m<sup>-2</sup> were produced by drill on beds, spray with bazegran and 15% of recommended rate. Moreover, the second order interaction was significant in the two growing seasons . The maximum mean values of spikes number m<sup>-2</sup> in the first and second seasons ( 422.3 and 418.5 in the two successive seasons) were obtained from drill on beds method sprayed with bazegran and sole planting.

#### **2- Number of spikelets /spike:**

The number of spikelets /spike was significantly affected by different planting method, weed control and seeding rates of fahl-berseem in both seasons. Also, the second order interaction was significant in the two growing seasons . The highest mean values of spikelets /spike were obtained from drill on beds under sole wheat and spray with bazegran in the first and second seasons.

#### **3- Number of grains/ spike.**

Planting methods had highly significant effects on number of grains / spike in both seasons. Also, weed control method and seeding rates of fahl-berseem had highly significant effects on number of grains / spike. Drill on beds method, spray with bazegran method and seed rate 15 % of recommended rate produced the highest number of grains / spike. The second order interaction was

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significant in the two growing seasons . The highest mean values of grains number/spike were obtained from drill on beds under sole wheat planting method sprayed with bazegran.

### **4- Thousand grain weight (g).**

Planting methods, weed control methods and seeding rates of fahl-berseem have a significant effect on the mean values of 1000-grain weight in both seasons. The second order interaction was significant in the two growing seasons . The highest mean values of 1000-grain weight (50.3 and 49.1 g. In the first and second seasons, respectively ) were obtained from drill on beds under sole wheat planting method and spray with bazegran in the first and second season.

### **5- Grain weight spike<sup>-1</sup> (g).**

Grain weight spike<sup>-1</sup> (g) was significantly affected by all factors in both seasons. Drill on beds planting method, spray with bazegran produced the maximum grains weight spike<sup>-1</sup> (g). Here too, The second order interaction was significant in the two growing seasons. The highest mean values of grain weight spike<sup>-1</sup>( 2.9 and 2.6 g in the first and second season, respectively) were obtained from sole wheat plants sown using drill on beds method and sprayed with bazegran.

### **6- Grain yield ( Kg/fed.).**

Planting methods affected significantly in the grain yield of wheat/fed. in the two growing seasons. The data showed that the maximum grain yields were obtained from drill on beds planting method. Spray with bazegran method produced the maximum grain yield. While, the lowest grain yield was produced from without weed control. The grain yield of wheat was reacated significantly to seeding rates of fahl-berseem in both seasons. Grain yield of wheat was decreased by increaseing seeding rates of fahl-berseem.

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The second order interaction was not significant in the two growing seasons. Whatever, the highest mean values of grain yield (3283 and 3032 kg/fed. in the two respective seasons) were obtained from sole wheat plants which were planted using drill on bed method and sprayed with bazegran.

### **7- Straw yield (Kg/fed.)**

Planting methods, weed control method and seeding rates of fahl-berseem had highly significant effects on straw yield (Kg/fed.) in both seasons. Also, the second order interaction was significant in both growing seasons. The maximum mean values of straw yield (Kg/fed.) were obtained from drill on beds planting method, under spray with bazegran and 15% of recommended rate of fahl-berseem.

### **2- Fahl-berseem characters.**

#### **1- Plant height (cm):**

Plant height at harvest was affected by different wheat planting method, weed control and seeding rates of fahl-berseem in both seasons. Drill on beds planting method, spray with bazegran and 15% of recommended rate of fahl-berseem produced the shortest plants. While the plants grown in broadcasting method, without weed control and 35% of recommended rate of fahl-berseem resulted the tallest plants. The second order interaction had a significant effect on plant height in both seasons. The tallest plants at harvest were obtained from broadcasting method, without weed control and intercropping systems 100% wheat + 35 % fahl-berseem.

#### **2- Thousand seed weight (g):**

Thousand seed weight (g) was affected significantly by wheat planting methods, weed control methods and seeding rate of fahl-berseem in both seasons. In addition, the second order interaction had a significant effect on 1000- seed weight (g) in both seasons. The maximum of 1000- seed weight (g)

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resulted from drill on beds method, spray with bazegran and intercropping systems (100% wheat + 15 % fahl-bersem) in the first and second seasons.

### **3- Seed yield (Kg /fed.):**

Seed yield (kg/fed.) of fahl-bersem was affected significantly by different wheat planting method, weed control methods and seeding rates of fahl-bersem in both seasons. Here too, the second order interaction was significant in the first and second seasons. The maximum seed yield (Kg/fed.) which were 140.4 and 135.7 Kg/fed. in the first and second seasons ,respectively were obtained from drill on beds method, spray with bazegran and intercropping systems (100% wheat + 35 % fahl-bersem).

### **3. Chemical analysis of straw:**

#### **A- Crude protein (CP) %.**

The highest mean values of crude protein % in the mixture were produced from drill on beds planting method, spray with bazegran and intercropping system 100% wheat + 35 % fahl-bersem.

#### **B- Nitrogen free extract (NFE) %.**

Nitrogen free extract was affected by different wheat planting method, weed control methods and intercropping systems .The maximum mean values of (NFE) % were obtained from drill on beds method, spray with bazegran method and intercropping system 100% wheat + 35 % fahl-bersem in the first and second seasons.

#### **C- Crude fiber (CF) % .**

Crude fiber % in the mixture was affected by different wheat planting method, weed control methods and intercropping systems. The highest mean values of crude fiber % were produced from broadcasting method, without weed

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control and intercropping system (100% wheat + 15 % fahl-bersem) in the first and second seasons.

### **4. Competitive relationships:**

#### **A- Land equivalent ratio (LER).**

Land equivalent ratio was affected significantly by different wheat planting method, weed control and seeding rates of fahl-bersem in both seasons. Furthermore, the second order interaction had a significant effect on LER in both seasons. The maximum LER (1.27 and 1.30 in the first and second seasons, respectively) were obtained from drill on beds method with hand weeding method and intercropping systems 100% wheat + 25 % fahl-bersem in the first season and drill on beds method , spray with bazegran and intercropping systems 100% wheat + 25 % fahl-bersem in the second season.

#### **B- Competitive ratio (CR).**

Competitive ratio (CR) was affected significantly by different wheat planting method, weed control and seeding rates of fahl-bersem in both seasons. The maximum mean values of CR for wheat resulted from broadcasting method, without weed control and intercropping systems 100% wheat + 35 % fahl-bersem in both seasons. Wheil, The maximum average values of CR for fahl-bersem resulted from drill on beds planting method, spray with bazegran and intercropping system 100% wheat + 15% fahl-bersem in both seasons.

#### **C- Monetary advantage index (MAI).**

Monetary advantage index (MAI) was affected significantly by different wheat planting method, weed control and seeding rates of fahl-bersem in both seasons. The second order interaction had a significant effect on MAI in both



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seasons. The maximum mean values of MAI (2246.7 and 2356.2 L.E in the first and second seasons, respectively) were obtained from drill on beds method with intercropping systems 100% wheat + 25 % fahl-bersem and handing weed control in the first season and drill on beds method with spraying bazegran and intercropping systems 100% wheat + 25 % fahl-bersem in the second season.

### **5. Water relations:**

#### **A- Water consumptive use (WCU m<sup>3</sup>/fed.):**

A significant differences in water consumptive use between all the studied factors, except interaction between weed control method and intercropping systems in the first growing season and interaction between planting methods, weeds control methods and intercropping systems in the second growing season. The lowest water consumptive use can be obtained for sole wheat when it cultivated in drill on beds and sprayed with bazegran, followed by intercropping fahl-berseem with wheat by 15% of its recommended planting density, cultivated in drill on beds and sprayed with bazegran.

#### **B- Crop coefficients for wheat and fahl-berseem:**

##### **1- Crop coefficients for wheat.**

The values of wheat K<sub>c</sub> was affected by planting methods but, did not affected by weeds control treatments or intercropping systems. The calculated values by BIS m model was close to the measured values under drill on beds cultivation.

##### **2- Crop coefficients for fahl-berseem.**

The calculated values of K<sub>c</sub> for fahlberseem by BISm model were close to the measured values under seeds broadcasting methods.

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### **C- Applied irrigation water(m<sup>3</sup>/fed.):**

There were a significant differences in the applied irrigation water between all the studied factors in the two growing season, except interaction between planting methods and intercropping systems, weeds control methods and intercropping systems in the first season only as well as the second order interaction in both seasons.

### **D- Saving in the applied irrigation water.**

#### **1- Saving in the applied irrigation water between planting method.**

The irrigation water saving for sole wheat in the first and second growing seasons, respectively were 29 and 28% when cultivation implemented on beds, compared to seeds broadcasting method. Regarding to seeds drill planting method, the saving in the applied irrigation water was lower, averaged between 9-10% under both sole and intercropping wheat systems.

#### **2- Saving in the applied irrigation water between chemical weeds control and without weeds control.**

Using chemical weeds control could save on the applied irrigation water to sole or intercropped wheat by 3-5%, in both growing seasons under drill on beds cultivation, compared to without weed control. However, the saving in the applied irrigation water under hand weeding treatment was very low, between 0 and 0.2%, compared to without weed control.

#### **3- Saving in the applied irrigation water between sole planting and intercropping systems.**

All intercropping fahl-berseem with wheat systems used extra irrigation water amounted to 1% or less, compared to sole wheat planting. Increasing percentage of fahl-berseem in the intercropping systems increase the applied irrigation water by 1% in S3 (fahl-berseem intercropped by 35% of its planting density).

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### **E- Water use efficiency(kg/m<sup>3</sup>).**

Water use efficiency was the highest when sole wheat and fahl-berseem cultivated in drill on beds, compared to the other planting methods. Furthermore, sprayed, either sole or intercropped wheat with bazegran increased water use efficiency, compared to the other weeds control methods. With respect to intercropping systems, sole wheat gave the highest water use efficiency, followed by intercropping fahl-berseem with wheat by 15% of its recommended planting density.

### **F- Water productivity (kg/m<sup>3</sup>).**

Water productivity values followed the same trend as water use efficiency values. It was the highest when sole wheat and fahl-berseem cultivated on drill on beds, compared to the other planting methods. Wheat gave the highest water productivity, followed by intercropping fahl-berseem with wheat by 15% of its recommended planting density. Thus, the highest water productivity can be obtained for sole wheat when it cultivated on drill on beds and sprayed with bazegran, followed by intercropping fahl-berseem with wheat by 15% of its recommended planting density.

### **6- Total income:**

Total income (L.E) was affected significantly by different wheat planting method, weed control and seeding rates of fahl-berseem in both seasons. The first order interaction between weed control method and seeding rate of fahl-berseem had a significant effect on total income in the second season only. While, the second order interaction did not significantly in total income trait in both seasons. Whatever, the highest total income (14459 L.E in the first season) was obtained from drill on beds method with 15% fahl-berseem seeding rate and sprayed with bazegran being 13645 L.E in second season which was obtained from drill on beds with 25% seeding rate of fahl-berseem and sprayed with bazegran.