

Effect of Irrigation Water Systems on the Qualitative Characteristics of Different Cultivars of Bread Wheat (*Triticum aestivum* L.)

Lezan Kamaran Shawkat¹, Fakhradeen A.Q. Sediq², Zakeria Mahmoud Mohamed³

^{1,3}College of Agriculture, Kirkuk University, Iraq

²College of Agriculture, Tikrit University, Iraq

Abstract: *The experiment was carried out in the field of one farmer in the Daraman region of Alton coupri in the winter season of 2020-2021 to aim of studying effect of irrigation water systems in the qualitative traits for eight varieties of bread wheat (*Triticum aestivum* L.). The experiment has been implemented according to RCBD (Randomize Complete Block Design) with three replicates included two factors: First was three irrigation systems, first on the rain, second by using Canadian sprinkler head; third Turkish sprinkler head. Canadian sprinkler with two holes (open) by 2 bar pressure 1.33 m³.hour with diameter spray at 2 bar 15.24 meter, the big hole (open) with diameter (4.4 mm) and the small one 2.4mm, other system was Turkish with two holes (opens) bar pressure 1.20 m³.hour by diameter of spray at 2 bar pressure 16.60 meter for big one 3.8 mm and small hole (open) 2.3 mm as written at the catalogue appendix of each one. The second factor was eight varieties of bread wheat all of them certified from the General Authority of Agricultural Research: (Ibaa 99, Adana 99, Aras, Babel, Baghdad, Bour (Italian), Rashid, and Tamuz 2) with three replicates, every treatment consist of four lines, the length of one line was 2.5 meter and the space between the lines was 25 cm, using 160 kg.h⁻¹ amount of seeding on the base 10 gm for every line. The study showed superiority of Rashid variety in the qualitative traits (protein percentage 14.69%, wet gluten 41.33%, dry gluten 13.63%) while the Bour (Italian) variety was surpassed in crinkle grain trait (2.06%) and Baghdad variety was surpassed in volumetric specific weight trait (86.22 kg.hect⁻¹). The irrigation system (1) (Canadian sprinkler) was surpassed in grain yield trait (1998.60 kg.h⁻¹), and starch percentage trait (68.06%). As the irrigation system (2) (Turkish sprinkler) was surpassed in protein percentage (15.31%), while the irrigation system (3) (on the rain) was surpassed in the traits (Volumetric specific weight 83.01 kg.hect⁻¹. And the crinkle grains 2.12%). The interaction between the varieties and irrigation systems, the Rashid variety with the irrigation system (2) (Turkish sprinkler) had surpassed in the traits (wet gluten 42.50% and Dry gluten 14.10%), while Baghdad variety with Turkish sprinkler (2) had surpassed in specific weight (87.80 kg.hect⁻¹) also Bour (Italian) with the irrigation system (2) (Turkish sprinkler) had surpassed in protein percentage (15.87%), while the Babel variety had surpassed in the third system (on the rain) in crinkle grains (2.60%) trait.*

Key words: *Wheat varieties – Irrigation systems – Qualitative traits – Soil moisture content.*

1. INTRODUCTION

Bread wheat (*Triticum aestivum* L.) consider from stratige crops with high food value, consists from protein, fats, viatamins and some salts more over amino acids which human needs in his food (Al. younos.1992 and Tony 2006). Also wheat grains rich from proteins, carbohy Arate, elements, fats and fibers which take agreat role in the physical, chemical and reialogical traits of the flour (AL.Saleh,1996 and Alphin,2004). Sprinkler spray of irrigation systems consider new irrigation system which had big role in exceeding of yield because of high reactive in exceeding efficiency of water distribution and economy in amount of adding water for the area controlled with classic irrigation method (Ismail 2009 and Al - hadithy et al 2010).

The goodness traits and flour protein of the wheat have effective by genotype and environmental factors,so the world begans to concentrate on the new varieties with high yield, and the methods or ways to applicate crop serving treatment, as irrigation treatments and the plant demands from water compsoption . Al - Hadethy (2003) refer to that the two wheat varieties (Ibaa 99 and Abou - Ghraib) were diffen signi ficantly in protein percentage in the grains, the Ibaa 99 gave high mean for this trait (13.82 and 13.26%) for two seasons respeatively. Abed(2008) found exceeding in wet gluten with exceeding of protein percentage in the sample. Through astudy done by AL - Dowody and AL - Aubiady (2014) to estimate 15 genotypes of bread wheat and it is effect on grain yield, specific weight, protein percentage, wet and dry gluten percentage , they refer there is significant difference at 1% probability for all studied traits unless specific weight and protein percentage, the Abu - Ghraib 3 variety was surpassed in the grain yield and qualitative traits (specific weigh, wet gluten and dry gluten percentage). While Al - zangana and sedeeq (2018) found that spray plants of wheat with amino acids in two stages (tillering and flowering) had showed significant differences for all studied traits unless small and damage grain percentage, as the sham6 variety was surpassed in grain yield (1066.9 g/m²), Dijlla Al - Khair variety was surpassed in gluten coefficient (75), while Ibaa 95 variety was surpassed in specific weight (83.77 kg/hect) and Aras variety was surpassed in protein percentage (13.23%).

In astudy was carried out in Tikrit University by Muhammad (2020) used three different levels from ivrigation with three varieties from bread wheat (Iraq, Adana 99 and Ibaa 99), was surpassed with higher levels of irrigation in the traits : Grain yield , protein percentage (12.83%) gluten percentage (34.33%) and starch percentage (63.17%).

The study aimed to Knowing the best varieties from bread wheat which surpassing in qualitative charactristics under certain system of irrigation and the best sprinkler in wheat agricultural in the region .

Materials and Methods.

The experiment was carried out in the farm of one farmers in Daraman region in Alton coupri of Kirkuk government in the winter season of 2020-2021, two factors were included the study, first: eight certified varieties of bread wheat from the general authourity of Agriculture research which were (Ibaa 99, Adana 99, Aras, Babel, Baghdad, Biur(Italian), Rashid and Tumuz 2), the second factor was three irrigation systems which were (Sprinkler irrigation (1)(S1) by using Candian sprinkler, sprinkler irrigation (2)(S2) by using Turkish sprinkler and irrigation open the rain Turkish sprinkler and irrigation open the rain (S3).

The land of the experiment was poluged twice vertically, then disced and leveled, after then planted by varities seeds or grains in 15 of November .

The experiment was carried out as (RCBD) design (Randomized Complete Block Design) with three replicates, every experimental unit included four lines, the length of the line was 2.5 meter, the space between the lines was 25cm, used seeding amount 160 kg.h⁻¹ on the base 10 g weight from the seeds in every line, the experiment land fertilized by (DAP) (18%N and 46%P) by rate 200 kg.h⁻¹ applied once at the planting, as the experiment was fertilized by Urea (46%N) as a source of nitrogen by level 200 kg.h⁻¹ twice, first at tillering stage . All the varieties seed was planted by hand, given agricultural irrigation after the planting, then all irrigation system applied as the plant demanding .

Studied Characters.

- 1- Grain Yield (kg.h⁻¹): calculated on the base weight of the grains for two middle lines from the experiment unit after harvested with adding the grains of harvested area, then converted it to ton.h⁻¹ .
- 2- Volumetric specific weight (kg.hect⁻¹): The specific weight was estimated by: 100 Hectoliter weight type mld apparatus, with ¼ liter of the grains.(Al - Saaidi,1983).

$$\text{Specific weight (kg.hec}^{-1}\text{)} = \frac{\text{weight of } \frac{1}{4} \text{ liter (g)} * 4 * 100}{1000} .$$

- 3- Crinkle grains percentage (%): It is grains which not completely filled through the season and have crinkled view, calculated its ratio from dividing the sample, then took a sample of 100g from the grains by electronic sensitive weight, the crinkled grain picked up by hand, weighed by sensitive weight, then the percentage of these grains calculated as:

$$\text{Crinkle grains percentage} = \frac{\text{weight of crinkled grains}}{\text{weight of 100 g}} \times 100 .$$

- 4- Protein percentage (%): Estimated by B18 kjeldae's Method for Crude protein to estimate total Nitrogen as based in (A.O.A.C,1980) by using the equation:

$$\text{Protein percentage} = \text{Nitrogen ratio \%} \times 5.7$$

- 5- Starch percentage (%): The starch percentage calculated, as accumulated the fillerting after washing the flour to estimate the gluten, then dried the sedimentary starch and calculated from the equation:

$$\text{Starch percentage} = \frac{\text{weight of the starch}}{\text{weight of the sample}} \times 100 .$$

- 6- Wet gluten : Calculated from wheat flour samples by using the method (77-38) AACC (1998) using the (Glutomatic gluten index) supplied from perten Sweden factory.

- 7- Dry gluten : Calculated after drying the sample in the oven on 105⁰c temperature for 4 minutes in the apparatus (Glutork 2020), the sample was weighed, then the result converted to ratio, as:

$$\text{Dry gluten percentage} = \frac{\text{Dry gluten weight}}{\text{Flour weight}} \times 100 .$$

Statistical Analysis.

All the data analysed by (SAS) program as (RCBD) design as the experiment which applied in the field, mean squares were compared for all the traits as Duncan multiple ranges, the

similar letters does not take significantly differences, on the contrary the un similar letters take significantly differences between the means, as reflexed to it in the tables .

2. RESULTS AND DISCUSSION

1- Grain Yield (kg.h^{-1}).

The table(1) refer that thereis no significant differences between means of genotypes, Babel variety surpassed for all the other varieties ($1564.00 \text{ kg.h}^{-1}$) and the variety Bour (Italian) gave less value ($1023.90 \text{ kg.h}^{-1}$) for this trait. In the effect of irrigation systems, the higher value shown in the first system (S1)(1998.2 kg.h^{-1}), while the interaction between these two factors shown the higher value in the treatment between Babel variety with the first system (S1) ($2650.90 \text{ kg.h}^{-1}$), the less valne in the interaction was in the treatment between Bour(Italian) and the S3 system on the rain (170.00 kg.h^{-1}). These results agreed with Al - Tahir and Israa (2016) for the treatment which have significant effect in the grain yield for wheat crop. The reason of superiority of control treatment in the grain yield trait may be come from the superiority of number of grains in the spike and weight of the grain because of these trait are from yield components. Also Hadi etal (2013) results refer to that the decreasing in the amount of irrigation water caused decreasing significantly in grain yield in meter square, may be this caused decreasing of one or more than one of yield components, moreover the effect of irrigation levels shown in the yield components like weight of 1000 grains.

Table (1) Effect of different genotypes and irrigation systems in Grain yield (kg.h^{-1}).

Simillar letters means there is no signify cant differences between different means on the 5% prob.

3. Volumetric specific weight (kg.hect-1).

Table(2) showed there are significant differences between the means of genotypes effect, and effect of irrigation systems. Baghdad variety surpassed with high value (86.22 kg.hect-1). While the Adana variety gave less value (77.58 kg.hect-1) for this trait. In the effect of irrigation system, the higher value gave the system (S3) (83.01 kg.hect-1), while the inten action between Baghdad variety with (S3) treatment had higher value (87.80 kg.hect-1),and the less value had with the treatment of the interaction between Babel variety and(S2)system (75.53kg.hect-1).

These results were agreed with Al - Atti etal (2017), that there are significant differences between the varities caused by specific weight trait because it is good parameter for flour production of wheat at milling, also it is benefits to giving grain filling, and the un suitable conditions at agricultural or her vesting may be decreased from specific weight in the grains. Also agreed these results with Sediq et al(2017) in presense effect significantly for fertilized treatments and varieties in specific weight of the grains, and every exceeding in nitrogen caused increasing in spike number or increasing of spike grains or both of them caused competition on nutrients in the plant.

| Irrigation Systems / Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of genotypes |
|--------------------------------|-----------------------------|-----------------------------|----------------|---------------------|
| Ibaa 99 | 2129.00 a | 1940.50 ab | 300.90 cde | 1456.80 a |
| Adana99 | 2313.70 a | 1786.00 a-d | 294.60 cde | 1468.80 a |
| Arass | 1572.40 a-e | 1769.60 a-d | 449.20 b-e | 1263.70 a |
| Babelon | 2650.90 a | 1857.50 abc | 183.70 e | 1564.00 a |
| Baghdad | 1807.40 a-d | 1314.80 a-e | 248.40 de | 1123.50 a |
| Bour (Italian) | 1229.70 a-e | 1672.00 a-e | 170.00 e | 1023.90 a |
| Rashid | 2217.50 a | 1608.10 a-e | 270.00 de | 1365.20 a |
| Tamuz2 | 2068.00 a | 2088.30 a | 228.70 de | 1461.70 a |
| Effect of irrigation systems | 1998.6 a | 1754.6 a | 269.2 b | |

Table (2) Effect of different genotypes and irrigation systems in volumetric specific weight (kg.hect⁻¹).

| Irrigation Systems / Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|--------------------------------|-----------------------------|-----------------------------|----------------|---------------------|
| Ibaa99 | 77.47 gf | 85.83 a-d | 80.97 b-g | 81.42 bc |
| Adana99 | 76.37 g | 76.03 g | 80.33 c-g | 77.58 d |
| Aras | 78.43 gf | 79.63 d-g | 78.97 efg | 79.01 cd |
| Babelon | 78.93 efg | 75.53 g | 84.73 a-e | 79.73 bcd |
| Baghdad | 84.73 a-e | 86.13 abc | 87.80 a | 86.22 a |
| Bour (Italian) | 78.80 efg | 75.57 g | 82.90 a-f | 79.09 cd |
| Rashid | 81.93 a-f | 85.50 a-d | 81.60 a-g | 83.01 b |
| Tamuz2 | 77.30 gf | 84.43 a-e | 86.83 ab | 82.86 b |
| Effect of irrigation systems | 79.25 b | 81.08 ab | 83.01 a | |

Similar letters means there is no significant differences between different means on the 5% prob.

3. Crinkle grains percentage (%).

Table (3) showed there are significant differences between means of genotype effect and irrigation systems. The variety Bour(Italian) recorded higher value (2.06%), while the variety Ibaa99 recorded less value for this trait (1.52%). In the effect of irrigation system (S3) (2.12%), while the interaction between these two factors shown higher value for the interaction in the treatment between Babel variety and (S3) system of irrigation (2.60%) and the less value was for the treatment in the interaction between Babel variety and (S1) system (1.10%).

The values of crinkle grains have visa vers meaning , so the higher values means that the grains are no good as a variety, but the less values means that these varieties have good traits and superior these results agreed with Al - Zangana and Fakhradeen (2018), that means the good variety must contain less percentage of crinkle grains .

Table (3) Effect of different genotypes and irrigation systems in crinkle grains percentage (%).

| Irrigation Systems Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|---|--|--|---|--------------------------------------|
| Ibaa 99 | 1.40 ghi | 1.27 hi | 1.90 b-g | 1.52 d |
| Adana99 | 1.43 ghi | 1.27 hi | 2.20 a-e | 1.63 cd |
| Aras | 1.60 e-i | 2.10 a-f | 1.80 c-h | 1.83 a-d |
| Babylon | 1.10 i | 2.30 abc | 2.60 a | 2.00 ab |
| Baghdad | 1.57 f-i | 1.67 d-i | 1.80 c-h | 1.68 bcd |
| Bour (Italian) | 2.00 a-g | 1.93 b-g | 2.23 a-d | 2.06 a |
| Rashid | 2.00 a-g | 1.53 f-i | 2.43 ab | 1.99 ab |
| Tamuz2 | 1.83 b-h | 1.87 b-h | 2.00 a-g | 1.90 abc |
| Effect of irrigation systems | 1.62 b | 1.74 b | 2.12 a | |

Similar letters means there is no significant differences between different means on the 5% prob.

4. Protein percentage (%).

Table (4) showed there are significant differences between means of the effect of genotyped and effect of irrigation systems . The Rashid variety was surpassed recorded higher (14.69%), while the variety Babel recorded less value for this trait (12.52%). In the effect of irrigation system, the more value was in the second system (S2) (15.31%), while the interaction

between these two factors shown higher value for the interaction at the treatment between Bour(Italian) variety with second system (S2) (15.87%), and the less value for the treatment of interaction was between Babel variety with (S3) system (11.27%). These informations agreed with Bartosova and Redlova (2007) that there are significant differences in protein percentage in the grains of several varieties of wheat .Also agreed with Sedeeq et al (2017). The reason of the superiaty of some varieties in protein percentage may be because the differ in genetic composition (genotype) and to different ability of these varieties to absorpion and transporting the nutrients like nitrogen.

Table (4) Effect of different genotypes and irrigation systems in protein percentage (%).

| Irrigation Systems Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|---|--|--|---|--------------------------------------|
| Ibaa 99 | 13.37 c-h | 15.37 abc | 11.67 gh | 13.47 bc |
| Adana99 | 15.67 ab | 15.07 a-d | 11.80 fgh | 14.18 ab |
| Aras | 13.20 d-h | 15.77 a | 11.70 gh | 13.56 abc |
| Babylon | 12.40 e-g | 13.90 a-f | 11.27 h | 12.52 c |
| Baghdad | 13.47 c-g | 15.60 ab | 13.37 c-h | 14.14 ab |
| Bour (Italian) | 13.60 b-g | 15.87 a | 11.30 h | 13.59 abc |
| Rashid | 14.40 a-e | 15.10 a-d | 13.87 a-f | 14.69 a |
| Tamuz2 | 13.20 d-h | 15.10 a-d | 13.40 c-h | 13.90 ab |
| Effect of irrigation systems | 13.66 b | 15.31 a | 12.29 b | |

Similar letters means there is no signify cant differences between different means on the 5% prob.

5. Starch percentage (%).

Table (5) showed significant differences between the means of genotypes effect and irrigation systems. Baghdad variety was surpassed recorded higher value (67.39%). While the Bour(Italian)gave less value (59.54%). In the effect of irrigation system there were significant effects in this trait, the higher value was in the (S1) system (68.06%). There is higher value shown in the interaction between Arass variety with the second system (S2) (72.00%), while the less value shown in the interaction between Bour(Italian) variety and treatment of third system (S3) upon rain (48.10%). These results agreed with Mohamad (2020) which included the effect of the varieties and numbers of irrigation, the reason of the superity of this trait may be beonyd to more irrigation water and genotypic nature which the roots of these genotypes

absorbs water from the soil and transport the untrients to the vegetative parts of the plants more over to exceeding in carbohydrate synthesis which is essential matter in starch formation.

Table (5) Effect of different genotypes and irrigation systems in starch percentage trait (%).

| Irrigation Systems / Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|---------------------------------------|------------------------------------|------------------------------------|-----------------------|----------------------------|
| Ibaa 99 | 65.67 a-e | 66.80 a-d | 57.50 ef | 63.32 ab |
| Adana99 | 66.27 a-d | 68.70 abc | 58.67 c-f | 64.54 ab |
| Aras | 70.10 ab | 72.00 a | 53.77 fg | 65.29 a |
| Babylon | 69.60 ab | 70.20 ab | 58.00 def | 65.93 a |
| Baghdad | 70.20 ab | 68.27 abc | 63.70 a-d | 67.39 a |
| Bour (Italian) | 65.47 a-d | 65.07 a-d | 48.10 g | 59.54 b |
| Rashid | 69.10 ab | 61.67 b-f | 62.97 a-f | 64.58 ab |
| Tamuz2 | 68.10 a-d | 68.27 abc | 63.60 a-d | 66.66 a |
| Effect of irrigation systems | 68.06 a | 67.62 a | 58.29 b | |

Similar letters means there is no significant differences between different means on the 5% prob.

6. Wet gluten (%).

Table (6) showed there are significant difference between the means of genotypes, but no significant differences between irrigation system. The Rashid variety was surpassed recorded (41.33%), while the Biur(Italian) recorded less value (34.00%) for this trait . In the effect of irrigation system there wasn,t significant effects but the higher value for this factor showed in (S2) system (38.56%) while the interaction between these two factors shown higher value in the treatment between Rashid variety with the second sprinkler irrigation system (S2) (42.50%), the less value was in the treatment that the interation between Bour(Italian) and third system of irrigation (S3) on the rain (31.50%). Hashim and Al - Hadaria (2014) results were not agreed with our study in the effect of irrigation systems in wet gluten trait. The reason in the exceeding of wet gluten in the grains may be due to exceeding of temoerature through gyain filling duration which affected negatively in grain yild, so this affected positively on grain content from the protein which caused finally exceeding in wet gluten percentage. The result agreed with Mohamad (2020). There are significant differences in wet

gluten percentage trait. These significantly differences due to genetic variation between the varieties at more irrigation water, because it increase of water as irrigation exceed wet gluten percentage, which also due to that the good gluten absorbs water highly from weak gluten.

Table (6) Effect of different genotypes and irrigation systems in wet gluten percentage (%).

| Irrigation Systems / Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|---------------------------------------|------------------------------------|------------------------------------|-----------------------|----------------------------|
| Ibaa 99 | 38.00 a-d | 38.50 a-d | 38.50 a-d | 38.33 b |
| Adana99 | 38.50 a-d | 38.00 a-d | 38.00 a-d | 38.17 b |
| Aras | 36.50 cd | 40.00 abc | 36.00 cde | 37.50 b |
| Babylon | 36.50 cd | 39.50 abc | 37.00 cd | 37.67 b |
| Baghdad | 36.00 cde | 37.50 bcd | 36.50 cd | 36.67 b |
| Bour (Italian) | 36.50 cd | 34.00 de | 31.50 e | 34.00 c |
| Rashid | 39.00 a-d | 42.50 a | 42.50 a | 41.33 a |
| Tamuz2 | 35.50 cde | 38.50 a-d | 42.00 ab | 38.67 b |
| Effect of irrigation systems | 37.06 a | 38.56 a | 37.75 a | |

Similar letters means there is no significant differences between different means on the 5% prob.

7. Dry gluten percentage (%).

Table (7) showed there are significant differences between the means of effect of genotypes, and no significant differences between irrigation systems. The Rashid variety recorded higher value (13.63%), and Bour(Italian) gave less value (11.27%) for this trait . In irrigation system effect, there was higher value of this trait shown in the second system (S2) (12.80%), while the interaction between these two factors shown in the treatment between Rashid variety and second system (S2) of irrigation (14.10%), the less value recorded in the treatment of the interaction between Bour(Italian) variety with the third system of irrigation (S3)(10.27%) . These results agreed with Al - Maqtri (2009) results that there are significant differences between the varieties in dry gluten percentage effected by the variety and agricultural season .

Table (7) Effect of different genotypes and irrigation systems in dry gluten percentage (%).

| Irrigation Systems Genotypes | S1 Sprinkler Irrigation (1) | S2 Sprinkler Irrigation (2) | S3 On the Rain | Effect of Genotypes |
|---|--|--|---|--------------------------------------|
| Ibaa 99 | 12.57 <u>abc</u> | 12.60 <u>abc</u> | 12.70 <u>abc</u> | 12.62 b |
| Adana99 | 12.30 <u>bc</u> | 12.60 <u>abc</u> | 12.67 <u>abc</u> | 12.52 b |
| Aras | 12.10 <u>bc</u> | 13.27 ab | 11.90 <u>bc</u> | 12.42 b |
| Babylon | 12.17 <u>bc</u> | 13.17 ab | 12.67 <u>bc</u> | 12.53 b |
| Baghdad | 12.57 <u>abc</u> | 12.40 <u>bc</u> | 12.07 <u>bc</u> | 12.34 b |
| Bour (Italian) | 12.07 <u>bc</u> | 11.47 cd | 10.27 d | 11.27 c |
| Rashid | 12.80 <u>abc</u> | 14.10 a | 14.00 a | 13.63 a |
| Tamuz2 | 11.90 <u>bc</u> | 12.80 <u>abc</u> | 13.97 a | 12.89 ab |
| Effect of irrigation systems | 12.31 a | 12.80 a | 12.48 a | |

Similar letters means there is no significant differences between different means on the 5% prob.

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