Growth test and Yield of some approved varieties of Rice Oryza sativa L. under different environmental conditions

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Abstract

A field experiment was carried out in five cultivation sites (L) (Dhi Qar 1 (Shatrah) (L1), Dhi Qar 2 (Karma) (L2), Al-Muthanna (Al-Rumaitha) (L3), Al-Qadisia (Agricultural Research Station) (L4), Najaf (Al-Mishkhab) (L5)) to grow six certified varieties of Rice (V) (Yasmin (V1), Furat (V2), Dijlah (V3), Amber baraka (V4), Ghadeer (V5), Amber 33 (V6)) during summer agricultural season 2019 for the purpose of studying the qualities growth and quotient components for varieties the Rice under the influence of various environmental conditions. The experiment was use Randomized Complete Block Design (RCBD) with three replications. It showed the consequences excellence Najaf site (L5) significantly over the remaining sites, with the highest grain yield reaching 4.216 t.ha⁻¹. Furat variety (V2) was superior to most of the varieties for the characteristics (number of panicles, weight of 250 grains and the total grain yield) (446.0 panicle.m⁻², 10.17 g, 5.08 t.ha⁻¹) respectively. Interaction treatment L4V2 achieved the highest average grain yield 5.680 t.ha⁻¹ Compared to the rest of interaction treatment.

Keywords: Test the Growth and Yield, Certified varieties, different environmental sites, Rice Crop.

1. Introduction

1.1. The importance of rice

Rice Oryza sativa L., is prepared the staple food for more than half of the world population, and its importance stems from its high content of carbohydrates and balanced protein [1]. In Iraq, rice comes second after the wheat crop in terms of cultivated area and productivity, and it is one of the strategic crops in food security. The environmental conditions in Iraq are suitable for the cultivation of the rice crop, but its productivity is low compared with the rest of the world, and the reasons for the low productivity are due to the failure to adopt high-productivity varieties on the one hand and on the other side. Varieties Do not pass for its inherent production capacity because of the lack of use of modern technologies to serve the land and crops, in addition to that the presence of various determinants, the most important of which is the prevailing environmental conditions, which differ from one region to another depending on the temperature and light, which affect directly or indirectly most of the physiological processes that occur inside the plant [2].

1.2. Aim of study

That understanding of crop management complete by choosing the appropriate environment for the varieties plus capacity its growth under multiple or changing environments given a plus in yielding a quotient, and since the studies that are concerned with the sites of rice cultivation are few and to reduce them to physiological studies, the goal was achieved from this study test the qualities the growth and output components to for the approved varieties under the conditions of five different environments in the governorates of central and southern Iraq.
2. Materials and methods

2.1. Experiment factors
A field experiment was carried out in five cultivation sites (Dhi Qar 1 (Shatrah) (L1), Dhi Qar 2 (Karma) (L2), Al-Muthanna (Rumaitha) (L3), Al-Qadisia (Agricultural Research Station) (L4), Najaf (Al Mishkhab) (L5) table (1). On 15 June 2019, six varieties of approved rice were planted (Yasmin (V1), Furat (V2), Dijlah (V3), Amber baraka (V4), Ghadeer (V5), Amber 33 (V6)), according to Randomized Complete Block Design (RCBD) with three replications for each site.

2.2. Field operations
The experimental units included six agricultural lines with a distance of 20 cm and dimensions (1 × 1.5) m, and the number of experimental units reached 18 experimental units in each site, soil service operations were carried out including plowing, smoothing and leveling, phosphate fertilizer P2O5 (DAP) was added 400 kg.ha⁻¹ mixed with soil, urea fertilizer (46% N) was added in two equal batches, the first after 10 days of seedlings, at a rate of 140 kg.ha⁻¹ the second batch is 35 days after the first batch [3].

2.3. Study of traits
It studied the following traits (number of days from planting to 50% flowering, number of days from planting to 75% physiological maturity, plant height, Area flag leaf, Panicle length, number of tillers.plant, number of panicles. m⁻², weight of 250 grain, grain yield t. ha⁻¹). Harvesting of the crop on 1/11/2019.

2.4. Statistical analysis
The data were statistically analyzed according to the design used by the statistical program Genstat Version 12 and the averages were compared using the lowest significant difference LSD at the probability level 0.05.

| N. | L. | S.T | pH | DC/ m | N mg/K g | P mg/K g | K mg/K g | Sand % | Clay % | Silt % |
|----|----|-----|----|-------|-----------|-----------|---------|--------|--------|--------|
| 1  | L1 | Silty| 7.2 | 4.21  | 32.4      | 15.29     | 1.62    | 25     | 30     | 45     |
| 2  | L2 | Silty| 7.7 | 4.81  | 37.2      | 18.31     | 2.73    | 27     | 29     | 44     |
| 3  | L3 | Clay Loam | 7.6 | 4.22  | 25.8      | 6.13      | 1.13    | 21     | 45     | 34     |
| 4  | L4 | Silt| 7.1 | 4.12  | 23.9      | 11.12     | 2.21    | 32     | 37     | 41     |
| 5  | L5 | Clay | 7.3 | 4.05  | 33.5      | 13.02     | 2.31    | 21     | 42     | 37     |

3. Results and Discussion

3.1. The number of days from planting to 50% flowering (day)
Refer results table (2) and figure (1,2) The moral effect of study factors and the overlap between them. Plants cultivated at site L2 gave the highest average of 93.39 days, while plants cultivated at site L5 the lowest average was 89.61 days. The reason may be due to the variation in temperatures and the intensity of lighting in the study sites, which affects the speed of flowering and the reduction in the period required collecting the cumulative heat to move from one growth stage to another until the flowering stage. This result agreed with [4].The variety V6 outperformed by giving it the highest average of 96.00 days, while the V1 variety gave the lowest average of 86.67 days. The difference in the varieties in the period required for flowering and maturity is due to their variation in the length of each of the periods of the vegetative and reproductive growth stages, starting from germination and ending with maturity. This finding is in agreement with [1].The interaction treatment L1V2 gave the highest average of 97.33 days, while the interaction treatment L5V1 gave the lowest average of 82.00 days. This indicates the nature of environmental conditions, the extent of each variety. Response to it, and its genetic ability to grow and adapt until flowering is reached.
Table 2. The number of days from planting to 50% flowering under the influence of the sites and varieties

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD  |
|-----------|-----|-----|-----|-----|-----|-----|------|------|
| L1        | 87.33 | 97.33 | 87.00 | 89.00 | 91.67 | 97.00 | 91.56 |      |
| L2        | 94.00 | 95.67 | 91.33 | 92.00 | 91.67 | 95.67 | 93.39 |      |
| L3        | 86.00 | 91.67 | 92.67 | 92.33 | 85.33 | 96.00 | 90.67 | 1.424|
| L4        | 84.00 | 95.00 | 91.33 | 93.33 | 92.33 | 96.33 | 92.06 |      |
| L5        | 82.00 | 93.67 | 84.00 | 92.33 | 90.67 | 95.00 | 89.61 |      |
| Mean      | 86.67 | 94.67 | 89.72 | 91.80 | 90.33 | 96.00 |       |      |
| LSD       |      |      |      |      |      |      | 1.56  |      |

LSD of A×B 3.389

3.2. The number of days from planting to 75% of physiological maturity (day)

It can be seen from Table (3) and Figure (1,2) the presence of significant differences for the study factors and the overlap between them. The L1 site recorded the highest average for this trait, which reached 115.89 days, while the L3 site recorded the lowest average of 113.44 days, the reason may be due to the difference in temperature between sites and soil factors. This result agreed with [5]. Variety V6 recorded the highest average of 120.20 days, while variety V3 recorded the lowest average of 105.20 days. The reason for this may be due to the genetic nature of the variety and its ability to respond to environmental factors in the study area. This result was consistent with [4]. Intervention treatment L1V6 gave the highest average of 123.67 days, while the interaction treatment L4V1 gave the lowest average of 72.00 days.

Table 3. The number of days from the planting to 75% of physiological maturity under the influence of the sites and varieties.

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD  |
|-----------|-----|-----|-----|-----|-----|-----|------|------|
| L1        | 107.00 | 112.00 | 108.33 | 116.67 | 117.67 | 123.67 | 115.89 |      |
| L2        | 107.00 | 121.67 | 104.00 | 119.00 | 117.67 | 120.00 | 114.89 |      |
| L3        | 107.33 | 116.33 | 103.67 | 117.67 | 116.67 | 119.00 | 113.44 | 1.352|
| L4        | 72.00 | 117.67 | 103.33 | 120.00 | 118.33 | 119.33 | 114.23 |      |
| L5        | 108.7 | 116.33 | 106.67 | 115.33 | 118.00 | 119.00 | 114.00 |      |
| Mean      | 108.07 | 118.80 | 105.20 | 117.73 | 117.67 | 120.20 |       |      |
| LSD       |      |      |      |      |      |      | 1.481 |      |

LSD of A×B 3.311

3.3. Plant height (cm)

Notes from the results of Table (4) and Figure (1,2) the plant height was significantly affected by the different sites studied, as the varieties planted at the L1 site recorded the highest average of 103.44 cm, while the varieties planted at the L3 site recorded the lowest average of 92.99 cm, this may be due to the effect of the environmental conditions of each site on the studied varieties. This result agreed with [5]. The variety V6 showed a significant superiority over the rest of the varieties, and it scored the highest average of 141.41 cm, while the V2 variety gave the lowest average of 77.02 cm. The differences in plant height reflect the genetic differences between the varieties. This finding is in agreement with [6]. The L1V6 treatment gave the highest average of 154.22 cm, while the L3V2 treatment gave the lowest average of 73.22 cm. This indicates the response of plants of the superior variety to the environmental conditions in which they are superior, which showed the genetic ability to grow and rise.
Table 4. Plant height (cm) under the influence of the sites and varieties.

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD |
|-----------|-----|-----|-----|-----|-----|-----|------|-----|
| L1        | 94.00 | 82.22 | 90.89 | 98.44 | 100.89 | 154.22 | 103.44 |
| L2        | 79.55 | 73.89 | 92.67 | 94.55 | 104.89 | 134.56 | 96.68 |
| L3        | 82.89 | 73.22 | 95.44 | 87.78 | 86.78 | 131.81 | 92.99 |
| L4        | 79.89 | 78.00 | 91.78 | 85.67 | 84.89 | 141.44 | 93.61 |
| L5        | 85.52 | 77.78 | 94.89 | 85.78 | 93.33 | 145.00 | 97.05 |
| Mean      | 84.37 | 77.02 | 93.13 | 90.45 | 94.15 | 141.41 |      |
| LSD       | 4.863 |      |      |      |      |      |      |

LSD of A×B 10.874

3.4. Area Flag leaf (cm²)

Show results table (5) and figure (1,2) the presence of significant differences for the study factors and the overlap between them. L3 site gave the highest average at 26.52 cm² while the L4 site gave the lowest average of 17.45 cm², the suitable environments for the variety gave the best efficiency for the growth of the variety, and this was reflected in the area of the flag leaf. This result came with [2]. The V3 variety gave the highest average of 31.92 cm² while the V4 variety gave the lowest average of 12.71 cm², may be due to the difference in the varieties between them in the period of growth and expansion of the flag leaf as a result of differences in their genetic structures. This finding is in agreement with [1]. The interference treatment L3V2, gave the highest mean of 47.01 cm² whereas, the interference treatment L2V4 gave the lowest average of 9.74 cm² this may be due to varieties differences in response to growth factors such as the nature of the soil, the nature of irrigation water, and the environmental conditions that have effects on the vegetative growth of plants.

Table 5. Area flag leaf (cm²) under the influence of sites and varieties

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD |
|-----------|-----|-----|-----|-----|-----|-----|------|-----|
| L1        | 21.14 | 19.03 | 41.46 | 13.21 | 20.59 | 23.36 | 23.13 |
| L2        | 13.85 | 26.40 | 25.03 | 9.74  | 19.80 | 27.75 | 20.43 |
| L3        | 20.64 | 47.01 | 40.11 | 10.43 | 17.47 | 23.48 | 26.52 |
| L4        | 15.98 | 18.58 | 26.35 | 12.98 | 13.47 | 17.31 | 17.45 |
| L5        | 18.65 | 27.53 | 26.67 | 17.18 | 22.10 | 22.99 | 22.52 |
| Mean      | 18.05 | 27.71 | 31.92 | 12.71 | 18.69 | 22.98 |      |
| LSD       | 5.896 |      |      |      |      |      |      |

LSD of A×B 13.189

3.5. Panicle length (cm)

Show the results of table (6) and figure (1,2) the presence of significant differences between the varieties and their overlap with the sites only. The variety V3 gave the highest average length of the panicle with 23.89 cm, while the variety V1 gave the lowest average of 18.63 cm. The reason may be attributed to the genetic differences between the varieties and the fact that this trait is not affected much by climatic conditions. This result is in agreement with [4]. The interference treatment L5V6 gave the highest average of 24.80 cm, while the interference treatment L5V1 gave the lowest average of 16.90 cm.
Table 6. Panicle length (cm) under the influence of sites and varieties.

| Treatment | V1    | V2    | V3    | V4    | V5    | V6    | Mean   | LSD    |
|-----------|-------|-------|-------|-------|-------|-------|--------|--------|
| L1        | 19.60 | 19.80 | 24.60 | 20.78 | 22.47 | 23.20 | 21.74  |        |
| L2        | 18.73 | 19.13 | 22.89 | 19.73 | 20.43 | 23.33 | 20.71  |        |
| L3        | 19.73 | 19.33 | 24.40 | 21.27 | 22.53 | 21.93 | 21.53  | 1.345  |
| L4        | 18.20 | 18.27 | 23.40 | 19.40 | 22.80 | 23.53 | 20.93  |        |
| L5        | 16.90 | 18.33 | 24.20 | 21.47 | 22.67 | 24.80 | 21.39  |        |
| Mean      | 18.63 | 18.97 | 23.89 | 20.53 | 22.18 | 23.36 |        |        |

LSD of A×B: 3.049

3.6. The number of Tillers in the plant (Tiller.Plant⁻¹)

Indicated results table (7) and figure (1,2) the presence of significant differences for the study factors and the overlap between them. The site L2 gave the highest average of 17.88 (tiller.plant⁻¹) while the site L4 gave the lowest average of 14.50 (tiller. plant⁻¹). The variety V4 outperformed with the highest average rating of 24.34 (tiller. plant⁻¹) while the variety V3 gave the lowest average of 12.52 (tiller. plant⁻¹). The reason for this may be attributed to the variety. Response to climatic conditions and soil fertility, which showed its genetic ability to disperse. This result agreed with [1]. The interference treatment L3V4 gave the highest average of 27.93 (tiller.Plant⁻¹) whereas, the interference treatment L4V5 gave the lowest average of 11.53 (tiller. plant⁻¹).

Table 7. the number of Tillers in the plant under the influence of sites and varieties

| Treatment | V1    | V2    | V3    | V4    | V5    | V6    | Mean   | LSD    |
|-----------|-------|-------|-------|-------|-------|-------|--------|--------|
| L1        | 14.87 | 16.47 | 12.20 | 25.89 | 16.80 | 13.47 | 16.61  |        |
| L2        | 15.60 | 22.60 | 12.27 | 26.20 | 18.46 | 12.13 | 17.88  |        |
| L3        | 15.67 | 19.13 | 12.00 | 27.93 | 17.67 | 11.74 | 17.36  | 2.359  |
| L4        | 15.87 | 17.73 | 11.87 | 18.22 | 11.53 | 11.80 | 14.50  |        |
| L5        | 13.48 | 19.00 | 14.27 | 23.47 | 19.13 | 14.53 | 17.31  |        |
| Mean      | 15.13 | 18.99 | 12.52 | 24.34 | 16.72 | 12.73 |        |        |

LSD of A×B: 5.779

3.7. Number of Panicles (panicle.m⁻²)

Notes from the results of table (8) and figure (1,2) the number of panicles square meter was significantly affected by the different sites and varieties and the overlap between them. The site L4 gave the highest average of 369.9 p. m⁻² while the site L1 gave the lowest average of 261.3 p.m⁻². The variety V2 significantly outperformed the rest of the varieties, with the highest average of 446.0 p.m⁻² while the variety V6 gave the lowest average of 209.6 p.m⁻². This is due to the nature of the varieties and their ability and genetic potential to produce the produced strands, which is a reflection on this characteristic. The interference treatment L4V2 gave the highest average of 517.3 p.m⁻² whereas, the interference treatment L4V6 gave the lowest average of 173.3 p.m⁻². This result was in agreement with [7] when they studied the evaluation of five varieties of rice under the conditions of Dhi Qar and Muthanna to the ability of the genetic varieties to respond to all growth factors in raising the susceptibility to clades and forming their hematomas.
Table 8. number of panicles .m$^{-2}$ under the influence of sites and varieties.

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD |
|-----------|-----|-----|-----|-----|-----|-----|------|-----|
| L1        | 313.3 | 259.3 | 248.0 | 353.3 | 241.3 | 252.7 | 261.3 |     |
| L2        | 274.0 | 461.3 | 322.0 | 578.7 | 291.7 | 226.7 | 359.1 | 24.38 |
| L3        | 358.7 | 488.7 | 280.0 | 491.3 | 344.0 | 216.7 | 363.2 | 9.95  |
| L4        | 324.7 | 517.3 | 376.0 | 466.7 | 361.3 | 173.3 | 369.9 |     |
| L5        | 331.7 | 503.3 | 368.7 | 310.7 | 366.0 | 178.7 | 343.2 | 0.687 |
| Mean      | 300.5 | 446.0 | 318.9 | 440.1 | 320.9 | 209.6 |     |     |
| LSD       |     |     |     | 10.90 |     | | | A×B 24.38 |

3.8. Weight 250 Grain (g)

Notes from table (9) and figure (1,2) the presence of the moral influence of the study factors and the overlap between them. The site L5 gave the highest average of 8.44 g, while the site L3 gave the lowest average of 6.25 g. The variety V2 gave the highest average of 10.17 g, while the variety V4 gave the lowest average of 4.78 g, this may be due to the ability of the varieties to represent and the speed of transport from the source-sink, which is reflected in the weight of the grain, this result agreed with [2]. The interference treatment L4V2 gave the highest average of 11.37 g, while the interference treatment L4V4 gave the lowest average of 3.12 g. This finding is in agreement with [8].

Table 9. Weight of 250 grains (g) under the influence of sites and varieties

| Treatment | V1  | V2  | V3  | V4  | V5  | V6  | Mean | LSD |
|-----------|-----|-----|-----|-----|-----|-----|------|-----|
| L1        | 7.33 | 10.19 | 9.95 | 5.15 | 8.69 | 4.90 | 7.70 |     |
| L2        | 5.23 | 9.41 | 8.64 | 5.63 | 9.29 | 5.69 | 7.32 |     |
| L3        | 4.17 | 9.99 | 8.32 | 3.16 | 7.29 | 4.55 | 6.25 | 0.687 |
| L4        | 7.84 | 11.37 | 4.42 | 3.12 | 6.44 | 6.63 | 6.30 |     |
| L5        | 7.72 | 9.87 | 10.33 | 6.85 | 9.54 | 6.32 | 8.44 |     |
| Mean      | 6.46 | 10.17 | 8.33 | 4.78 | 8.25 | 5.22 |     |     |
| LSD       |     |     |     | 0.753 |     | | | A×B 1.683 |

3.9. Grain yield (t.ha$^{-1}$)

Proven results table (10) and figure (1,2) the presence of the moral influence of the study factors and the overlap between them. The site L5 outperformed it with the highest average of 4,216 t.ha$^{-1}$ whereas, the site L4 gave the lowest average of 3.152 t.ha$^{-1}$. The variety V2 outperformed by giving the highest average of 5.08 t. ha$^{-1}$ while the variety V4 gave the lowest average of 2.439 t.ha$^{-1}$. The interference treatment L4V2 gave the highest average of 5.680 t.ha$^{-1}$ while the interference treatment L4V4 gave the lowest average of 1.560 t.ha$^{-1}$. The significant difference in grain yield between sites and varieties, and the overlap between them, corresponds to differences in the yield components (number of panicles.m$^{-2}$, weighing 250 grain) and this result agreed with [7].
Table 10. Grain yield (t ha\(^{-1}\)) under the influence of sites and varieties.

| Treatment | V1   | V2   | V3   | V4   | V5   | V6   | Mean | LSD |
|-----------|------|------|------|------|------|------|------|-----|
| L1        | 3.80 | 5.08 | 4.96 | 2.81 | 4.34 | 2.45 | 3.89 |     |
| L2        | 2.61 | 4.70 | 4.32 | 2.81 | 4.64 | 2.84 | 3.65 |     |
| L3        | 2.09 | 4.98 | 4.16 | 1.58 | 3.64 | 2.85 | 3.22 | 0.34|
| L4        | 3.92 | 5.68 | 2.21 | 1.56 | 3.22 | 2.21 | 3.15 |     |
| L5        | 3.86 | 4.92 | 5.16 | 3.42 | 4.76 | 3.16 | 4.21 |     |
| Mean      | 3.23 | 5.08 | 4.16 | 2.44 | 4.12 | 2.73 | 3.79 |     |
| LSD       | 0.38 |     |      |      |      |      |      |     |
Conclusions

The suitability of the growth of the varieties to the environmental conditions in which they were planted, and this is evidence of the high capacity of these varieties for response and environmental adaptation to the studied areas. Especially the Furat variety V2, who gave the highest grain yield on the site L4.

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