Response of Yield Components of Some Black Rice Cultivars to Spraying With The Amino Acid Phenylalanin

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Abstract

Three rice varieties (Goura, Chakhao and Local) were grown during two seasons 2019-2020, aimed to assessment of different levels of spraying of phenylalanine on performance of the grain yield components in different rice varieties. The selected three varieties (sub plots) were grown under the influence of four levels of phenylalanine spraying (main plots), included amino acid treatments occupied the main plates 50, 100 and 150 mg.L\textsuperscript{-1} as well as the control treatment (spraying distilled water only), the experiment applied in split plots arrangements in RCBD with three replications. The results showed a significant superiority of the Goura genotype selected by giving the highest averages in plant height, total grains number per panicles, 1000 grains weight, grain yield, Biological yield, percentage of harvest index and tillers number plant, that reached to 118.47 cm, 144.25 grains.panicl\textsuperscript{-1}, 23.44 g, 6.70 tons.hectare\textsuperscript{-1}, 12.06 tons.hectare\textsuperscript{-1},54.82\% and 18.40 tillers.plant\textsuperscript{-1} respectively, while the genotype significantly superior to Local Selected by giving the highest averages in the leaves content of total chlorophyll pigments SPAD, which amounted to 39.13 SPAD. The spraying of the amino acid phenylalanine at a concentration of 50 mg.l\textsuperscript{-1} was significantly superior by giving the highest averages in the indicators of vegetative growth, yield and its components.

Keywords: Phenylalanine, Black rice, Grain yield.

1. Introduction

The rice plant, whose scientific name is Oryza sativa L. belongs to the Poaceae family, is one of the important grain crops in Iraq for its high nutritional value as a source of energy, protein, and carbohydrates. It comes in second place after the wheat crop in its economic importance and its role in food security in Iraq and the world. Half of the world’s population depends on rice as basic food and the main source of energy for them. It enters the food of another 25% of the world’s population as well, and it is the most important grain crop that is directly eaten. In view of the increase in the incidence of chronic diseases and addiction, the global health community awareness has increased, researchers have directed their attention to searching for ways to increase the concentrations of antioxidant compounds in the grains and fruits of dual-purpose plants in food and medical use especially which plants are included in the daily food of most countries of the world [1]. Black rice, which contains good concentrations of anthocyanin pigment group, which has shown an important role in increasing the immune system effects of patients with anemia, diabetes, heart disease, and cancer [2], the accumulation of anthocyanins in black rice variety approximately between 0.262 to 2.539 mg. g\textsuperscript{-1} dry weight. The interest in this variety of rice has increased in the past few years because it is rich in protein and nutrients and the presence of the antioxidant anthocyanin pigments and the percentage of anthocyanins of the type Cyaniding-3-O.glucoside and Peonidin-3- O.gluciside in the grain of rice varieties It constitutes 90\% of the total amount of pigment in grain [3]. While [4,5] showed that there is a wide variation in the physical and chemical traits of black rice varieties. [6] presented that when they used three groups of rice with a total of 49 varieties, Indian 14 varieties, Javanese 5 varieties and Japanese 30 varieties, there were significant differences between the varieties, as Lomelto of the Javanese group gave the highest mean 1000 grains weight of 34.0 g compared to IR- 50 of the Indian group, which gave the lowest mean of 16.3 g. In a study conducted by [7] for the cultivation of two black rice varieties, Woja laka and Laka, they showed significant differences between the cultivated varieties for grain yield and biological yield, as Laka gave the
highest average of the studied traits, which amounted to 7.40 tons/hectare and 17.78 tons/hectare, while the Woja laka variety gave the lowest average of 5.37 tons/hectare and 6.56 tons/hectare respectively for two traits. In study by [8] who explained that the effect of spraying the amino acid Phenylalanine at a concentration of 50, 100 and 200 mg.L⁻¹, in addition to the comparison treatment on three varieties of rice, there were significant differences for spraying these amino acids, as the spraying treatment of 50 mg.L⁻¹ gave the highest mean of all yield traits and components in the number of grains in the panicle, 1000 grains weight, grain yield, biological yield and the percentage of harvest index amounted to 147.7 panicle⁻¹, 19.08 g, 4,751 tons.hectares⁻¹, 12,352 tons.hectares⁻¹ and 38.79% respectively. Furthermore, by comparison f, with the lowest average for the above traits when the comparison treatment was 132.6 panicle⁻¹ and 9.66% and 17.19 g, 3,521 tons.hectares⁻¹, 11.129 tons.hectares⁻¹ and 33.08%, respectively. Phenylalanine represents one of the important amino acids for plant growth, as it is the basic unit of protein building and the initiator of many compounds involved in plant metabolism, which play an important role in its growth, reproduction and response to environmental conditions, especially in building lignin in vascular plants, which is the main component of plant cell walls, as phenylalanine also plays an important role in the biosynthesis of salicylic acid, and it is a compound that is necessary to stimulate biological resistance in many plants to biotic and abiotic stresses [9].

For all of the above, due to the scarcity of studies that dealt with this crop, it was necessary for us to study it to investigate of different levels of spraying of phenylalanine on performance of the grain yield components in rice varietes in the Iraqi environmental conditions.

2. Materials and Methods

Three plates were planted in the first season with Goura, Chakhao and Local rice variety (one plate for each variety) with 100 plants per variety per plate. The first variety was introduced from the United Kingdom for the first time to Iraq in 2018, and the local variety was first introduced to Iraq in 2001 from Vietnam from the rice research station in Mashkhab, while the Chakhao variety was introduced from India for the first time in 2019. A selection intensity of 10% was used to select plants with the highest content of total anthocyanin pigment. RCBD was used according to the order of the panels, splinter and three replications, as the amino acid treatments filled the main panels and the spraying process was done for three times during the growing season, the secondary panels filled the selected genotypes with the original so that the number of cultivated genotypes was 6 genotypes, The means were tested according to the least significant difference test at a probability level of 0.05. The experimental land was tillage by two perpendicular tillage with a moldboard plows, then the smoothing and leveling process was conducted. Three samples were taken from each depth of the field soil 0-30 cm. They were air-dried, then crushed, mixed well, and sieved for the purpose of preparing them for analysis in the laboratories of the Soil and Water Resources Department at the College of Agriculture, Al-Qasim Green University to determine some of the physical and chemical properties as in Table (1):

| Table 1. Some physical and chemical properties of field soil. |
|-------------------------------|-----------------|--------------|--------------|
| Traits                        | Type            | Values       | Units        |
| Sand                          | 222             | g.Kg⁻¹       |
| Soil texture components       | Silt            | 474          | g.Kg⁻¹       |
| Clay                          | 304             | g.Kg⁻¹       |
| silty clay loam               |                 |              |
| bulk density                  | 1.29            | Mg.m⁻³       |
| Organic matter                | 1.60            | g.Kg⁻¹       |
| availability nitrogen         | 0.44            | %            |
| availability phosphorous      | 0.61            | %            |
| availability potassium        | 0.52            | %            |
| electrical conduction EC      | 3.21            | DS.m⁻¹       |
| pH                            | 7.78            | -            |

Experiment plants were fertilized for all treatments according to the recommendation of [10] by adding 140 kg N.ha⁻¹ nitrogen fertilizer, 46 kg P₂O₅.ha⁻¹ phosphate fertilizer and 50 kg K₂O ha⁻¹ potassium fertilizer. Phosphate fertilizer (Super Triple Calcium Phosphate) was added. Ca₃(PO₄)₂, 46% P₂O₅ by mixing it with the soil before planting. Nitrogen fertilizer (urea 46%) was added in two batches, the first 10 days after planting and the second a month after the first batch. As for the potassium fertilizer (potassium sulfate, 50% K₂O added after 10 days of planting. The weeds growing in the experimental plots was manually removed three times. The first weeding was conducted 10 days after planting, the second 15 days after the first weeding, and the third 15 days after the second weeding and cut off irrigation 15 days before harvest. In order to measure the grain content of total anthocyanin...
pigments and their compounds, the selected varieties were grown with the original variety under the influence of four levels of phenylalanine spraying. The amino acid treatments occupied the main plates 50, 100 and 150 mg.L\(^{-1}\) as well as the control treatment (spraying distilled water only). The first spraying was done three times, the first in the tillering stage after 50 days of planting and the second in the heading stage after 75 days from planting, and the third in the stage of ripening after 100 days of planting. The sub plot occupied the selected genotypes with the original so that the number of varied genotypes was 6 genotypes, thus bringing the number of experimental units to 72 experiment units. The plants of the experimental unit were distributed on the dimensions of (2\(\times\)3 m\(^2\)) where they contained eight lines, as well as two guard lines for each experimental unit, the length of each of them was 2 m, and the distance between one line and another was 30 cm, and between one plant and another 20 cm [11] (2).

The cultivar Goura was harvested on 20\(^{th}\) November for the two experiment seasons in 2019 and 2020, and the other two cultivars were harvested on 1\(^{st}\) and 10\(^{th}\) December for the experiment season 2019 and 2020, respectively. The irrigation has been stopped and the plots has dried up when the plants reached the stage of physiological maturity by turning the panics to a yellow color tinged with black, and the leaves and stems withered, and the moisture content of the grains began to decrease. A selection intensity of 10% was used to select plants with the largest content of total anthocyanin, which was measured according to the [12] method. After data collection, the ready-made statistical program GenStat V.20 was used according to the method approved by [13].

### 2.1. Studied traits

#### 2.1.1. plant height (cm)

#### 2.1.2. Leaves content of total chlorophyll pigment (SPAD)

#### 2.1.3. The number of total grains in panicle (grains.panicle\(^{-1}\))

#### 2.1.4. The number of tillers in the plant (tiller.plant\(^{-1}\))

#### 2.1.5. The weight of 1000 grains (g)

#### 2.1.6. Total grain yield (tons.hectares\(^{-1}\))

#### 2.1.7. Biological yield (tons.hectares\(^{-1}\))

#### 2.1.8. Harvest Index Percentage (%)

### 3. Results and discussion

Table (2) shows that there is a significant effect of the study factors and the interaction between them on plant height. The selected Goura variety significantly outperformed and gave the highest average of 118.47 cm compared to the lowest average of 104.38 cm for Chakhao variety. The spraying of the amino acid concentrations of phenylalanine also had a significant effect, the concentration of 50 mg.L\(^{-1}\) provided the best averages was 114.11 cm compared to the spray concentration was 0.0 mg.L\(^{-1}\), which showed the lowest average of 105.31 cm.

The same table shows that there are significant differences between the interaction between the variety and the spraying of the amino acid phenylalanine, as the interaction treatment between the selected Guora variety and the spray concentration 150 mg.L\(^{-1}\) was superior, which passed the highest mean of 125.73 cm compared to the lowest mean of 99.20 cm for the interaction of the original Chakhao cultivar with The spray concentration is 0.0 mg.L\(^{-1}\).

Table (3) shows that there is a significant effect of the study factors and the interaction between them on the content of total chlorophyll pigments SPAD, as the local variety selected significantly outperformed and gave the highest mean reached 39.13 SPAD compared to the lowest m.

The same table showed that there were significant differences between the interaction between the variety and the concentrate of 50 mg.L\(^{-1}\) of spraying had concentrations of the amino acid phenylalanine, as the interaction treatment between the selected Guora variety and

The superiority of spraying concentration of phenylalanine acid 50 mg.L\(^{-1}\) in all indicators of plant height and leaves content of total chlorophyll pigment (SPAD) may be attributed to the fact that the acid promotes plant growth during the vegetative and flowering stages and as a result of the application of the acid associated with its role as the basic building blocks of proteins and stimulation of a number of additional vital functions in regulating the construction of food compounds and the transport of nutrients nitrogen storage, moreover, can serve as a source
of carbon, energy and synthesis of other organic compounds such as proteins, amines, purines, alkaloids, vitamins, enzymes, terpenoids, etc. [18,19].

**Table 2.** Effect of variety and spraying with the amino acid phenylalanine and the interaction between them on plant height (cm).

| Varieties | Phenylalanine spraying concentrations (mg L\(^{-1}\)) | Mean variety effect |
|-----------|--------------------------------------------------|-------------------|
|           | 00 | 50 | 100 | 150 |                      |
| Guora     | Origin | 103.80 | 117.60 | 112.80 | 110.07 | 111.07 |
|           | Selected | 109.80 | 119.47 | 118.87 | 125.73 | 118.47 |
| Local     | Origin | 102.13 | 110.13 | 107.07 | 105.20 | 111.37 |
|           | Selected | 109.13 | 117.53 | 108.13 | 110.67 | 111.37 |
| Chakhao   | Origin | 99.20 | 109.33 | 102.53 | 106.47 | 104.38 |
|           | Selected | 107.80 | 110.60 | 106.93 | 112.87 | 109.55 |

Mean effect of Phenylalanine

| L.S.D 0.05 Varieties | Phenylalanine | Interaction |
|----------------------|---------------|-------------|
|                       | 2.06          | 3.50        |

**Table 3.** Effect of variety and spraying with the amino acid phenylalanine and the interaction between them on the total chlorophyll pigment content (SPAD) in leaves.

| Varieties | Phenylalanine spraying concentrations (mg L\(^{-1}\)) | Mean Variety effect |
|-----------|--------------------------------------------------|-------------------|
|           | 00 | 50 | 100 | 150 |                      |
| Guora     | Origin | 28.33 | 38.39 | 34.27 | 32.20 | 33.43 |
|           | Selected | 33.73 | 41.67 | 37.07 | 32.60 | 36.27 |
| Local     | Origin | 32.53 | 41.60 | 40.73 | 35.80 | 37.67 |
|           | Selected | 34.80 | 42.13 | 41.80 | 37.80 | 39.13 |
| Chakhao   | Origin | 36.07 | 40.00 | 34.87 | 35.80 | 36.69 |
|           | Selected | 39.13 | 40.20 | 38.27 | 36.27 | 38.47 |

Mean effect of Phenylalanine

| L.S.D 0.05 Varieties | Phenylalanine | Interaction |
|----------------------|---------------|-------------|
|                       | 3.83          | 0.52        |

Table (4) shows that there is a significant effect of the study factors on the total number of grains in panicle, as the variety Guora selected significantly outperformed and gave the highest average of 144.25 grains.panicl\(^{-1}\). The local variety selected, which gave an average of 123.35 grains. panicl\(^{-1}\), and spraying the concentrations of the amino acid phenylalanine also had a significant effect in this trait, the concentration 50 mg L\(^{-1}\) gave the best averages amounted to 139.87 grains.panicl\(^{-1}\) compared to the spray concentration of 0.0 mg L\(^{-1}\), which gave the lowest mean of 128.00 grains.panicl\(^{-1}\), and the same table shows that there are no significant differences for the interaction between the variety and the spraying of the amino acid Phenylalanine.

**Table 4.** Effect of variety and spraying with the amino acid Phenylalanine and the interaction between them on the total number of grains in panicle (grains.panicl\(^{-1}\)).

| Varieties | Phenylalanine spraying concentrations (mg L\(^{-1}\)) | Mean Variety effect |
|-----------|--------------------------------------------------|-------------------|
|           | 00 | 50 | 100 | 150 |                      |
| Guora     | Origin | 138.53 | 146.03 | 138.60 | 140.60 | 140.94 |
|           | Selected | 131.77 | 152.10 | 143.03 | 150.10 | 144.25 |
| Local     | Origin | 117.00 | 127.63 | 120.93 | 122.43 | 122.00 |
|           | Selected | 117.67 | 127.57 | 126.20 | 121.97 | 123.35 |
| Chakhao   | Origin | 133.60 | 141.20 | 134.30 | 133.40 | 135.63 |
|           | Selected | 129.40 | 144.70 | 137.93 | 136.43 | 137.12 |

Mean effect of Phenylalanine

| L.S.D 0.05 Varieties | Phenylalanine | Interaction |
|----------------------|---------------|-------------|
|                       | 3.38          | 3.08        |

Table (5) shows that there is a significant effect of the study factors and the interaction between them in this trait, as the selected Goura variety was significantly superior and gave the highest average of 18.40 tiller.plant\(^{-1}\) compared to the lowest average of 14.59 tiller.plant\(^{-1}\) of the local variety, which did not significantly different. For the variety Chakhao Origin, which gave an average of 14.87 tiller.plant\(^{-1}\), and spraying the concentrations of the amino acid
phenylalanine also had a significant effect on this trait, giving the concentration 50 mg.L\(^{-1}\) the best averages reached 16.92 tiller.plant\(^{-1}\) compared to the spray concentration of 0.0 mg.L\(^{-1}\), which gave the lowest average of 14.17 tiller.plant\(^{-1}\). The same table shows that there are significant differences between the interaction of the variety and the spraying of the amino acid phenylalanine, as the interaction treatment between the selected Guora variety and the spraying concentration of 50 mg.L\(^{-1}\) was superior, which gave the highest mean of 22.40 tiller.plant\(^{-1}\) compared to the lowest mean of 13.17 tiller.plant\(^{-1}\) To treat the interference of the local variety with the spray concentration of 0.0 mg.L\(^{-1}\).

**Table 5.** Effect of variety and spraying with the amino acid phenylalanine and the interaction between them on the number of stems per plant (tiller.plant\(^{-1}\)).

| Varieties | Phenylalanine spraying concentrations (mg.L\(^{-1}\)) | Mean Variety effect |
|-----------|------------------------------------------------------|---------------------|
| Guora     | 00  15.92  16.71  16.35 | 15.55 |
| Local     | 00  15.00  14.85  14.95 | 14.95 |
| Chakho    | 00  15.33  15.43  15.47 | 15.47 |
| Mean effect of Phenylalanine | 14.17 16.92 16.09 15.80 | 15.80 |

**Table (6)** shows that there is a significant effect of the study factors and the interaction between them on the total grain yield, as the selected Guora variety significantly outperformed and gave the highest average of 6.70 tons/hectares\(^{-1}\) compared to the lowest average of 3.69 tons/hectares\(^{-1}\) for the local variety, and it was sprayed The concentrations of the amino acid phenylalanine also had a significant effect in this trait The concentration of 50 mg.L\(^{-1}\) gave the best averages of 6.13 tons. hectares\(^{-1}\) compared to the spraying concentration of 0.0 mg.L\(^{-1}\), which gave the lowest average of 4.11 tons. hectares\(^{-1}\).

The same table shows that there are significant differences between the interaction of the variety and the spraying of the amino acid Phenylalanine, as the interaction treatment between the selected Guora variety and the spray concentration of 50 mg.L\(^{-1}\) was superior, which gave the highest average of 8.99 tons.hectares\(^{-1}\) compared to the lowest average of 3.00 tons.hectares\(^{-1}\) For the interfering treatment of Guora variety with a spray concentration of 0.0 mg.L\(^{-1}\).
Table 7. Effect of variety and spraying with the amino acid Phenylalanine and the interaction between them on the total grain yield (ton/hectares⁻¹).

| Varieties | Phenylalanine spraying concentrations (mg L⁻¹) | Mean Variety effect |
|-----------|-----------------------------------------------|---------------------|
|           |                                               |                     |
| Guora     |                                               |                     |
| Origin    | 3.00                                          |                     |
| Selected  | 4.39                                          |                     |
| Local     |                                               |                     |
| Origin    | 3.25                                          |                     |
| Selected  | 4.47                                          |                     |
| Chakha    |                                               |                     |
| Origin    | 4.61                                          |                     |
| Selected  | 4.96                                          |                     |
| Mean effect of Phenylalanine | 4.11 | 6.13 | 5.17 | 4.58 |

L.S.D 0.05 Varieties Phenylalanine Interaction 0.25 0.33 0.51

Table (8) shows a significant effect of the study factors and the interaction between them on the biological yield, as the selected Goura variety was significantly superior and gave the highest average of 12.06 ton/hectares⁻¹, which did not differ significantly from the selected Local variety, which gave an average of 11.91 ton/hectares⁻¹. Compared with the lowest average of 9.87 ton/hectares⁻¹ for the variety Guora origin, and spraying the concentrations of the amino acid phenylalanine also had a significant effect in this trait, giving the concentration 50 mg L⁻¹ the best averages amounted to 12.24 ton/hectares⁻¹, which did not differ significantly from the concentration of Spraying 100 mg L⁻¹, which gave an average of 11.20 ton/hectares⁻¹, compared to the concentration of spraying 0.0 mg L⁻¹, which gave the lowest average of 10.13 ton/hectares⁻¹, which did not differ significantly from the concentration of 150 mg L⁻¹. Which gave an average of 10.41 ton/hectares⁻¹.

The same table shows that there are significant differences between the interaction of the variety and the spraying of the amino acid phenylalanine. The interaction treatment between the selected Guora variety and the spray concentration of 50 mg L⁻¹ was superior, which gave the highest average of 14.70 ton/hectares⁻¹ compared to the lowest average of 8.39 ton/hectares⁻¹ For the overlap of Chakha variety origin with a spray concentration of 150 mg L⁻¹.

Table 8. Effect of variety and spraying with the amino acid Phenylalanine and the interaction between them on the biological yield (ton/hectares⁻¹).

| Varieties | Phenylalanine spraying concentrations (mg L⁻¹) | Mean Variety effect |
|-----------|-----------------------------------------------|---------------------|
|           |                                               |                     |
| Guora     |                                               |                     |
| Origin    | 9.23                                          |                     |
| Selected  | 10.40                                         |                     |
| Local     |                                               |                     |
| Origin    | 9.59                                          |                     |
| Selected  | 10.57                                         |                     |
| Chakha    |                                               |                     |
| Origin    | 10.42                                         |                     |
| Selected  | 10.55                                         |                     |
| Mean effect of Phenylalanine | 10.13 | 12.24 | 11.20 | 10.41 |

L.S.D 0.05 Varieties Phenylalanine Interaction 0.43 1.20 0.85

Table (9) shows a significant effect of the study factors and the interaction between them in the harvest index, as the selected Guora variety was significantly superior and gave the highest average of 54.82% compared to the lowest average of 35.50% for the local variety, and spraying the concentrations of the amino acid Phenylalanine also had a significant effect in these. The characteristic that the concentration of 50 mg L⁻¹ gave the best averages of 50.00% compared to the spray concentration of 0.0 mg L⁻¹, which gave the lowest average of 40.36%. The same table shows that there are significant differences for the interaction between the variety and the spraying of the amino acid Phenylalanine, as the interaction treatment excelled. Between the selected variety Guora and the spraying concentration of 50 mg L⁻¹, which gave the highest mean of 61.17% compared to the lowest mean of 28.23% for the interaction of the selected Local variety with the spraying concentration 150 mg L⁻¹.

The results shown in Tables 4, 5, 6, 7, 8 and 9 show a significant effect of varieties on these traits, as the yield and its components for each genetic structure are determined by three main factors: genetic, environmental and field practices. Several studies have also shown that the components of the yield work in concert to give an increase in the final yield of the crop, especially the number of grains, which is the most closely related component to the yield. A team that achieved the best averages of yield components with a combined effect of the surrounding environment conditions that indirectly affected the yield components through their influence on the vegetative
growth characteristics of the plant and the general plant activity represented by division, metabolism and transport of dry matter [20].

Table 9. Effect of variety and spraying with the amino acid phenylalanine and the interaction between them on the percentage of harvest index (%).

| Varieties | Phenylalanine spraying concentrations (mg L−1) | Mean Variety effect |
|-----------|-----------------------------------------------|---------------------|
|           | 00    | 50    | 100   | 150   |                      |
| Guora     |       |       |       |       |                      |
| Origin    | 32.52 | 59.94 | 58.53 | 50.60 | 50.40                |
| Selected  | 42.16 | 61.17 | 57.86 | 58.11 | 54.82                |
| Local     |       |       |       |       |                      |
| Origin    | 33.92 | 39.39 | 33.26 | 35.42 | 35.50                |
| Selected  | 42.29 | 45.04 | 40.42 | 28.23 | 39.00                |
| Chakhao   |       |       |       |       |                      |
| Origin    | 44.23 | 43.23 | 41.98 | 51.41 | 45.22                |
| Selected  | 47.02 | 51.21 | 45.83 | 41.70 | 46.44                |
| Mean effect of Phenylalanine | 40.36 | 50.00 | 46.31 | 44.25 |

L.S.D 0.05 | Varieties | Phenylalanine | Interaction
|------------|-----------|---------------|----------------|
|            | 2.03      | 3.26          | 4.07           |

Varieties reflect their branching ability in the number of stems that arise from the lateral buds that bear panicule in the future, and that increasing their number contributes to increasing the productive capacity of the plant by increasing the number and weight of grains. Then, the characteristic of the number of stems in the plant is an important feature that contributes to yield, and the differences in this trait may be due to To the genetic differences, physiological functions and growth characteristics of the genotypes under study, and the difference in cultivars at the rate of crop growth between the stage of emergence of the panicule and flowering may be the reason for their discrepancy in the length of the period of filling the bean and the efficiency of the downstream (Sink) in receiving the products of photosynthesis from the vegetative parts (Source), especially the flag leaf Because it participates in 70% of the metabolites that reach the deltoid in addition to being the closest to the estuary, in addition to the fact that the grain of rice is defined since its inception by the covers of the grain and its variation in the number of main branches of the deltoid, as it varies in the area and duration of the survival of the flag leaf effective as a main source of photosynthesis products. Varieties differing in length of growth and downstream capacity (grains number) had an effect on dry matter production, which indicates the overall activity of the plant in photosynthesis [21]. Perhaps the difference in genotypes in the total grains number in the panicule is due to a large variation in the full grains number in relation to the number of empty grains, or the reason may be due to a large increase in the leaf area of the selected Guora genotype compared to other genotypes, which caused an increase in its ability to Giving the highest number of total pills in panicule, and this was confirmed by the results of a study [14, 22, 23]. The effect on the active fullness period is reflected in the weight of the bean, as it is restricted to a few pairs of genes, so the direct genetic action is inherited from one generation to another, thus controlling its weight over the years. The superiority of the selected Guora genotype in this trait (Table 6), and many studies have shown that increasing the speed of filling the bean causes an increase in the weight of the bean, which is generally reflected in the final yield of the grain, and this is consistent with what was stated in the general framework of [17, 24, 25].

The reason for the difference in varieties in the harvest index is that the evolution of the morphological characteristics of the plant and the increase in the biological yield and the increase in the grain yield of the selected local genotype do not match the increase in the weight of the total dry matter, which was reflected in the decrease in the values of the harvest index, in contrast to the selected genotype Goura if the yield The biological yield was in balance with the grain yield, which gave a higher evidence for the harvest [26, 27], that the harvest index differs greatly between the genotypes due to their genetic diversity and their ability to differentially adapt to the different grain and biological yields, and this is consistent with what was stated in the general framework Both [28, 29].

The results shown also in Tables 4, 5, 6, 7, 8 and 9 show a significant effect of foliar spraying with phenylalanine acid at a concentration of 50 mg L−1 on yield indicators and its components. The reason for this may be due to the role of amino acids in increasing the production of some plant growth hormones such as Tryptophan, which is the basic building block of auxin 3-Indol Acetic Acid (IAA) and the amino acid phenylalanine enters the biosynthesis of gibberellins as a basic material in building terpenes, and the increase of these hormones causes an increase in the frequency of the cellular division process, elongation and large cell size, and this in turn increases the indicators of yield and its components, or Phenylalanine may be combined with some proteins to form a complex called Protine–Fluorophenylalanine that catalyzes an increase in deltoid number, deltoid length, and deltoid branch count [30, 31].
Conclusion

There were significant differences between the genotypes of all the studied traits, as the selected Goura genotype was significantly superior by giving the highest averages in most indicators of vegetative growth and yield indicators and its components, and spraying black rice plants for the studied genotypes with the amino acid phenylalanine increased the indicators of vegetative growth and yield indicators. And its components and the content of the grains of the active compounds.

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