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CORRELATION OF ECONOMIC AND BIOCHEMICAL TRAITS IN RICE VARIETIES

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Abstract
This article examines the correlation between economic traits and biochemical parameters of selected rice (Oryza sativa L.) varieties cultivated under the conditions of the Andijan region. Furthermore, the obtained results were comparatively analyzed with similar research conducted by scientists worldwide, and it was emphasized that the economic and biochemical parameters of rice varieties hold significant scientific importance in breeding and variety identification practices.

Keywords: Rice, panicle length, protein, amylose, "Tarona" variety.

Introduction

Currently, studying the interrelationship between agronomic and biochemical traits is considered essential for improving rice yield and grain quality. Through correlation analysis, relationships among characteristics such as yield, grain weight, protein, and starch content are determined. Previously conducted studies have demonstrated the presence of significant correlations between agronomic traits (e.g., panicle length, number of seeds, 100-grain weight) and quality indicators (amylose, amylopectin, protein content) [1], [2; pp. 226–232]. Research has noted that 1000-grain weight and seed number are positively correlated with yield. Additionally, it has been established that amylose content is often associated with yield [2; pp. 226–232]. In this study, separate correlation matrices were constructed based on data for 9 traits from 8 rice varieties presented by the researcher in 2022 and 2023. Their results and analysis are presented.

Methods and methodology

Data obtained in 2022 and 2023 were used for the research. For each year, the following traits were recorded for 8 rice varieties (Tantana, Iskandar, Tarona, Lazurniy, Mustaqillik, Mustaqillik (Klaster), Uz Ros7-13, Devzira): panicle length (cm), number

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of seeds per panicle, number of empty (chaff) and filled seeds per plant, 100-seed weight (g), yield (c/ha), total protein content (%), amylose (%), and amylopectin (%). Pearson correlation coefficients were calculated based on 8 observations for each year. In correlation analysis, a positive coefficient indicates a direct relationship between traits, where an increase in one trait corresponds to an increase in the other. A negative coefficient indicates a direct relationship, where an increase in one trait corresponds to a decrease in the other. Correlation matrices were constructed and evaluated in tabular form. This method has been widely applied in the research of most scientists as well [3; p. 123], [1].

Results and Discussion

The correlation relationships obtained based on 2022 data are presented as follows (Table 1). In each cell, negative signs of the coefficient indicate negative correlation, while positive signs indicate positive correlation.

Table 1 Correlation of Economic and Biochemical Traits of Rice Varieties
(Based on results obtained in 2022)

Relationship between traits	Panicle length	Number of grains	Empty seeds	Filled seeds	100-grain weight	Yield	Protein (%)	Amylose (%)	Amylopectin (%)
Panicle length (cm)	1.000	0.326	0.233	0.270	-0.610	0.374	0.017	0.100	-0.100
Number of grains	0.326	1.000	-0.110	-0.002	-0.241	0.728	0.598	0.082	-0.082
Number of empty seeds	0.233	-0.110	1.000	0.994	-0.100	-0.273	-0.284	-0.551	0.551
Number of filled seeds	0.270	-0.002	0.994	1.000	-0.127	-0.196	-0.221	-0.545	0.545
100-grain weight (g)	-0.610	-0.241	-0.100	-0.127	1.000	-0.059	0.259	-0.117	0.117
Yield (s/ga)	0.374	0.728	-0.273	-0.196	-0.059	1.000	0.872	0.541	-0.541
Protein (%)	0.017	0.598	-0.284	-0.221	0.259	0.872	1.000	0.575	-0.575
Amylose (%)	0.100	0.082	-0.551	-0.545	-0.117	0.541	0.575	1.000	-1.000
Amylopectin (%)	-0.100	-0.082	0.551	0.545	0.117	-0.541	-0.575	-1.000	1.000

According to the table indicators, in 2022, a strong positive correlation (r=0.728) was observed between yield and seed number in particular. This means that varieties with more seeds per panicle achieved higher yields. This situation was also noted in

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previously examined stages. The detection of a significant negative correlation (r=–0.610) between panicle length and 100-seed weight indicates that grains in longer panicles are relatively lighter. The presence of a very strong positive relationship (r=0.872) between yield and total protein content is also remarkable. Indeed, some studies have reported a strong positive relationship between protein content and yield; for example, Zhu et al. (2015) found that seed protein concentration was closely associated with yield (r>0.88) [2; pp. 226–232]. This result is also consistent with our data. A moderate positive correlation (r=0.541) was observed between amylose content and yield; this factor also suggests that yield may be somewhat higher in high-amylose varieties (others have studied the relationship between amylose and yield and reached similar conclusions). Overall, the above results for 2022 are consistent with previous scientific research: it has been emphasized that seed number and panicle weight are important factors determining yield in most varieties [2; pp. 226–232]. Additionally, the correlation between amylose and amylopectin concentrations was –1.000, indicating that they are completely interdependent (due to the constant total starch content).

The correlation relationships constructed based on 2023 data also demonstrated similar associations. The modified coefficients for 2023 (with two decimal places in Table 2) are presented below.

Table 2 Correlation of Economic and Biochemical Traits of Rice Varieties
(Based on results obtained in 2023)

Relationship between traits	Panicle length	Number of grains	Chaff seeds	Filled seeds	100-grain weight	Yield	Protein (%)	Amylose (%)	Amylopectin (%)
Panicle length (sm)	1.000	0.130	0.236	0.250	-0.266	0.151	0.096	0.024	-0.024
Number of grains	0.130	1.000	-0.142	-0.049	-0.197	0.580	0.493	-0.022	0.022
Number of chaff seeds	0.236	-0.142	1.000	0.996	-0.125	-0.252	-0.266	-0.537	0.537
Number of filled seeds	0.250	-0.049	0.996	1.000	-0.144	-0.200	-0.222	-0.544	0.544
100-grain weight (g)	-0.266	-0.197	-0.125	-0.144	1.000	-0.059	0.259	-0.117	0.117
Yield (s/ga)	0.151	0.580	-0.252	-0.200	-0.059	1.000	0.872	0.541	-0.541
Protein (%)	0.096	0.493	-0.266	-0.222	0.259	0.872	1.000	0.575	-0.575
Amylose (%)	0.024	-0.022	-0.537	-0.544	-0.117	0.541	0.575	1.000	-1.000
Amylopectin (%)	-0.024	0.022	0.537	0.544	0.117	-0.541	-0.575	-1.000	1.000

In 2023, the relationship between seed number and yield was also high (r= 0.580), a factor frequently noted over successive years. The negative relationship between panicle length and 100-grain weight (r=-0.266) manifested similarly to the previous year. The

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correlation between total protein and yield (r= 0.872) was almost identical to that of 2022, indicating that varieties with higher protein content also have higher yields [2; pp. 226–232]. Amylose and amylopectin contents again showed a completely inverse relationship (r=-1.000), which is explained by their composition of total starch. The 2023 results corresponded well with 2022, with similar patterns observed among varieties. According to the research results of Hua Zhao et al., the yield of the 'Shenliangyou 58 xiangyouzhan' variety selected as the research object was higher than that of the 'Yuxiangyouzhan' variety, and this difference was primarily attributed to grain mass size and panicle length. A long-term study observed an increasing trend in grain yield, while yield differences between years were explained by variations in plant height, proportion of filled grains, and grain mass. Yield differences across planting locations were mainly associated with the combined effects of agronomic traits strongly influenced by different climatic conditions. Grain yield showed significant and positive correlations with plant height, number of grains per m^2, number of filled grains per panicle, proportion of filled grains, and grain mass [5; pp. 72-79].

Grain yield demonstrated significant and positive correlations with plant height, number of grains per panicle, number of filled grains per panicle, proportion of filled grains, and grain mass.

Conclusion

Based on the tables regarding correlation relationships presented above, the following conclusions can be drawn. In the research of A. Gunasekaran et al. [6; p. 250], it was determined that panicle characteristics—number of spikelets per panicle, number of primary branches, number of secondary branches, number of spikelets on primary branches, number of spikelets on secondary branches, and primary branch length—have significant positive correlations with overall plant yield and number of filled grains per panicle. This indicates that improving panicle morphological characteristics is an important factor for increasing rice yield. The results of research analysis by several other scientists have shown that the number of panicles per square meter, number of filled seeds per panicle, thousand-grain weight, and panicle length exert a large and significantly positive direct effect on yield [7; pp. 17-28].

A negative relationship has been observed between quality indicators such as amylose and amylopectin, where an increase in one reduces the other, because the total amount of starch is limited. The interrelationship between protein content and yield has been evaluated differently in scientific literature. In our research, a positive relationship was observed. In the research of K.M.H. Abdelsalam et al. [8; p. 492], high correlations were noted in joint correlation analysis of quality parameters. In their analysis, very strong correlations ($r \approx 0.99$) were observed between phenological observation results and nutritional parameters. Our research results also provide the same conclusion as this study. Consequently, correlations between economic and grain quality indicators must be taken into account when selecting rice plant varieties.

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