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Carotenoid Content Test of Drought-Tolerant Inpago Paddy Cultivars to Support National Food Security

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Abstract

Rice (Oryza sativa L.) is one of the staple crops that plays a significant role in national food security in Indonesia. Rice plants require 75% water for growth, however drought poses a major challenge in the production of cereal crops. Climate change is a contributing factor to drought conditions. Inpago cultivar of rice is an excellent variety suitable for cultivation in dry land in Indonesia. This study aimed to examine the carotenoid content in drought-tolerant Inpago rice cultivars to support national food security. The method used was UV-Vis spectrophotometry at wavelengths of 470, 646, and 662 nm. The procedures involved sample extraction, separation, measurement, and data analysis. The data obtained showed that the carotenoid content in Inpago 5 was 286.84 mg/g dry weight, Inpago 7 was 131.36 mg/g dry weight, and Inpago 10 was 139.18 mg/g dry weight. It can be concluded that rice with the Inpago 5 genotype represents a new superior variety with high drought tolerance.

Keywords: *Carotenoid; Drought Tolerant; Food; Inpago; Paddy*

Introduction

Rice (*Oryza sativa* L.) is a staple food that meets the dietary needs of the Indonesian population. Rice plants require water to grow and develop; however, the availability of water for irrigation is decreasing due to climate change and competition among sectors [1]. Drought has become one of the issues that can affect the production of cereal crops, including rice. The decline in rice production can impact its strategic role in national food security [2-3].

Drought can affect the production of carotenoids in plants. Carotenoids in rice leaves play a crucial role in plant physiology and can benefit human health. Their function in rice leaves includes serving as photosynthetic pigments and enhancing photosynthetic efficiency. The presence of carotenoids affects rice's ability to anticipate and withstand environmental stress. As an adaptive response to stress, carotenoid content often increases. This increase in carotenoid content serves to protect plant cells from damage caused by reactive oxygen species (ROS) produced during drought conditions [4].

The Inpago cultivar is a type of rice that possesses drought-resistant characteristics. This cultivar has the ability to maintain yields even under water stress. The development of the Inpago cultivar contributes not only to the increase in rice agricultural production but also to the sustainability of agricultural ecosystems in

Indonesia [5]. Therefore, this study aimed to examine the carotenoid content in drought-tolerant Inpago rice cultivars to support national food security.

Materials and Methods

Materials

The equipment used in this research included a mortar and pestle, digital scale, micropipette, centrifuge, and UV-Vis spectrophotometer. The materials used were rice leaf samples of Inpago cultivars 5, 7, and 10; nitrogen; absolute alcohol; and distilled water.

Methods

This research was conducted to determine the carotenoid content in Inpago rice plants using UV-Vis spectrophotometry. Samples were taken from three different genotypes, Inpago 5, Inpago 7, and Inpago 10. The extraction process began with weighing 0.002 grams of leaves from each cultivar, grinding the leaves with liquid nitrogen, and adding 1 mL of absolute ethanol. Phase separation was performed by centrifuging each leaf sample, resulting in a pellet phase and a supernatant phase. The supernatant phase was measured using a UV-Vis spectrophotometer at wavelengths of 470, 646, and 662 nm. The carotenoid content data obtained was processed using Microsoft Excel software to count and compare the correlation between carotenoid content and the plant's tolerance to drought stress.

Results and Discussion

This study was conducted to examine the carotenoid content in several rice cultivars subjected to drought stress. The results presented in Table 1 show that there is variation in the carotenoid content obtained, with the average for each replicate as follows: Inpago 5 has a carotenoid content of 286.84 mg/g dry weight, Inpago 7 has 131.36 mg/g dry weight, and Inpago 10 has 139.18 mg/g dry weight.

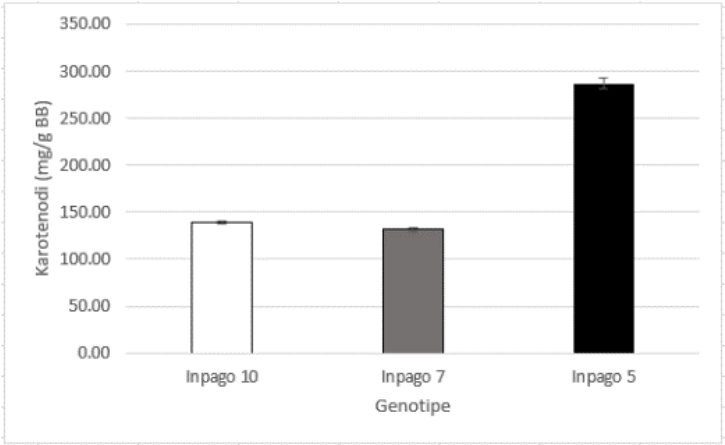

Figure 1. Carotenoid content (mg/ g FW) on several genotypes of paddy under drought stress.

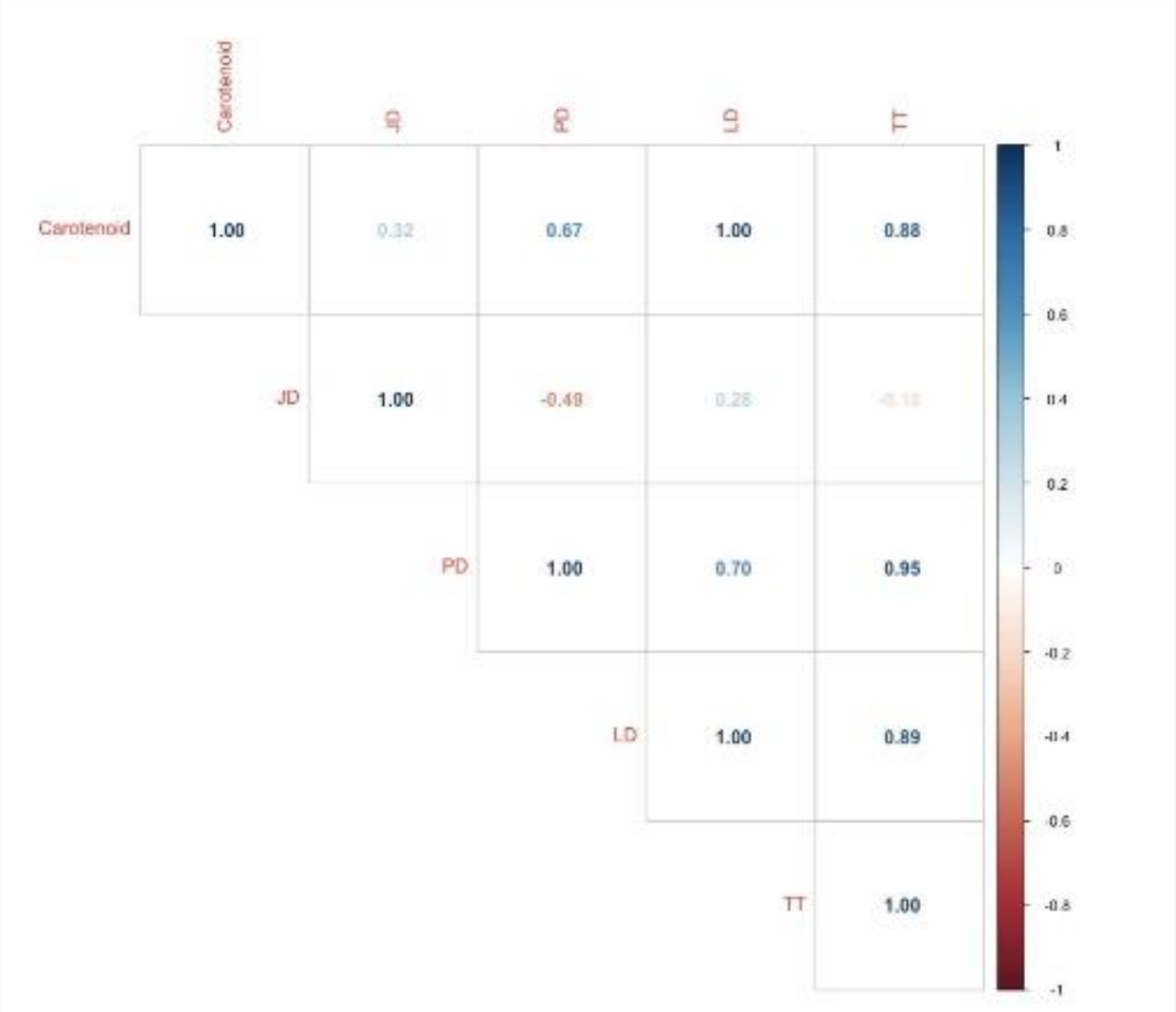

Figure 2. Relationship between carotenoid content and plant appearance. JD: leaf number; PD: leaf length; LD: leaf wide; TT: plant height.

The results of this study indicate that the Inpago 5 cultivar has the potential to be a good source of carotenoids. The high carotenoid content also positively impacts the rice plants themselves. The antioxidants produced can protect the plants from damage and make them more resistant to various types of stress.

Conclusion

This study has demonstrated that Inpago 5 rice cultivar possesses the highest tolerance to drought, as evidenced by its elevated carotenoid content. Inpago 10 cultivar showed moderate tolerance, while Inpago 7 was found to be susceptible. These findings highlight the potential of Inpago 5 cultivar as a promising source of carotenoids and a candidate for developing drought-resistant rice varieties. By unraveling the mechanisms underlying the differential drought responses of these cultivars, this research contributes to our understanding of plant physiology and genetics. This study highlights the potential of utilizing carotenoid content as a marker for drought tolerance in rice. The results can inform breeding programs

aimed at developing new rice varieties that are not only high-yielding but also resilient to changing climatic conditions, ultimately enhancing food security in Indonesia.

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References

[1] Sujinah, and Jamil, A. (2016). Mechanism Response of Rice Under Drought Stress and Tolerant Varieties." *Iptek Tanaman Pangan,* 11(1),1–7.

[2] Suwarno. (2010). Meningkatkan Produksi Padi Menuju Ketahnan Pangan Yang Lestari. *Jurnal Pangan,* 19(3), 233–243.

[3] Fadela, D. M., Zakaria, A., & Pradipta, A. R. (2024). Study of Anaerobic and Aerobic Fertilizers of Organic Waste Treatment. *Indonesian Journal of Chemical Studies*, 3(2), 41-45. https://doi.org/10.55749/ijcs.v3i2.48.

[4] Sulistyowati, Nurchayati, Y., and Setiari, N. (2021). Growth and Fruit Production of Tomato Servo Variety (*Lycopersicon Esculentum Mill.*) at the Different Watering Frequency. *Buletin Anatomi Dan Fisiologi,* 6(1),26–34.

[5] Abidin, and Indradewa. (2021). Relationship Between Deep Rooting Ratio, Drought Tolerance, and Yields of Six Rice Cultivars (*Oryza sativa L.*). *Vegetalika,* 10(1),18-30.