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Prediksi Hasil Padi (Oryza sativa L.) Berdasarkan Citra SPUKTA Berbasis RGB dari Tiga Waktu Perekaman dalam Satu Hari
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Pendugaan hasil panen padi secara cepat dan spasial dibutuhkan dalam mendukung pengelolaan pertanian presisi. Penelitian ini bertujuan mengevaluasi kemampuan tiga indeks vegetasi berbasis RGB dari citra SPUKTA, yaitu EXG, MGRVI, dan RGBVI, dalam menduga Gabah Kering Panen (GKP) padi, serta menentukan kombinasi fase pertumbuhan dan waktu pengamatan yang menghasilkan model prediksi paling akurat. Penelitian dilaksanakan di Moyudan, Sleman, DIY, pada Februari–April 2026 menggunakan Rancangan Acak Kelompok Faktorial tiga blok dengan faktor varietas (MSP dan Gamagora 7) dan sistem tanam (Jajar Legowo dan Ubin). Citra RGB direkam menggunakan drone DJI Mavic Air 2 pada ketinggian 70 meter di sepuluh fase pengamatan (3–13 MST) dan tiga waktu (pagi, siang, sore). Analisis meliputi uji asumsi, analisis ragam, korelasi Pearson, dan regresi linier sederhana. Hasil penelitian menunjukkan bahwa seluruh indeks hanya berkorelasi nyata terhadap GKP pada fase pemasakan (12–13 MST). Model terbaik dihasilkan oleh EXG pada 12 MST siang dengan persamaan GKP = −1,8727 + 0,0575 × EXG, R^2 = 0,7908, dan RRMSE = 7,15%. MGRVI pada 12 MST pagi menghasilkan model terbaik kedua (R^2 = 0,7207, RRMSE = 8,27%), diikuti RGBVI pada 12 MST pagi (R^2 = 0,6853, RRMSE = 8,77%). Faktor varietas merupakan sumber keragaman paling dominan, dengan MSP yang bersifat stay-green secara konsisten menghasilkan dugaan GKP lebih tinggi dibandingkan Gamagora 7. Peta heatmap prediksi yang dihasilkan melalui QGIS berhasil memetakan sebaran potensi hasil panen secara spasial di seluruh hamparan lahan dengan akurasi sangat baik.

Kata Kunci: EXG, MGRVI, RGBVI, drone RGB, prediksi hasil panen, padi, SPUKTA

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ABSTRACT

Rapid and spatially comprehensive rice yield estimation is essential for supporting precision agriculture management. This study aimed to evaluate the capability of three RGB-based vegetation indices derived from SUAV imagery, namely EXG, MGRVI, and RGBVI, in predicting Dry Harvested Grain (DHG) yield of rice, and to identify the combination of growth stage and observation time that produces the most accurate prediction model. The research was conducted in Moyudan, Sleman, Special Region of Yogyakarta, from February to April 2026, using a Factorial Randomized Complete Block Design with three blocks, two varieties (MSP and Gamagora 7), and two planting systems (Jajar Legowo and Ubin). RGB imagery was acquired using a DJI Mavic Air 2 drone at 70 meters altitude across ten growth stages (3–13 WAP) and three observation times (morning, noon, and afternoon). Analyses included normality and homogeneity tests, analysis of variance, Pearson correlation, and simple linear regression. Results showed that all three indices only exhibited significant correlation with DHG during the ripening phase (12–13 WAP). The best model was produced by EXG at 12 WAP noon with the equation DHG = −1.8727 + 0.0575 × EXG, R^2 = 0.7908, and RRMSE = 7.15%. MGRVI at 12 WAP morning produced the second best model (R^2 = 0.7207, RRMSE = 8.27%), followed by RGBVI at 12 WAP morning (R^2 = 0.6853, RRMSE = 8.77%). Variety was the most dominant source of variation, with the stay-green variety MSP consistently producing higher predicted DHG than Gamagora 7. The predictive heatmap generated through QGIS Raster Calculator successfully mapped the spatial distribution of yield potential across the entire field with very good accuracy.

Keywords: EXG, MGRVI, RGBVI, RGB drone, rice yield prediction, sUAV.