UNIVERSITAS
GADJAH MADA
**Kajian Irigasi Hemat Air Untuk Budidaya Tanaman Padi Dataran Tinggi Dengan Penambahan Bahan Organik
Isi Rumen Kerbau**
Dian Pranata Putra Ambali, Prof. Dr. Ir. Fatchan Nurrochmad, M.Agr.; Ir. Endita Prima Ari Pratiwi, S.T., M.Eng., Ph.D
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# Intisari

Budidaya padi lokal dataran tinggi Toraja yang digunakan dalam penelitian ini memiliki umur panen relatif panjang dan banyak dibudidayakan pada lahan sawah tadah hujan, sehingga memerlukan pengelolaan tanah dan air irigasi yang sesuai dengan kebutuhan tanaman. Di Toraja, limbah isi rumen kerbau (IRK) dari pemotongan kerbau pada ritual *Rambu Solo'* berpotensi dimanfaatkan sebagai bahan organik lokal untuk mendukung sistem budidaya padi. Penelitian ini bertujuan menganalisis potensi IRK sebagai amandemen tanah dalam memperbaiki sifat hidrofisik dan kimia tanah, meningkatkan pertumbuhan dan hasil padi, serta meningkatkan produktivitas air tanaman padi.

Penelitian dilakukan dalam dua tahap. Tahap pertama berupa pengujian campuran tanah sawah dan isi rumen kerbau (IRK) kering untuk mengevaluasi sifat hidrofisik tanah, meliputi *bulk density*, porositas, berat jenis, kapilaritas, perkolasi, dan retensi air tanah, serta sifat kimia tanah, meliputi C-organik, N-total, $P_2O_5$, $K_2O$, pH, Ca, Mg, dan S. Tahap kedua berupa percobaan tanam padi di dalam rumah kaca menggunakan *box container* dengan dua faktor perlakuan, yaitu jenis amandemen tanah berupa pupuk kimia dan IRK, serta metode irigasi berupa irigasi konvensional dan *Alternate Wetting and Drying* (AWD). Parameter percobaan tanam padi meliputi volume air irigasi, perkolasi, tinggi tanaman, jumlah anakan, jumlah malai, gabah kering giling (GKG), berat 1000 butir, persentase gabah bernas, dan produktivitas air. Data dianalisis menggunakan ANOVA dua arah untuk menguji pengaruh amandemen tanah, metode irigasi, dan interaksinya, dilanjutkan uji *Least Significant Difference* (LSD) dengan taraf 5%.

Hasil penelitian menunjukkan bahwa IRK memperbaiki sifat hidrofisik tanah, ditunjukkan oleh penurunan bulk density dari 1.11 menjadi 0.90 g/cm³, peningkatan porositas dari 0.51 menjadi 0.58, penurunan perkolasi dari 1.94 menjadi 0.05 cm/jam, serta peningkatan kemampuan tanah mengikat air dari 9.48% menjadi 21.20%. Perubahan tersebut diikuti oleh peningkatan C-organik, N-total, $P_2O_5$, dan $K_2O$ tanah. Pada percobaan tanam padi, amandemen IRK berpengaruh signifikan terhadap pertumbuhan, hasil, kinerja penggunaan air, dan produktivitas air. Metode irigasi berpengaruh signifikan terhadap perkolasi total dan evapotranspirasi aktual, sedangkan interaksi amandemen tanah dan irigasi berpengaruh signifikan terhadap jumlah anakan dan perkolasi total. Perlakuan IRK menghasilkan tinggi tanaman 224.72–235.00 cm, jumlah anakan 58.00–70.67 pot$^{-1}$, jumlah malai 56.33–69.67 pot$^{-1}$, dan GKG 156.96–175.46 g/pot, lebih tinggi dibandingkan pupuk kimia. Total air irigasi pada perlakuan IRK lebih besar dibandingkan pupuk kimia, yaitu 230.92–234.86 L/pot dibandingkan 178.45–185.76 L/pot, tetapi perkolasi total lebih rendah, terutama pada kombinasi IRK dan AWD, yaitu 15.48 L/pot dibandingkan 38.64 L/pot pada kombinasi pupuk kimia dan AWD. Produktivitas air irigasi meningkat dari 0.48 menjadi 0.65 kg/m³ pada irigasi konvensional dan dari 0.31 menjadi 0.76 kg/m³ pada AWD. Dengan demikian, peningkatan produktivitas air pada perlakuan IRK terutama disebabkan oleh peningkatan hasil gabah, disertai penurunan kehilangan air melalui perkolasi. IRK berpotensi sebagai amandemen tanah lokal untuk mendukung budidaya padi dan pemanfaatan limbah organik berbasis kearifan lokal secara berkelanjutan.

**Kata kunci**: isi rumen kerbau, sifat hidrofisik tanah, irigasi konvensional, *alternate wetting and drying*, produktivitas air

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## *Abstract*

The local highland rice used in this study has a relatively long growth duration and is widely cultivated in rainfed paddy fields in Toraja; therefore, it requires soil and irrigation water management that is appropriate to crop needs. In Toraja, buffalo rumen content (BRC) waste from buffalo slaughtering during the Rambu Solo' ritual has the potential to be utilized as a local organic material to support rice cultivation systems. This study aimed to analyze the potential of BRC as a soil amendment to improve soil hydrophysical and chemical properties, enhance rice growth and yield, and increase rice water productivity.

The study was conducted in two stages. The first stage involved testing mixtures of paddy soil and dried BRC to evaluate soil hydrophysical properties, including bulk density, porosity, particle density, capillarity, percolation, and soil water retention, as well as soil chemical properties, including organic C, total N, $P_2O_5$, $K_2O$, pH, Ca, Mg, and S. The second stage was a rice cultivation experiment conducted in a greenhouse using box containers with two treatment factors: soil amendment type, consisting of chemical fertilizer and BRC, and irrigation method, consisting of conventional irrigation and Alternate Wetting and Drying (AWD). The observed parameters in the rice cultivation experiment included irrigation water volume, percolation, plant height, number of tillers, number of panicles, milled dry grain (GKG), 1000-grain weight, percentage of filled grains, and water productivity. The data were analyzed using two-way ANOVA to test the effects of soil amendment, irrigation method, and their interaction, followed by the Least Significant Difference (LSD) test at the 5% level.

The results showed that BRC improved soil hydrophysical properties, as indicated by a decrease in bulk density from 1.11 to 0.90 g/cm³, an increase in porosity from 0.51 to 0.58, a decrease in percolation from 1.94 to 0.05 cm/hour, and an increase in soil water holding capacity from 9.48% to 21.20%. These changes were accompanied by increases in soil organic C, total N, $P_2O_5$, and $K_2O$. In the rice cultivation experiment, BRC amendment significantly affected growth, yield, water use performance, and water productivity. The irrigation method significantly affected total percolation and actual evapotranspiration, while the interaction between soil amendment and irrigation method significantly affected the number of tillers and total percolation. The BRC treatment resulted in plant height of 224.72–235.00 cm, number of tillers of 58.00–70.67 pot$^{-1}$, number of panicles of 56.33–69.67 pot$^{-1}$, and GKG of 156.96–175.46 g pot$^{-1}$, which were higher than those obtained with chemical fertilizer. Total irrigation water in the BRC treatment was greater than that in the chemical fertilizer treatment, namely 230.92–234.86 L/pot compared with 178.45–185.76 L/pot. However, total percolation was lower, particularly under the combination of BRC and AWD, namely 15.48 L/pot compared with 38.64 L/pot under the combination of chemical fertilizer and AWD. Irrigation water productivity increased from 0.48 to 0.65 kg/m³ under conventional irrigation and from 0.31 to 0.76 kg/m³ under AWD. Therefore, the increase in water productivity under the BRC treatment was mainly attributed to higher grain yield, accompanied by reduced water loss through percolation. BRC has the potential to serve as a local soil amendment to support rice cultivation and the sustainable utilization of organic waste based on local wisdom.

**Keywords**: buffalo rumen content, soil hydrophysical characteristic, conventional irrigation, alternate wetting and drying, water productivity