

RESPONS FISIOLOGIS DAN KETAHANAN PADI (*Oryza sativa* L. 'CEMPO MERAH') TERHADAP CEKAMAN KADMIUM DENGAN PEMBERIAN PUPUK SILIKAT

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ABSTRAK

Pencemaran kadmium (Cd) di tanah persawahan dan sistem irigasi menjadi masalah lingkungan yang serius di berbagai daerah. Cd menyebabkan toksisitas pada tanaman pangan. Unsur *beneficial* silikon (Si) mampu mengurangi dampak negatif pada tanaman yang mengalami stress abiotik. Penelitian ini mengkaji respons fisiologis, ketahanan, dan karakteristik anatomis akar tanaman padi 'Cempo Merah' terhadap cekaman Cd dengan pemberian pupuk silikat. Penelitian ini menggunakan desain Rancangan Acak Lengkap, dua faktorial, yaitu $3\text{CdSO}_4 \cdot \text{H}_2\text{O}$ dan CaSiO_3 dengan dosis yang sama (0, 50, dan 100) mg/kg tanah, dengan 3 kali ulangan. Data dianalisis menggunakan *Analysis of Variance* dan dilanjutkan dengan *Duncan's Multiple Range Test* pada taraf kepercayaan 95%, serta dilakukan analisis *Pearson Correlation*. Hasil penelitian menunjukkan bahwa cekaman Cd (100 mg/kg tanah) secara signifikan ($p \leq 0,05$) menghambat pertumbuhan. Cekaman Cd menurunkan kadar klorofil dan menyebabkan stres oksidatif, ditunjukkan dengan tingginya kadar *malondialdehyde* (MDA) yang berkorelasi dengan kadar Cd di tajuk. Aplikasi Si secara signifikan ($p \leq 0,05$) meningkatkan pertumbuhan, kadar klorofil dan aktivitas *SOD*, serta menurunkan kadar MDA padi yang tercekam Cd. Aplikasi Si mengurangi toksisitas Cd dengan cara membentuk pertahanan apoplas dengan meningkatkan ketebalan dinding sel endodermis, sklerenkim dan eksodermis akar sehingga memperkecil faktor translokasi Cd dari akar ke tajuk dan mengakumulasi Cd lebih banyak di akar. Terdapat korelasi antara kadar Cd tajuk, kadar MDA, aktivitas *SOD*, dan kadar klorofil total dengan pertumbuhan tanaman.

Kata kunci: silikon, kadmium, padi 'Cempo Merah', respons fisiologis, ketahanan

PHYSIOLOGICAL RESPONSE AND RESISTANCE OF RICE (*Oryza sativa* L. 'CEMPO MERAH') TO CADMIUM STRESS WITH APPLICATION OF SILICATE FERTILIZER

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ABSTRACT

Contamination of trace metal (Cd) in agricultural soil and irrigation systems becomes a serious environmental problem in many regions. Cd causes toxicity in many crops. Silicon (Si) has beneficial effects on many crops for alleviating negative effects of abiotic stress. The objective of this study was to determine physiological response, resistance, and root anatomical characteristics of rice 'Cempo Merah' to Cd stress with application of silicate fertilizer. This study used completely randomized design with two factorials, consisted of $3\text{CdSO}_4 \cdot \text{H}_2\text{O}$ and CaSiO_3 with equal dose (0, 50, and 100 mg.kg^{-1} of soil) with 3 replications. Data were analyzed by Analysis of Variance followed by Duncan's Multiple Range Test at 95% confidence level and tested with Pearson correlation. The results showed that Cd stress (100 mg.kg^{-1} of soil) significantly decreased ($p \leq 0.05$) the growth. Cd stress decreased chlorophyll content and superoxide dismutase (SOD) activity, and caused oxidative stress (high MDA level) which were correlated with shoot Cd content. Si application significantly increased ($p \leq 0.05$) the growth, chlorophyll content, superoxide dismutase (SOD) activity and decreased MDA level of rice under Cd stress. Si application alleviated Cd toxicity by forming appolastic barrier by thickening cell wall of endodermis, sclerenchyma, and exodermis cell, therefore it decreased translocation factor of Cd from root to shoot and accumulated more Cd in root. There was correlation between shoot Cd content, MDA level, SOD activity, total chlorophyll content with the growth.

Key words: silicon, cadmium, rice 'Cempo Merah', physiological response, resistance