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MITIGATING EFFECT OF PUTRESCINE AGAINST 2,4-D HERBICIDE IN WHEAT: DNA STABILITY AND METHYLATION

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Abstract

Wheat, a widely consumed nutritional resource, faces a significant threat from the synthetic herbicide known as 2,4-dichlorophenoxyacetic acid (2,4-D). In light of previous successful research and recommendations from experts in the field, we employed Random Amplified Polymorphic DNA (RAPD) analysis to assess genomic template stability (GTS) and Coupled Restriction Enzyme Digestion-Random Amplification (CRED-RA) to investigate DNA methylation changes induced by 2,4-D exposure in wheat. Our experimental design involved subjecting wheat seedlings at the three- and four-leaf growth stages to varying concentrations of 2,4-D (5, 10, 20, and 40 mM) and putrescine (Put) (0.01, 0.1, and 1 mM). As the dose of 2,4-D increased, we observed a corresponding decrease in genomic template stability (GTS). GTS declined from 100% in the control treatment (0 mM 2,4-D and 0 mM Put) to 33.2% under the highest 2,4-D concentration of 40 mM. Importantly, the introduction of Put treatments ameliorated GTS in wheat plants exposed to 2,4-D, with the 1 mM Put treatment yielding the highest GTS ratio across all 2,4-D concentrations. Furthermore, our study revealed that the application of 2,4-D resulted in alterations in DNA methylation levels within the wheat genome. Conversely, Put treatment effectively restored DNA methylation levels to their initial state, mitigating the adverse effects induced by 2,4-D. In summary, our research unequivocally demonstrates that 2,4-D negatively impacts GTS and induces changes in DNA methylation levels in wheat. Moreover, the exogenous application of Put has been shown to alleviate the deleterious effects of 2,4-D on GTS and DNA methylation, highlighting its potential as a protective measure for wheat cultivation.

Key words: CRED-RA, DNA damage, DNA methylation, putrescine, 2,4-D

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