The Effects of Caffeine on Glycine max (Soybean) Morphology and Genomics

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Glycine max (soybeans) hold significant global agricultural and economic values. Although caffeine is used as a soil fertilizer, it could inflict adverse effects on the seed itself, hindering the plant's overall growth. This study evaluated the effects of caffeine on Glycine max radicle morphology and proteogenomics. We hypothesized that if Glycine max seeds are exposed to higher concentrations of caffeine, then the germination rate and water content will be lower, while the Momilactone-A Synthase-like gene expression in the radicle tissue will be higher in response to the cellular stress. An experimental design was used to split 720 seeds into six groups of 120 seeds, each irrigated with caffeine solutions of 0 (control), 0.10, 0.15, 0.20, 0.25, or 0.30 mg/ml. After ten days, germinated Glycine max seeds were studied morphologically and genomically. There was a statistically significant increase in the germination rate (p-value <0.0001), radicles' green hue (p-value <0.0001), and the dry weight of the radicles (p-value = 0.0024) with higher caffeine concentrations. There was a statistically insignificant increase in the water content in the radicles (p-value = 0.2501) with higher caffeine concentrations. The RT-PCR showed no detectable expression of Momilactone-A Synthase-like enzyme gene (stress gene) in the radicles of all groups. This study failed to support both hypotheses.

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