Chitosan Treatment of Wheat Seeds Induces Resistance to *Fusarium graminearum* and Improves Seed Quality

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Abstract

Chitosan treatment (2–8 mg/mL) of wheat seeds significantly improved seed germination to recommended seed certification standards (>85%) and vigor at concentrations >4 mg/mL, in two cultivars of spring wheat (Norseman and Max), by controlling seed-borne *Fusarium graminearum* infection. The germination was <80% in the control and >85% in benomyl- and chitosan-treated seeds. Seed-borne *F. graminearum* was reduced to >50% at higher chitosan treatments compared to the control. Synthesis of phenolic acids was stimulated in primary leaves following chitosan treatment, and levels of these phenolic acids, especially ferulic acid, increased significantly with increasing chitosan concentration. Lignin content of primary leaves also showed a similar pattern. The synthesis of precursors of lignin such as *p*-coumaric, ferulic, and sinapic acids and phenolic acids having antimicrobial activity such as benzoic, *p*-coumaric, caffeic, protocatechuic, chlorogenic, ferulic, and gallic acids was also stimulated by chitosan treatment. The induction of phenolic acids and lignin was significantly lower in cv. Max compared to Norseman. Chitosan also inhibited fungal transmission to the primary roots of germinating seedlings. Results suggest that chitosan controlled seed-borne *F. graminearum* infection and increased the resistance in seedlings by stimulating the accumulation of phenolics and lignin. Thus, chitosan has a potential for improvement of seed quality and enhancement of crop yields as well as increased value of stored grains for food and feed.

Keywords: *Fusarium graminearum*; wheat seed; chitosan; induced resistance; phenolic acids; lignin; seed quality