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## **Modeling Ground Engaging Tools and Seed Placement of Planters Using the Discrete-Element Method**

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**ABSTRACT** A discrete element model was developed to simulate the soil interaction with the ground engaging tools of planters (opener discs, seed shoe, gauge wheels, packing wheels). The model included the rheological parameters of the soil, seeds and plant residues under investigation. In addition the following parameters were an input in the model: true density, cohesion, adhesion, static/dynamic friction, rolling friction, soil type (clay/loam/silt). Foreign objects were also included in the soil structure including rocks and biological materials (roots, stems, leaves and chaff). The geometry of the planter was imported into a Discrete-Element Method software package and tested in a virtual soil bin to determine the soil flow behavior and the forces exerted on the tools. The efficiency of the planter was evaluated based on the level of control achieved on the depth and spacing of seeds in the soil. A set of experiments were completed to validate and improve the model. The experiments were completed in a linear soil bin and in field test plots. Measurements of forces, soil fracture, seed placement and wear on the ground engaging tools are normally performed to validate the model.

**Keywords:** ground engaging tools, planter, discrete element method