

Physical and Flow Properties of Solid and Semi-Solid Manure as Related to the Design of Handling and Land Application Equipment

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Technological alternatives for the handling and land application (H&LA) of solid and semi-solid manure (S&SSM) are very limited compared to corresponding systems for liquid manure and slurry. Moreover, the efficiency of the few H&LA systems currently available for S&SSM needs to be improved. There is thus a need to investigate the technical requirements for H&LA systems for S&SSM and the general objective of the reported research effort is to contribute to the development of improved equipment for the H&LA of S&SSM. An improved understanding of the machine/product interactions which occur in this type of equipment are necessary to reach that objective. As a result, the sequence of specific research objectives follows a logical progression: (1) determining relevant physical and flow properties of S&SSM, (2) understanding the behaviour of S&SSM in H&LA equipment and machines and (3) applying this knowledge to improve the design of H&LA equipment.

Specialized laboratory equipment was designed and built to measure the following physical and flow properties of S&SSM: (a) total solids concentration, (b) density, (c) particle size distribution, (d) shear stress-shear strain relations and (e) friction characteristics. These selected properties are measured for different types of manure at different levels of total solids concentrations in the solid and semi-solid ranges. Models will then be developed to (a) relate selected physical and flow properties to easily measurable manure properties (e.g. density, solids content) and (b) describe the machine/product interactions and predict machine performance. The long-term benefits for the pork industry are improved H&LA equipment for S&SSM, which will make solid and semi-solid manure management systems a more effective and efficient alternative for pig producers.