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Exploration of Agricultural Product Flow Behavior and Entrainment Characteristics During Velocity Reduction

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ABSTRACT Pneumatic conveying is widely used in the agricultural industry to perform many material handling functions. Of interest is the use of dilute, two-phase conveying to move seed and granular fertilizer from a mobile air cart to the seeding implement of choice. This method of product delivery is widely used in the industry but it has its disadvantages. These include higher power per unit mass conveyed and seed damage at higher conveying velocities. A reduction in conveying velocity, while maintaining mass flow rates and seeding uniformity, would reduce the power required as well as product and pipe wear.

Therefore a method of reducing air velocity downstream of product entrainment was developed to explore the minimum conveying velocity of various agricultural products. This velocity reducer will be used to bleed off a measured amount of air, therefore lowering the conveying air velocity while keeping the products in suspension in the main conveying line. This method will allow for exploration of the product behaviour at differing entrainment and conveying velocities. The product distribution will be evaluated using optical flow profiling and center of particle distribution methods developed in previous work. The effect of the velocity reducer assembly itself will be explored, as well as preliminary findings on the minimum conveying velocity of agricultural products.

Keywords: Pneumatic conveying, dilute two-phase flow, flow profiling, product distribution, product entrainment