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MATHEMATICAL MODEL FOR PARTICLE MOTION APPLIED ON A MANURE SPREADING APPARATUS USED IN ENVIRONMENTALLY FRIENDLY TECHNOLOGY

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Abstract

It is acknowledged that organic fertilizers and wastes, such as animal slurries/manure from intensive farm enterprise, sewage sludge, poultry litter are and will continue to be spread on agricultural land and provide beneficial nutrients to crops. However, many of these materials which are also potentially polluting if not properly managed can pose a risk to groundwater and surface water quality. Generally, their distribution on the soil is performed with specialized machines to reduce the risk of overdosing (pollution) or underdosing (inefficiency) with material. For these machines to be properly dimensioned it is necessary to create mathematical models that take into account the factors that influence the distribution of the material on the soil and which can be validated experimentally.
This paper presents a mathematical model for organic waste (manure) movement containing second and first derivatives, based on force equilibrium. For simplicity, we divided the path of the material point into two parts: the first part consists of curved surface (helicoid), the second part consists of a parabolic one described in the air. The two movements are studied separately considering that particle position and speed at the end of motion should be the initial conditions of motion for the second path. There are taken into consideration the relations between design parameters of the distribution machine and the material used, relations that have logical-mathematical and theoretical foundations in classical mechanics. Also, an equation that is used to calculate the necessary time for the manure to reach the soil is given together with different working hypotheses.

Keywords: manure spreader, mathematical model, distribution, spreading, uniformity

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