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Review

Control and monitoring systems used in variable rate application of solid fertilizers: A review

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A B S T R A C T

Practicing variable rate application (VRA) technology depends mainly on using advanced methods (sensors or prescription maps) and complex control system modules. Although VRA is steadily spreading and offering significant benefits in the management of agricultural inputs, there are still some technical limitations that need to be addressed and improved by researchers and companies. Fertilization is an important component of agricultural production worldwide, solid and liquid are the two main forms of fertilizers used in agriculture; whereas solid fertilizers are widely used in agriculture because they are affordable and easy to store and use. Therefore, the main objective of this study was to review the performance of the existing control and monitoring systems used in the map and sensor based VRA of solid fertilizers and to highlight their inadequacies. The current study demonstrated that map based VRA system is characterized by high accuracy resulting from its ability to use multiple sources of information to prepare accurate prescription maps. However, previous research has shown that, depending on the actuation method employed, the map-based systems utilized for VRA of solid fertilizers operate with an overall accuracy ranging between 94% and 98%. The study also demonstrated that the capacity to achieve on the go VRA of agricultural inputs, with an overall accuracy of roughly 96% and without any time lag between measurements and application, has recorded the most significant benefits for sensor-based systems. While, the limitations in easy access, simple and accurate sensors; as well as the demand for more potent data analysis and real-time decision-making software's, are among the drawbacks of these systems. Overall, there is still an urgent need for more research to come up with practical solutions for accurate and effective feedback systems to optimize the VRA systems, especially for solid fertilizers applications.

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