

## Development of an Opto-Electronic Monitoring System for Crop Planter Seed Metering Unit

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**Abstract:** The main objective of a seeding machine is to put seeds at a desired depth and spacing within the row. Seed spacing uniformity is one of the most important criteria in evaluating planter performance. Therefore, the objective of this research work was to develop an Opto-electronic monitoring system for the assessment of a mechanical planter seed metering unit performance. The developed system was used to monitor seed flow from the metering system of the row crop planter and to determine seed spacing. The developed system comprised of an optoelectronic sensor for seeds detection, a rotary encoder for forward speed and seed position measurement, amplifiers for adjusting sensors signals, a microcontroller for synchronizing sensors signals and a PC for operating the program and displaying process. The opto-electronic monitoring system has been successfully developed and tested on chickpeas seeds at two operating speeds ( $1.3 \text{ ms}^{-1}$  and  $1.9 \text{ ms}^{-1}$ ) and three metering system gear combinations. Both seed numbers and positions of the dropped seeds were assessed. The results indicated that the developed system can be accurately used to detect seeds flow from the metering system with strong linear relationship between the system measured and the actual measurements ( $R^2 = 0.993$ ). Furthermore, the system could be easily modified to measure seed spacing on-the-go in order to monitor both seed flow and seed spacing. Consequently, the developed system will enhance the process of precision seed placement.

**Key words:** Opto-Electronic Sensor • Precision Farming • Seed Metering • Seed Spacing

### INTRODUCTION

The main objective of a seeding machine is to put seeds at a desired depth and spacing within the row. Uniform seed spacing and depth result in better germination and emergence and increase yield by minimizing competition between plants for available light, water and nutrients; and the quality of horizontal and vertical distribution of seeds is influenced by row spacing, sowing depth, soil conditions, seeders design, seed density and operator skill [1, 2]. Plant population is an important factor in crop production, which can affect growth and yield and this to a great extent depends on the performance of the metering mechanism.

Robinson *et al.* [3] studied the effect of uniformity of plant spacing within the row on sunflower yield and quality. They found that uniformity of plant spacing within the row affected yield, seed size and consistency of seed size in some of the sites and years of their study. Thus, both seed population and seed spacing at planting time have effects on the harvested seed yield and seed size. Examples of studies conducted to determine the effect of plant population on seed quality include projects conducted by Robinson *et al.* [4] and Johnson *et al.* [5]. Both studies found that specific plant populations provided maximum yield depending on test location. Both studies also showed that seed size generally decreased as plant population increased.

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