2025 Georgia Peanut Commission - 1-Page Report

Investigating Peanut Seed Meters and Planting Parameters for Maximizing Peanut Emergence

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Objectives: The objectives were to develop a computer vision object detection model to accurately count singulated peanuts, missing peanuts, and doubles to measure the performance of agricultural seed meter. Additionally, design advanced seed plates to enhance seed singulation uniformity at higher planting speeds and validate seed meters performances under different ground speeds and vacuum levels.

Methods: A YOLOv10-based software was created to measure the performance of agricultural vacuum seed meters. The software analyzed videos captured in test stands and field conditions. To develop the software, images were collected under varying light conditions and camera angles, manually annotated, and digitally edited and multiplied to create a robust dataset. The trained computer vision model achieved a reliable detection of singulated peanuts, missing peanuts, and doubles. Paired with a counting algorithm, the software reaches a measurement error rate of below 2%, providing precise performance metrics for operating seed meters. The field trial was designed as split-split-plot to compare three seed meters (JD, MS, and PP) as main plots, two speeds (3 mph and 5 mph) as split plots, and three vacuum levels (low, medium, high) as split-split plots. Emergence data were collected by counting plants from the middle two rows of each 4-row plot at multiple intervals after planting, and a 2-row plot harvester was used to harvest data rows at the end of the season.

Results: The computer vision system proved highly effective in quantifying seed meter performance, enabling better decisions on seed plate design, vacuum pressure, and operational speed. These findings offer practical insights for improving peanut planting efficiency and yield maximization. Ongoing, the measurement software significantly speeds up the development of advanced, 3D printed seed plates which will lead to advanced seed meter performance. The field trial showed significant difference in emergence among the tested seed meters: MS had the lowest emergence averaged across speeds and vacuum levels. At 3 mph, emergence rates were comparable across all seed meters while at 5 mph, JD demonstrated the highest emergence, and MS the lowest. High vacuum levels improved emergence for all meters, even when the high vacuum level exceeded the manufacturer's recommended range (JD seed meter). Yields were generally comparable except for MS at 5 mph, where the poor emergence determined yield reduction. The study concluded that high vacuum improves emergence for all meters and JD and PP seed meters should be prefered when planting at higher speed.

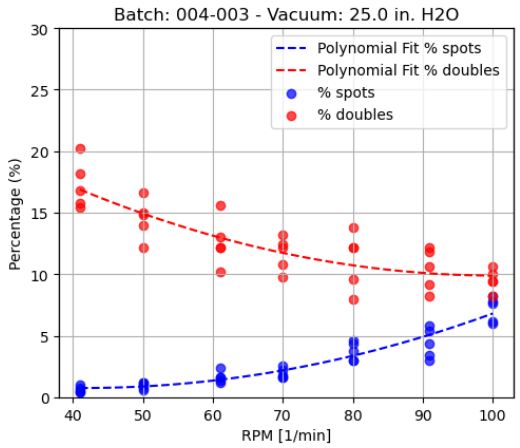

Figure 1: Results from the Computer Vision Measurement Software

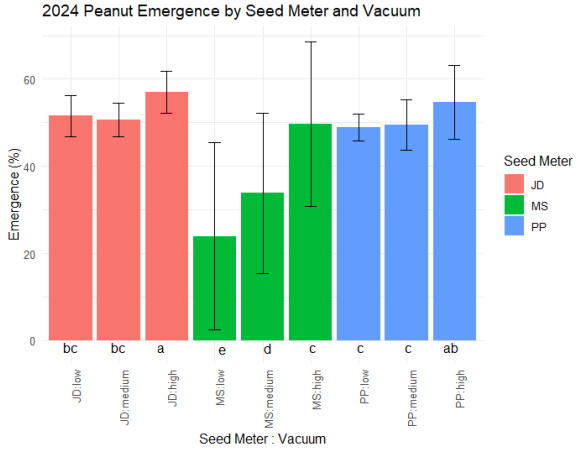

Figure 2: Results from the Field Trials