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Evaluating Drone-Seeded Cover Crops

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JUSTIFICATION

Recent interest has been generated in using drones to seed cover crops into agronomic crops in small, irregularly shaped fields with rolling terrain or those fields otherwise not suitable for aerial seeding using a fixed-wing aircraft or helicopter. However, little is known about how effective drones are at seeding cover crops and if they can deliver seed at the appropriate rate to establish a sufficient cover crop. In order to evaluate cover crop stand establishment seeded via drones, we conducted an on-farm trial with support from the Maryland Soybean Board.

OBJECTIVES

1. Evaluate cover crop establishment flown on standing corn using a drone applicator on cooperating local farms.

METHODS & RESULTS

Figure 1. *DJI drone equipped with hopper and spin spreader.*

A cover crop of radish was flown on to a 71-acre standing corn field in Baltimore County, MD on September 14, 2022 at the rate of 12.5 pounds of pure live seed per acre using a DJI drone (Figure 1) equipped with a spin spreader capable of carrying 16 pounds of seed. The field was an excellent candidate for this trial because of its irregular shape, rolling terrain, and close proximity to wood lines (Figure 2). Corn grain was harvested on November 4, 2022.

Figure 2. *Field location of drone-seeded cover crop (outlined in red).*

Canopy density as a measure of cover crop establishment was calculated on December 9, 2022 using the Canopeo© application for smartphones (Oklahoma State University Department of Plant and Soil Sciences, Stillwater, OK; www.canopeoapp.com). Images were captured at 20 random locations across

the field at a height of 3 feet above the ground using a DJI Maverik Mini drone and percentage green canopy was calculated by the Canopeo software (Figure 3). Average canopy coverage was 23.2%, with a minimum and maximum value of 3.8 and 53.3%, respectively.

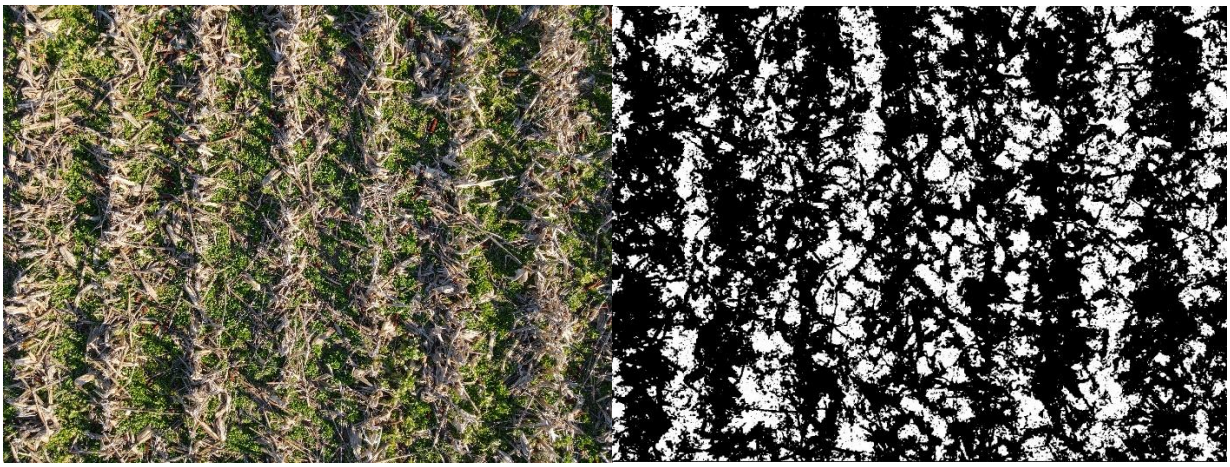

Figure 3. *Unedited image (left) and percentage canopy cover image (right) calculated by Canopeo® software showing 30.81% coverage.*

In comparison to 2020 and 2021 (39.1% and 30.0%), we observed slightly less canopy coverage on average (23.2%). We attribute this lower reading to the time of year our data was collected, which was December 9 vs. October in 2020 and 2021. By this point in December we had already experiences some killing frost events and the radishes were not as large and robust and were beginning to wilt and die. Aerial establishment of cover crops is heavily influenced by soil moisture availability.

Table 1. Cover crop establishment, 2020 vs. 2021.

Rating	2020	2021	2022	3-yr. Average
Plant Density (plants/ft^2)	3.10	1.95	2.36	2.47
Canopy Coverage (%)	39.1	30.0%	23.2%	30.8

During the period of August through November, a total of 15.6 inches of rain fell in 2022, slightly lower than 2021 and significantly lower than 2020 (Table 2), which likely contributed to the differences observed in canopy greenness between the years.

Table 2. Monthly precipitation from August-November, 2020, 2021, and 2022.

Month	Precipitation (in)		
	2020	**2021**	**2022**
August	11.81	4.36	2.30
September	4.48	6.04	5.50
October	4.36	5.24	5.30
November	6.35	1.33	2.50
Total	***27.0***	***16.97***	***15.6***

These data show the potential for aerial seeding a radish cover crop with drones as a viable method for establishing cover crops, and offers a method for planting early cover crops for many farmers that do not have access to a helicopter or plane. Additional acres in cover crops will help Maryland farmers improve their soil and help meet stringent water quality goals. Future work will be done to replicate and gather additional data so that we can fully understand the feasibility of seeding cover crops with drones, as well as to perform a series of outreach and education for farmers interested in using this technology for planting cover crops.

ACKNOWLEDGEMENTS

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