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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 28-acre standing corn field in Baltimore County, MD on August 30, 2021 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 11, 2021 and cover crop establishment was measured on November 19, 2021 by counting the number of radish plants per square foot in a one square foot area at 20 random locations across the field. The average cover crop plant population in the field was 1.95 plants/ft^2, with a minimum of 0 and maximum of 4. Radish plants averaged 4 inches in height at the time of rating.

Figure 2. *Field location of drone-seeded cover crop (outlined in red). Image: Google Maps (left).*

Canopy density was calculated 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 2.5 feet above the ground and percentage green canopy was calculated by the Canopeo software (Figure 3). Average canopy coverage was 30%, with a minimum and maximum value of 6.6 and 62%, respectively.

Figure 3. *Unedited image (left) and percentage canopy cover image (right) calculated by Canopeo® software showing 31% coverage.*

In comparison to 2020, we observed decreased establishment and canopy coverage (Table 1). Aerial establishment of cover crops is heavily influenced by soil moisture availability. During the period of August through November, a total of 10 more inches of rain fell in 2020 than 2021, which likely contributed to the differences observed in establishment between the two years. A second contributing factor may have been corn hybrid plant characteristics. From the aerial images of the field there is a noticeable pattern of greener, thicker cover crop growth next to thinner growth occurring roughly every 12 rows. This field was planted with two different corn hybrids, one in each half of the planter and one of the hybrids was considerably taller than the other. Better establishment was observed in the shorter hybrid where more seed likely hit the soil, along with more sunlight.

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

Rating	2020	2021
Plant Density (plants/ft^2)	3.10	1.95
Canopy Coverage (%)	39.1	30.0%

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

Month	Precipitation (in)	
	2020	**2021**
August	11.81	4.36
September	4.48	6.04
October	4.36	5.24
November	6.35	1.33
Total	***27.0***	***16.97***

These data show the potential for aerial seeding a radish cover crop with drones may be an effective method for establishing cover crops in these challenging fields. 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.

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