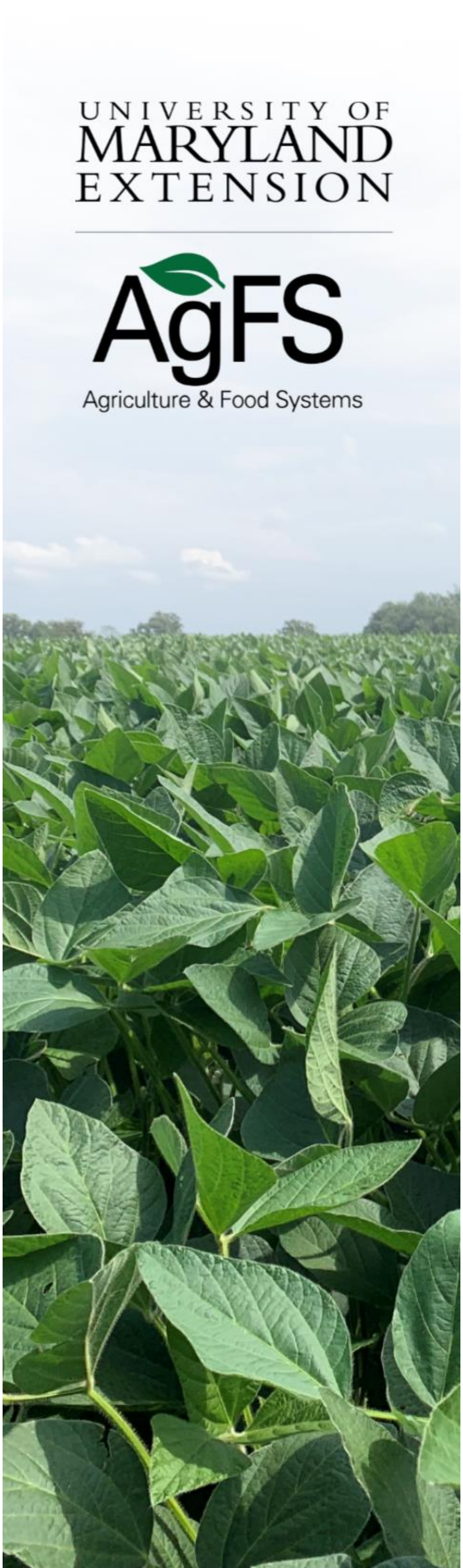

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Evaluating Efficacy of Aerial Pesticide Spray Applications Using Drones

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JUSTIFICATION

Drones are becoming increasingly popular in agriculture for not only imagery, but product application. As a result, startup companies offering aerial pesticide application via drone are emerging. Farmers have taken interest in the technology and service for several reasons, but the main benefit to using a drone to apply crop production products in soybean and corn is that it offers a feasible method for in-season foliar product application to fields that are smaller, fragmented, or irregularly shaped, without the potential for damaging the crop with a ground spray rig. Additionally, drones may have an advantage over helicopters or fixed-winged aircraft in small fields because they are more nimble and have the potential to achieve application to field edges that would be missed by aircraft. Finally, drones are much less intrusive to curious neighbors who often raise concerns when they see an aircraft applying products to fields.

Although drones offer a lot of potential, there is very little published data on their efficacy to apply products, which is cause for question and concern as to if drones are a viable and worthwhile means of applying products, such as pesticides, to corn and soybeans.

In previous years using spay cards and water, we tested the spray coverage of agricultural drones at various application volumes, including 1.5, 2.5, and 5 gallons per acre. We concluded that drones can achieve similar droplet density, volume median diameter (VDM), and coverage as planes and helicopters at spray volumes between 2.5-5.0 gallons per acre. During the 2022 growing season we tested the efficacy of drone-applied fungicides to corn at the Western Maryland Research and Education Center (WMREC).

OBJECTIVES

1. Evaluate spray coverage achieved with drone application in soybeans and corn

METHODS

A DJI drone (Figure 1) was used to apply Miravis Neo (Syngenta AG®, Basel, Switzerland) to corn at the Western Maryland Research and Education Center in Keedysville, MD on August 1, 2022. Corn was planted on 30-inch rows and at the VT growth stage during application. The drone was equipped with TeeJet® TXA8002VK nozzles.

The drone was operated by certified pilot who offers custom pesticide application in field crops and nurseries. Weather conditions were sunny and 68°F with light winds out of the north at 3 mph.

Figure 1. *DJI spray drone used for the project.*

Miravis Neo 2.5 SE (a.i. azoxystrobin + propiconazole + pydiflumetofen) was flown onto the corn at 2.0, 3.0, and 5.0 gallons per acre in replicates of three per treatment. A non-treated replicate was used for the control.

Aerial drone images were collected on September 16, 2022 to evaluate plant greenness and senescence.

Plots were harvested with a John Deere 9500 combine operating a six-row header. Each replicate was harvested and weighed in a weight wagon, and a subsample was collected to measure test weight and moisture. Yields were adjusted and reported at

15.5% moisture.

Statistical analysis was completed in JMP software (SAS Institute, Cary, NC) using ANOVA and means separated using Fisher's Least Significant Difference (α=0.05).

RESULTS & DISCUSSION

Average yield in the trial was 192.02 bushels per acre, with a low of 177.51 and high of 203.56 bushels per acre. There were no significant differences in yield between any treatments (P=0.9016). There were also no significant differences in moisture (P=0.9926) or test weight (P=0.4878). All data is summarized in Table 1 below. Foliar disease pressure in the plots remained relatively low until black layer was reached, which likely explains the lack of separation between treated and non-treated plots.

Table 1. Harvest data for 2022 WMREC corn drone trial.

Treatment	Moisture (%)	Test Weight (lbs)	Yield (bu/a)	Greenness (1-10)
2.0 gal/a	20.2	56.4	190.9	3.3 b
3.0 gal/a	20.3	56.4	191.5	4.3 b
5.0 gal/a	19.9	57.4	199.8	6.0 a
Non-treated	20.1	57.1	190.8	1.0 c
P>F	*0.9226*	*0.4878*	*0.9016*	*0.0018*

Treatments connected by the same letter are not significantly different (α=0.05).

Figure 2. *Drone image of corn plots.*

Using aerial drone imagery (example, Figure 2), plots were rated visually on a 1-10 scale for "greenness" as a measure of plant greenness and delayed senescence, which is often induced by many fungicides. Plots with higher ratings were greener for longer compared to the non-treated control. All three fungicide application volumes had plant greenness ratings above the non-treated control, with 5.0 gallons per acre being the highest (Table 1). This is consistent with other research and observations where fungicides typically induce a greening or "stay green" effect in plants, but does not always contribute to higher yields.

Based on our two years previous work with drones, we have confidence that they can deliver an adequate amount of product and achieve, at the very least, similar spray coverage at 2.0-5.0 gallons per acre as a helicopter or fixed-wing aircraft; we did not observe any yield benefit to the fungicide application in this test, which is likely a function of low and late foliar disease pressure. Future work will focus on education and outreach to farmers interested in using this technology on their own farms.

ACKNOWLEDGEMENTS

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LITERATURE CITED

1. Hunter JE III, Gannon TW, Richardson RJ, Yelverton FH, Leon RG. (2020). Coverage and drift potential associated with nozzle and speed selection for herbicide applications using an unmanned aerial sprayer. Weed Technol. 34: 235–240. doi: 10.1017/ wet.2019.101