Evaluating the Response of Blackbird Flocks to a Precision Agriculture Spraying Drone: Future Directions for Avian Repellent Applications

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Background

- Mixed flocks of blackbirds cause (US $) millions of dollars worth of damage to commercial sunflowers fields [1]
- In the Prairie Pothole Region of the Dakotas, damage can greatly exceed the acceptable industry standard of 5% and reach total field losses [2]
- A dynamic tool is needed to reduce blackbird damage to sunflowers as the damage is actively occurring [3]
- Unmanned aircraft systems (UAS) have been used to reduce human-wildlife conflict
- Research using multiple UAS platforms to haze blackbirds in sunflower found that an increased negative stimulus is needed to promote flock abandonment [4]
- Applying avian repellent via UAS to flocks of foraging birds damaging crops has been the basis of theoretical research, but has not been field tested [5]
- A first step to is to develop an effective application protocol and evaluate the reaction of blackbird flocks to the spraying UAS will administer the avian repellent

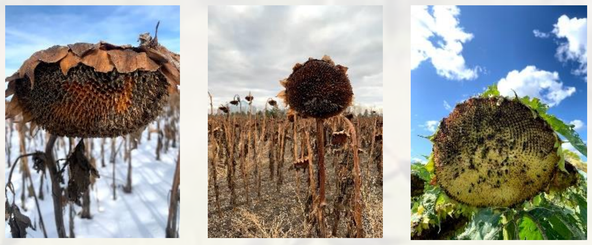


Figure 1. Blackbird damage to sunflower crops in North Dakota.

Objectives

The main objective was to evaluate the response of free-ranging blackbird flocks foraging in commercial sunflower fields to the approach of the spraying drone (DJI Agras MG-1P).

Specifically, we were interested in the following:

1. Establishing the flight initiation distance (FID)
   - FID is an important metric used to measure the risk perception that a bird, or flock, has towards an approaching object
2. Measure variables that may impact the FID
   - Field size, presence of raptors, weather, flock measurements, and flock behavior

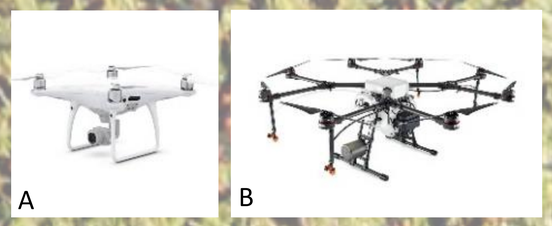
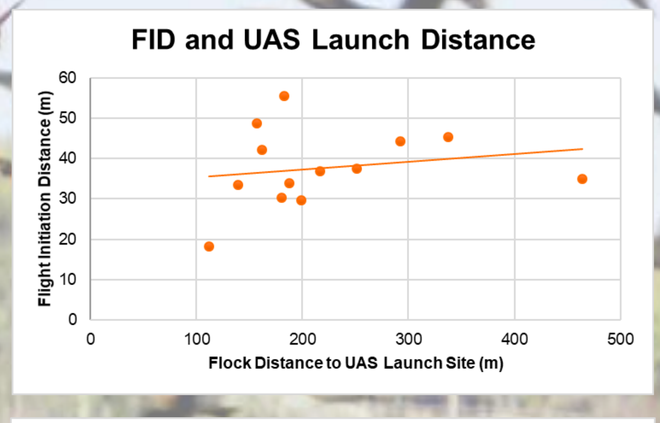


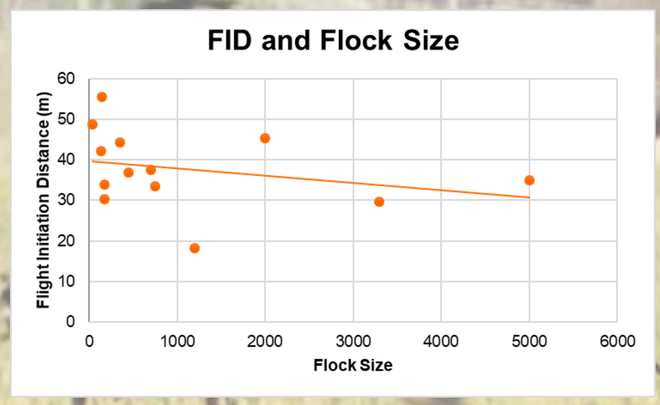
Figure 2. The DJI Phantom 4 (Figure 2A) was flown above the DJI Agras MG-1P (Figure 2B) to record the flock response to the Agras approach and measure the distance at which the flock took flight.

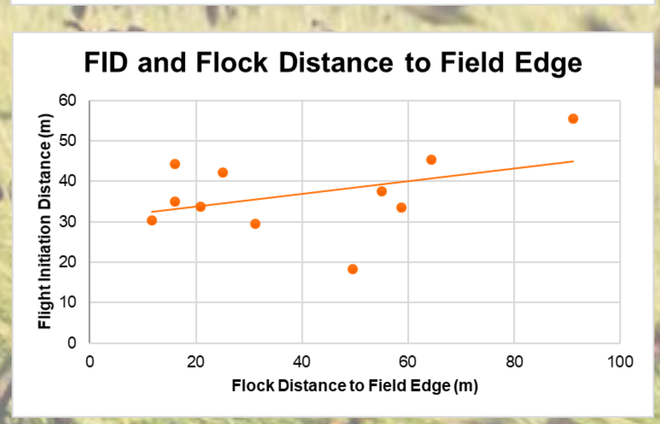
Methods

- Trials began with 5 minutes of pre-observation including number of times the flock lifted off, time the flock spent in flight, and presence of raptors
- The flock location was identified visually by the remote pilot-in-command
- The Phantom was launched to 60 m above ground level (AGL) for video recording
- Once the Phantom reached altitude, the Agras was launched to 5 m AGL
- At a speed of 4 m/s the Agras approached the flock, with the Phantom overhead
- When the majority of the flock flushed due to the approach of the Agras, we halted the platforms and recorded data prior to returning to the launch site
- Trials concluded with 5 minutes of post-observation.

Results







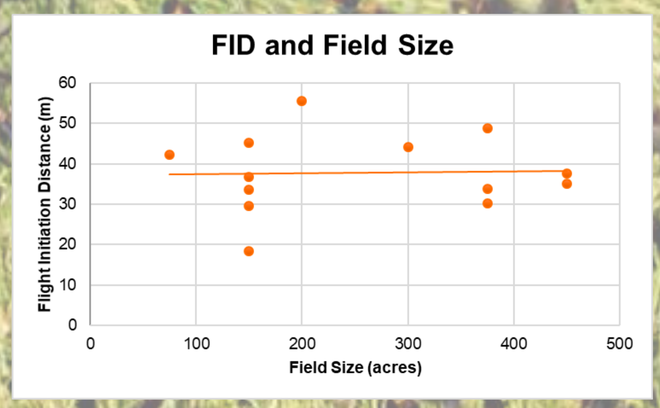


Figure 3. The relationship between the flight initiation distance (FID) and variables that have a possible impact on FID. A total of 13 trials captured the FID of independent flocks actively foraging in commercial sunflower fields in North Dakota.

Summary

- We conducted 35 trials in Emmons, Burleigh, Kidder and Logan counties during the months of September and October 2019. (viable trials in sunflower = 13; viable trials in corn = 1; viable trials in cattails = 4)
- Trials were conducted during daylight hours when winds did not exceed 17 mph (sustained) and there was no precipitation
- Out of the 13 trials, the Agras approach only caused one flock to leave the field

38 ± 3 m Flight Initiation Distance	**1,110 ± 414 birds** Flock Size	**258 ± 37 ac** Field Size
40 ± 7 m Flock Distance to Field Edge	**222 ± 27 m** UAS Launch Distance to Flock	

Figure 3. A quick glance at some of the variables that were measured during each trial, average ± SE provided for each variable.

Figure 4.
The view from the Phantom (60 m above the Agras) as the Agras approaches a flock, and the on-the-ground view of a flock. Both flocks are foraging in commercial sunflower fields.

Future Directions

- We will analyze the relationship between FID and the landscape and flock variables to determine an effective protocol for the application of an avian repellent, methyl anthranilate, during the Fall of 2020
- Testing will be conducted to determine the spray pattern of the Agras
- A survey will be developed and administered to commercial sunflower producers across the state to investigate blackbird damage estimates and the perception of UAS devices to mitigate blackbird damage
- Results from this study will inform the use of UAS platforms for precision agriculture and spot treatment of an avian repellent to reduce bird damage to crops

Acknowledgements & Literature Cited:

Acknowledgements

A special thank you to all of the farmers that granted us access to their sunflower fields; without their permission this project would not be possible. Additionally, thank you to Allison Schumacher for her tireless work by my side and Bonne Clark for her support, and the North Dakota USDA-APHIS Wildlife Services employees that helped along the way.

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