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In defense of field experiments: response to Askham and Godfrey (2014)

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Two knowledgeable colleagues have taken exception to some research conducted by us on Canada geese (*Branta canadensis*) published in the last issue of *Human–Wildlife Interactions* (Dieter et al. 2014). We appreciate the opportunity to respond. Regarding bird feeding behavior, Askham and Godfrey were correct in their assertion that evaluation of bird behavior on agricultural crops is poorly understood. Birds will indeed sometimes feed on plants treated with a chemical repellent if they have no other choice. However, the authors cite unpublished data (by Askham) stating that 32 times the recommended amount of methyl anthranilate (MA) was needed to prevent birds from feeding after food deprivation (in a pen trial, we assume, since it was not stated).

A primary problem with Askham's cited research is that pen trials do not realistically represent conditions found in nature. Oftentimes, an experiment in a laboratory does not have the same result as an experiment conducted under field conditions. Laboratory experiments have a high level of control, but they have numerous disadvantages, including scale, scope, realism, and generality (see details in Garton et al. 2005). In wildlife science, field experiments are considered a compromise between laboratory experiments and natural experiments (Wiens 1989). Field experiments have greater scope and realism compared to pen or laboratory trials, and treatments can be randomly assigned (Garton et al. 2005). In field studies, we can control manipulations, but other factors are not subject to control. There are a plethora of things to consider when examining chemical effects in field studies, including environmental factors (e.g., temperature, humidity, and precipitation), biological factors (e.g., plant and animal communities, as well as genetic, health, gender, diseases, and behavior of the species being studied), and nutritional factors (such as food availability, food palatability, proteins, vitamins, etc.; Landis and Yu 1999).

Our goal was to conduct research on possible bird repellents in a realistic field situation and, specifically, the conditions that are present in eastern South Dakota. Even though MA products have been shown to have some deterrent effects in controlled situations, the product BirdShield® (an MA product endorsed by Askham and Godfrey) was ineffective in field situations at repelling red-winged blackbirds (*Agelaius phoeniceus*) from agricultural crops (Werner et al. 2005). Belant et al. (1996) also had poor results using MA to deter grazing by Canada geese. Even so, we decided to examine 3 MA products in our project because the chemical had not been evaluated in the conditions present in eastern South Dakota. We also selected anthraquinone, which has been found to successfully repel Canada geese, red-winged blackbirds, and ring-necked pheasants (*Phasianus colchicus*) in some field situations (Werner et al. 2009). In order to develop a reliable recommendation for effective field application of chemical deterrents, both laboratory and field testing are necessary (Werner et al. 2014). For example, Werner et al. (2014) found that field efficacy of anthraquinone was observed at different concentrations (lower in this case) than that observed in captive studies.

The geese in our study did not have to either "eat the treated soybeans or starve," as stated by Askham and Godfrey. Geese at all study sites had options of other food to eat. As shown in Figure 1 of our publication, electric fencing was present around only the soybean field that held our study sites. Depending on the habitat at each wetland, the geese had access to grass on pastures, islands with mixed vegetation,

Figure 1. Exclosure in a soybean study site treated with methyl anthranilate. Geese consumed all the soybeans surrounding the exclosure.

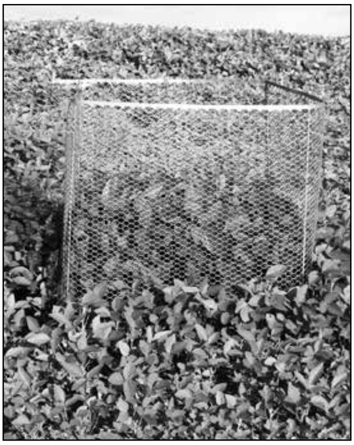

Figure 2. Exclosure in a soybean study site treated with anthrquinone. Geese did not consume the soybeans surrounding the exclosure, so growth of plants continued.

various aquatic plants in the wetland, and even other crop fields, such as corn or wheat. We stated this fact quite plainly in the methods section. I am quite certain that Canada geese thrived in South Dakota prairies long before soybeans were planted. Askham and Godfrey also stated that we did not include the dates of the field experiments. After treatment, we monitored each site until the crop was entirely consumed or the geese had fledged and left the area (as we stated in the methods).

Contrary as to what was stated by Askham and Godfrey, the use of time-lapse photography was essential in our study. As a wise man once said, "a picture is worth a thousand words." With our cameras, we captured a picture every 10 seconds. When played rapidly, the photos appear similar to a movie. We have hours of documentation of geese entering the study sites and consuming soybeans.

When evaluating crop damage, we did not conduct a pre-assessment of crop damage, because there was no damage prior to treating the soybeans. When the sites were first made available to geese, treated soybean plants had similar growth and were in vegetative state V2–V4 (Pederson 2007). As far as post-assessment, we had planned to conduct yield trials. However, at all sites where MA products were used, the soybeans were totally destroyed. There were no beans to harvest, and there was no plant material to oven dry. It was very obvious to even a casual observer that the geese had eaten all the beans. As we verified with the use of an exclosure at each study site, beans that were protected from geese grew well and had a yield comparable to the rest of the harvested field where there were no geese present.

The number of geese at each site was confirmed by cameras. While it was not possible to get an exact count, it was evident that numbers of geese at each site were relatively constant. Concerning the amount of time spent by geese on each site in 2011, as was criticized by Askham and Godfrey, we believe that these data reinforced our conclusions. Geese used the treated sites as loafing areas because they had already eaten all the plant material there. On the anthraquinone sites, the geese spent some time there, but in most cases vacated the site and searched for other food sources. We have been studying crop damage by Canada geese in South Dakota for over a decade (see Schaible et al. 2005, Radtke and Dieter 2010, 2011) and feel confident in our ability to identify goose damage on soybeans.

Askham and Godfrey also criticized our use of the term "reference" rather than "control" for untreated sites. Field studies really have no true "control" as can be used in laboratory studies, so the "reference" is generally used in place of "control" (see Landis and Yu 1999). If they would prefer, the word "untreated" can be substituted in place of "reference".

Concerning the comparison of study design between years, we did make a change in methodology that we believed would increase the value of our results. The reason we used the study design in 2011 was that manufacturers of the MA advised us strongly to avoid having a reference site next to a treated site. They believed that the chemical would be so effective that geese would move away and even avoid the nearby reference sites. Obviously, that was not the case, so we altered our study design in 2012 to provide a better comparison between adjacent treated and untreated sites. With the change in design in 2012, we still found that soybeans treated with MA were totally consumed by geese, while study sites treated with anthraquinone were damaged little or not at all (Figures 1 and 2). We did not conduct a yearly comparison of data, but, rather we let each year stand alone.

As far as errors are concerned, there was a mistake in the results section, as the caption for Figure 4 and 5 were incorrect. The caption for the 2 figures should be exchanged. As hard as authors and publishers try, sometimes mistakes get to print. We are not sure when the error occurred, but we take full responsibility for the mistake.

It is obvious that Askham and Godfrey were very disappointed in our findings. As far as the effectiveness of MA products is concerned, we stated that we do not recommend the use of these products on soybean fields in the conditions that are present in eastern South Dakota. We did not imply that these products would not work in other situations.

The research project we reported on was conducted to determine if there was a chemical that works to deter crop damage by geese in field conditions in South Dakota. Because we found that anthraquinone showed some promise, we are now working on refining recommendations as to use of the chemical. We are currently examining application rates, timing of application, number of applications needed, and area of the field that needs treatment. We do not have any vested interest in specific chemical companies. In fact, we would prefer it if no additional chemicals were introduced into the environment. However, the application of a chemical that works well to deter crop damage would be welcomed by farmers, game managers, and sportsmen alike. The use of an effective chemical to deter crop damage by geese may be preferable to some of the current lethal management techniques being used.

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