efficacy. To address this knowledge gap, we evaluated rotations of synthetic and organic insecticides in tandem with variety selection as strategies against a major pest group in collard production: caterpillars.

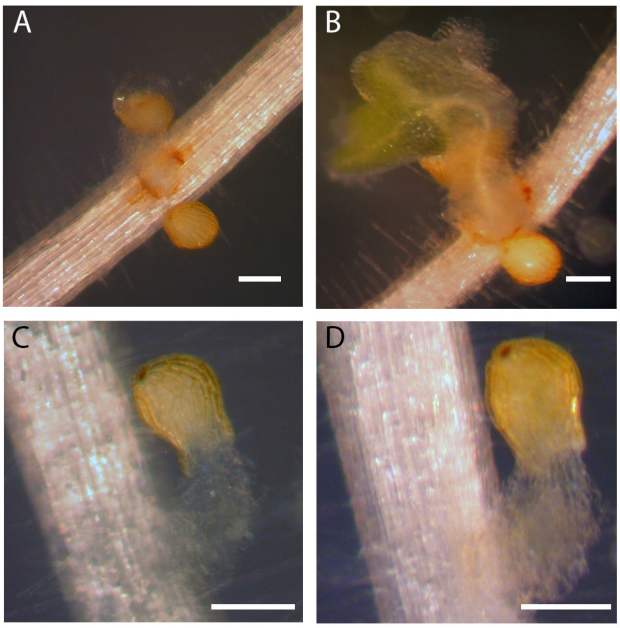
Over a 13-week period from June through August 2022 at the Throckmorton-Meigs Purdue Agricultural Center, we scouted replicated plots of collards (var. *flash*, *champion*, and *top bunch*) and recorded the number and identity of caterpillars on plants of each variety when subjected to rotations of synthetic + organic, organic-only, or no insecticides. We also recorded yield across varieties and treatments on six dates. We found 4 caterpillar species feeding during the season but there was no difference in mean number of caterpillars on any of the three collard varieties. Synthetic + organic and organic-only rotations suppressed caterpillars equally well, and these plots had significantly fewer caterpillars than untreated plots ($P < 0.05$). Finally, we found that collards var. *flash* had significantly higher yields than var. *champion* or *top bunch* ($P < 0.05$) regardless of insecticide rotation, but yields did not differ between synthetic + organic and organic-only sprayed plots ($P = 0.07$). Our results demonstrate that organic products alone can be just as effective against caterpillars as a rotation of synthetic and organic products.

Research advisor Elizabeth Y. Long writes: "This project emerged from requests from backyard gardeners who wanted more information about how to manage insect pests on their vegetables with products you can find at home improvement stores. There are a lot of questions about the efficacy of organic insecticides in particular and it was fun to work with Elliott and see such good results using these products. Elliott's enthusiasm for agriculture and helping people find inexpensive and effective solutions to manage pest insects made this project both fun and successful!"

Laboratory Screening of Sorghum Lines for Incompatibility: A Postattachment Resistance Mechanism to the Parasitic Weed *Striga hermonthica*

Student researcher: *Cameron Matthews, Senior*

Striga hermonthica is an obligate root parasitic weed in sorghum, reducing crop yield severely, especially in low-input agriculture common across sub-Saharan Africa. Host plant resistance is an essential component of *Striga* control. Only one resistance gene is known, *LGS1*, controlling strigolactone production. Sorghum *lgs1* mutants have reduced *Striga* germination stimulant activity. After germinating in response to host-exuded strigolactones, *Striga* attaches to its roots. Another resistance mechanism called incompatibility occurs at the postattachment stage. *Striga* on an incompatible host fails to form the functional xylem connection necessary to sustain continued growth. We screened 58 inbred sorghum lines of common pedigree, including some released as resistant varieties in Africa, by laboratory co-culture that allowed successive observations of parasitic attachments. Differences in *Striga* germination stimulant activity between lines were overcome by exogenous application of strigolactones. One parent was the donor of both *lgs1* and incompatibility. The second parent was a high stimulant (*LGS1*) line with presumed susceptibility to *Striga*. Phenotyping included *Striga* germination stimulant activity, germination inhibition, haustorial initiation by the sorghum roots as well as the number of *Striga* attachments and whether these grew over the observation period. Although the second parent was *LGS1*, it did not contrast with the resistant parent sufficiently enough in terms of postattachment success of *Striga* to distinguish the progeny lines for resistance at



Striga *growth on a susceptible and resistant sorghum root.* Striga *attached to a susceptible sorghum root at 10 (A) and 17 (B) days of co-culture in agar. Attachment on a resistant sorghum root at 10 (C) and 17 (D) days.* Striga *on the sorghum with incompatibility fails to grow. Bar = 0.2mm.*

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this stage. This co-culture method will be used to phenotype recombinant inbred lines derived from parents contrasting for incompatibility in efforts to identify the gene(s) underlying this *Striga* resistance trait.

Research advisor Patrick Rich writes: "Cameron meticulously phenotyped a recombinant *inbred sorghum population for resistance to the parasitic weed* Striga hermonthica. *He worked for months in our special containment facility with delicate biological materials that required careful handling, observations, and record keeping. His work moves us closer to finding genes controlling post-attachment* Striga *resistance."*

Gossypium hirsutum as a Study Species to Understand Plant Responses to Drought Stress

Student researcher: *Sam Schafer, Senior*

Throughout the past year of working with cultivated upland cotton (*Gossypium hirsutum* L.), it has been intriguing to learn how it can serve as a study species for understanding the effects of genotype and water stress on photosynthetic parameters. The goal of the project is to discover whether genotype and environment play a significant role in crop photosynthesis and to quantify any potential interaction between the two variables. Photosynthesis-CO_2 response (A/C_i) curves of 14 biogeographically diverse cotton accessions grown under controlled greenhouse conditions were collected using a Li-COR 6800 Portable Photosynthesis System (Li-COR: Lincoln, Nebraska) and analyzed using R software. Broad-sense heritability (H^2) for maximum rate of rubisco carboxylation (V_{cmax}) and electron transport (J_{max}) were 0.575 and 0.686, respectively. Paired with a one-way ANOVA test, results suggested that photosynthetic parameters were not significantly affected by genotype. A subset of 4 cotton accessions were selected for a follow-up study. During the second experiment, a control group of replicates were maintained under well-watered conditions while another replicate group experienced a 75% reduction in irrigation for two weeks after flowering. Following the first week of treatment, a suite of physiological parameters were collected including plant height, number of developing bolls, number of healthy leaves, and number of buds. Results indicated significant differences between the two populations, which suggests a reduction in photosynthetic activity.

Upland cotton plants growing under controlled greenhouse conditions.

A/C_i curves were collected at the two-week mark of drought treatment and are yet to be analyzed. Conclusions will be drawn based on the differences in photosynthetic performance between accessions from the first and second experiments.

Research advisor Diane Wang writes: "Sam came to me one and a half years ago with an interest in plant physiology research. He has since led this study from concept to analysis and has continuously impressed me with his energy, enthusiasm, and ability to master new skills from technical measurements to data analysis using R."

Lake Michigan Shoreline Landowner Survey

Student researcher: *Colby Smock, Junior*

The Lake Michigan Shoreline Landowner Survey was developed to understand the perspectives of homeowners along Indiana's shoreline who have experienced rapidly changing conditions due to water level fluctuations over the past 10 years. From near-record lows in 2013 to record highs in 2020, the significant water level swing is one of many factors that are causing severe erosion of the beach and foredune area. These erosion problems have put the communities along the Indiana shoreline in a dire spot as they risk losing their beaches and homes along the lakeshore. Based on a comprehensive review of community plans and ordinances, many of these communities have little to no plan for addressing the management of their shoreline, significantly altering the ability to fund future management advancements.