ML 2015, Ch 76, Art. 2, Sec. 6a Project Abstract
For the Period Ending December 31, 2021

PROJECT TITLE: MITPPC #4: Decreasing environmental impacts of soybean aphid management
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LEGAL CITATION: MINNESOTA INVASIVE TERRESTRIAL PLANTS AND PESTS CENTER. ML 2015, Ch. 76, Art. 2, Sec. 6a.
APPROPRIATION AMOUNT: $570,000
AMOUNT SPENT: $570,000
AMOUNT REMAINING: $0

Sound bite of Project Outcomes and Results
Management of soybean aphid relies on applications of broad-spectrum insecticides. This work aimed to decrease insecticide use and ameliorate associated environmental impacts through development of aphid-resistant soybean and advancement of remote scouting.

Overall Project Outcome and Results
The invasion of US soybean by the soybean aphid resulted in dramatic increases in insecticide use, which has increased production costs for farmers and environmental and human-health risks. This proposal takes a two-pronged approach (preventative and therapeutic) to improve management of the soybean aphid through decreased insecticide input, which will result in increased environmental and economic sustainability of soybean production. Integration of preventative and therapeutic pest management tactics is fundamental to integrated pest management (IPM). For preventative management, we advanced the development and availability of aphid-resistant soybean. This included advancement of numerous resistant soybean lines already in the soybean breeding pipeline, including commercial release of one line. Furthermore, numerous crosses were made to incorporate different combinations of aphid-resistance genes into soybean lines, and to test and advance them through the pipeline. Novel research was also performed to examine the variability in susceptibility of aphid populations to these aphid resistant lines. For therapeutic management, we advanced the ability to use remote sensing for soybean aphid through a series of field experiments and technological advancements. Through caged experiments and open-field experiments, we documented that aphid-induced stress to soybean can be detected from drone-based sensors. In addition, through additional caged experiments we found that typical levels of defoliation (<5%) from another insect, the Japanese beetle, is unlikely to affect the ability to scout for soybean aphid; however, higher levels of defoliation (>33%) could impact scouting for soybean aphid. In addition, we built hardware to host new algorithms for autopilots used to guide small drones for accurate and safe pest management missions. We have tested the algorithm in simulation and by post-processing data collected from flight tests. These advancements will help farmers prevent soybean aphid outbreaks through the use of aphid-resistant soybean and to more effectively respond to outbreaks through efficient drone-based scouting.

Project Results Use and Dissemination
An aphid-resistant variety stemming from the work has become commercially available. Results of this project have been actively disseminated to stakeholders and the scientific community. Project results were shared in extension presentations to farmers and agricultural professionals throughout the life of this project and a video was created for stakeholders. A publication for stakeholders listed available resistant soybean varieties. Updates on this work were also shared at several scientific conferences. This work has led to scientific publications on

remote sensing applications and technology (2019, 2020, 2021), and aphid-resistant soybean, and led to detection of a new soybean pest.