Identification of insect resistance genes in plants

A. What is this research project?

Identification of effective insect resistance genes and gene products from plants and other sources.

B. What problem does it address?

- Insect damage to field crops causes billions of dollars in losses each year and also can promote the presence of plant diseases, including those that produce toxins.
- These factors affect the health of humans and animals, and also inhibit the acceptance of U.S. crop products to importers due to quality issues. Among the affected field crop plants are corn and other grass relatives. Incorporation of resistance genes into crops plants by breeding has historically reduced insect problems.
- Genetic engineering allows for the incorporation of insect resistance genes not possible by conventional breeding due to linkage with genes that produce undesirable traits.

C. How is the project different from or how does it enhance other projects?

- This project is unique in its biotechnological approach to controlling corn insects that promote the establishment of fungi that produce toxins.
- The experience gained in work with corn is applicable to other systems, including biomass grasses such as switchgrass.
- Recent investigations of switchgrass have indicated lines that are being considered for biomass production for ethanol are readily consumed by potential pests, such as fall armyworms. Some field-collected lines are damaged to the same degree as the biomass lines, while others are highly resistant and will kill the insects within a few days.
- We have shown that switchgrass has a diversity of potential insect resistance genes, including some not associated with lignification or other polymer crosslinking factors that inhibit the fermentation process.
- We have the capability to significantly expand this line of research toward corn stover, switchgrass, and other biomass grasses in order to promote the sustainable production for bioenergy uses.

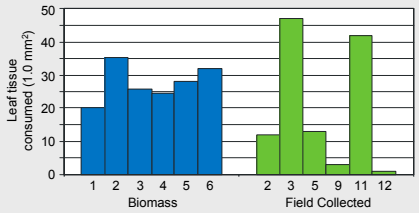
D. What are the potential benefits of partnering with ARS on this research?

- We have over 25 years experience with insect resistance genes and products, including plant resistance chemicals.
- We have worked with transgenic plants for over 15 years, and have several years experience with plant transformation and regeneration.
- Ample facilities and equipment are available to support these investigations, but additional equipment and personnel would be readily utilized and significantly enhance these investigations.

E. Who are the potential customers?

Worldwide users of corn, both human and animal, benefit from our research directed at effective pest management strategies (both related to insect resistance and pest predictive capabilities).

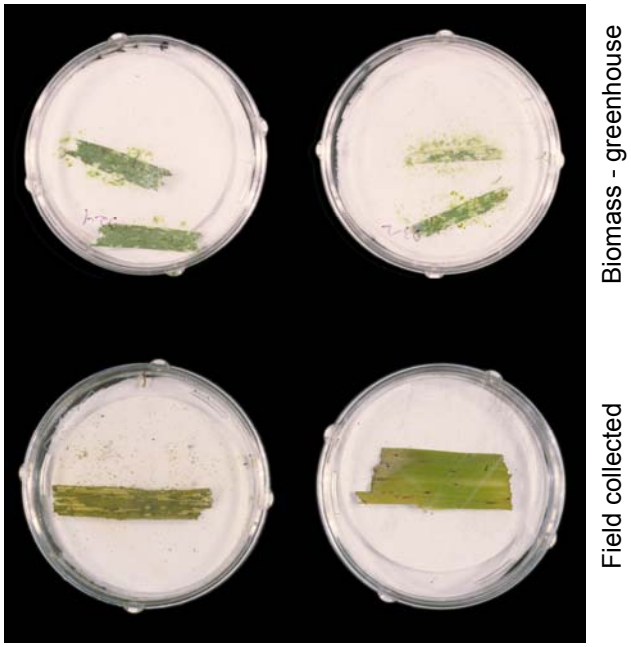
Fall armyworm feeding ratings on different switchgrass lines



Values reported for miomass lines are means of 4-10 plants

Numbers of putative insect resistance genes identified from switchgrass through bioinformatics

Resistance Gene #	# matches for sequence 1	2	3	4
1	100+	100+	100+	44
2	100+	100+	100+	41
3	100+	71	82	38
4	1	3	5	1



Differential feeding by fall armyworms on different switchgrass lines

Stage of Development

An invention disclosure, ARS docket #133.08 has been submitted for the putative resistance gene sequences identified so far.

Expression studies are needed for confirmation.

Moving Forward

We have the existing knowledge base and transformation capability to identify insect resistance genes from switchgrass and other biomass crops. Collaborations are needed in order to realize this potential.

PARTNERSHIP OPPORTUNITY

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