

PROJECT DATA

MTEC Photoacoustics, Inc. - 01GO11039

Seed Selection Technology for Genetic Enhancement of Grains Targeted for Specific Processes

Recipient:	MTEC Photoacoustics, Inc.	Instrument Number:	DE-FG36-01GO11039
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		B & R Number(s):	ED1906020
		PES Number(s):	01-2031
		State Congressional District:	IA - 3

PROJECT SCOPE: The objective of this project is to develop a technology based on molecular imaging and parallel processing to be used by plant breeders to speed and improve the development of specialty grains. This project will build and optimize a prototype seed sorting device capable of sorting corn kernels by percent-oil content at a rate of one kernel per second. Substantial energy savings will result because of a more rapid introduction of specialty grains that often replace petroleum-based feedstocks reducing the amount of grain needed for a specific process.

FINANCIAL ASSISTANCE

Approved DOE Budget	\$200,000	Approved DOE Share	\$200,000
Obligated DOE Funds	\$200,000	Cost Share	\$184,250
Remaining Obligation	\$0		
Unpaid Balance	\$37,774	TOTAL PROJECT	\$384,250

Project Period: 5/1/01 - 5/31/04

TECHNICAL PERFORMANCE

DE-FG36-01GO11039

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PROJECT SYNOPSIS

This project will develop a technology based on molecular imaging and parallel processing that will be used by plant breeders to speed and improve development of specialty grains. This project will build and optimize a prototype seed sorting device for selection of germplasm according to seed chemistry. The principle deliverable of the project will be a functioning prototype capable of sorting corn kernels by percent-oil content at a rate of one kernel per second. Substantial energy savings will result due to the more rapid introduction of specialty grains that reduce the amount of grain needed for a specific process and that often replace petroleum-based feed stocks.

SUMMARY OF TECHNICAL PROGRESS

A StellarNet Fiber optic spectrometer has been chosen and the prototype imager assembled. The pick up system has been modified to allow vibration of the seed in the well to gain better positioning over the fiber optic light source. Evaluations have been performed on the new configuration using the same soybeans as in previous evaluations. An optimal position for the distance from the bean to the detector was also determined. Calibration parameters have also been determined. This completes Task 4: Design, Procurement and Assembly of Prototype Imager.

Task 5: Data Analysis Software is also complete. The interactive software between the National Instruments LabView instrument control, StellarNet spectrometer, and Grams Chemometrics is now fully interfaced and functional. The transport and measurement systems have been modified to sit directly on the enclosure holding the electronics. A blower vacuum pump has been replaced with a linear vacuum pump, thus completing Task 6: Seed Transport.

MTEC is currently working on Task 7: Prototype Testing. Initial tests were performed with soybeans and upon destructive testing following the sort, only 2% of the rejected tests were found to be in error. This was followed by a trial using corn seeds with four different genotypes with the sorter being correct 93% of the time. This work was done in collaboration with Paul Scott, ISU Department of Agronomy.

SUMMARY OF PLANNED WORK

MTEC will sort 48,000 soybean seeds for spring planting by Prof. Fehr's group for low palmitic acid. The sorting is expected to allow these plant breeders to reduce the number of seeds planted, harvested, and processed by a factor of two. Seed chemistry calibration will also continue.

PROJECT ANALYSIS

MTEC has had communications with BASF Plant Sciences and Dow Mycogen regarding the technology. Both companies have expressed an interest in partnering in the next phase of the project. Based on the current results and investor interest, the potential for successful commercial application of the technology is high.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK

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Detailed Task Description

Tasks 2 & 9. Attend Annual Project Review

At the request of DOE, attend a project review and present project status and discuss upcoming goals and objectives.

Task 4. Design, Procurement, and Assembly of Prototype Imager

A spectral imaging prototype will be designed to image simultaneously 100 corn kernels at selected wavelengths in the short-wave near-infrared. Each kernel will be in its own well in a multi-well plate imaged by the device. The components for the imager will be procured, and the device will be assembled and optically tested.

Task 5. Develop Data-Analysis Software for Imager

The software necessary for converting the multiple, single-wavelength, multi-kernel images into spectra for the individual kernels will be developed in this task. The software will also analyze the kernels for oil content based on a factor-analysis model, or building such a model from the spectra.

Task 6. Develop Vacuum-Based Seed Handler

A hand-held, suction-based device for picking up multiple corn kernels from a random collection of kernels and placing them in the wells of the multi-well imager plate will be designed and built. The array of pick-up points on the device will match the array of imager-plate wells so that the device will fill each plate well with exactly one kernel.

Task 7. Prototype Testing

The prototype sorter will be tested at MTEC with both kernels and ground corn to measure and optimize spectroscopic performance. Illumination and imaging parameters will be adjusted to optimize repeatability and the signal-to-noise ratio, consistent with a goal of imaging seeds at a rate of ten per second (i.e., ten seconds per 100-kernel plate).

Task 11. On-Site Sorter Testing

The complete prototype will be set up in the laboratories of Pioneer Hi-Bred International. The staff there will be trained in its use and they will test it using their own seed stock. They will build and assess factor-analysis models for kernel analysis and provide MTEC with test results and operating history on the prototype.

Tasks 1, 3, 8, 10, 12 & 13. Project Management and Reporting

In this task, the Principal Investigator will manage the project. This includes overseeing the other tasks, preparing the required status and final reports, preparing the market assessment, and participating in the Commercialization Strategy Workshop.

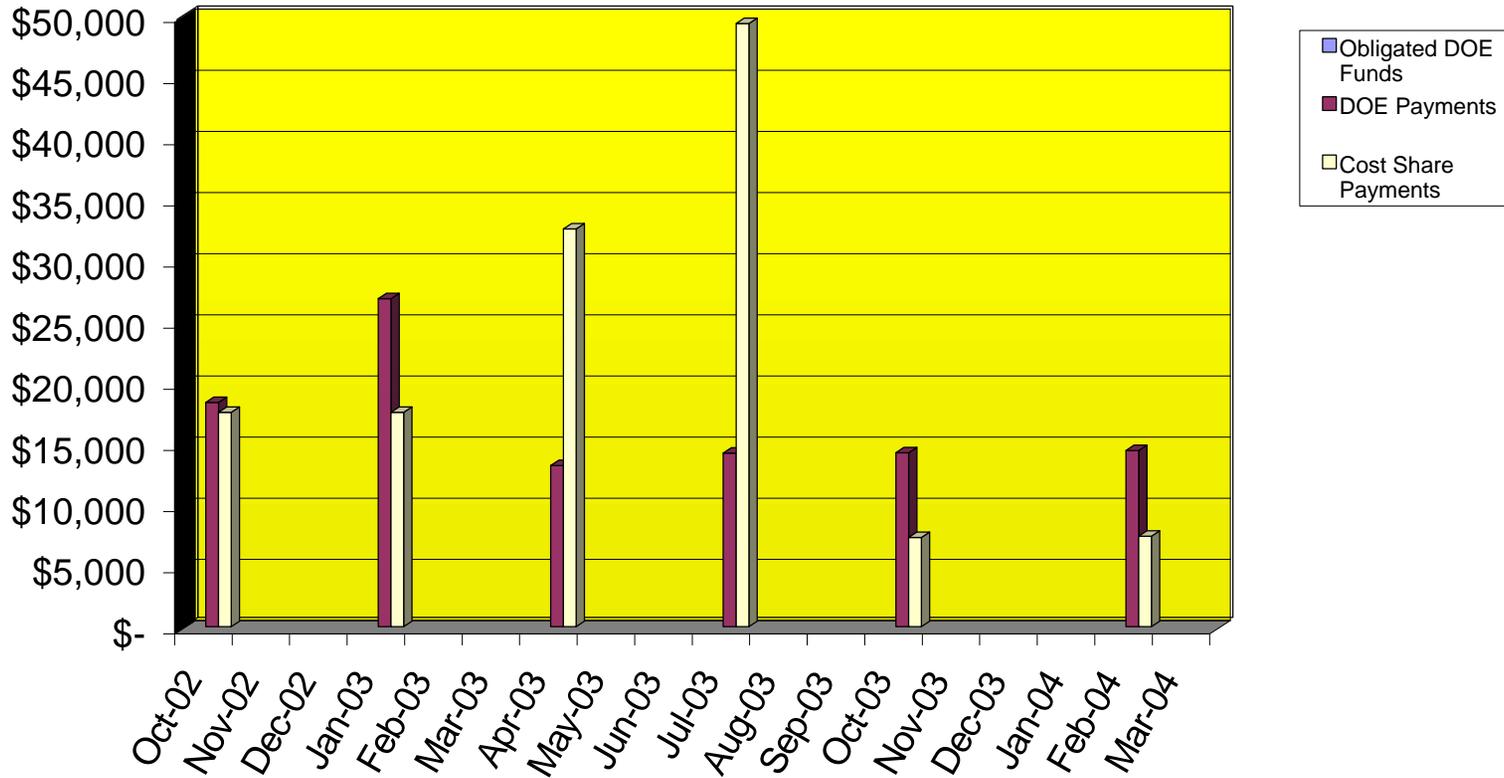
Overall project management and timely reporting and preparation of project results will be conducted. This includes project and financial status reports and the final project report due 90 days after completion of the project. This task also includes other DOE requirements for a market assessment, fact sheets, benefits analyses, market assessments, workshops, etc.

Project Cost Performance in DOE Dollars for Fiscal Year 2003

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	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE Payment	\$0	\$18,343	\$0	\$0	\$26,840	\$0	\$0	\$13,193	\$0	\$0	\$14,210	\$0
Cost Share Payment	\$0	\$17,536	\$0	\$0	\$17,536	\$0	\$0	\$32,535	\$0	\$0	\$49,346	\$0

	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	PFY*	Cumulative
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	\$200,000
DOE Payment	\$0	\$14,227	\$0	\$0	\$0	\$14,420	\$60,994	\$162,226
Cost Share Payment	\$0	\$7,307	\$0	\$0	\$0	\$7,406	\$87,675	\$219,339

Approved DOE Budget:	\$200,000
Approved Cost Share Budget:	\$184,250
Total Project Budget:	\$384,250

* Prior Fiscal Years

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Task Name	Start	Finish	2001			2002				2003								
			Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4					
Design, Procurement, and Assembly of Prototype Imager	Fri 6/1/01	Wed 5/1/02					100%											
Develop Vacuum-Based Seed Handler	Fri 6/1/01	Wed 5/1/02					100%											
Develop Data Analysis Software for Imager	Fri 6/1/01	Wed 5/1/02					100%											
Prototype Testing	Thu 5/2/02	Tue 10/1/02									100%							
On-Site Sorter Testing	Wed 10/2/02	Thu 5/1/03													10%			
Gather Data; Prepare and Submit Final Report	Fri 5/2/03	Fri 8/1/03													90%			