



Michigan Corn ANNUAL RESEARCH REPORT

Corn Marketing Program of Michigan | 2006



January 2007

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Dear Michigan Corn Producers:

In 1992, corn producers in Michigan established the Corn Marketing Program of Michigan, the state's check-off program, in order to enhance the economic viability of corn production in Michigan. In February of 2003, corn producers once again gave the Corn Marketing Program of Michigan overwhelming approval and voted to keep the program for five more years.

Through the Corn Marketing Program of Michigan (CMPM), corn producers in Michigan invest in check-off funded research projects that focus on improving on-farm production and conservation practices and also developing new uses for corn. The CMPM strives to expand and enhance current markets while at the same time developing new markets for our state's corn.

Over the past thirteen years, the CMPM has funded over 150 projects that have led to improved production and

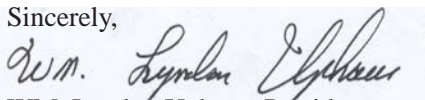
conservation practices, a booming ethanol industry within the state, an expanding corn heating industry, and the development of corn-based products for new markets such as carpeting, fabrics, packaging materials, salt substitutes and plastics that replace petroleum-based products.

The results of producer investments in the industry can be seen through the development of new markets and products, increased educational events for producers and consumers, and significant advances in corn-related research.

The following pages in our annual Research Report showcase how the CMPM has invested some of the check-off funds over the past couple of years. Some of the research cited in this report are completed projects while others are ongoing. All of the research is designed to help keep the Michigan corn industry on the cutting edge of production, technology, and new uses.

If you have any questions or suggestions about the research funded through the producer check-off funds, please contact the CMPM office at 1-888-323-6601.

Sincerely,



WM. Lyndon Uphaus, President
Corn Marketing Program of Michigan
Manchester Corn Producer



Corn Marketing Program of Michigan Board of Directors. Pictured left to right: Scott Lonier, Mark Kies, Lyn Uphaus, Bruce Noel, Frank Lipinski, and Carl Barth. Not pictured: Jay Drozd, Clark Gerstacker, Ken Wadsworth and ex-officio members Dr. Doug Buhler, MSU; Robert Craig, MDA; Pat Feldpausch, MCGA; and Ken Lake, MABA.

Established under 1965 P.A. 232, and voted in by the state's corn producers in 1992, the Corn Marketing Program of Michigan (CMPM) receives one penny per bushel for all field corn grown in Michigan and sold. The "check-off" funding is invested in education, market development, new uses and research. The continuation of the program is voted on by Michigan corn producers every five years. For the program to continue, the referendum vote must be approved by both the majority of voting producers and corn production. The nine-member Board of Directors, appointed by the Governor, sets the yearly direction of the program. Board terms are staggered, and each year three board positions are up for appointment or reappointment. Michigan is divided into nine districts based on corn production, with each board member representing a district.

As a way to dispense research results to the state's corn producers, CMPM publishes an annual Research Report, highlighting current and past check-off funded research projects.

PRODUCTION AND CONSERVATION INVESTMENTS

The Corn Marketing Program of Michigan (CMPM) board of directors understands the importance of agronomic research and the role it plays within the agricultural industry. It is with this agronomic research that advancements in production and conservation practices are made, which ultimately improves the bottom line for the state's corn producers. The CMPM works on behalf of corn producers in Michigan to fund research looking at tillage practices, pest control, and fertilizer recommendations just to name a few. CMPM strives to stretch the producer penny in order to keep corn production an economically viable industry within the state.

Corn producers take a gamble every year when they plant their crops in the spring; but when they try a new production or conservation technique as well, that risk escalates. Through check-off funded research, producers can benefit from ground-breaking practices which are analyzed in test plots across the state without jeopardizing their bottom line.

Nitrogen and Sulfur Study Could Lead to New Recommendations

The Corn Marketing Program of Michigan (CMPM) works to stretch producers' pennies by funding agronomic research that will help maintain or decrease input costs, while still enhancing yields.

Recent research has shown that in order to fully realize the genetic potential of modern corn hybrids, planting should occur as early as possible in the growing season. In Michigan, this often means planting in cool soils. Additionally, cool wet weather after plant-

ing results in less than ideal conditions for corn seedling root growth and early season nutrient uptake. The

Figure 2.

2005 Sulfur Starter Fertilizer

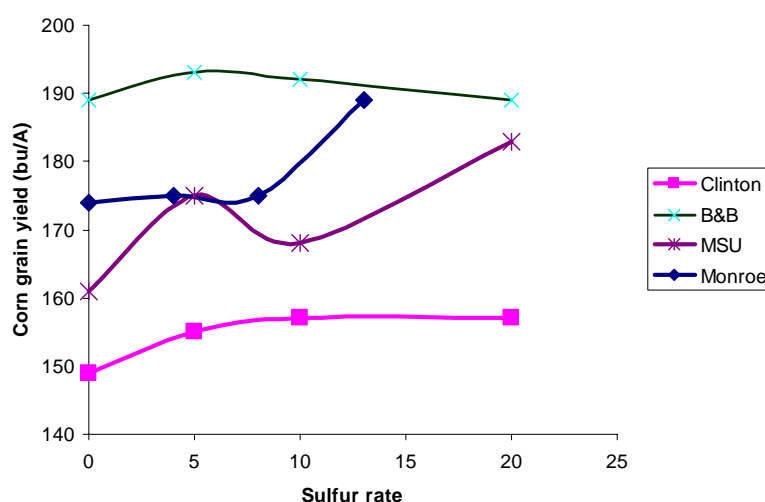
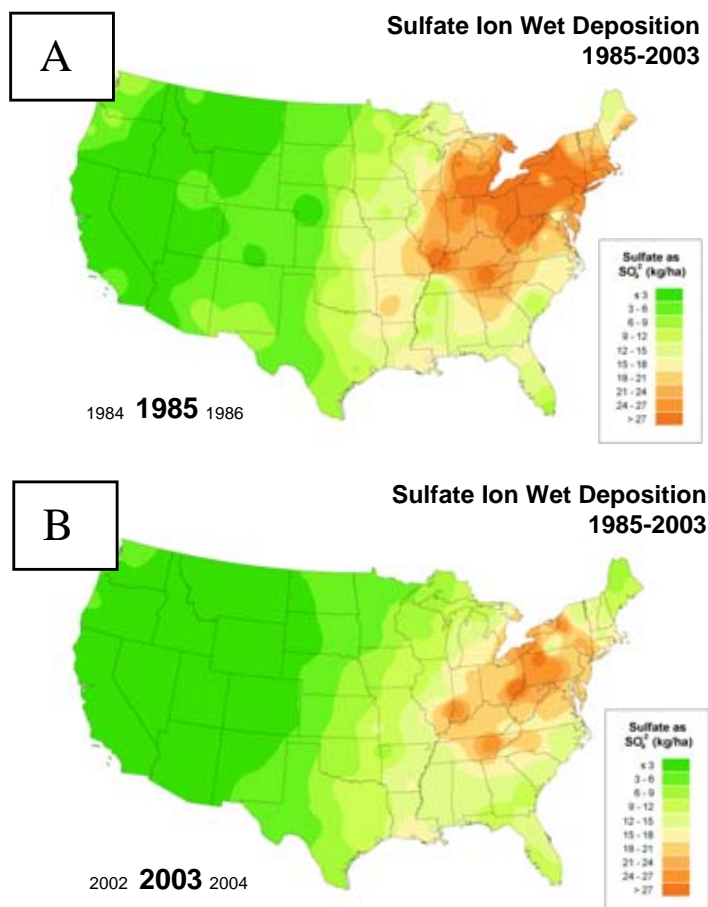


Figure 1.



weather related inhibition of corn seedling root growth is compounded by the fact that nitrogen and sulfur become available to plants primarily through soil organic matter and residue decomposition and mineralization. These soil processes are temperature dependent and under cool wet conditions, early season nutrient availability to corn seedlings can be reduced. A third contributing factor concerns the reduction in atmospheric sulfur deposition and the resulting reduction in soil concentrations of sulfur. Federal environmental policy has significantly reduced sulfur deposition from industrial emissions in Michigan since the mid 1980's as shown by figure 1.

As a result, the CMPM partnered with Drs. Kurt Thelen, Ronald Gehl and Darryl Warncke, all from Michigan State University, to evaluate the impact of these reductions on corn growth and development in the northern growing conditions of Michigan. Dr. Thelen

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PRODUCTION AND CONSERVATION INVESTMENTS

Addressing Emerging Problems with Corn Rootworm

Corn rootworm management is of increasing interest in Michigan. Continuous corn has always suffered rootworm challenges, but now there are several more options to manage damage besides soil insecticides. These options include seed treatments as well as transgenic hybrids expressing Bt toxin in the root system.

Now in addition to challenges in continuous corn, a rotation resistant variant is becoming an increasing problem in rotated (first year) corn. Adult variant females lay eggs in soybean fields in August. The eggs overwinter, then hatch into the rotated corn field the following spring. Signs of a variant include rootworm adults in soybean fields, plus root damage the following year in rotated corn. In 1997, corn rootworm adults were found in soybeans in southwest Michigan. By 1999, root feeding was discovered in rotated corn in the same area, although at non-damaging economic levels. By 2003, economic damage, including severe goosenecking, was seen in first-year corn in Berrien and Cass counties, as well as reported non-economic root feeding in central



Corn Rootworm damage can result in stalk breakage or 'goosenecking' as shown.

Michigan and the Thumb. Model predictions are that variant corn rootworm would move into Michigan, but at a slow pace due to the state's extensive crop diversity.

"With this project, we wanted to determine if the variant has moved further into Michigan," Dr. Chris

DiFonzo, an entomology researcher at Michigan State University, explained. "Once we had collected our data, we could decide to update our recommendations as appropriate."

DiFonzo and her assistant, Mike Jewett, found evidence of root pruning, a sign of potential economic damage, in Berrien, Cass, Monroe and Eaton counties. Cass County in particular, suffers from root damage that likely exceeds economic thresholds. When examining the high-



Corn rootworm are tiny larva that can do extensive damage to corn yields.

est root rating from each county, the variant had moved even further northeast into Allegan, Barry, St. Joseph and Calhoun counties. While the fields themselves may not show economic loss overall, there is potential for damage in individual fields and in certain years of high rootworm populations. The movement north and east is slow as predicted by models based on landscape diversity.

"Growers in Berrien and Cass counties should seriously consider using insecticide on rotated corn," recommended DiFonzo. "A seed treatment might fit in well in their counties, where many growers may not have the interest, experience or equipment to apply soil insecticides. In other counties in the southern and central tiers, growers, extension agents and agribusiness need to be vigilant for the variant, but treatment still may not be justified."

DiFonzo explained that scouting fields is the best way to determine the need for insecticide. "Although scouting and sampling are perceived as costly in field crops, the increase in pest pressure in field corn from rootworm, European corn borer and grubs plus the increasing input cost of seed treatments and transgenic varieties will make scouting more cost effective and perhaps routine, as it is in specialty crops," she said. "As the number of pests and treatments increase, growers who use insurance or calendar-based applications should save money by scouting and treating only when needed."

PRODUCTION AND CONSERVATION INVESTMENTS

Stacking Insect and Herbicide Resistance Traits

One cutting-edge project funded by CMPM and initiated during the 2004 growing season focused on corn with stacked transgenic herbicide and insect resistant traits. Stacking both insecticide and herbicide resistant traits into a single corn hybrid offers new strategies for pest management in Michigan corn production. These technologies will be aggressively marketed strategies in the near future.

“As more of these products come to the market, it is important that we look at the results and efficacy of the stacked trait corn and also the economics of these systems,” said principle investigator, Dr. James Kells, a leading weed expert at Michigan State University (MSU). Kells thinks transgenic traits will offer corn growers new options for weed and insect management. “Stacking both insect and herbicide resistant traits into a single corn hybrid gives producers new and innovative strategies for insect and weed management. We wanted to really explore the economic impact these new strategies could have versus the more conventional types of weed and insect control,” he added.

The three-year study examined the economics of managing weeds and corn rootworm through stacked transgenic corn hybrids as compared to conventional insect and weed management strategies. Field trials were conducted at four locations during the 2004-2006 growing seasons. Research sites varied in weed and insect pressures and were chosen based on past history of infestation levels.

Near-isogenic corn hybrid lines were used throughout the trials to minimize agronomic differences be-

tween the hybrids. Transgenic and conventional weed management strategies involved preemergence and postemergence herbicide applications and herbicide

Figure 4. Corn yields across insect control treatments at MSU2 and St. Johns in 2004, 2005 and 2006.

MSU2	Yield ----- (bu/A) -----		
	2004	2005	2006
Hybrid	227.1 (± 2.1)	231.1 (± 2.5)	214.2 (± 4.7)
Force	230.6 (± 2.6)	226.6 (± 3.3)	170.7 (± 6.2)
Force + Poncho 250	233.8 (± 2.6)	219.1 (± 3.3)	207.8 (± 6.2)
Poncho 1250	227.4 (± 2.6)	189.3 (± 3.3)	206.4 (± 6.2)
Poncho 250 + Weed Free	223.6 (± 4.6)	223.1 (± 6.7)	211.1 (± 12.4)
No insecticide + Weed Free	225.9 (± 4.6)	223.6 (± 6.7)	187.1 (± 12.4)
Yield Reduction by CRW	3 %	3 %	13 %

St. Johns	Yield ----- (bu/A) -----		
	2004	2005	2006
Hybrid	162.2 (± 4.0)	153.1 (± 5.1)	185.7 (± 7.8)
Force	164.8 (± 5.3)	132.7 (± 7.2)	165.6 (± 8.8)
Force + Poncho 250	165.4 (± 5.2)	138.8 (± 7.2)	175.3 (± 8.8)
Poncho 1250	166.7 (± 5.2)	119.7 (± 7.2)	148.4 (± 8.8)
Poncho 250 + Weed Free	151.1 (± 7.3)	73.6 (± 10.2)	135.9 (± 10.6)
No insecticide + Weed Free	164.5 (± 6.9)	75.9 (± 10.2)	110.8 (± 10.6)
Yield Reduction by CRW	1 %	50 %	40 %

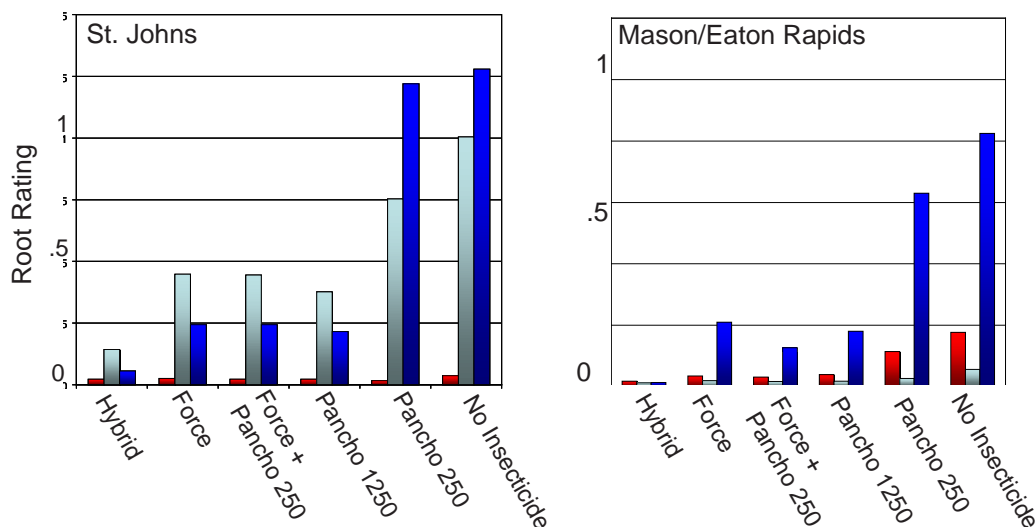
selection based on scouting. Corn rootworm strategies included a resistant hybrid, a conventional soil-applied insecticide, and a seed treatment. Data collected included weed control efficacy, visual assessment of corn rootworm damage, and corn grain yield.

Figure 3 illustrates the root damage rating across the corn rootworm control treatments across the four locations.

Figure 4 illustrates the corn yields across insect control treatments at the MSU2 and St. Johns locations.

“The data generated through this research will be the basis of recommendations on the adoption and utilization of these technologies, which should lead to greater production efficiency and profitability,” explained Kells. “This study will provide the information needed to determine those situations in Michigan where stacked resistant traits are economically justified.”

Figure 3. Root damage across rootworm treatments



NEW USE DEVELOPMENT

The Corn Marketing Program of Michigan (CMPM) works to stretch the producer penny by not only focusing on production research and enhancing traditional markets, but also by creating new and innovative markets for corn. The CMPM works with a diverse group of partners across the state to look five, ten, and even twenty years into the future to identify new markets and possible uses for Michigan corn. Through state check-off funded research, the CMPM has played an integral role in the development of corn-based polylactic acid fiber, or PLA, which can be used to make plastics, fabrics, and packaging materials. That is just the tip of the iceberg when it comes to the development of new uses and markets for corn.

CORN CAN BE USED AS NOT ONLY A FUEL, BUT AS AN ENGINE LUBRICANT

For years, farmers have grown corn specifically for the purpose of converting the full-grown crop into a renewable, alternative fuel - Ethanol. The Corn Marketing Program of Michigan is taking that concept one step further. As a result, farmers may be able to grow a crop specifically for a corn-based engine oil market.

The Corn Marketing Program of Michigan (CMPM) has partnered with Michigan Molecular Institute (MMI) to develop an auto engine lubricant that contains corn oil. "Corn producers have long known the value of their crop as an energy source and can now utilize the crop in a new way," said Jody Pollok, CMPM executive director. "It's important for corn producers to have options when it comes time to market their crop. The addition of a new corn oil market will only strengthen their position. We have seen the changes in the corn market due to the ethanol industry. We want to make sure we diversify those opportunities even more in the future."

Through research done at the MMI laboratories, David Dalman, principal investigator on the project, has looked at the blending of various levels of corn oil and additives with different commercial automobile engine lubricants. "The addition of corn oil to commercial automobile engine oils acts like a performance-enhancing additive by reducing all additive levels, including the reduction of undesirable phosphorus, lowering pour

points, reducing wear levels, and increasing the load-bearing capability of the engine oil," said Dalman.

The engine oil market offers a large opportunity



Dave Dalman (left) and Mike Rozniak with some of the equipment used at Michigan Molecular Institute (MMI) to develop corn oil containing automotive engine oil lubricant.



Photo Courtesy of the Corn Refiners Association

to corn producers, not only to those in the Great Lakes State, but also in other corn growing states. "Even with the modest goal of adding 10% corn oil to engine oil and achieving a 10% share of the U.S. market, the potential for automotive engine oils alone is so large that all the corn grown in Michigan would have to be converted to oil just to supply this market," said Clark Gerstacker, member of the National Corn Growers Association Research and Business Development Action Team and a corn grower from Midland. "This represents a large opportunity to capitalize on a new market for our corn."

Work is still being done at MMI to further enhance the corn-based engine oil to get it ready for commercialization. A patent has been submitted that would allow for the licensing of the technology and the further study of commercialization.

NEW USE DEVELOPMENT

Converting Distillers Dried Grains (DDG) Into Plastics

The Corn Marketing Program of Michigan (CMPM) works to stretch the producers' pennies by seeking new and innovative markets for Michigan's corn and its value-added products. CMPM looks beyond traditional markets for corn and has expanded into alternative markets such as ethanol, polylactic acid for corn-based clothing and fabrics, and is now expanding into plastics.

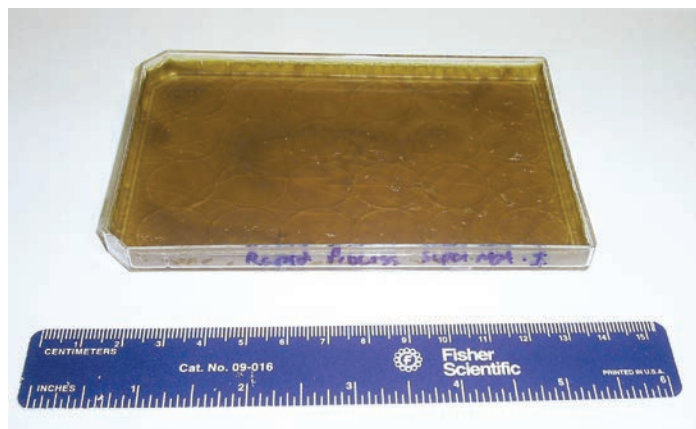
In 2002, two hundred billion pounds of plastics were manufactured globally, 40 percent of which came from the United States. The production of plastic has increased by approximately 49 percent since 1986. This traditional plastic is derived from petroleum and the majority of plastics are used as disposable packaging. Since these plastics are derived from petroleum, they biodegrade slowly and persist for many years in our country's landfills.

In order to address this problem, Dr. Chris Schilling, an engineering professor at Saginaw Valley State University, in conjunction with the CMPM, has developed a method for creating plastics from distillers dried grains (DDG), a co-product of ethanol production. "As ethanol production continues to increase in Michigan, it is important that we find new uses for the co-product, DDG," said Bruce Noel CMPM treasurer and chair of the National Corn Growers Association Ethanol Committee. "By producing plastics from DDG, we are helping to reduce the amount of petroleum used by the United States."

Figure 6 shows the amount of DDG that will be produced from all five ethanol plants that will be producing 250 million gallons of ethanol in the next year.

Schilling uses a pelletized form of DDG to create environmentally-friendly and biodegradable plastics which can then be used in furniture, architectural panels,

temporary landscape structures, and fugitive patterns to replace wood and polystyrene foam in composite molding applications. "Our intent was to produce biodegradable solids from simple, economical, and environmentally-safe methods that rely on abundant, low cost biomass feedstocks usually considered by-products or waste products from industrial sources," said Schilling. "This plastic has the look and feel of hard plastic or wood and has the promise as strong, lightweight, biodegradable structural materials."



Bioplastic created by Schilling.

"As corn growers, we have always known the value of our crops," said Lyn Uphaus, CMPM president and a corn grower from Manchester. "The corn industry is doing its part to reduce the amount of energy that has to be imported into our country. We have the capability to utilize energy from a renewable crop to replace petroleum in plastics and help reduce our country's dependence on foreign oil."

After his research verified that plastics could be made from DDG, Schilling filed a patent and decided to take the plastics one step further. He has partnered with the CMPM and leveraged funds through the United States Department of Agriculture and the Michigan

Department of Agriculture Federal State Market Improvement Program (FSMIP) in order to assess the economics and perform a market analysis for creating construction, automotive, aerospace and other products from these plastic materials. He is also continuing his experiments with the goal to reduce processing times and mitigate drying shrinkage cracks and has shown significant progress in these areas.

Figure 6

Michigan Ethanol Plants	Annual DDG Production (metric tons)
Michigan Ethanol, LLC	155,000
The Andersons Albion Ethanol, LLC	170,000
US Bio Woodbury	155,000
Global Ethanol, LLC	185,000
Marysville Ethanol, LLC	170,000
Total	835,000

NEW USE DEVELOPMENT

2006 CORN UTILIZATION AND TECHNOLOGY CONFERENCE HELD

More than 500 people from 27 countries attended the 2006 Corn Utilization and Technology Conference. The CUTC, sponsored by the National Corn Growers Association (NCGA) is the premier conference on corn research and new product development. Representatives from agricultural production, academia, industry, and the scientific community met to discuss and learn more about research projects specifically relating to the corn industry through new value-added uses for corn and improving upon current markets and technologies.

At this year's conference, Michigan was very well represented by the scientific community. Three researchers from Michigan presented their research projects to those in attendance and two participated in the poster sessions.

Why Net Energy Is an Absurd Idea and Why Fuel Ethanol Is a Great Idea



Dr. Bruce Dale

A few vocal ethanol critics have disseminated the idea that corn ethanol have a negative net energy. Dr. Bruce Dale, a professor at Michigan State University believes the basic premise of the net energy argument is completely wrong. "The premise is that all BTUs are created equal," said Dale. "This is an absurd idea; otherwise we would not pay 12 times

as much for a kcal of energy embodied in electricity as we do for a kcal of energy in the coal from which the electricity was generated."

Even if the flawed net energy premise is accepted for the sake of argument, the analysis done by the critics is poor. "The critics failed to compare ethanol's net energy with the net energy of other fuels, so the unwary reader is not able to determine if ethanol's net energy is better or worse than other fuels," added Dale. Two independent, high profile recent publications have highlighted a number of deficiencies in the analyses of these critics, including their failure to properly allocate energy to co-products and their use of obsolete data.

Ethanol is and will be an important contributor to reducing our dependence on foreign oil. Ethanol from grain and sugar crops, and later from cellulose is one of a very few real potential petroleum replacements. A barrel of oil

invested in ethanol production yields 20 times as much liquid fuel (on an energy basis) as does that same barrel of oil invested to make gasoline. Thus both corn and cellulosic ethanol can extend the life of existing petroleum supplies.

Corn ethanol has positive economic and environmental benefits and will serve as a bridge to a much larger cellulosic ethanol industry. According to Dale, "Corn ethanol improves the rural economy, reduces net farm subsidies, can reduce greenhouse gases, reduces petroleum price volatility and, as noted above, greatly extends existing petroleum supplies. Cellulosic ethanol will extend and enhance the positive effects of corn ethanol and provide great benefits for America's farmers and corn ethanol producers."

Reactive Distillation



Dr. Dennis Miller

The Corn Marketing Program of Michigan (CMPM), in conjunction with the NCGA, has been working with Dr. Dennis Miller of Michigan State University to study a separation process known as reactive distillation.

Reactive distillation is a technique in which a mixed chemical stream is treated with a reactive chemical in the presence of a catalyst. This results in a mixture of chemicals that can be easily separated, saving both energy and plant design costs. It is anticipated that this technology will allow the application of traditional catalysts to non-traditional corn-derived feed streams.

Acid esters are compounds that could be produced via this method. The current market for these chemicals is around \$3 billion a year. Development of this technology will build a large and valuable market for corn.

Reactive distillation involves simultaneous chemical reactions and product purification in a single unit of process equipment. We illustrate the application of reactive distillation to the efficient production of biorenewable based organic acid esters, a class of products that have low toxicity, excellent solvent properties and a wide range of industrial applications.

"The emerging development of the biorefinery concept for biorenewable fuels and chemicals has opened opportunities for novel reaction pathways and processes,"

NEW USE DEVELOPMENT

said Miller. “New reaction pathways for biorenewables have received considerable attention during the past decade, but separation processes, which are critical to achieve marketable products, have lagged somewhat in their development.”

Succinic Acid



Dr. Kris Berglund

Dr. Kris Berglund, chief science officer for Diversified Natural Products (DNP) has been working with the CMPM and devised ways to ferment, separate, and purify succinic acid.

Succinic acid production from glucose based feedstocks has been previously demonstrated by Dr. Berglund's work. A metabolically engineered *E. coli* strain developed by the U.S. Department of Energy, which is able to produce succinic acid fermentatively from both glucose and xylose feedstocks, was evaluated to assess the feasibility of industrial grade hydrolyzates for succinic acid production.

DNP's technology to make succinic acid is notable because it's "green." Succinic acid is made from natural sugars, such as Michigan corn. It serves as a starting point for chemicals that can lower the freezing point of water and thus be used to make safer engine coolants and jet runway de-icers; find uses in biodegradable industrial solvents that pose little threat of air pollution or ozone damage; or make biodegradable polymers for car parts such as dashboards.

Succinic acid is a colorless crystalline dicarboxylic acid that occurs naturally in amber, and is also synthesized

for use in pharmaceuticals and perfumes. It is also clean burning and biodegradable, and can be used to replace petrochemicals used in the production of biodiesel, industrial solvents, polymers and deicers for roads, airport runways and airplane wings. It also can be used in cosmetics and, because it's edible, in foods as a taste enhancer.

Poster Sessions

Michigan also had two researchers showcase posters on their current projects. Dr. Amar Mohanty, Michigan State University, had a poster detailing the work he's done to create plastics from distillers dried grains, a co-product of ethanol. Dr. Chris Schilling, Saginaw Valley State University, showcased a poster of his work in the corn heating industry.



Dr. Chris Schilling

Clark Gerstacker, NCGA Research and Business Development Action Team member, moderated a value-added session during the conference and also provided closing remarks to end the three-day conference. “All of the researchers and speakers at the CUTC presented their materials with depth and candidness, and it is refreshing to experience all of this new and exciting research at one conference,” said Gerstacker, who is also a corn producer from Midland. “You cannot find a better range of discussion, from increasing ethanol efficiencies to discovering more value-added products to dried distillers grains diets. We're already looking forward to the 2008 conference.”



Clark Gerstacker



Dr. Amar Mohanty

NEW USE DEVELOPMENT

Corn Producers Support Engineering Students in Developing Quicker, Quieter and Cleaner Burning Snowmobiles

Michigan has long provided a winter wonderland for hundreds of thousands of snowmobile enthusiasts each year. Now, thanks to cooperation between the Corn Marketing Program of Michigan (CMPM) and Kettering University, snowmobilers may soon have the option of using fuels that will actually help to keep Michigan's trails and environment in pristine condition.

In recent years the environmental hazards of snowmobiles have come under scrutiny by the federal government. According to the U.S. Assistant Secretary for Fish and Wildlife and Parks, as compared to other emission estimates, a snowmobile using a conventional two-stroke engine on a per-passenger mile basis, emits approximately 36 times more carbon monoxide and 98 times more hydrocarbons than one automobile.

As a result of insufficient data on the effects of using ethanol in a two-stroke engine, the CMPM partnered with Kettering University to study the concept. Kettering University students have developed a clean snowmobile technology that is used when they compete in the SAE Clean Snowmobile Challenges. As most snowmobiles are still powered by two-stroke engines due to cost and additional weight, Kettering University decided to test the effects of ethanol on a commercial snowmobile using a conventional two-stroke engine.



The Kettering E85 Powered Snowmobile

"Thanks to the support of sponsors like CMPM, we've been able to research the use of ethanol-blended fuels in recreational vehicles such as snowmobiles," said Dr. Greg Davis, a Professor of Mechanical Engineering and competition advisor at Kettering University. "We have as many as 20 students working on this project year-round, and it gets them excited to be able to work on real-world problems and find solutions that can really make a difference."

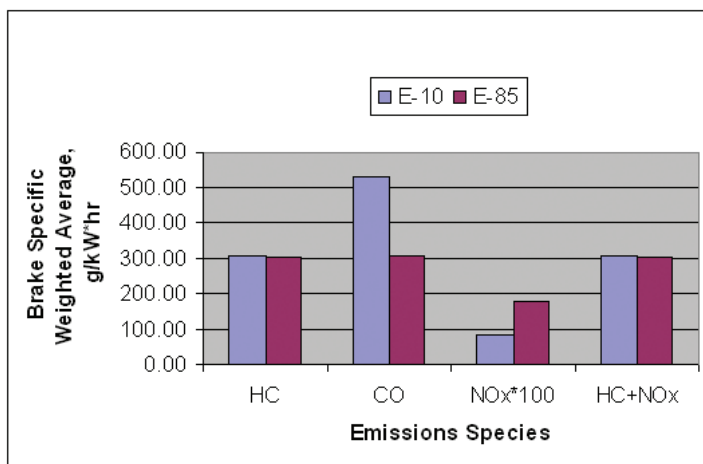


Figure 7. Emissions Results

Data showed that using E85 in a two-stroke engine resulted in a large reduction of carbon monoxide (CO), and a large increase in oxides of nitrogen (NOx), which exhibit little effect on unburned hydrocarbons. It is important to note that NOx emissions are generally not significant sources of pollution in two-stroke engines. "The preliminary testing showed that the emissions from existing two-stroke snowmobiles can benefit from using E85," said Davis. Figure 7 shows the emissions results from the two-stroke sled versus a control sled.

In addition to the laboratory research completed, Kettering University students also studied the effects and benefits of using ethanol through the development of a cleaner and quieter snowmobile for the 2005 Clean Snowmobile Challenge. This project is also used as a way to educate the public on the use of ethanol-blended fuels in snowmobiles.

The goal of the challenge is to design a snowmobile with reduced emissions and noise characteristics that also equals or improves upon the performance of current snowmobiles. The Kettering University team finished

NEW USE DEVELOPMENT

Nitrogen and Sulfur Study Could Lead to New Recommendations

Continued from Page 3

examined the effectiveness of nitrogen and sulfur starter fertilizer on corn growth, nutrient uptake and yield under Michigan planting conditions.

The research was a collaborative project between campus based researchers, extension agents and cooperating growers. A total of six experimental sites were developed across the state, with locations at Michigan State University and the Saginaw Bean and Beet Farm, as well as sites in Clinton, Lapeer, Monroe, and Berrien counties. The Lapeer county site involved sidedress applications of sulfur.

Figure 2 illustrates the effect of nitrogen/sulfur starter fertilizer on corn grain yield at the four starter fertilizer study locations. The yield response ranged from 0 to 23 bushels per acre for the 20 pounds of elemental sulfur treatment. There was no yield response as a result of the side-dress application of sulfur at the Lapeer county location.

“The plant response to the nitrogen/sulfur starter fertilizer appeared to occur relatively early in the growing season,” said Dr. Thelen. “The results of the study were consistent with our hypothesis that Michigan’s typically cool, early growing season would predispose plants to a sulfur/nitrogen starter fertilizer response since soil mineralization of sulfur and nitrogen is temperature dependent.”

However, since this is only one year of data, the results should be interpreted as preliminary. Dr. Thelen will continue the study for another growing season and is hoping to be able to formulate a recommendation from the combined years’ results.

“By completing the first year of this research, we are providing Michigan corn producers with a management strategy for using nitrogen and sulfur starter fertilizers,” said Lyn Uphaus, CMPM president and corn producer from Manchester. “Farmers will have a better basis for deciding which nutrients to include in their starter fertilizer when growing corn.”

If the second year results are consistent with the 11.5 bushels per acre average first season response, the potential impact to Michigan growers is highly significant. An extra 11.5 bushels per acre on Michigan’s approximately two million acres of corn would return a value of approximately \$46 million statewide based on a price of \$2.00 for a bushel of corn.

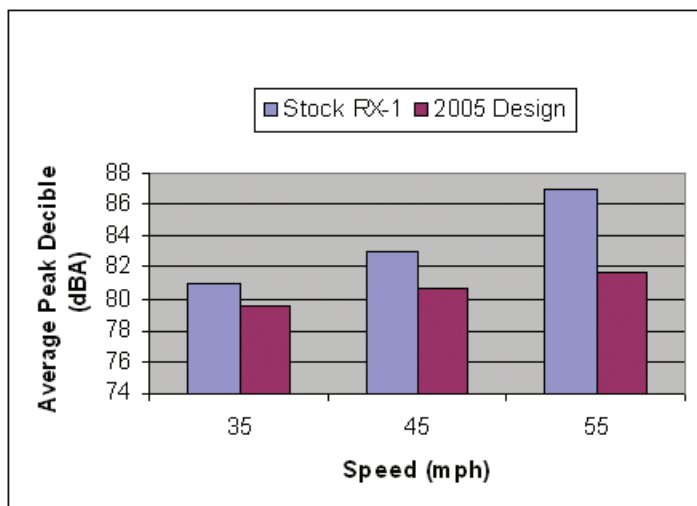


Figure 8. Noise Test Results

in fifth place overall at the competition. Figure 8 illustrates the noise test results for the racing sled versus the control sled and Figure 9 illustrates the emissions test results of the same.

“This is something we’re very pleased to be a part of,” said Lyn Uphaus, CMPM president and corn producer from Manchester. “Any automobile can use a blend of 10 percent ethanol but it’s important that innovative work, like that by Dr. Davis and his team, continues to show the benefits of using ethanol in other vehicles as well. It’s always exciting, too, to work with students in this capacity. Today’s students are tomorrow’s engineers, so it’s important they develop an understanding of alternative fuels now.”

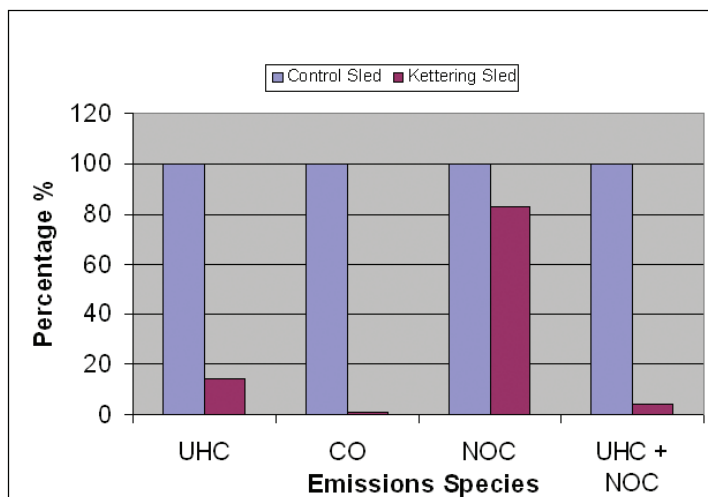


Figure 9. Emissions Test Results



Corn Marketing Program of Michigan
12800 Escanaba Drive, Suite B
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PRST STD
U S POSTAGE
PAID
PERMIT #108
LANSING MI

Corn Marketing Program of Michigan



Headquartered in DeWitt, Michigan, the CMPM is a legislatively-established statewide program that utilizes one-cent per bushel of corn produced in Michigan and sold. Investments are made in the areas of research, education, market development, and new uses in an effort to enhance the economic position of Michigan corn producers. The CMPM works cooperatively with the Michigan Corn Growers Association, a grassroots-membership association representing the state's corn growers' political interests.

For more information on the Corn Marketing Program of Michigan,
call the office toll-free at 1-888-323-6601 or visit us online at www.micorn.org.