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NCAT

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Oilseeds for Fuel, Feed and the Future

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Contents

Cover photo courtesy USDA NRCS.

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Introduction

The Oilseeds for Fuel, Feed and the Future project was created because Montana oilseed production, coupled with on-farm or near-farm biofuel production appears to have benefits for:

1) Soil quality and crop yields

Adding a broadleaf such as an oilseed to a dryland small-grain rotation could make a no-till system more effective in managing straw residues over time. Adding a cool-season oilseed such as camelina would shorten the typical summer fallow period in a dryland small-grain rotation, thereby reducing the amount of time soil is bare. Adding an oilseed to a wheat rotation can break disease, pest and pathogen cycles and provide a slight yield boost for subsequent crops.

2) Air quality

Biodiesel has been proven to reduce carbon monoxide, particulate matter, unburned hydrocarbons, air toxics and other tailpipe emissions, including carbon dioxide. Early tests show that nitrous oxide emissions from biodiesel are reduced if the diesel is running a biolubricant at the same time (1). Real-time, in-use emissions analysis shows that biodiesel has no statistical effect or slight reductions in nitrous oxide emissions (2). The use of biodiesel is an acceptable method for rural, agrarian settings to reduce all three major green house gas emissions: methane, carbon dioxide and nitrogen oxide (3).

3) Farmers and ranchers

Biodiesel production is a relatively safe, simple, low-cost way of producing fuel. The equipment and the basic chemistry are within the reach of almost anyone with the space, basic mechanical skills and modest financial resources. One co-product of oilseed crushing is animal feed, which reduces imported feed costs in the same way that homegrown fuel reduces a key off-farm input.

This paper outlines the experiences and lessons of the many participants in the Oilseeds for Fuel, Feed and the Future project. This paper also considers prospects for achieving the benefits listed above. The National Center for Appropriate Technology (NCAT) hopes this paper serves as a starting point for a discussion with the National Resources Conservation Service (NRCS), other agencies and policymakers interested in making oilseeds and oilseeds-based fuels and feeds a much larger part of the Montana agriculture landscape over time.

This paper is built around several technical, economic and policy questions. To avoid the repeated use of the phrase *farmers and ranchers*, the word *farmers* is assumed to include both.

Project goal and methods

The Oilseeds for Fuel, Feed and the Future project aimed to reduce the risk and create new opportunities for Montana farmers who want to participate in and benefit from an emerging bio-based economy. To achieve this goal, the project was designed to create and link new educational products, workshops and farm tours with the experiences of farmers and ranchers who received Innovation Grants. These $2,000 to $3,000 annual grants were used to test some facet of oilseeds production, crushing and oilseeds-based fuel production and use. Grantees served as speakers at workshops or hosted farm tours. Several of the grantees worked with Montana State University or University of Montana scientists to more systematically analyze their on-farm or on-ranch experiments.

At the onset of this project, farmer interest in oilseeds and biodiesel was high. Failed efforts, such as engine malfunctions and biodiesel facility explosions, provided dangerous and expensive lessons. This project sought to reduce these kinds of problems, while at the same time encouraging innovation and sharing new information.

Can farmers grow and make their own biofuel?

The short answer is yes. The basic chemistry and technology to grow and crush an oilseed crop and make biodiesel are well within an individual farmer's grasp. When the Oilseeds for Fuel, Feed and the Future project started, the basic hardware cost for a homebuilt biodiesel processor was $300. A farmer could purchase a pre-built 40-gallon-a-day processor with tanks, plumbing, pumps and other accessories for $4,000. Many farmers have purchased Chinese oilseed presses for prices ranging from $1,000 to $5,000 (4). In an unpublished 2007 analysis, NCAT project staff members estimated that a much higher-quality oilseed crusher and an 80-gallon-a-day processor with sufficient safety and reactant recovery systems would cost about $20,000 delivered and ready.

Including the cost of the hydroxide catalyst and methanol reactant, an individual could buy the most basic equipment and materials to make 60 gallons of biodiesel a day for as little as $3,000. This is just what Ken DeBoer of Ryegate did with his Innovation Grant.

By the end of the first year of his project in 2007, DeBoer, like other early adopters, concluded that he or any other committed farmer could grow, crush and process oilseeds into biodiesel. But he questioned if it was really worth one person's time to do so at a small scale.

DeBoer and other farmer innovators in Montana see multi-farm or community-level production as the next logical step. This next level of production captures some efficiency that could not be obtained by farmers setting up and running individual operations.

Efficiencies include:

1) Labor

This is perhaps the most important factor. If people place no value on their time, this is not an issue. But on-site labor is necessary because even the most reliable crushing and biodiesel production equipment require attention. In 2007 and 2008, Montana farmers confirmed the results of a late-1990s study by the Kansas-based Land Institute. The study and the farmers show that the transaction costs — particularly labor costs — of crushing oilseeds and making biodiesel made individual farm-scale production economically impractical over time, even though it is technologically feasible (5).

According to Joel Schumacher of Montana State University's Department of Agriculture Economics and Economics, labor costs at $10 an hour add 31 cents per gallon to the operating cost of oilseeds crushing and about 37 cents per gallon for producing 10,000 gallons of biodiesel per year in 80-gallon batches (6, 7). Labor applied to producing fuel for more than one farm would make more efficient use of the materials and resources.

2) Taxation and permitting

Unless one intends to "stay under radar" and hope for the best, taxation of homegrown biodiesel very quickly becomes an issue. While the state of Montana has made reasonable efforts to not punish small-scale biodiesel producers who are slow to pay fuel excise taxes, the state still has to uphold laws that require collecting taxes on the first usable gallon of biodiesel whether that fuel is used on or off roads.

Notifying one's insurance company and the local fire marshal are important practical steps to take before starting biodiesel production. Additionally, January 2009 Environmental Protection Agency (EPA) regulations related to the Clean Air Act and the 2005 Energy Policy Act require producers to develop and report renewable identification numbers (RINs) and then retire the number for off-road use. RINs are numbers assigned to every gallon of biodiesel produced to assess progress towards meeting the national Renewable Fuel Standard (RFS). If not addressed and revised, the new deployment regulations will require daily reporting. The permitting and taxation paperwork might be a set of tasks better attended to by one person on behalf of many.

3) Use or disposal of oilseed and biodiesel by-products

There are several by-products and coproducts produced in crushing oilseeds and making biodiesel that might be more efficiently and effectively managed by one person on behalf of several farms. Oilseed pressings, or cake, can be fed to livestock but feeding rates vary by crop types.

There are now legally established standards for feeding rates of all oilseed meal or cake. Feeding the oilseed cake is potentially the most profitable aspect of crushing oilseeds and producing biodiesel, according to almost all biodiesel and biolubricant producers of any scale.

On February 20, 2009 the Food and Drug Administration (FDA) issued a rule stating that broiler chickens can be fed a ration of 10 percent camelina. The camelina feed ration for beef cattle and swine remains at 2 percent. However, this low percentage is not economical for feed mills to incorporate at this time. The Montana Department of Agriculture (MDA) has appealed the FDA ruling on camelina, noting that current research shows camelina can be safely fed to beef cattle at rates three or more times higher than the FDA's 2-percent standard. However, it appears that the FDA ruling will likely stay at the 2-percent threshold for the foreseeable future (8).

This could be devastating news in the near term for Montana camelina processors and growers who were hoping for a higher allowable feeding rate in order to use all the meal that is created in camelina crushing. This ruling could have some bearing on the number of acres seeded to camelina in 2009 and 2010.

Biodiesel production yields several by-products that can become significant management challenges at any scale, including:

1) Glycerin (glycerol)

About 1 pound of glycerol is produced for every 10 pounds of biodiesel. Glycerin can be used as a boiler fuel, animal feed and compost additive or a base for soap, cosmetics and explosives. But the supply of pure glycerin can readily outstrip demand, and there are unique chemical, technical and biological issues in all these applications. Most small producers cannot afford the capital equipment needed to clean glycerin for higher-value products. Other local or regional markets need to be developed.

2) Methanol

While either ethanol or methanol or any alcohol can be used as a reactant, methanol tends to be more frequently used than ethanol. During biodiesel processing, adequate ventilation and careful management of the chemical reaction is essential

so methanol exposure does not create a health hazard for the producers.

Methanol can remain a health, safety and environmental factor well after the fuel is stored or poured. The glycerin by-product can be nearly 40 percent unreacted methanol by volume. Recovering this methanol is an environmental imperative and is almost an economic necessity when methanol costs are high. During the life of this project, methanol prices nearly quadrupled before dropping somewhat in the late fall of 2008. Petroleum diesel fuel prices went up 250 percent before plummeting in the fall of 2008.

3) Wash water

Wash water needs to be properly managed because oil gums, methanol and other contaminants removed by washing the fuel will be present in this water. Wash water and glycerin should not be dumped into septic systems. This is partly because the glycerin and methanol will cause the system to become aerobic and smelly, while the wash water will dilute the ability of the system's bacteria to properly process the waste water.

Other issues include:

4) Fuel quality

Making biodiesel that meets the ASTM (formerly the American Society for Testing and Materials) D6751 standard may not be necessary for a home brewer running an older diesel engine. But for any engine still under warranty, fuel quality and consistency are critical. Biodiesel has to meet the ASTM standard if it is sold commercially or even gifted or distributed within a cooperative.

5) Safety and proper processing technology

Rapid changes in biodiesel processing technology have made waterless washing of fuel affordable. Methanol recovery has evolved from being a good idea to a must-do item, but small- to mid-scale technology is now available to recapture methanol.

These thorny technical and chemical issues can be addressed one farm at a time, but at what point do these issues overwhelm individual, small-scale biodiesel producers? This question should be posed to experienced farm-based biodiesel producers to determine where the tipping point might be.

Animal nutritionist Brian Kerr feeds piglets crude glycerin (the dark liquid), which he has shown to be an excellent source of energy for the animals.

Photo courtesy USDA ARS.

What about straight vegetable oil?

The other vegetable oil-based biofuel

All of the production issues listed above have at least a few Montana farmers thinking that biodiesel production is too fraught with complexities. Some farmers are considering burning straight vegetable oil (SVO) as fuel. There are several companies that make post-market engine conversion kits that allow burning SVO in diesel engines.

One of the Innovation Grants funded through this project tested SVO in farm tractors. The farmers encountered some problems, including fuel corroding the glow plugs.

When properly made, biodiesel can be produced from almost any oil feedstock and burned in virtually any diesel, with the likely exception of the newest Volkswagen TDI engines (9). SVO use requires careful engine retrofits and a very keen understanding of certain oil chemical properties, such as oleic and linoleic acid levels, to ensure that engine damage does not occur.

SVO is not currently a fuel certified by the EPA under the Clean Air Act, so its use in U.S. commerce is not legal. Although Germany is developing a SVO fuel standard, no similar effort is currently being undertaken in the United States.

Bio-energy production or energy efficiency?

NCAT surveyed farmers who attended the project's 2007-2009 workshops and farm tours. Interest in oilseeds and biodiesel production ran consistently higher than interest in all other farm energy efficiency measures. Among farm energy efficiency measures, reducing fertilizer and fuel use were always the highest priorities among survey respondents, but always lower than oilseeds production, crushing and biodiesel processing (10).

The complete survey results were delivered to Montana NRCS in late October 2008. That report is attached as **Appendix I.**

Adding oilseeds to Montana crop rotations

NCAT gave workshop participants the opportunity to complete pre- and post-workshop evaluative surveys at all five oilseeds and biodiesel workshops held from January 2007 through January 2009. Thirty-seven percent of farmers and ranchers who completed the post-workshop survey said they intended to try out an oilseed crop in the next growing season. The percentage varied among the workshop location, from 27 percent to 50 percent. No follow-up was conducted because the survey responses were anonymous. But workshops appear to have had a motivating effect.

On the other hand, statewide statistics tell a very different story. Acres planted to canola, sunflower, safflower and flax have all declined in the past five years. Camelina production in 2008 was roughly half of what it was in 2007. Only mustard production has continued to increase in Montana (11). A summary of Montana oilseed production appears as **Appendix 2** at the end of this report.

The most commonly cited reason for this decline in oilseed acres is higher wheat prices, but that may not be the only factor. Changing agroclimatic conditions or lower prices for some oilseed crops may need to be considered as well.

Changes in current regulations

What's needed to spur oilseeds- and oil-based fuel production in Montana?

Setting aside the macroeconomic conditions such as wild swings in fossil fuel and commodity prices or political factors including such as the RFS, changes needed to create a more supportive environment for on-farm fuel production include:

1) Uniform standards for local fire marshals and health officials on biodiesel production, storage and distribution.

Reports from early adopters cite ignorance and inconsistencies on the part of local officials. Biodiesel storage and handling was simply too new for local officials to set policy and protocols. Probably enough time has passed to develop at least uniform standards.

2) Rules on animal feeding standards for camelina that take into account evolving research on this topic.

Almost all fuel and feed entrepreneurs, advocates and regulators agree on one thing: FDA ruling on camelina feeding rates for beef, dairy cattle and swine are crucial for more of this oilseed being planted and processed.

3) Tax exemption of biodiesel produced exclusively for off-road use at both the federal and state level.

A new Montana law exempts producers who make less than 2,500 gallons of waste vegetable oil-based biodiesel from having to pay state fuel taxes. House Bill 416 was signed into law by Gov. Brian Schweitzer on April 17, 2009. The law takes effect July 1, 2009. There is no exemption from federal or state taxes for biodiesel made from virgin oils. Even biodiesel for exclusively off-road use is taxed in Montana because there is no legal provision for

mechanically injecting dye in off-road biodiesel.

Federal law enforcement is also inconsistent with respect to small-scale biodiesel production and taxes. For example, a producer who attended one of the project workshops had met with a state Internal Revenue Service (IRS) official for many hours to explain what he wanted to do and determine the taxes and reporting needed for IRS compliance. Upon receipt of the tax report, the Washington, D.C., office of the IRS sent a notice of fines and collection of additional taxes because the information provided — as defined by the Montana-based IRS official — did not qualify.

4) Clarity and consistency in the evolving EPA and federal regulations for vegetable oil-based fuels.

Production of biodiesel is relatively simple and a large number of farmers and small businesses can produce fuel for their own use. Unfortunately, current interpretations of EPA and IRS regulations prevent these small producers from taking advantage of the incentives available to larger producers. These small producers cannot sell their biodiesel or collect the $1-a-gallon federal distributor excise tax credit.

To sell fuel commercially or to collect the federal excise tax credit, biodiesel producers must be registered with the EPA and IRS. To become registered, producers must submit data about the health effects of their product and laboratory data certifying its quality.

Small biodiesel producers have been frustrated by the high cost of the testing required to demonstrate that their fuel satisfies the ASTM specification D6751. Being able to prove their fuel meets this specification is not necessary if these small producers use the fuel themselves and do not claim any credits. But if the producers want to sell the fuel or claim the federal excise tax credit, they need proof that their fuel meets the specification. The cost of the testing to provide this proof is from $1,200 to $2,500 for each sample of fuel, a cost that is beyond the reach of many small biodiesel producers. The ASTM specification includes many tests that are unrelated to proper performance of the fuel and it also does not allow the use of less expensive test methods to validate properties.

EPA fuel registration also requires engine and animal testing that can cost several million dollars. The cost of the engine and animal testing can be avoided if the producers join the National Biodiesel Board (NBB), which provides the data as a benefit of membership, but dues are at least $2,500 a year. This is a significant obstacle for small biodiesel producers.

The EPA fuel registration regulations include small business exemptions that were intended to provide a way for small business owners to avoid the requirement for expensive testing. These exemptions are widely used by small companies that produce other fuels and fuel additives. But due to a technicality in the EPA's interpretation of the regulations, the exemptions are not available to small biodiesel producers. If these exemptions could be made available to small producers without the need for expensive testing, it would improve the profitability of biodiesel production.

Rather than trying to meet broad quality specifications, small producers could focus on those properties that directly impact consumer needs and provide a marketable fuel with reasonable testing requirements. Since the objectives of the excise tax credit are to displace petroleum and encourage growth of the biodiesel industry, the IRS should focus on whether vegetable oils and animal fats were used to produce the fuel and let the market and contractual relationships between producers and marketers determine the need for quality confirmation. This could open an avenue for small producers to use less expensive test methods to validate their fuel quality (12). This topic is explored further in an extended citation at the end of this paper.

5) Readily accessible means and venues to quickly share credible information on rapidly changing technologies and policies.

Research, development and decision-making tools have emerged in the last few years that can help prospective biodiesel producers assess materials, equipment, labor and operating costs for certain thresholds of farm biofuel production. However, staying current on these matters can be daunting. Ready access to this dynamic information may increase the efficiency and effectiveness of farmers who want to reduce their fuel and feed bills with homegrown alternatives.

Costs of administering of the Innovation Grants program

What are the implications of grants to farmers for spurring oilseeds- and farm-based vegetable oil fuel production?

NCAT designed the Innovation Grants program with several principles in mind:

1) The grants were to be small (a maximum of $3,000) to stay within the project budget, spur very focused requests from farmers, reduce the price of any failures and ensure that grantees didn't exceed

the Environmental Quality Incentives Program (EQIP) fund ceiling.

2) The grant-making process would be made as simple as possible to keep the paperwork burden to a minimum. The grant applications were one to three pages in length, as were the grant award agreements. The final reports required farmers to briefly answer six questions.

3) NCAT would bear the responsibility of making sure that grants were made in a timely manner and that reports were received and shared with the public. NCAT also made sure that grantees were able to share their experiences in appropriate venues, either workshop presentations, farm tours or on the Internet.

The hourly requirement of administering the Innovation Grants and publicizing the results were about 10 hours for each grant award. This estimate is based on the following activities: writing and distributing the request for applications, recruiting a grant proposal review panel, reviewing all 23 proposals, sending award letters and contracts to nine grantees, notifying those who were not funded, securing reports from grantees, reading and editing those reports for online publication, posting the reports to the Innovation Grants Web site and closing out the grants. The Innovation Grants Web site is www.ncat.org/special/oilseeds.php.

Only one grantee of the nine did not deliver a final report, but that grantee spoke during one of the workshops at the midpoint of his canola feeding project. The other grantees provided written reports and spoke at workshops or hosted tours. The Innovation Grants made to these farmers were good short-term investments.

For organizations such as NRCS, another question needs to be considered. Much larger direct grants to farmers probably have far lower overhead costs per dollar awarded, so what is an effective trade-off from the agency's perspective?

Future paths for NRCS?

NRCS or other agencies need to decide if they accept the premise that multi-farm-based fuel production is a better use of resources than supporting individual farm-scale production or very large commercial biodiesel production of greater than 1 million gallons annually. If the agencies decide this, then following questions need to be considered:

1) Are enough of the favorable taxation, regulation and other conditions listed above in place to ensure that farmers can readily organize and make near-farm, oil-based fuel production a reality?

2) Have the farmers developed a coherent plan to produce fuel for farm use?

3) Have the farmers made a financial commitment to support the production and to use the product?

4) Should a multi-farm, vegetable oil-based fuel production project be piloted or are the necessary ingredients all in place to launch a broad initiative in this area?

5) Should participating farmers be required to partner with local Resources Conservation and Development Programs (RC&Ds), conservation districts or qualified nongovernmental organizations (NGOs)? This may lighten the administrative load for the farmers and the partnering entity may be able to draw outside technical resources to support the effort. But that partnership comes at a cost to the RC&D, conservation district or NGO. Who bears that cost — the granting agency, farmers or the partner?

Using an Innovation Grant, the PEAS Farm in Missoula determined its carbon footprint using petroleum diesel, B20 biodiesel and virgin straight vegetable oil in Kubota tractors on the farm.

Photo courtesy PEAS Farm.

Conclusion

Crushing oilseeds and making biodiesel at an individual farm or on a community scale is happening in Montana. The technical, chemical, safety and quality issues can be addressed with a relatively modest commitment of resources and expertise.

Homegrown biodiesel is here, but is it here to stay? It is unclear what impact regulatory and taxation approaches will have over time on the development curve of smaller-scale biodiesel and other oilseed coproducts. Early evidence suggests that one-size-fits-all taxation and regulatory policies will inherently favor large-scale, well-capitalized production and could discourage or hinder smaller-scale biodiesel producers.

Can regulations and tax policy be "right-sized" to allow some flexibility for smaller-scale production while still maintaining health, safety and quality? How do organizations that want to support sustainable oilseed bio-products and biofuels development provide effective, focused support? Where should they place their emphasis?

How these questions are answered will determine if farm-level or rural, community-based oilseed bio-products and biofuel development can proceed and grow, or if the new, smaller-scale ventures are driven underground or out of business. If the goals of improving soil and air quality; reducing off-farm inputs and fossil fuel dependency; and creating new, profitable, small- to mid-scale businesses for rural communities are worth achieving, aligning policy with these objectives needs to be a priority in the years to come.

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Note: Biodiesel made from canola or rapeseed will work effectively in Volkswagen TDI diesels, according to Howard Haines.

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Background

As a safeguard against harmful exhaust emissions, the EPA requires that producers of fuels and fuel additives (F/FA) intended for use in motor vehicles register their products. The authorization for this registration process is provided in sections 211(b) and 211(e) of the Clean Air Act and the F/FA regulations are sometimes referred to as the 211 regulations. The regulations are described in detail in 40 CFR Part 79.

Fuels that are not sold into on-road markets are exempt from 40 CFR Part 79. These include fuels sold as heating oil; for farming, construction, marine and power generation; and for other off-road uses. To qualify for this exemption, a biodiesel producer can never sell biodiesel to anyone who will use the fuel in a licensed vehicle for on-road use all or part of the time.

Many groups have started producing biodiesel for their own use on and off the farm and have gained the expertise needed to produce high-quality fuel. These groups are often surprised when they want to produce a commercial product and find out that they are subject to fines of up to $25,000 a day for producing unregistered fuel.

Small business provisions

To ease the impact of the testing costs on small producers, the F/FA regulations state that fuel manufacturers of baseline and non-baseline fuels with annual sales of less than $50 million only need to submit basic registration data such as what the fuel contains and how it is used. These companies are not required to submit engine testing or animal testing data. This is a savings of virtually all of the cost of the registration process. Baseline fuels are petroleum-based and non-baseline fuels can come from other feedstocks. Biodiesel was initially considered to qualify as non-baseline by the EPA. But biodiesel was reclassified as atypical because it is not identical to diesel fuel. Atypical fuels are considered to be potentially dangerous and subject to more severe testing requirements. Ironically, although biodiesel is nontoxic and has been demonstrated to have less harmful emissions, the EPA has grouped it with the most dangerous class of fuels.

Small producers of atypical fuels can also qualify for an exemption but the limiting figure for annual sales is only $10 million. These producers are also still required to submit engine testing data. Collecting these data can be quite expensive, costing between $200,000 and $250,000.

In addition to small business waivers, the EPA allows manufacturers to submit health effects test data that conforms to the same grouping criteria, such as atypical, as the tested product. The NBB, using funds from the National Soybean Checkoff program, sponsored a program to develop the required data. This test program has been described in a number of publications [1-4]. The EPA has

accepted the NBB data and now other companies, with written permission from the NBB, are allowed to use the data for their own registration process. The NBB has made their health effects data available to its members at no charge beyond their annual membership dues. Non-members must pay $100,000 plus twice the volume dues paid by NBB members on gallons produced. The regulation specifically states that previous submitters, NBB in this case, are entitled to reimbursement for an appropriate portion of its costs incurred to gather the information. This has produced a situation where NBB, as the submitter of data, has an EPA-enforced role as the gatekeeper for new entrants to commercial biodiesel production. They currently charge membership dues of $2,500 a year plus a fee for each gallon of fuel produced. Since their dues are based on annual production, the NBB claims the right to inspect the facilities and audit the financial records of all their members to ensure the accurate reporting of production levels.

Conclusion

To sell fuel commercially, biodiesel producers must be registered with the EPA. This registration requires expensive health effects testing and proof that the fuel meets the requirements of the ASTM specification. To collect the federal excise tax credit, the IRS also requires fuel testing to confirm that the fuel meets the ASTM specification. If the EPA could be convinced to return to their earlier conclusion that biodiesel was a non-baseline fuel, this would eliminate the need for the expensive testing or membership in the NBB by allowing small producers to qualify for existing small business exemptions. If the IRS could be convinced to focus on whether the fuel was produced from a vegetable oil or animal fat feedstock rather than on strict compliance with every property in the ASTM specification, then small producers could certify their quality much less expensively.

Appendices

1) Montana farmers' and ranchers' perceptions of on-farm energy efficiency and bio-energy development

2) 2008 annual oilseeds summary and table

Appendix I

Montana farmers' and ranchers' perceptions of on-farm energy efficiency and bio-energy development

October 24, 2008

Al Kurki, National Center for Appropriate Technology

Introduction

One of the Oilseeds for Fuel, Feed and the Future Project outcomes is: "100 producers involved in the project clearly indicate their perceptions (interest or disinterest) of farm energy audits and farm energy calculators – in terms of cost, benefit, user friendliness, and usefulness."

During the spring and summer of 2008 the National Center for Appropriate Technology (NCAT) used two survey instruments to gather input from 85 farmers and ranchers. NCAT was seeking answers to several questions including:

1) What is the perceived importance of reducing costs in fertilizer, fuel, home/shop heating and home/shop electrical power, relative to one another?

2) What factors are most important for a farmer to conduct a farm energy audit?

3) What tends to be a farmer's price point for farm energy audits?

4) How important is farm energy management relative to on-farm bio-energy production?

Methodology

A short survey and stamped return envelope was mailed in April 2008 to 276 farmers and ranchers who received the March 2008 Montana Oilseeds Update, a pilot publication developed by NCAT. The survey was also posted to the Oilseeds for Fuel, Feed and the Future project Web site. The survey tool and processes were designed to ensure complete anonymity and confidentiality of the survey respondent.

The survey covered three topics:

1) Any change in action that growers undertook as a result of having attended Oilseeds for Fuel, Feed and the Future workshops in 2007.

2) Impressions of the Montana Oilseeds Update newsletter.

3) Several questions on farm energy management and audits, which are described in detail in the **Results** section below.

NCAT followed the survey mailing with a post card reminder, and finally a letter asking survey recipients to complete the survey. Twenty-five farmers and ranchers returned the mail survey and 3 completed the online survey. The low response rate was due to the timing of the mail survey. Spring seeding had already begun and it was early June by the time the last reminder letter was sent out.

NCAT used a different survey and approach at three Oilseeds for Fuel, Feed and the Future farm tours held in May and June 2008. At all three tours attendees were affirmatively handed the short survey and asked to complete it on the spot. One-hundred-ninety-six people attended these tours, 83 completed the survey and 57 of those respondents were farmer or ranchers.

In the half-page survey, NCAT asked attendees for their impressions of the farm tour and then asked them to rank several farm energy management and bio-energy production factors.

Copies of both survey instruments are available upon request, as are the results of the non-farm survey respondents. For the purposes of this project report, the results discussed below are only farmer and rancher responses to the surveys.

Farm energy management survey results

Farmers and ranchers gave much higher priority to reducing fuel and fertilizer costs than to reducing home and shop heating or electrical power costs. Furthermore, respondents were somewhat more likely to rate reducing heating and electrical power costs as "not at all important" or "not important" than they were to give these low ratings to fertilizer and fuel cost reduction.

Cost was the most important factor in deciding whether to have a farm energy audit, followed by auditor's skill and qualifications and then convenience. No respondent was willing to pay more than $499 for a farm energy audit, and most producers would pay $0-$299 for an energy audit. Just under half of all respondents indicated they would pay $100-$299.

Over 80 percent of respondents said they would attend a free farm energy management winter-time workshop within 100 miles of their farm or ranch. The tables at the end of this report outline complete questions and results.

Weighing bio-energy production and farm energy management survey results

Farm tour attendees were asked the following question in the short survey they received:

Please rank the items below in terms of what is most important (#1) to what is least important (#8) to you.

____ How to raise and harvest oilseed crops

____ Oilseed crushing

____ Making biodiesel

____ Reducing shop/home heating costs

____ Reducing shop/home electricity costs

____ Reducing fuel consumption in crop production

____ Reducing commercial fertilizer use

____Other: _____

While there was some variation in among farmer/rancher respondents at each of the three tours, the aggregate results were:

1) Reducing shop/home electrical costs always ranked last

2) Reducing home/shop heating costs never ranked higher than fifth of the eight choices, and only that high with attendees of one farm tour.

3) Reducing fuel consumption in crop production was consistently rated fourth or fifth most important.

4) Reducing commercial fertilizer was consistently rated sixth among all tour respondents.

5) Oilseed crushing and how to raise and harvest oilseeds were always in the top three.

6) Making biodiesel was always the most important or second most important priority.

Discussion

Several qualifiers need to be outlined as they may limit what conclusions can be drawn from the findings. First, this is a very small sample of Montana farmers and ranchers. They were involved in one or more facets of the Oilseeds for Fuel, Feed and the Future project — having either attended a farm tours or workshop or having received the Montana Oilseeds Update newsletter. They were motivated to participate and gain more information on the project topics.

Second, the tour topics — a ranch making and using both biodiesel and straight vegetable oil, a farm raising camelina and a farm raising and crushing camelina for farm equipment fuel — would draw an audience with possibly higher interest in bio-energy over farm energy management.

Finally, the timing of the survey may have had a slight effect on the respondent's choices. Both surveys were conducted when petro-diesel fuel and fertilizer prices were nearly at their 2008 peak. However, the entire project for which this evaluation was conducted was conceived and supported by farmers and agriculture professionals in early 2006. Attendance at project events and other activities has been high throughout its two-year existence.

Recognizing these limits does not render the results invalid. NCAT's experience in conducting farm energy calculator use workshops showed that far fewer people were drawn to farm energy management events than to renewable energy or bio-energy events, even with the same commitment of resources to publicity and organizing. Likewise, NCAT's irrigation efficiency work over the years generated many stories of producers participating in irrigation system audits and retrofits only to the point that someone else's money was "on the table," not their own.

Conclusion

NCAT conducted these surveys to get a sense if this anecdotal evidence and impressions gathered over the years carried any weight. While these efforts are no substitute a more scientifically rigorous survey process conducted of a large farming population, we conclude that the results have value in several ways.

This data suggests that audit and educational efforts aimed at reducing fuel and fertilizer costs probably will elicit more buy-in on the part of producers than those focused on reducing space heating and electrical power use and costs. In addition, NCAT will probably continue its efforts to integrate energy-saving information into more attractive bio-energy education events.

The energy audit price point information may prove helpful for organizations interested in working with producers on farm energy management. The results of question 5 suggest that there is a wide gap between what farmers and ranchers are willing to pay and what an energy audit really costs. See **Table 5** below for more information. For example, companies such as Ensave charge $1200-$1500 for a basic farm energy audit. NCAT's actual costs for irrigation audits conducted mainly in Southwest Montana were $700-800.

NCAT is interested in further discussions on farm energy management with technical service providers and policymakers.

2008 biofuel and oilseed workshop feedback results

28 total surveys received

Table 4

	Not important at all	Not important	Somewhat important	Very important
Reducing shop/home heating costs	3	5	6	13
Reducing shop/home electricity costs	3	3	9	12
Reducing fuel consumption in crop production	2	2	6	18
Reducing commercial fertilizer use	1	1	6	16

Other responses:

"Reducing irrigation pumping costs — very important"

"Coal uses"

"Protecting fuel costs"

"Variable rate fertilizer"

"Reducing Roundup costs"

"Getting our co-op provider to accept 1-year net meter reading"

Table 5

What would be the most important factor to you in deciding whether to have a farm energy audit?

Cost	18
Qualifications and skill of the audit provider	13
Convenience	11
Under no circumstances would I consider a farm energy audit	4

Table 6

If an energy audit could provide you information on any of the items you marked important or very important in question 4, how much would you be willing to pay for an energy audit?

$0	6
Less than $100	4
$100-$299	11
$300-$499	4
$500-$799	0
$800-$999	0
$1,000-$1,199	0
$1,200-$1,500	0

Table 7

If a free workshop on farm energy calculators and how farm energy audits work were held within a 100-mile radius of your farm or ranch during the winter, would you attend it?

Yes	21	No	4

Appendix II

2008 annual oilseed summary and table

Released: January 12, 2009 by the Montana Agricultural Statistic Service.

For more information contact John Hilton or Thomas Chard at 1-800-835-2612.

Montana's flaxseed production in 2008 was 72,000 bushels, down from 180,000 bushels in 2007, according to the Montana Field Office of the U.S. Department of Agriculture National Agricultural Statistics Service. Growers planted 9,000 acres and harvested 8,000 acres in 2008, compared with 21,000 acres planted and 20,000 acres harvested in 2007. The average yield for 2008 was 9 bushels per acre, unchanged from 2007.

Production of mustard seed for 2008 was 9.59 million pounds, compared with 6.63 million in 2007. Planted acres were 27,000, up 12,000 from in 2007. Harvested acres were 23,400, compared with 13,000 acres in 2007. Mustard seed yields averaged 410 pounds per acre in 2008, down 100 pounds per acre from 2007.

Montana canola growers planted 7,500 acres in 2008, down 1,000 acres from 2007. Harvested acreage was 7,400 acres, down 700 acres from 2007. The 2008 canola yield was 1,910 pounds per acre, up 720 pounds per acre from 2007. Canola production totaled 14.13 million pounds, up from 9.64 million pounds in 2007.

Growers produced 16.80 million pounds of safflower, down from 31.88 million pounds produced in 2007. Safflower planted acres for 2008 totaled 29,000, with 28,000 acres harvested. In 2007 there were 39,000 acres planted with 37,500 acres harvested. Yield was 600 pounds per acre, down 250 pounds per acre from 2007.

Montana's 2008 all sunflower production was 650,000 pounds, compared with 2.97 million pounds produced in 2007. Producers in the state planted 1,500 acres and harvested 1,300 acres in 2008, compared with 2,600 planted acres and 2,500 harvested acres in 2007. The average yield was 500 pounds per acre for 2008, down 686 pounds per acre from 2007. Yield was the lowest since the series began in 1999.

Flaxseed production in 2008 totaled 5.72 million bushels, down 3 percent from 2007 and 48 percent below 2006. Harvested area totaled 340,000 acres in 2008, down 3 percent from 2007 while the average yield, at 16.8 bushels per acre, is down 0.1 bushel from 2007. Production decreased from 2007 in all four states in the estimating program (Minnesota, Montana, North Dakota and South Dakota).

Mustard seed production for 2008 increased 19 percent from last year to 41.3 million pounds. Planted area, at 79,500 acres, is up 33 percent and harvested area, at 71,500 acres, is up 25 percent from 2007. Yields averaged 577 pounds per acre, 31 pounds below 2007.

Canola production in 2008 is 1.45 billion pounds, up 1 percent from 2007 but down 3 percent from the October forecast. The yield, at 1,461 pounds per acre, is up 223 pounds from the 2007 yield but down 53 pounds from October. The yield is the third highest since records began in 1991. Planted area is estimated at 1.01 million acres, 14 percent below 2007 acreage. Harvested area, at 989,000 acres, is also down 14 percent from 2007. Production in North Dakota, the leading canola-producing state, is estimated at 1.31 billion pounds, down less than 1 percent from 2007. Although the yield in North Dakota was up 230 pounds from 2007, harvested area was down 16 percent from 2007.

Safflower production in 2008, at 310 million pounds, is up 47 percent from 2007 and is the largest production since 1999. Growers planted 202,000 acres in 2008, an increase of 12 percent from 2007, while harvested area, at 195,000 acres, is up 14 percent from 2007. The yield, at 1,592 pounds per acre, increased 364 pounds from 2007.

The 2008 sunflower production totaled 3.42 billion pounds, up 19 percent from 2007. The U.S. average yield per acre increased 3 pounds from 2007 to 1,429 pounds. Planted area, at 2.52 million acres, is 22 percent above 2007. Area harvested increased 19 percent from 2007 to 2.40 million acres.

2008 annual oilseed summary

Crop	Year	Montana						US
		Planted (000) acres	Harvested acres (000)	Yield Bu/ acre	Production (000) Bu	Season avg. price $ 1/	Value of production (000) 1/	Production (000) Bu
Flaxseed	2005	55	54	17	918	$6.20	$5,692	19,695
	2006	35	33	9	297	$6.13	$1,821	11,019
	2007	21	20	9	180	$13.10**	$2,358	5,896
	2008	9	8	9	72	--	--	5,716
		(000) acres	**(000) acres**	**Lbs/acre**	**(000) lbs**		**(000)**	**(000) lbs**
Canola	2005	17	16.5	1,290	21,285	$9*	$1,916**	1,580,985
	2006	10	9.8	1,120	10,976	$11.70	$1,284*	1,394,312
	2007	8.5	8.1	1,190	9,639*	$16.20**	$1,562	1,430,734
	2008	7.5*	7.4*	1,910	14,134	--	--	1,445,064
Mustard seed	2005	11.5	10.8	580	6,264	--	--	35,114
	2006	7	6.9	570	3,933	--	--	28,220
	2007	15	13	510	6,630	--	--	34,670
	2008	27	23.4	410	9,594	--	--	41,255
Safflower	2005	30*	29	890**	25,810	$14	$3,613*	218,995
	2006	39	37	750	27,750	$13.50*	$3,746	196,955
	2007	39	37.5	850	31,875	$16.50**	$5,259**	210,645
	2008	29	28	600	16,800	--	--	310,433
Sunflower	2005	6.8	6.4	1,150	7,360**	--	--	4,017,115
	2006	3.6	3.5	1,278**	4,474	--	--	2,143,613
	2007	2.6	2.5	1,186	2,965	--	--	2,868,870
	2008	1.5*	1.3	500*	650	--	--	3,422,840

1/ season average price and value of production for 2008 are not yet available *Record low **Record high

Camelina

Acreage, yield and production for Montana

Year	Acreage		Production		Value	
	Planted	Harvested	Yield per acre (pounds)	Total pounds (000)	Price per cwt. dols.	Value of production dols (000)
2008	12,200	9,100	569	5,181		
2007	22,500	20,400	598	12,197	9.18	1,112