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Research Investigates Economics of Biodiesel Production from Dryland Camelina

By Thomas Foulke

Thinking about producing biodiesel on the farm? Some new research from the University of Wyoming, College of Agriculture and Natural Resources might help in your decision-making process. As part of a wider ranging project studying the suitability of Camelina as a dryland crop for Wyoming, research in the Department of Agricultural & Applied Economics has been investigating the economics of on-farm biodiesel production.

Essentially, at current fuel prices, the economics are not favorable for on-farm biodiesel production from camelina (other oilseeds were not specifically addressed in this project but may have similar cost structures). So why would anybody look at biodiesel production in the first place? Bret Hess, the project's principle investigator and the Director of the UW Agricultural Experiment station put it this way, "This project is cutting edge science to try and get ahead of the curve in evaluating new crops for Wyoming," says Hess, adding, "When we started this project in 2008, diesel prices reached over $4.00 per gallon and there was a lot of interest in on-farm biodiesel production. The emphasis has waned somewhat, but as we have seen over time, it is likely to return. By completing this research now, we hope to be ready, when the next energy crunch comes along."

The economics portion of the project uses a systems approach to try to understand how a biodiesel production scheme would fit into a dryland wheat farm. Budgeting software was used to evaluate the cost and returns of growing camelina in place of fallow and then taken several steps further to investigate the pressing costs, the substitution of camelina meal for other grains as a feeding supplement for cattle and the costs of producing biodiesel from the oil.

The results show that it is fairly expensive for an individual farmer to set up a biodiesel production facility to handle the amount of oil produced, while trying to cover the costs of production, especially with a new crop such as camelina, which does not have a well-developed market. In that respect, it is not too surprising that the economics are not currently favorable.

How much?

People often ask, "How much does it cost to make biodiesel and at what price of petroleum diesel does it make sense to start making your own?" I'm not trying to dodge the question when I answer, "It depends," because there are so many variables involved. You have to think of this system, kind of like a machine with lots of gears. The more gears you have, the tighter the tolerances. In this system we don't just have a crop or livestock question, we have both, plus the biodiesel manufacturing process.

As with any economic question, it's a matter of costs and returns; how much it costs to grow the crop, press the oil and convert it to biodiesel versus what the value of the product is. If the price of petroleum diesel rises, then so do your growing costs, fertilizer, fuel, pesticides, and even labor. These will feed back into the system, reducing potential returns. Of course, if crop prices rise, these will be mitigated, but as all farmers know, there is no guarantee there.

Capital Summary	
Total estimated	Startup costs
Capital equipment	$4,671
Press cost	$12,500
Storage tanks	$1,959
Testing and Safety equipment	$312
Total estimated start-up costs	**$19,443**

So what do the economic look like? Starting from scratch, it would cost about $19,400 for a complete 50-gallon batch system (makes 50 gallons at a time). That includes a one ton per day press, all the tanks, pumps and piping as well as testing equipment to get started. Tanks for oil storage and blended biodiesel (we assumed a 20 percent or B20 blend) will also be needed. This assumes that you provide all your own labor too. There are some kits available, but people should be careful with these as they often do not include all the materials really needed for processing, production and storage of your biodiesel. Like any investment decision, it is important to do your homework first, before you start writing checks.

The press is a huge part of the overall costs and with the prices received today. It's hard to justify a press for on-farm use, unless you are pressing a lot of seed and have a lot of cattle to feed. This means that if you are really interested in on-farm biodiesel production today, it may make more sense to investigate some sort of multiple ownership arrangement for the press. Our project did not allow for that in the initial phase, but we are currently investigating that question. It appears to make more sense to share the cost of an expensive piece of equipment such as a press. Still, that leads to questions about timing the usage of the press and could add transportation costs for seed, meal, and oil.

As an economist, when I look at costs, I try to get the whole picture. That means looking beyond just the cash costs for inputs and trying gather all the costs associated with this enterprise. I want to understand the opportunity costs of capital. In other words, what else could I be doing with my money if I were not investing in biodiesel equipment? And what makes this opportunity a compelling value for my money? To do this, I need to think through the entire process and account for depreciation of the equipment as well as factors in the growing process such as taxes, insurance and machinery costs as well as annual maintenance (Is there anything that is really "maintenance free"?).

Putting all this together, we can now look at the cost of producing biodiesel from two different perspectives. One includes ownership costs, such as depreciation and the costs of growing the camelina seed feedstock. The other is without ownership costs and more akin to cash costs, though I have added in the depreciation of the biodiesel equipment just to be on the conservative side. Note that there are no transportation costs as this is assumed to be all on-farm.

Cost of production *(batches are 50 gallons)*	**With ownership costs**		**Without ownership costs**	
	Per gal	per batch	Per gal	per batch
Camelina oil, gallons	$3.48	$174.21	$0.56	$27.98
Chemicals	$0.15	$7.60	$0.15	$7.60
Annual operating cost	$0.03	$1.69	$0.03	$1.69
Capital depreciation (5 percent of startup)	$0.61	$30.58	$0.61	$30.58
Annual maintenance costs (5 percent of startup)	$0.61	$30.58	$0.61	$30.58
Total	**$4.89**	**$244.65**	**$1.97**	**$98.42**

The results show that from a full cost perspective it will cost about $4.90 to produce a gallon of biodiesel. Without ownership costs, the per gallon costs are reduced to about $2.00 per gallon. These numbers were produced based on a petroleum diesel input price of $2.78 per gallon. If the price of a gallon of diesel were to rise, then one could expect growing costs to rise as well, effectively making the breakeven cost of producing biodiesel a moving target.

Our investigation was necessarily narrow, given our project goal of evaluating the potential of camelina for dry land applications and feeding in Wyoming. Per unit growing costs would be less in areas where yields are higher. Some producers might be able to assemble their equipment for less cost or have some other arrangement for pressing to reduce those costs as well. Every situation is going to be a little different. The important thing to remember is to try and think through the entire process, collecting cost information before investing time and money in materials and equipment.