Harvesting Energy from Plants

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By Roger Witherspoon

It is called winter canola, and the crop is a mainstay in Canada.

But that harsh northern climate allows for the maturation of only one canola crop annually, while the warmer Alabama climate and rich soil is capable of producing two hardy harvests per year. That agricultural fact, and the growing need for biofuels, propels Alabama A&M University's Ernie Cebert (**Ernst.cebert@aamu.edu**) to try and coax local farmers into planting more of the crop.

"Currently," explained Cebert, "soy bean is the primary crop used to produce bio diesel fuel. It is a simple chemistry process: you get the seed, press the oil, and it gives you about 50 gallons of diesel per acre.

"Canola can produce up to 170 gallons per acre of bio diesel as the seed has a higher concentration of oil than soy bean seed. Because of the push for more and more bio-energy, canola is gaining a great deal of popularity among bio diesel producers and people who would like to produce bio diesel."

Cebert, an assistant professor in plant breeding at Alabama A&M, has been dividing his time between agricultural pursuits and the mechanical engineering technology group in the school's eight-year-old engineering department measuring the oil production and, more importantly, the energy rating of the different types of biofuels. Their research shows, he said, that in terms of power there is virtually no difference between the petroleum diesel purchased at a gas station and the energy produced from any plant source, though there are other distinctions.

"The problem that exists with bio diesel is the same you would see with lard or grease," said Cebert. "If the temperature gets too cold – whether it is from peanut oil, coconut oil, or canola – you can have problems with the fuel lines. The coconut oil can actually gel.

"That's why no one promotes using 100 percent biodiesel in your vehicle. There is E-85, where there is 15 percent regular gasoline. With biodiesel, you use 20 percent biodiesel and 80 percent regular diesel. The advantage is that diesel is a clean fuel and does not produce carbon dioxide that will increase pollution. It burns completely, as opposed to the old diesel car and trucks where you see smoke coming out of the tailpipe as they rev the engine. That is the unburnt part of the fuel escaping. With biodiesel, all of it will burn in the compression process."

Cebert, a plant specialist, and the engineering department have been studying the effectiveness of bio diesel on small engines, like those used in lawn care businesses. Using an Alabama Department of Agriculture grant, Cebert and the engineering school developed a bio-diesel classroom on wheels which tours the state and shows farmers how to convert plants into fuel.

"We are going green in the agricultural department," Cebert said, "and we depend on the engineering sector to help us do that."

The melding of teaching and research between engineering schools and disparate departments at universities has been fostered by the need to consider environmental impacts that transcend single disciplines. Civil engineers can no longer learn just to build bridges over different types of terrain. They have to consider ways to minimize the impact on surface and sub-surface water systems, protect wetlands, allow for animal migration and develop catch systems to contain runoff from the surface of their highways.

That has pushed departments which often competed against each other for grants, to look at collaborative ventures.

"Now, you have to have inter-disciplinary projects before going out to seek funds," said Cebert. "This is the reason my little biofuels project is working with people in the engineering and biology and chemistry departments, and I am not just sticking with my agricultural colleagues. We need to be able to cover all of the angles."

Covering all of the angles is the goal of, Dean Trent Montgomery (**trent.montgomery@aamu.edu),** whose School of Engineering and Technology**,** still in its infancy, is working with the Department of Agriculture to set bio-fuel energy standards for Alabama. "If you buy gasoline," said Dr. Montgomery, "all regular gasoline is the same, even though companies advertise that they put cleaning ingredients in it. The government says you really have to get the same amount of energy out of the same amount of fuel.

"As we develop new fuels, there have to be standards, and we are working to determine what that standard should be."

The engineering school began just a decade ago, and was fully accredited for civil, electrical, and mechanical engineering in 2001. They are in the process of developing masters level engineering programs – but for now, are dealing primarily with the basics.

"We have had to go through the whole experience of building up our enrollment, hiring faculty members, building lab experiments and, after we were accredited, working with architects to get the engineering building constructed," Dr. Montgomery said. "Now we are at the point of working on specialty labs.

"The agricultural department, on the other hand, has been here and gets resources from the US Department of Agriculture. They have gotten whole buildings from the USDA, but we don't have a national engineering foundation with the resources to do that.

Down the road there will be more collaboration with the Agriculture department. They have a top rated department and those guys have done some rather amazing things at the school. But engineering is relatively new and we have to work on the relationship between departments."

The Dean's environmental list calls for research ties with virtually every department at Alabama A&M, a step which will be necessary to compete for federal funding in the future. The National Science Foundation, he said, has changed its funding formula so at least half of its grants will go to multi-disciplinary projects.

"The handwriting is on the wall," Dean Montgomery said. "We know we need to move in that direction and

But the reality of the development of a new department is that first they have to teach core courses and, with time, develop the financial resources to bring in research faculty and expand their range.

"In civil engineering," Dr. Montgomery said, "we have five faculty members teaching engineering science courses and civil engineering. They are hard core civil engineers. I worry about how well we can compete with other universities that have full time researchers and no classes to teach. They don't have to answer to any accrediting agency. They don't have to get out monthly reports on retention and can look exclusively at research projects and write proposals.

"I can't do that yet. We hope to get additional faculty members and are trying to bring a few projects onto campus so we can get a higher research profile. It takes time and money. One of these days, I feel sure we will get there. But it's a step by step process."