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## *Technology: Biomass, Fuels and Co-Products*

### *Q&A*

MODERATOR: KEN DASCHIELL

*USDA-ARS North Central Agricultural Research Laboratory  
Brookings, SD*

*Sonny Ramaswamy (Purdue University):* Mark, in your gasifying system, how do you deal with the carbon dioxide that is released as well? It tends to be quite a lot.

*Mark Bricka:* I'm not real worried because it's not controlled—it's not regulated. If the government comes back in and says you have to control it then you could absorb it. Our students have done some studies on how to absorb and sequester it, but right now it's not an issue.

*Wally Tynes (Purdue University):* Kurt, you indicated that poultry people aren't interested in the DDG that comes out of the fractionated process and I don't quite understand why. In poultry rations the constraint you hit is fiber and usually the fractionation processes cut both the oil and the fiber. If you need more oil they can get a cheaper oil or you can put the corn oil back in. It's not clear to me why the poultry people or hog people wouldn't be interested in something with lower fiber.

*Kurt Rosentrater:* I'm not an animal scientist and don't claim knowledge in that arena. I'm reporting what I've heard. I should give you the caveat that they still don't completely understand the DDGS in poultry or swine diets, although there's a lot of work going on right now. An aspect they are really interested in: if we pull out the fiber and if we pull out the oil what can we use to supplement DDGS in these complete rations? Glycerol—a by-product from the biodiesel industry—is a potential source of energy. So, with DDGS from a traditional dry mill plant they've got a product stream that they are still learning about. They haven't completely encapsulated all of the knowledge in terms of feeding. When we start using these modified products, it throws the whole system out of whack and they're going to have to do a lot more research.

*Dennis Buffington (Penn State University):* I'm interested in water requirements for conventional corn-based ethanol plants and for biomass-ethanol plants.

*William Gibbons:* For corn-ethanol production plants, they've become extremely good at recycling water and so utilization now is just a matter of 2 to 3 gallons of water per gallon of ethanol. A lot of that is due to recycling and reuse of the thin stillage stream and they do a lot of evaporation which, of course, is energy-intensive. Nobody really has a good feel right now for biomass, cellulosic ethanol, what that's going to entail. The demonstration plants the DOE is helping to fund will hopefully answer a lot of those questions, but, just anecdotally, corn-ethanol plants now typically run in the 15% to 18% ethanol concentration range in their fermentation streams and with biomass—just due to low bulk density—you might be able to reach 7% to 8% ethanol tops, before you start running into problems in terms of flowability issues. So, those numbers show you have significantly more water in the system. Now you are not going to dispose of that water, it's going to cost you in terms of evaporating that water, concentrating the resulting stream so the net use might end up being fairly similar. But there is going to be a lot more water flowing around in the plant during the operations.

*Audience Member:* Mark, you mentioned that Europe is ahead of us in technology as far as gasification is concerned. Are we in the US trying to advance their technology or create a better mousetrap?

*Bricka:* A lot of people are working on gasification and are in close communication with colleagues in Europe. We're trying to expand upon what they've done—not necessarily reinventing it, but improving it.

*Maria Wellisch (CANMET Energy Technology):* Kurt, I understand that antibiotics are used in commercial ethanol fermentation. Are issues or concerns raised regarding antibiotics in DDGS and potential impacts in terms of feed and so forth?

*Rosenrater:* Prior to this year I hadn't heard much talk of antibiotics in DDG. It was just one of those “don't mention it, don't think about it, don't talk about it” things. Antibiotics are used from time to time. In fact, in several states, the FDA is starting programs to monitor antibiotics and DDG. It's on the radar screen. In fact, the meeting I was at last week, with the Distillers Grains Technology Council, had a presentation on this subject. There's one antibiotic that is not necessarily approved yet, but they haven't said it can't be used. So it's a growing concern and it's on the FDA's radar screen.

*Gibbons:* A side-note to that—several companies are looking at alternative materials to antibiotics to control contamination in ethanol plants.

*John Gross (Farm Service Agency):* A two-part question for Kurt: One, has there been any cost study on pelleting distillers grains, because I know there's a problem shipping them

to the west coast and getting them out of railcars. Number 2, many are concerned about what to do with all of the distillers grains and other by-products. I visit dairies and within the past 2 months was told by the management of a very large operation in the upper Midwest that this might be the last year they use products from ethanol plants as feed. The reason is that poor digestibility is causing lower butterfat content. To get high butterfat you feed rough hay and a lot of fiber. When a person milking 3,000 cows makes that kind of comment, it's something for you to think about.

*Rosenrater:* Regarding pelleting: I've received several calls this past year about pelleting DDG, specifically from West River South Dakota. Several ranchers are interested in feeding the material, but they can't logistically handle it. In my laboratory we're looking at approximately ¼-inch diameter pellets. We can make them for somewhere between \$1 and \$3 a ton and we've had success working with some of the pellet mill manufacturing companies. There's potential, not just for West River but also for west-coast rail shipment. Pelleting DDGS reduces propensity for flowability issues. It increases flowability, it increases bulk density, so you can actually get more of your DDG on your rail cars, up to 20% to 30% more. That has interesting implications for the logistical side of things. Whether between \$1 and \$3 a ton is justifiable economically is for specific plants to look at.

Regarding question #2, every once in a while I come across people who say that they are not going to feed DDG or the wet grains any more, but 99% of the time the people that I interact with say they want more. I've talked to several dairy producers and they can't get enough of it. In fact, last year the price of DDG was relatively high compared to those of other feedstocks. There was a tight supply of DDG, yet people couldn't get enough. That pressure is going to be somewhat alleviated this year as more plants come on line. There's still a lot of opportunity for research on how best to use DDG in animal rations, whether it's dairy-cow or grower/starter diet for pigs.

*Tony Shelton (Cornell University):* This is a question for Richard Flavell. You work primarily with perennial crops and mentioned that you are using traditional plant-breeding techniques as well as looking at genetic engineering. What traits would you be able to introduce into your plants only through genetic engineering? And do you have any concerns, especially with perennial plants, about obtaining approvals in the United States as well as other countries?

*Richard Flavell:* There are the sorts of properties that don't exist in those species, *e.g.* some sorts of pest resistance or disease resistance. One might focus on composition; how do you change cell-wall structure in a way that's going to open up the economics of what we've been talking about. Another aspect is that the genetics of these crops is very complicated and, therefore, getting all the right alleles together in the right plant—commercially and agronomically—will be more difficult than with corn, for example. So, it may turn out that if you have a form of drought tolerance that is existent in that species but it's hard to get it into an array of desired cultivars efficiently, then put it in transgenically.

On the second issue—reactions from the general community, the environmentalists, the regulators, are hard to know. I suspect there will be a lot of caution, a lot of concern, and that is clearly going to delay taking up any opportunities that are perceived to be valuable. That's why, on my last timescale slide, we put transgenics much further back. It's not that they couldn't be brought in earlier, but I think the reality is it's going to be a slower process due to acceptability. I would add that there are good reasons why one would want to control pollen flow from and seed viability of transgenics, and that's why companies like ours are making sure that we have the toolbox to stop seed production and pollen flow if and when there are characters that we want to introduce with transgenes, but we don't want to contaminate the rest of the species with those features.

*Rick Brenner (Agricultural Research Service):* David, you had some difficulty with venture funds. Have you looked at any state-operated funds or even something available through rural development? If you have, what are you seeing as the barriers from these sources?

*David Ramey:* Basically name recognition. I'm not the greatest grant writer in the world. Dr. Yang wrote our grant for the DOE, but I submitted a couple of proposals after phase 3 came into effect and was rejected. So we tried to find a source in the private sector. I think now that we've got a person who understands that we've just got to make 50 gallons a week. When we achieve that, we'll probably be able to access some state and federal funds to leverage that money. Money definitely helps, but microbes are different critters. They take time to mature and we're after stability. Once you get one of these reactors up it's like a cat or a dog, it's a living entity that can survive for years. So, we're really after stable runs and scaling up bigger and bigger.