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# *Biofuels, Food & Feed Tradeoffs*

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*Edited by*

**Joe L. Outlaw**

*Agricultural and Food Policy Center  
Texas A&M University  
College Station, TX*

**James A. Duffield**

*Office of Energy Policy and New Uses  
US Department of Agriculture  
Washington, DC*

**David P. Ernstes**

*Agricultural and Food Policy Center  
Texas A&M University  
College Station, TX*

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# What We Know and What We Need to Know On Biofuels, Food and Feed Tradeoffs

Wallace E. Tyner<sup>1</sup>

## *Introduction and Background*

My charge was to summarize, based on this conference and other sources, our current state of knowledge in the renewable fuel area with respect to tradeoffs between biofuels, food and feed. As you know, the title of this presentation is what we know and what we need to know. Summarizing our knowledge base in this area is a daunting and huge task.

One thing we know is that we are dealing with huge uncertainty. We are dealing with large shocks to the food and agricultural system, which makes it very difficult to model. Our conventional modeling techniques usually work well with small shocks and incremental changes. In the biofuels arena, today we are not in that realm; rather, we are dealing with very large shocks, and understanding the impact of those

shocks brings us into uncharted waters. We will need to use simulation models and other techniques to try to get a better handle on what the ultimate impacts of this new course will be.

This summary is divided into four general topic areas: corn based fuels, cellulose based fuels, global impacts and economic analysis. Table 1 summarizes the corn based fuels; Table 2, the cellulose based fuels; Table 3, global impacts; and Table 4, economic analyses.

No doubt I have left out many important points. I have tried to highlight the areas that seem to me to be most important. I thank you for your participation in this excellent conference. We have all learned a lot.

<sup>1</sup> Tyner is a professor in the department of agricultural economics at Purdue University, West Lafayette, Indiana. This paper was derived from a presentation concluding the Farm Foundation/USDA conference on "Biofuels, Food & Feed Tradeoffs," St. Louis, MO, April 12-13, 2007.

**Table 1: Corn Based Fuels.**

**What We Know**

- We know that the technology works and works well. We also know that under the current policy regime and oil prices, production will continue to grow until the price of corn chokes off increased growth. Most people feel that with no change in policy or oil prices that is likely to be around 15 billion gallons (gal) of corn ethanol.
- We know that corn and other feed ingredient prices will be substantially higher than historical norms. We also know that other markets will adjust to these substantial price changes.
- We do expect that food prices will increase because of the higher ethanol demand, but perhaps not at a very high rate locally and globally at least initially. That is mainly true because agricultural commodity prices are a small fraction of food item costs except for livestock products.
- We do know that increased corn production will have some adverse environmental consequences.
- We can see early signs of considerable supply response capability in the United States in reaction to the higher corn prices. Brazil has about 35 million hectares of land that could be put into sugar cane production without reducing area in soybeans.
- With the low stocks to use ratio projected for the next few years, we know that we are more vulnerable to supply shocks. It is quite likely that commodity prices will be more variable than historic norms.

**What We Need to Know**

- We don't know what will happen to the price of ethanol as production increases. At today's ethanol production levels, ethanol commands a premium because of its value as an octane enhancer and oxygenate. However, most feel that as production increases and the oxygenate and octane additive values diminish, ethanol pricing likely will move towards gasoline on an energy equivalent basis. In other words, ethanol ultimately could be valued at about 70% of gasoline price. However, there are many uncertainties associated with that path and its timing.
- Some of the models that we've seen at this conference show that most of the response is in export markets. Others show that a good bit of the response is in domestic feed markets. The bottom line is that we really don't have a good idea what the reactions in other markets are going to be for a change this large.
- We do not understand what will be the political reaction to rising food costs especially if shocks are larger than currently perceived.
- We don't know how large the environmental consequences will be either of the substantial increase of corn production or ethanol production.
- We don't have a good idea of what the supply response potential is in the rest of the world except perhaps for sugar cane in Brazil.
- We don't have a good idea about how other markets will adjust in the rest of the world either to the higher commodity prices or the increased variability.
- We don't have a good idea of the government cost and other impacts if variable subsidy policies or fuel economy standards were to be enacted.
- We have not evaluated the impacts of renewable fuel standards that might be partitioned between corn ethanol and cellulose based ethanol production.

**Table 2: Cellulose Based Biofuels.**

**What We Know**

- We know that liquid fuels can be made from cellulose materials using a variety of technologies – the familiar technology pathways have been outlined by the US Department of Energy (DOE). We also know that with today's technology the cost of producing cellulose based ethanol is over \$100/barrel of crude oil on an energy equivalent basis.
- We will be able to make substantial progress in reducing biofuels cost only with substantial investments in research and development, which we like to call an Apollo-type program for energy security.
- We know that cellulosic raw materials are likely to cost \$50 to \$80 per delivered dry ton except in niche markets. The figure of \$30 of dry ton that you often see is simply not in cards except in very special circumstances.
- As USDA Under Secretary Tom Dorr indicated, cellulosic biofuel is a distributed system and will be local by its very character.
- Cellulosic crops will have to compete for land with corn at \$3.50 to \$4.50/bushel and other high value crops.
- Cellulose yields are likely to be 5 to 8 tons/acre, perhaps as much as 10 tons/acre, but not the 20 tons/acre some are claiming.

**What We Need to Know**

- We do not know by how much the cost of producing cellulose based biofuels can be reduced nor over what time period that can happen. It is unlikely that the DOE goal of \$1.07/gal of ethanol can be achieved, at least in the near term, meaning the next five to ten years.
- Even if we launch an Apollo-type program for energy security, we don't know how much we can bring down the cost nor how much time will be required to do so.
- We have some localized case studies of cellulose cost, but we need many more.
- There has been very little analysis of the logistical implications of transporting all this cellulose to local plants. We must do more in depth studies on this topic.
- We have not studied the implications of the interaction between high commodity prices and what it would take to increase substantially area in cellulosic crops.

**Table 3: Global Impacts.**

**What We Know**

- We know that the impacts seen in the US markets for corn, soybeans and wheat are not just US impacts but are global impacts because the US prices are really world prices.
- We know that US and European Union policies will have impacts that reach into every corner of the world.
- We know that Brazil has tremendous potential to export sugar cane based ethanol to the US and other countries.
- We know that there could be important greenhouse gas (GHG) consequences of a growing biofuel economy. Renewable fuels can have very positive GHG reduction impacts.

**What We Need to Know**

- We do not know what these price changes will mean in terms of global production, trade, prices or poverty increases or decreases.
- We do not know who will win and who will lose globally – especially in developing countries. We simply must get a better understanding of these global impacts of rich country policies aimed at using more of their biological resources for energy instead of food and feed.
- We have not evaluated the impacts of a reduction or elimination of the US tariff on ethanol. We need to look at innovative policy alternatives that would permit some growth in ethanol trade that could, in fact, enhance use of renewable fuels in the United States as cellulosic ethanol is taking off.
- We do not know quantitatively how important the greenhouse gas emissions reductions will be, and most importantly, we have not linked our own policies or economic incentives to greenhouse reduction. We need more work on innovative policy alternatives to credit renewable fuels for their contribution to GHG reduction.

**Table 4: Economic Analysis.**

**What We Know**

- Over the course of this conference we have seen four models with their different analyses of particular issues. The models use different assumptions regarding cost, yields, supply response, etc., and so they get different answers. In general, the size of the shocks supplied to the models, with perhaps one exception, are fairly small, so they don't give us a good idea of the implications of the large shocks we are now witnessing.
- We know that we need better systems research that evaluates in a systems context the pros and cons of different energy options.
- We know that there is plenty of work that needs to be done, and much of it needs to be done quickly.
- We know that given all the uncertainties in moving to cellulose based energy production, finding ways of public/private risk sharing will be important.
- We know that the policy choices and policy pathways that we follow will be absolutely critical.

**What We Need to Know**

- While it may be impossible for analytical and or political reasons to get the models on the same page in terms of assumptions, we might want to get closer than we are now just to see what are the key drivers of the differences.
- A good example of where we need better systems research is in the use of distillers dried grain with solubles (DDGS). In this conference we have seen some good papers on this topic but we need more. Systems work is hard and requires us to interact closely with other disciplines, and for some of us, that takes us out of our comfort zone. But if we are going to be able to solve these problems, it is absolutely imperative that we do more of the systems work.
- It is not at all clear that in the rush to fund technology research, our friends in Washington DC will provide enough funding for economics and policy research. We must continue to work toward increased funding in these areas.
- We need to do much more research into the risk reduction, government cost and other impacts of a wide range of policy alternatives.
- Let's figure out how we can do the analysis that is needed so that, as USDA Chief Economist Keith Collins said, we leave it to choice, not chance.