Ceres Written Testimony to Senate Agriculture Committee Energy Subcommittee Field Hearing in Brookings, South Dakota:

"The Next Generation of Biofuels: Cellulosic Ethanol and the 2007 Farm Bill"

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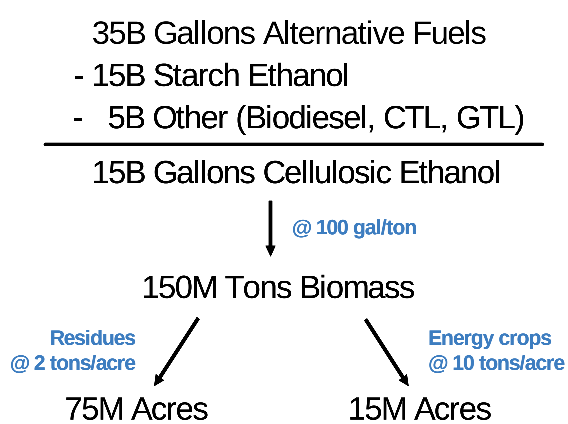
Good morning and thank you to Senator Thune for inviting me to testify. My name is Anna Rath, and I am here representing Ceres, a leading developer of dedicated energy crops for cellulosic biofuels.

Why Dedicated Energy Crops?

We believe that dedicated energy crops such as switchgrass and miscanthus will be essential to realizing the scale currently envisioned for biofuels. There are three reasons for this: critical mass, productivity and feedstock cost.

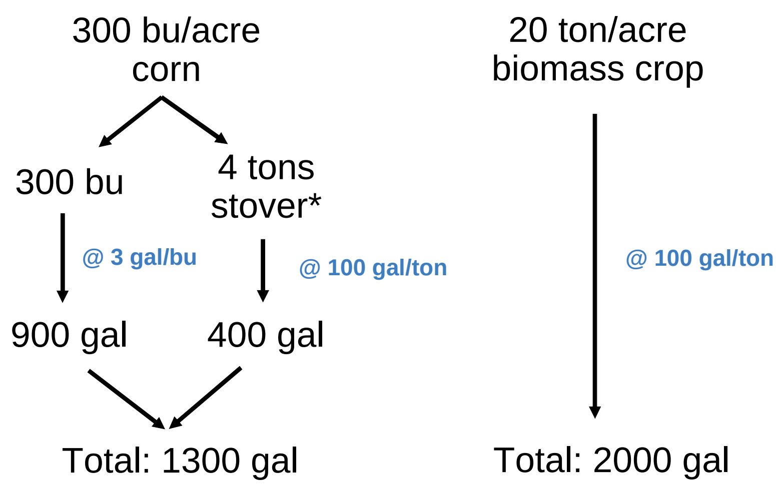
Critical Mass: The President has called for 35 billion gallons of alternative fuels by 2017. As part of meeting this objective, one can imagine that we will derive 15 billion gallons from starch-based ethanol and 5 billion from a combination of sources including biodiesel, coal-to-liquids, gas-to-liquids, etc. This leaves another 15 billion that must come from cellulosic biofuels. At a conversion ratio of 100 gallons per ton of biomass (higher than today's technology can deliver but likely achievable by 2017), this 15 billion gallons of cellulosic biofuels will require 150 million tons of biomass.

If we could harvest an average of two tons of agricultural residues per acre, it would require 75 million acres to meet this demand. This represents a large fraction of the total potential acreage from which agricultural residues could be collected in the United States. And while there are some areas of the country, such as the Corn Belt, where these resources are sufficiently concentrated to enable the creation of biorefineries based entirely on agricultural residues, these areas are relatively few and would not serve to greatly expand the geographic scope of biofuel production.



In contrast, with a high-yielding dedicated energy crop producing an average of 10 tons per acre, only 15 million acres would be required. We do not believe that this is an "either/or" choice. Rather, we believe that in some cases energy crops will be used as sole feedstocks to cellulosic biorefineries and in other cases as complements to agricultural and forestry residues to enable biorefineries to collect a sufficient volume of feedstock within a reasonable radius.

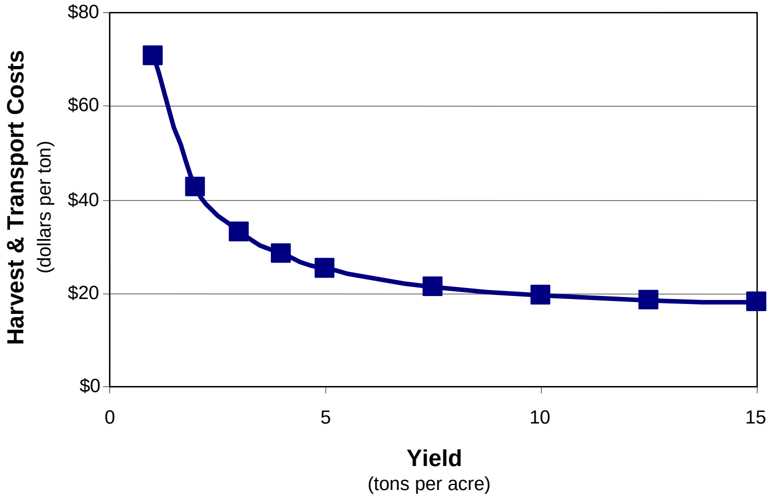
Productivity: The corn seed industry has projected that by 2030 we will see average yields of 300 bushels per acre. This is a worthy goal and one that we will help enable through our collaboration with Monsanto. However, even when this goal is reached, energy crops will remain the more productive alternative in terms of producing gallons of fuel per acre. With 300 bushel per acre corn, one could reasonably expect to harvest four tons of stover. At 3 gallons per bushel and 100 gallons per ton of stover, this would yield a total of 1300 gallons of biofuel (900 from the corn grain and 400 from the stover). By the time we reach 300 bushel per acre corn, though, dedicated energy crop yields will also have improved substantially – we believe to 20 tons per acre. At the same conversion ratio of 100 gallons per ton, a 20 ton per acre energy crop will yield 2000 gallons per acre.



* Assumes a total of 8 tons with 50% removal

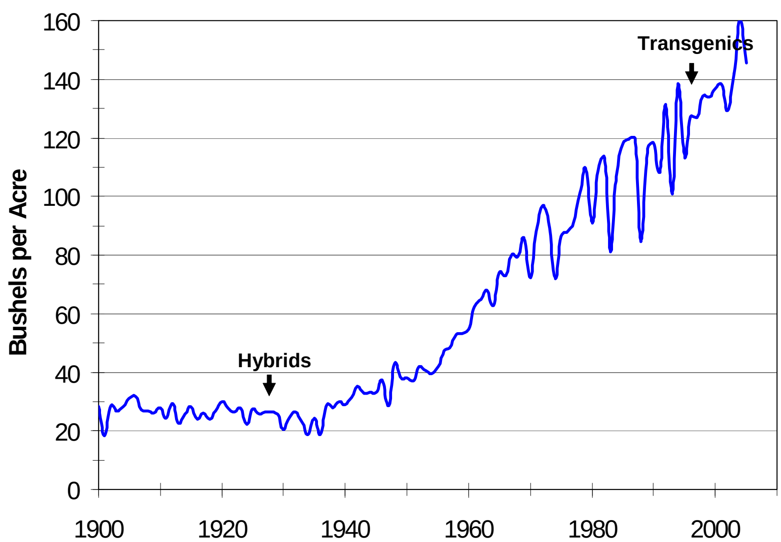
Feedstock Cost: In mature fuel and bulk chemical industries, the cost of feedstock is typically greater than fifty percent of the wholesale cost of the finished product. This is true today for both gasoline and starch ethanol and will likely be true in the future for cellulosic biofuels. As of today, more than fifty percent of the delivered cost of biomass feedstocks is the cost of harvesting and transporting the material to the biorefinery. This cost varies greatly with the yield density (tons per acre) of the biomass feedstock. It costs little more to harvest ten tons of biomass from a dedicated energy crop acre than it does to harvest two tons of residues. In the case of the dedicated energy crop, though, this cost can be allocated over ten tons of biomass rather than only two in the case of residues. In addition, higher yield densities can mean a reduction in the radius from which the biorefinery must draw its feedstock. A smaller radius means lower transportation costs.

Thus, while harvest and transport costs can be as much as $40 per ton for two ton per acre residues, they will be closer to $20 per ton for ten ton per acre biomass crops.

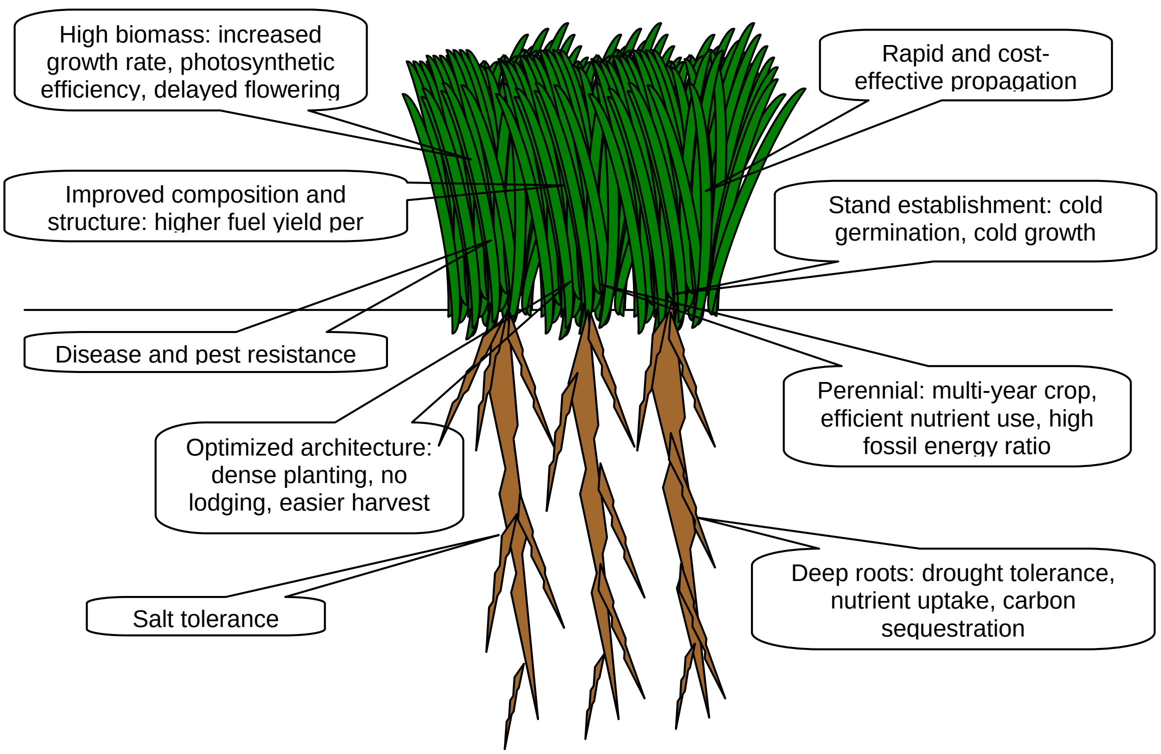


Ceres' Efforts in Energy Crop Development and Commercialization

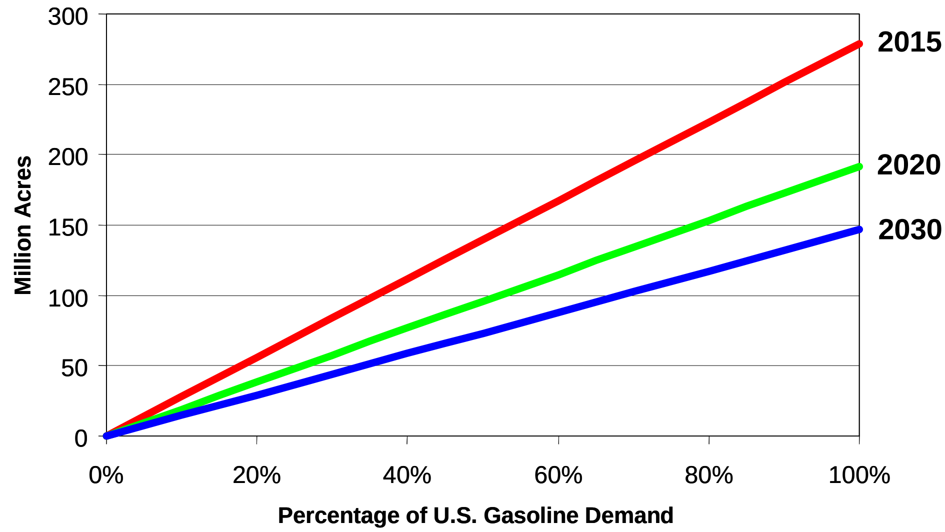
Over the past 70 years corn yields have improved more than five-fold. This is due to the development of a variety of technologies including marker-assisted breeding and creation of hybrids and transgenics.



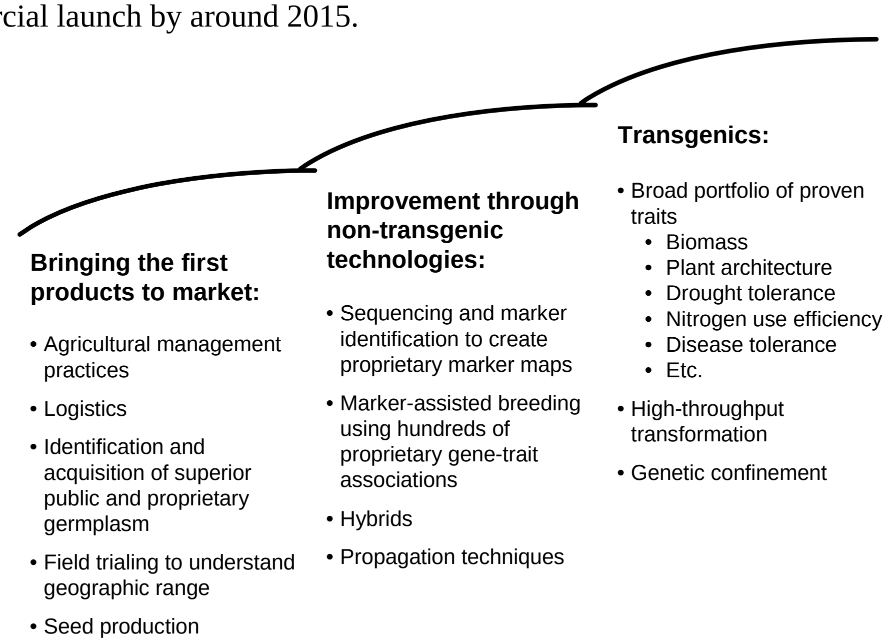
We now have all of these same technologies readily available for deployment in energy crops and should be able to use them to produce multiple fold increases in energy crop yields within the coming decades. In addition to yield, there are several other traits that will be important breeding targets for energy crops. Improvements in composition and structure will enable more gallons of biofuel per ton of biomass and will bring down the cost of processing through reducing the severity of pretreatment and volume of enzymes required. Maintaining and improving disease and pest resistances will be essential for yield stability and risk mitigation. Optimized architecture will help increase per acre yields by allowing increased planting density and will improve the ease and efficiency of harvesting. Salt tolerance will be important for growth on more marginal soils. Maintaining and improving drought tolerance and nitrogen use efficiency will be critical for minimizing the cost of production and environmental footprint of energy crops as well as maximizing the potential growing area. Maintaining the perennial nature of these crops will also help with production costs and environmental impact. Improving stand establishment will help overcome what is currently the most challenging aspect of growing dedicated energy crops – getting a good stand established. Finally, increasing the efficiency and reducing the cost of propagation will be essential to meeting the rapidly growing demand for these crops.



We project that the pace of improvement in energy crop yield (tons per acre), composition (gallons per ton) and processing technologies will mean that, over time, the number of acres required to produce a given fraction of transportation fuel needs will actually decline, despite the fact that the amount of fuel associated with this fraction will increase. For instance, we estimate that in 2020, 50 million acres of biomass crops would be sufficient to meet 25% of U.S. then current gasoline demand. By 2030, this same 50 million acres could supply 33% of demand even though demand will have increased during this interval.



Ceres is rapidly developing and scaling up commercial varieties of energy crop species. We have an extensive field trialing program including trials in conjunction with what will be some of the first commercial scale biorefineries at their planned locations. These trials are for the purpose of understanding which are the optimal species and varieties to grow at particular locations, what growing practices should be employed and what grower economics will be in the particular location. Ceres anticipates that large-scale planting of dedicated energy crops to support some of these initial biorefineries will begin in 2009. We are rapidly scaling up seed of leading energy crop varieties to meet this need. At the same time, Ceres is developing the next generations of dedicated energy crops using marker-assisted breeding and the creation of hybrids and transgenics. Ceres is creating high-density marker maps of these crops using the hundreds of gene-trait associations we have identified using our genomics platform to enable this process. We project that improved varieties from our breeding programs will be ready for commercial launch by 2012 and that the first transgenic varieties of dedicated energy crops will be ready for commercial launch by around 2015.



Challenges in Energy Crop Commercialization

Large-scale commercialization of dedicated energy crops will not be without challenges. The first of these is that most farmers are not familiar with the growing practices necessary to successfully establish and optimize the production of dedicated energy crops. Also, there is limited information about the potential range and optimal growing conditions for existing varieties. Ceres is working to understand these issues at our field trial locations, but more work will be necessary for large-scale adoption.

The logistics of harvest, transport and storage have not been fully worked out for commercial scale biorefineries. All of the necessary technologies and equipment exist, but the first biorefineries will truly be pioneers in bringing these elements together on a commercial scale. There is significant opportunity going forward for optimization of many of these elements.

Finally, seed quality and availability is an issue that this industry should be concerned with. As part of our efforts to understand the capabilities of existing forage seed producers, Ceres has collected switchgrass seed samples from many of them. What we found was that while some companies produce high quality seed, others produced seed that contained large fractions of weed seed and/or had extremely low germination rates. It will be important for growers to have access to high-quality seed to avoid bad experiences, which could have repercussions for the industry for years if not decades to come. In addition, to my knowledge, Ceres is the only company rapidly scaling up leading energy crop varieties and doing so in conjunction with companies planning to build biorefineries to ensure that there is supply available to meet the coming demand.

Policy Priorities for Enabling Cellulosic Biofuels

Because we see the cellulosic biofuels industry as one that is ready for commercialization, our policy priorities are aimed at providing the necessary opportunities and incentives to enable this commercialization. Some of these are feedstock-specific policy priorities – an area that has been somewhat overlooked by commercialization-related policies to date – others are more general.

<u>Feedstock Specific Priorities</u>:

<u>Feedstock pilot or demonstration programs</u>**:** As mentioned above, most growers have not had much if any experience growing dedicated energy crops. As a result, getting farmers comfortable with growing these crops will be a challenge for the first commercial biorefineries that choose to use these feedstocks for part or all of their supply. For this reason we propose pilot or demonstration scale programs aimed at providing farmers with the opportunity to become familiar with growing these crops. There are many existing proposals for what this kind of program could look like, so we have chosen not to put forth yet another. Rather, we would simply offer the guidance that these programs will be most effective if the farmers being given the opportunity to grow dedicated energy

crops are farmers that are likely to be called on by some of the first biorefineries to provide energy crops to them. The impact of these programs could also be optimized by having enough feedstock grown in a sufficiently concentrated area to allow the study of harvest, transport and storage logistics for that area as these logistics will vary substantially by region and choice of dedicated energy crops. For these reasons we would recommend that these programs be done in areas where a biorefinery company has expressed an interest in siting a biorefinery.

Transitional assistance: For perennial crops such as switchgrass and miscanthus, growers will not achieve a full yield in their first year of cultivation. Depending on what region of the country the grower is located in, the first year yield achieved may or may not be sufficient to warrant harvesting. Because it will require 18 months or more to construct a biorefinery, this lag in achieving full yields is acceptable. If farmers plant dedicated energy crops around the same time that the biorefinery company begins construction, they will be ready to provide a full or near-full yield of their dedicated energy crop at the point when the biorefinery is operational. The issue for the grower, though, is the year of lost revenue on those acres. In order to facilitate adoption of dedicated energy crops, we therefore propose a program that would provide transitional assistance to these growers in the form of compensating them for their opportunity cost for their year of lost revenue. This is a program that we would envision existing as the industry is getting started. Once the industry is established, growers may be more willing to shoulder the risk of this year of lost revenue in exchange for the long-term contracts they will likely be provided by the biorefinery. We also expect that our breeding programs will continuously improve first year yields so that this opportunity cost declines over time.

Crop insurance pilot program: As the cellulosic biofuels industry develops, we believe it is of critical importance that dedicated energy crops not be disadvantaged relative to other crops in terms of the safety net that the government provides for these crops. This safety net could come in a form similar to existing crop programs or could be substantially different. The goal must be to allow growers to make decisions about which crops to grow based on market forces, not based on which crops are or aren't supported by government programs. Toward this goal, we suggest a pilot program to begin collecting the data that will be necessary to enable a program like crop insurance. The objective of this pilot program would be that by the 2012 Farm Bill, the necessary data will have been collected to enable the roll-out of a crop insurance program for dedicated energy crops.

Additional Priorities:

Biorefinery grants and loan guarantees: We are supportive of the cost-sharing grant programs and loan guarantee programs that the government has created to help foster the construction of the first commercial scale biorefineries. We would hope that additional programs of this nature will be forthcoming to help hasten the growth of this industry.

Commodity Credit Corporation's bioenergy program: We support the proposal made by the USDA that a program similar to the CCC program that existed in the early days of the starch ethanol industry be created for the cellulosic biofuels industry. As with the starch version, this program would help make biorefinery start-up and expansion more affordable and easier to finance by covering the cost of initial feedstock in the first year of biorefinery operation and incremental feedstock used to increase capacity in subsequent years. The USDA suggested that this program could be simplified to provide a per gallon payment rate, include a payment limit per eligible entity, and be terminated as cellulosic ethanol becomes commercially feasible.

Renewable reserves: As was demonstrated by Shell's restatement of reserves in 2004 and the resulting decline in their share price, the market capitalization of the oil majors is determined at least in part by their proved reserves. This provides an incentive for these companies to continue to invest in exploration because their share price should increase with any new finds. As of today, there is no equivalent incentive for these companies to invest in development of renewable fuels nor is there a good metric for them to be able to measure themselves against one another in terms of how aggressively they are pursuing biofuels. We therefore suggest that the SEC be asked to convene the necessary experts and promulgate a definition of "renewable reserves", which would exist alongside the definition of proved reserves. From our perspective, long-term contracts with growers around a biorefinery that give the biorefinery the right to purchase biomass feedstock from those growers are not substantially different from long-term leases that oil companies have on oil fields that give them the right to extract oil from those fields. Creating this definition would have negligible cost and would provide a market-based incentive for the oil majors to invest significantly in the development of this industry.