



# Ag Decision Maker

## A Business Newsletter for Agriculture

Vol. 12, No. 6 [www.extension.iastate.edu/agdm](http://www.extension.iastate.edu/agdm) April 2008



### Global warming – agriculture’s impact on greenhouse gas emissions

by Eugene Takle, Professor of Atmospheric Science and Professor of Agricultural Meteorology, 515-294-9871, [gstakle@iastate.edu](mailto:gstakle@iastate.edu) (pictured, left) and Don Hofstrand, value-added agriculture specialist, co-director AgMRC, Iowa State University Extension, 641-423-0844, [dhof@iastate.edu](mailto:dhof@iastate.edu)

(Third in a series)

In this article we will examine the size and sources of greenhouse gas emissions from the agricultural sector. We will also discuss greenhouse gas sinks (the removal or sequestration

of gases). Finally, we will examine ways agriculture can reduce emissions and increase sinks.

Greenhouse gas emissions (primarily carbon dioxide, methane and nitrous oxide) by sector of the U.S. economy are shown in table 1. Electric power generation accounts for one-third of all greenhouse gas emissions. Although wind and hydroelectric generation are very clean technologies, half of U.S. electricity is generated by coal fired plants.

The transportation sector produces over one-fourth of the greenhouse gas emissions, primarily from gasoline and diesel fuel. Agriculture produces about eight percent of emissions.

#### Agricultural greenhouse gas emissions

Agricultural greenhouse gas emissions come from several sources as shown in table 2. Each of the sources is discussed along with possible ways of reducing emissions.

#### Agricultural soil management

These are nitrous oxide emissions and account for about 60 percent of the total emissions from the agricultural sec-

tor. Nitrous oxide is produced naturally in soils through the microbial processes of nitrification and de-nitrification.

During nitrification, ammonium (NH<sub>4</sub>) produces nitrates (NO<sub>3</sub>). During de-nitrification, nitrates (NO<sub>3</sub>) are reduced to nitrogen gas (N<sub>2</sub>). An intermediate step in both of these processes is the creation of nitrous oxide (N<sub>2</sub>O).

The large increase in the use of nitrogen fertilizer for the production of high nitrogen consuming crops like corn has increased the emissions of nitrous oxide. Although nitrogen fertilizer is essential for profitable crop production, the development of practices for more efficiently using nitrogen fertilizer has the potential to significantly reduce nitrous oxide emissions while also reducing production costs and mitigating the nitrogen contamination of surface and ground waters.

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**Handbook updates**  
 For those of you subscribing to the handbook, the following updates are included.

**Historic Corn Yields by County** – A1-12 (10 pages)

**Historic Soybean Yields by County** – A1-13 (10 pages)

**Corn and Soybean County Yields** – A1-14 (2 pages)

**Historic Custom Rate Survey** – A3-12 (3 pages)

**Livestock Enterprise Budgets for Iowa** – B1-21 (22 pages)

**Farmland Value Survey (Real-tors Land Institute)** -- C2-75 (1 page)

Please add these files to your handbook and remove the out-of-date material.  
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**Table 1. U.S. Greenhouse Gas Emission by Economic Sector (2005) (percent)**

Sector	Percent
Electric power industry	33.5%
Transportation	27.7
Industry	18.6
Agriculture	8.2
Commercial	5.9
Residential	5.2
Other	.8
Total	100.0%

Source: EPA, U.S. Inventory of Greenhouse Gas Emissions and Sink (1990 – 2005), Trends in Greenhouse Gas Emissions, Table 2-14.

**Table 2. U.S. Agricultural Greenhouse Gas Emissions by Source (2005) (percent)**

Source	Percent of	
	Total Emissions	Agricultural Emissions
Agricultural soil management	5.0%	61%
Enteric fermentation	1.5	18
Manure management	.7	9
CO <sub>2</sub> from fossil fuel consumption	.6	7
Other	.3	4
Total	8.2%	100%

Source: EPA, U.S. Inventory of Greenhouse Gas Emissions and Sinks (1990 – 2005), Trends in Greenhouse Gas Emissions, Table 2-14.

**Enteric fermentation**

Methane is produced as part of the normal digestive processes in animals. During digestion, microbes in the animal’s digestive system ferment feed. This process, called enteric fermentation, produces methane as a by-product which can be emitted by the exhaling and belching of the animal.

Because of their unique digestive system, ruminant animals (e.g. cattle) are the major emitters of methane. Beef cattle account for about 70 percent and dairy cattle for about 25 percent of these methane emissions. If beef and dairy cattle numbers increase, methane emissions will also increase.

Feed quality and feed intake influence the level of methane emissions. In general, lower feed quality and higher feed intake lead to higher methane emissions.

**Manure management**

Methane is produced by the anaerobic (without oxygen) decomposition of manure. When manure is handled as a solid or deposited naturally on grassland, it decomposes aerobically (with oxygen) and creates little methane emissions.

However, manure stored as a liquid or slurry in lagoons, ponds, tanks or pits, decomposes anaerobically and creates methane emissions. Dairy cattle and swine produce about 85 percent of the methane emissions. Methane emissions will increase as the number of large scale livestock confinement systems increases.

Methane emissions can be reduced through the application of technologies designed to capture the methane and use it as an energy source. In addition to reducing methane emissions, methane capture will improve the profitability of the livestock operation by offsetting the need for fossil fuel energy from outside sources.

**Carbon dioxide from fossil fuel consumption**

The use of fossil fuels in agricultural production accounts for eight percent of the emissions from agriculture. These emissions are primarily from combustion of gasoline and diesel fuel. Using renewable fuels can reduce the carbon dioxide emissions from agriculture production.

**Other**

A variety of other sources produce greenhouse gas emissions. For example, most of the world’s rice and all of U.S. rice is grown on flooded fields, which prevents atmospheric oxygen from entering soil. When rice is grown with no oxygen, the soil organic matter decomposes under anaerobic conditions and produces methane that escapes into the atmosphere.

**Agricultural greenhouse gas sinks**

A sink is a reduction in atmospheric greenhouse gases by storing (sequestering) carbon in another form. A traditional carbon sink is underground coal and oil deposits where millions of year ago living plants (and other organisms) used atmospheric carbon to build the plant. When the plants died, instead of decomposing and releasing carbon back into the atmosphere, they were stored under high pressure and became oil and coal. When oil and coal are recovered and consumed, the sequestered carbon is emitted into the atmosphere as carbon dioxide.

Greenhouse gas sinks reduce annual greenhouse gas emissions by 11.4 percent. Ten percent of these offsets are due to forests and soils as shown in Table 3.

**Forest management practices**

Growing trees sequester large amounts of carbon dioxide from the atmosphere through photosynthesis. The carbon is used to build the plant and the oxygen is released back into the atmosphere. An increase in biomass from the growth of forests (both above ground and below ground) provides a carbon sink. As long as the wood does not decompose or is not burned or otherwise destroyed, the carbon is maintained in the wood and the wood continues to be a carbon

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**Table 3. Greenhouse Gas Sinks (2005) (percent of total emissions)**

	Sink
Forest management practices	9.6%
CO <sub>2</sub> flux from agricultural soils	.4
Other	1.3
Total	11.4%

*Source: EPA, U.S. Inventory of Greenhouse Gas Emissions and Sinks (1990 – 2005), Trends in Greenhouse Gas Emissions, Table 2-14.*

sink. Trees harvested for building materials maintain the carbon in the new structure (houses, etc.) for decades. Wood disposed of in a solid waste disposal site provides an almost permanent carbon sink. The growth of new trees planted on harvested areas sequesters additional carbon.

The carbon sink created by forests and forest products (9.6 percent) more than offsets the greenhouse gas emissions from agriculture (8.2 percent). Although most forested areas are not located in the Midwest, sinks do occur in Midwest agriculture. Agroforestry practices such as managed shelterbelts and forested riparian zones enhance carbon emission offsets and provide other wildlife and aesthetic benefits.

**CO<sub>2</sub> flux from agricultural soils**

The soil is a great storehouse (sink) of carbon in the form of organic matter. Currently agriculture soils provide a small (.4%) positive flux (soil sequestration slightly exceeds soil emissions) of carbon dioxide.

Midwest topsoil was created by the decomposition of prairie grasses that grew on these soils. Over the centuries, carbon was stored (sequestered) in the soil. When the prairie was plowed, soil carbon oxidized and became atmospheric carbon dioxide. Tillage of the soil over the decades released more carbon than was added by crop residue and thereby reduced soil organic matter. However, equilibrium has been reached in most soils where the amount of carbon sequestration approximately equals the amount of carbon released. In individual situations, however, excessive tillage continues to release carbon and no-till practices sequester carbon.

No-till farming practices provide a great potential for the future sequestration of atmospheric carbon and building soil organic matter while also minimizing soil erosion and reducing production costs. Carbon sequestration programs created by organizations such as the Iowa Farm Bureau provide the opportunity for farmers to transform the sequestered carbon into “carbon credits” that can be sold (AgDM Newsletter, Aug. 2007). These programs provide a way for farmers to generate revenue while also reducing atmospheric carbon dioxide levels.

**Other**

Other sinks include the planting of trees in urban areas and landfilled yard trimmings and food scraps.

**Opportunities for midwest agriculture**

If federal and state governments create incentives for lowering greenhouse gas emissions and expanding sinks, Midwest agriculture will be uniquely positioned to take advantage of these by:

- 1) Sequestering carbon in agricultural soils by reducing tillage,
- 2) Reducing nitrous oxide emissions through more efficient use of nitrogen fertilizer,
- 3) Developing viable technologies for creating ammonia (nitrogen fertilizer) from feedstocks other than natural gas.
- 4) Capturing methane emissions from anaerobic manure handling facilities,
- 5) Substituting renewable fuels for gasoline, diesel fuel and natural gas used on the farm,
- 6) Increasing the generation of electricity from wind and other renewable sources,
- 7) Expanding the use of practices like managed shelterbelts and forested riparian zones,
- 8) Others we haven’t thought of yet.

The next article in this series will deal with the issues of greenhouse gases from renewable fuels.

## Value-added business success factors -- organizational issues

*by Don Senechal, Founding Principal, The Windmill Group, F. Larry Leistritz, Professor, Department of Agribusiness and Applied Economics, North Dakota State University, Nancy Hodur, Research Scientist, Department of Agribusiness and Applied Economics, North Dakota State University*

(fourth in a series of six)

There has been a surge of interest in farmer-owned business ventures that seek to capture additional value from commodities past the farm gate. Some of these ventures have been very successful, some marginally successful, and some have failed. Supported by funding from the Ag Marketing Resource Center at Iowa State University, we conducted in-depth interviews with farmer-owned businesses to determine the key factors that influenced the relative success or failure of these ventures. A better understanding of why some ventures succeeded while others failed provides valuable insight for the success of future farmer-owned businesses. This article focuses on the role of organizational issues on business success.

### Research method

To identify factors having the greatest impact on the success or failure of farmer-owned business ventures, a cross-section of seven farmer-owned commodity processing businesses formed since 1990 in North Dakota, South Dakota, and Minnesota were selected. Extensive interviews were conducted with individuals who played, or continue to play, an important role in the formation and operation of the business. This included leaders in the formation of the business, key members of the management team, selected board members, lenders, local leaders and others.

### Research results

Most New Generation Cooperatives (NGC) were organized prior to the mid-1990s. Organizational structure was less important at that time than it is today. There were no viable alternative legal business structures for farmers that wanted to band together to form a new business venture to add value to their commodities. So, for a time, this structure met the needs of farmer-owned business ventures. It provided limited liability and pass through taxation. But many ventures realized that the business principles that served distribution and supply cooperatives well did not work for capital intensive processing ventures that characterized most NGC.

In the early to mid-1990s, many states passed legislation to allow agricultural ventures, as well as other types of ventures, to organize as limited liability companies (LLCs). It retained the principles of a traditional cooperative but removed some of the restrictions that made the cooperative cumbersome for farmer-owned processing facilities. The LLC retains key characteristics of traditional cooperatives such as limited liability and pass through taxation, but removes restrictions on non-farmer investors and membership delivery requirements.

**Legal organizational structure** -- An early decision for a group organizing a farmer-owned venture is the legal organizational structure to be adopted. In recent years, most farmer groups have formed as an LLC or corporation (subchapter C). These are more favorable organizational structures than a traditional cooperative. An LLC offers similar advantages as an NGC with fewer restrictions on membership and purchasing inputs (no delivery requirements).

For other groups, a corporation was most appropriate by providing better access to capital from non-producer investors or equity funds. However, a corporation's earnings are taxed twice -- once at the corporate level and again when distributed as dividends to the owners.

Although more options for organizational structure are available today, the traditional cooperative structure is still the model of choice for certain types of farmer-owned businesses. An example is the highly successful sugar beet cooperatives of North Dakota and Minnesota. Sugar beets and other specialized commodities that lack spot markets find the traditional NGC model preferable.

**Decision making** -- Another consideration when deciding on a business model is the seemingly cumbersome decision making process inherent in the traditional cooperative structure. All major decisions must be approved by the members in a one-member, one-vote process. Not only is the process cumbersome but there are issues of confidentiality. Some of the businesses we interviewed stated that some companies prefer not to do business with cooperatives because of confidentiality issues. For example, an agribusiness company might wish to discuss a joint venture project with a cooperative but prefer to have the information kept confidential until the details are worked out. However, maintaining confidentiality may not be possible with a cooperative where management and the board must obtain member approval. In any event, the LLC appears to be the preferred organizational form for most new farmer-owned businesses (e.g., new ethanol plants). Many businesses that were organized prior to advent of the LLC have subsequently converted to an LLC.

**Board composition and training** -- A critical decision when organizing a new venture is the composition and size of the board of directors. Board members with previous board experience and appropriate business or industry experience is critical. Because farmer-owners seldom have sufficient experience or expertise in the production and marketing of processed products or experience in managing an organization as large or complex as a processing venture,

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including outside board members (board members from industry who may not be owners) is often desirable.

It is also important to conduct training for board members. This includes not only training for new board members but on-going board training programs as well. Just like the business itself, the board must make an investment in the form of on-going board training to maintain its industry competitiveness.

Board size and the meeting schedule should be manageable. Even an experienced and well-trained board of directors can encounter problems if the board size or meeting agenda is unmanageable. Two of the organizations we interviewed had boards of directors with more than 20 members. They suggested that their boards were too large. The desire for equitable representation of the business's farmer-investors often leads to large board size. However, this desire should not be allowed to jeopardize the board's ability to effectively lead the company.

**Professional team** -- When making important business decisions, access to business, legal, financial, and industry expertise is critical. Early in the process, founding members should seek professional expertise. While retaining professional services can be costly for a start-up with little or no working capital, the importance of professional council cannot be over-emphasized. For some businesses, state assistance was available and pivotal in financing feasibility studies and business plans. Another business reported that their attorneys worked on a contingency basis during the early days of the organization. State and local economic development programs may be a good place to find access to, or funding for, professional services.

*(next article – the role of management and operations)*

*Major funding for this research provided by the Agricultural Marketing Resource Center. Additional funding provided by Farmers Union Marketing and Processing Association Foundation, Co-Bank and Ag Ventures Alliance.*



## New Iowa farm custom rate survey available

*by William Edwards, extension economist, 515-294-6161, wedwards@iastate.edu*

For many years Iowa State University Extension has surveyed farmers, custom operators and farm managers to gather information about current rates for performing machinery operations and services. The purpose is to provide benchmark information that can be used for negotiating a fair and competitive charge for individual situations. The first survey, done in 1974, listed 38 different field operations. The most recent survey covered a total of 134 machinery operations, rental rates and miscellaneous services!

### Rates reflect all costs

Custom farming rates assume that the operator provides the machine, fuel and labor. Thus, custom rates should reflect the costs of depreciation, interest on investment, insurance, housing, repairs and maintenance, fuel, lubricants, repairs, labor and a profit margin. However, some operators who do a small amount of custom work in addition to farming their own land may be satisfied just to cover their variable costs, this is, fuel, repairs and labor. In the long run, though, machinery must be replaced and a return on investment earned.

The values reported on the survey are simply the average of all the responses received for each category. The range of the highest and lowest responses received is also reported. These values are intended only as a guide. There are many reasons why the rate charged in a particular situation should be above or below the average. These include the timeliness

with which operations are performed, quality and special features of the machine, operator skill, size and shape of fields, number of acres contracted, and the condition of the crop for harvesting. The availability of custom operators in a given area will also affect rates.

### Methodology

Efforts are made to survey a balance of both custom operators and farmers, managers and landowners who hire custom work done. This year 581 surveys were mailed out, and 185 were returned. Of the people who responded, 34 percent indicated that they performed custom work, 17 percent indicated that they hired work done, and 49 percent indicated that they did both. Those who performed custom work reported slightly higher rates than those who hired it done, generally around 5 to 10 percent higher. Anyone who would like to be included in future custom rate surveys should contact William Edwards at wedwards@iastate.edu.

Several new operations were included in the 2008 survey. Complete harvesting includes combining the crop as well as supplying a grain cart and truck or wagon, plus drivers, to deliver grain to farm storage. Also included this year was combining corn with a stalk chopper head, baling large square straw or stalk bales, and managing grain stored in on-farm bins.

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New Iowa farm custom rate survey available, continued from page 5

## Machinery rental

Sometimes machinery owners rent pieces of equipment to another operator, who provides the fuel and labor to operate it. In the case of a pulled implement, the renter often provides the tractor, as well. The Iowa Farm Custom Rate Survey shows average rental rates for about 20 commonly rented machines. For machines not included in the survey, a short worksheet is provided that starts with a custom rate and subtracts the cost of fuel, labor and a tractor in order to estimate a rental rate.

## Trends

The table on this page compares average rates reported for a few common operations over the past three decades. All rates have increased, due to increases in machinery prices, fuel prices, repair costs and labor. Some operations, such as planting, have roughly tripled, and probably reflect improvements in technology as well as cost increases. Combining has not increased as rapidly as other operations, despite improved harvesting technology. One possible explanation is that custom operators have been able to operate more hours per day with wider heads and at higher speeds, thus allowing more acres to be covered with each combine in a season. Having grain carts and larger trucks available has also improved harvesting efficiency.

Complete custom farming rates include tillage, planting, pest control and harvesting. These rates have not increased as fast as rates for individual operations, possibly because the number of operations performed has decreased over time. Many custom operators charge for each operation completed rather than a flat rate for the crop. See *Information File A3-12, Historic Iowa Farm Custom Rate Survey* for more information on trends in average rates.

Adjusting rates for volatile fuel prices has been a problem in recent years. In this year's survey it was suggested that respondents assume that diesel fuel would cost an average of \$2.75 per gallon delivered to the farm in 2008. However, prices have increased since then. One convenient way to adjust custom rates is to use *ISU Extension publication Pm-709, "Fuel Required for Field Operations,"* which contains estimated fuel consumption values per acre for many common operations. This publication is also available on the Ag Decision Maker web site as information file A3-27. Multiplying the fuel used per acre by the change in the price of fuel since the survey was conducted can provide an estimate of the most recent cost increases per acre.

The 2008 Iowa Farm Custom Rate Survey is available at county Extension offices or on-line as publication FM-1698, from the ISU Publications Store, or as information file A3-10 on the Ag Decision Maker web site ([www.extension.iastate.edu/agdm/crops/html/a3-10.html](http://www.extension.iastate.edu/agdm/crops/html/a3-10.html)).

### Average Farm Custom Rates Reported for Iowa

Operation	1978	1988	1998	2008
Chisel plowing, per acre	\$6.00	\$8.40	\$9.65	\$13.70
Planting, per acre	\$4.40	\$6.80	\$8.85	\$13.20
Spraying, per acre	\$2.40	\$3.50	\$4.00	\$5.60
Combining corn, per acre	\$16.20	\$22.00	\$23.40	\$28.10
Combining soybeans, per acre	\$14.00	\$20.60	\$22.55	\$27.10
Baling square bales, per bale	\$.21	\$.29	\$.36	\$.48
Custom farming, corn, per acre	\$58.00	\$71.00	\$75.80	\$94.10
Custom farming, soybeans, per acre	\$50.00	\$65.00	\$70.65	\$83.00
Machinery operating wage, per hour	\$3.50	\$5.10	\$7.20	\$11.70

Source: Iowa State University, Iowa Farm Custom Rate Surveys, FM-1698.

### Updates, continued from page 1

#### Tools

The following profitability tools have been updated on [www.extension.iastate.edu/agdm](http://www.extension.iastate.edu/agdm) to reflect current price data.

**Corn Profitability – A1-85**

**Soybean Profitability – A1-86**

**Ethanol Profitability – D1-10**

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