THE INDIANA LIVESTOCK SECTOR: CHALLENGES AND OPPORTUNITIES

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The livestock sector has been a critical component of the agricultural industry in the state of Indiana, and in recent years livestock production has reversed the decline of the 90's and has generally been growing in numbers and value. Table 1 summarizes livestock production by species from 2001 through 2006; note the stabilization in hog production which had been declining in numbers during the 1990's, and the growth in diary, egg and turkey production since 2001. Further evidence of growth in the livestock industries is provided in Table 2 which summarizes CAFO and CFO construction applications issued since 2003.

Challenges and Opportunities

Further growth of the livestock sector in Indiana will be facilitated or challenged by the following forces: demand for niche products, food safety and traceability, crop-livestock synergies, labor and immigration, environmental regulations, and livestock feed costs and DDGS use. Based on current research underway at Purdue, more detail is provided concerning the utilization of DDGS as a feedstuff than the other forces.

Demand for Niche Products

Organic, natural, and locally produced food products are all growing in popularity among consumers whose incomes have risen and who are willing to pay for unique attributes that cannot be delivered by conventional production systems and extensive marketing channels. The natural food segment is somewhat loosely defined because rigorous product standards for such labeling do not exist. Thus, it is difficult to develop precise market estimates for these niche products. Most organic produce, however, is labeled under the National Organic Program (NOP). According to the Organic Trade Association (2005), the total retail value for all organic food products was nearly $12 billion in 2004. Fresh produce captured the largest share of the market value, 42 percent, whereas meat represented 3 percent, or $408 million. Organic meat represented only 2 percent of the total retail value for all meat products. The overall organic market has experienced rapid growth over the past couple of years with annual growth rates of nearly 20 percent. The growth in the organic meat segment has been even stronger, however. In 2003, the latest year for which data is available, the market grew by nearly 78 percent for fish, poultry and meat. With over $6.5 billion in sales in the fiscal year ending September 2007, Whole Foods Markets is by far the largest natural foods retailer in North America (Datamonitor). The rapid rise of natural food retailers such as Whole Foods, Henry's Marketplace and Trader Joe's has attracted the interest of big box retailers such as Walmart to the organic and natural produce markets. Therefore, continued growth in demand is almost assured as the supply chain for such products is expanded.

In order to capitalize on these opportunities producers will eventually be called upon by retailers or customers to verify production process claims. In the case of organic production, federal standards exist. In other categories such as natural, environmentally friendly, animal humane, etc. producers and their partners may find opportunities to develop their own standards to be verified by independent third parties. In some cases, government may find a role in certifying the compliance such as is the case with the USDA Agricultural Marketing Service's Process Verified Program.

Food Safety and Traceability

Food safety is a key risk for all segments of the livestock industry. Food products that make people ill, or in a worst case scenario cause death, can quickly destroy brand value, the most valuable asset of a branded food product company. Supply chain management using a traceback system, combined with quality assurance procedures such as Hazard Analysis and Critical Control Point (HACCP), facilitates control of the system to minimize the chances of a food contaminant, or to quickly and easily identify the sources of contamination. Traceability is increasingly a key motivation for controlled origination of raw materials from certified suppliers to implement a supply chain philosophy.

Animal identification and traceability systems have a key role to play in the future of the animal agriculture industry. Whether the underlying issue is animal health, food safety, animal welfare, process assurance, or quality attributes, animal identification and traceability are necessary. Identification and traceability systems should be evaluated and implemented to enhance the industry's ability to respond to natural and intentional disease outbreaks, improve food safety, and provide assurances of food quality and wholesomeness. Some elements of these systems will be developed and managed by government; other parts may be purely private, and some elements may require public/private partnerships.

Crop-Livestock Synergies

Increased synergy between animal and crop producers is anticipated in the future. In a long-term scenario of fertilizer costs increasing and fertilizer resources diminishing, the use of organic fertilizers will likely be much more valuable. When rations can be formulated to meet a specific animal's requirements, the need to supplement diets will be reduced, reducing excess excretion of nutrients that need to be stored, treated, and used on cropland. Costs would also be reduced, as would the pressure on the environment. On farms or in regions that import grain to feed animals because not enough is produced locally, manure nutrient management is more challenging.

Technologies are available to enhance the efficiency of animal production and control the impact of animal production on the environment. Large operations can better afford and manage manure treatment technologies, particularly those with high fixed

costs such as biodigestors. They can spread the costs over a larger volume of product and have sufficient volume to potentially sell value-added products. Some technologies in nutrition or housing designs are size neutral and will not affect the structure of the industry as long as the technologies are cost effective.

Labor and Immigration

Most segments of animal agriculture in the United States and Indiana depend on a foreign born labor force; many of these workers are from rural Mexico or Central America and some may be undocumented. The legal uncertainty associated with this undocumented work force has consequences for the workers and the companies for which they work. Workers may not receive full legal protections and may be reluctant to complain about working conditions. Employers are vulnerable to a variety of legal sanctions and risk the loss of a significant portion of their work force if immigration laws are strictly enforced. This legal uncertainty creates a cost that can be mitigated with revised immigration and guest worker government policies.

A critical issue for both the livestock production and processing industries will be the resolution of the uncertainty surrounding immigration policy and guest worker programs so that the livestock sector can access a reliable and stable work force.

Environmental Regulations

Some of the most critical issues to shape the structure and location of the livestock industry in the future are storage and utilization of manure and other byproducts from production and processing and mitigation of air and water pollution from the industry. Key environmental issues include: recycling of animal manure, processing manure into energy or other productive resources, and technological mitigation of nutrients and odors.

Recycling of animal manure as a crop nutrient would be facilitated by business models that efficiently aggregate, transport and land apply organic waste (maybe in combination with urban organic waste) combined with injection and other technology that reduces nutrient volatilization and odor problems. Biodigestor processing is increasingly technologically and economically feasible – for larger scale operations that can spread the fixed costs over more volume, the amount of energy produced will likely exceed that used in the livestock production unit and access to the electrical transmission grid at competitive prices may be the key to the future of biodigestors.

Until and unless technological fixes to environmental and odor problems occur, environmental challenges will continue to dramatically affect the size, location, and structure of the livestock industry. Relocation of the industry to geographic regions where there is more environmental absorptive capacity (lower population density, drier climates, fewer surface waterways, less permeable soils, or sufficient crop production), or where there is more willingness to exploit the environment, is likely to occur if technology is not available to solve environmental problems.

Environmental regulations can be a significant cost factor for the industry and will likely be a major factor in future investment decisions by the industry. While predictions of a “race to the bottom” are made, the increasing variability of regulation from location to location will impact decisions concerning the location of future animal production and processing units. Differences in environmental regulation across locales are problematic for animal agriculture. Broader multijurisdictional regulatory approaches may represent an opportunity for more efficient environmental management and lower industry costs.

Litigation related to environmental issues is a growing problem in the United States. While litigation is a symptom, not a cause of conflict, continued litigation can be expected unless there is meaningful legal reform that provides the industry with some safe harbor legal parameters in exchange for assuming greater responsibility for environmental concerns. Litigation or legislative outcomes must provide legal rights and responsibilities that balance business practices with environmental concerns to resolve the issues. In the environmental arena, uncertainty is often a greater problem than the level or type of environmental regulation.

Livestock Feed Costs and DDGS Use

The rapid growth in feed grains based ethanol production has drastically affected the cost of feed for the state’s livestock and poultry producers. Both corn and soybean meal (traditionally the two largest ingredients in confined animal and poultry feed rations) have essentially doubled in price over the past two years. At the same time, the boom in bio-fuel production promises greater availability of by-products that, to some extent, can substitute for corn and soybean meal in feed rations. Dried Distiller’s Grains with Solubles (DDGS) has the potential to be a valuable alternative feedstuff for the state’s livestock and poultry industries.

Biological Concerns

All livestock and poultry producers are wary of utilizing DDGS because the nutritional quality of DDGS varies widely from one batch to another and across ethanol plants. Accurate nutritional and fat composition information is not possible to determine in a timely fashion that would allow accurate reformulation of diets as DDGS quality changes. Additionally, several biological phenomena related to the feeding of DDGS may determine the upper limits of DDGS inclusion in livestock and poultry feed rations.

The first limiting issue for use of DDGS in swine and poultry rations is the inconsistent and poor amino acid digestibility and amino acid profile relative to their amino acid (protein) requirements. This poor digestible amino acid profile limits the muscle growth of these species when DDGS is used as the primary protein source. The fat profile in DDGS poses another limit on inclusion for pork, broiler, and turkey producers because these animals tend to directly deposit lipid in the form it is fed into their fat tissue. The result of feeding high levels of DDGS to these species is meat and meat products that have an unappealing soft and oily appearance and products that do

not process well. In fact, some pork packers have placed a limit of no more than 10% DDGS in the diets of pigs that they slaughter. Another factor in determining the optimal level of DDGS feeding for swine relates to its affect on carcass yield and leanness, both of which are common factors in determining carcass value. As DDGS inclusion rates rise, the carcass yield declines, resulting in a decrease in value for the animal, but carcass leanness increases. In net, the decline in carcass yield outweighs the increase in carcass leanness for most packer grids when the inclusion rate reaches 20% or more of DDGS in the diet.

While ruminants such as cattle transform the fats in DDGS and convert them to beef tallow on the carcass or milk fat, there are limits to DDGS inclusion in their diets due to the relatively high concentration of sulfur and fat in the DDGS. Dairy cattle producers worry that feeding high levels of DDGS may result in milk quality suffering with the variation in the DDGS attributes as well as the potential of mycotoxins from the grain being concentrated three-fold in the DDGS. Typically, concerns about sulfur toxicity limit DDGS inclusion in beef cattle finishing rations to no more than 30-40%, and excess fat and protein fermentation characteristics from the DDGS can create rumen fermentation problems in dairy and beef cattle when levels exceed 30%.

An additional biological issue relates to the effect of DDGS feeding on nutrient excretion in manure and the associated manure management concerns. In cattle, the primary environmental concern is excess phosphorus excretion; while in swine and poultry the primary environmental concern is excess nitrogen. In cattle, the high levels of nitrogen in DDGS are converted to microbial protein in the rumen and subsequently digested and absorbed by the animal. The result is a relatively low nitrogen to phosphorus ratio (high P) in the excreted manure. This means that manure applied at the phosphorus needs of a corn or wheat crop will require supplemental nitrogen application and a 50-100% increase in the land base of the cattle operation. If cattle manure was applied at the nitrogen needs of these crops it would represent a gross over application of phosphorus. In swine, the situation is primarily reversed. Because the pigs do not utilize the nitrogen in DDGS as well, the excreted manure has a higher nitrogen to phosphorus ratio than manure from pigs fed a traditional corn and soybean meal diet and only a slight rise in phosphorus content. This manure may actually do a better job of matching the nitrogen to phosphorus ratio of crop requirements and lead to less demand for supplemental fertilization, but may drastically increase the odor and gas (N, HS, VOC's) emissions from swine and poultry operations.

Economic Concerns

While preliminary work by Hollas (2008) suggests that DDGS based swine diets are cheaper per pound of feed, this is not the correct measure for determining optimal DDGS inclusion rates. A measure of profit such as profit per pound of gain or whole farm profit should be the final deciding factor. The discussion above makes it clear that swine producers face tradeoffs between carcass yield, leanness, ingredient costs, and manure management expenses that are not directly captured by a simple computation of the least cost ration. Table 3 summarizes key economic considerations for inclusion

of DDGS in swine rations. As depicted in the table the feed cost measures all decline with increased DDGS inclusion, but the return over feed cost peaks at a DDGS inclusion rate of approximately 10%.

Additional work by Hollas that accounts for the cost and returns of manure disposal on an integrated swine and crop farm scenario, suggests that 10% inclusion is the most profitable of the five diets examined in Table 3.

Handling and logistical concerns may also affect the economic decision related to use of DDGS in feed rations. Concerns over storage and handling of DDGS on the farm include the potential for spoilage and difficulty in moving DDGS through standard feed processing systems. Additionally, procuring DDGS for small scale farms may be difficult because of their inability to utilize large semi-loads of the product at one time.

It's also worthwhile noting that the cost differences between diets in Table 3 are not very large. This is because, in general, DDGS are not in oversupply in the market. Efficiency in the markets for feedstuffs suggests that DDGS prices will be equivalent to their ability to substitute for the alternatives of corn and soybean meal. Thus, unless there is substantial expansion of ethanol production beyond the current ability of the livestock and poultry industries to utilize the byproducts, long-lived bargains associated with DDGS feeding should not be expected.

Potential State Initiatives

1. The key issues in DDGS feeding surround product quality and consistency. Efforts to identify the factors in the ethanol production and byproduct drying activities that adversely affect the nutrient profile of the DDGS should be encouraged. In addition, fractionation in the ethanol production process either pre or post-fermentation shows promise to improve the fat profile of the subsequent DDGS byproduct while capturing the oil for human consumption or bio-diesel. The State may find it useful to facilitate logistical matters for smaller scale farm use of DDGS. Standards for measuring, testing and reporting the nutritional value of DDGS could be developed and implemented. Finally, education would seem to be warranted to inform producers that DDGS can be fed to swine and poultry in only limited quantities without significantly adversely affecting carcass quality. In addition, education on the handling and storage of DDGS could encourage greater adoption among livestock and poultry producers.

2. Immigration policy is critical to the Indiana livestock industry. The state could proactively encourage resolution of the Federal immigration/guest worker regulations to enable continued cost effective access to this critical workforce.

3. To encourage renewable energy production and environmental responsiveness, the state could evaluate the potential of using biodigestors to produce electrical energy from animal wastes and having cost-effective access to the electrical grid

at competitive prices to create and capture value from energy production beyond on-farm use.

4. Animal identification and trace-ability systems are critical for disease control and food safety implementation as well as verification of production practices in branded niche markets. The state could assess the potential of developing and implementing an animal identification program as well as the proper protocols for verification of product processes for those producing animal products with natural humane animal treatment or similar attributes.

5. CFO and CAFO regulations are critical to the growth and continued viability of the livestock industries. The state could assure that such regulations are outcome based and encourage adoption of best technologies/management practices for waste storage/disposal and odor control that are appropriate to the site/locale of the livestock production facility.

6. The state could monitor the continuing discussion of state based guest worker programs. It appears that Arizona is moving forward with their own program for attracting Mexican nationals to work in the state. They would be background checked in both countries, fingerprinted, documented, and would not be allowed to travel legally outside Arizona. The advantage of the state based program is the reduction in "red tape" relative to the existing federal temporary worker program. The paperwork burden for the existing federal program appears to be quite onerous and discourages participation by entities that are unable to attract domestic laborers even with relatively high wages. Monitoring the development of this and similar state programs would provide useful information to determine if Indiana might develop and implement a similar program.

References

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Table 1: CFO & CAFO Construction Applications Issued*

	2003	2004	2005	2006	2007
Total CFO & CAFO Applications Issued	89	80	106	173	73
Swine					
Swine CFO & CAFO Issued	52	43	70	139	55
New Swine Listed	114,082	62,047	153,239	579,910	228,888
Total Swine Listed	4,003,953	4,066,552	4,055,277	4,042,328	4,525,148
Beef					
Beef CFO & CAFO Issued	5	5	6	5	1
New Beef Listed	145	498	1,020	3,911	-50
Total Beef Listed	62,634	55,749	54,056	50,756	54,953
Chicken					
Chicken CFO & CAFO Issued	11	16	10	11	3
New Chicken Listed	1,409,472	2,508,500	2,147,620	467,476	-151,688
Total Chicken Listed	38,147,844	39,727,036	41,639,896	42,550,940	43,870,725
Dairy					
Dairy CFO & CAFO Issued	18	10	17	15	10
New Dairy Listed	7,509	-232	25,802	15,686	21,276
Total Dairy Listed	138,521	144,224	142,987	166,183	176,576
Turkey					
Turkey CFO & CAFO Issued	17	19	9	10	7
New Turkey Listed	145,360	103,200	82,800	207,600	1,800
Total Turkey Listed	5,966,180	6,088,340	6,061,540	5,789,940	5,905,539
Duck					
Duck CFO & CAFO Issued	2	1	0	0	0
New Duck Listed	5,000	0	0	0	0
Total Duck Listed	313,700	306,500	271,700	268,700	258,700
Sheep					
Sheep CFO & CAFO Issued	1	1	0	0	0
New Sheep Listed	0	0	0	0	0
Total Sheep Listed	3,337	3,337	3,337	3,337	3,337

*These data reflect construction applications issued; the number of production units are the capacities listed on the applications; actual production in the facility may be less than that listed because only a proportion of the facility capacity may have actually been constructed (for example only one of two farms listed on the application) or the facility may not be operating at full capacity.

Table 2: Trends in Livestock Production – Indiana *

	2001	2002	2003	2004	2005	2006	2007
Hog Marketing's - thousand head	6,397	6,236	6,736	6,099	6,354	6,477	
Cattle Marketing's – thousand head	282	293	283	270	250	280	
Calf Marketing's – thousand head	117	127	114	107	97	124	
Dairy Cows on Farms – thousands	153	151	149	151	156	165	
Dairy Cows Milk Produced – million pounds	2,567	2,658	2,939	3,027	3,166	3,299	
Sheep/Lamb Marketing's – thousand pounds	5,792	4,704	3,184	3,816	3,744	3,560	
Eggs Produced – millions	6,025	5,973	6,035	6,256	6,254	6,593	
Turkeys Produced – thousand pounds	399,000	403,000	396,800	409,640	428,800	462,300	

*Source: Indiana Agricultural Statistics, 2006-207, USDA, NASS, Indiana Field Office, West Lafayette, Indiana, 2007.

Table 3. Costs and Returns Associated with DDGS Feeding in Finishing Swine

Economic Indicator	DDGS Inclusion Rate				
	0%	5%	10%	20%	30%
Cost/lb of feed	0.105	0.102	0.101	0.100	0.099
Feed Cost/lb of live weight	0.276	0.269	0.268	0.267	0.266
Feed Cost/lb of carcass	0.299	0.292	0.292	0.291	0.291
Ret. over feed cost/head	114.77	116.42	116.58	113.73	113.68

Source: Hollas, 2008