Chapter 6

The Value of Distillers Dried Grains in Large International Markets

John A. Fox

As of January 2008, U.S. ethanol production capacity stood at 7.9 billion gallons per year, with additional capacity of 5.5 billion gallons under construction (Renewable Fuels Association, 2008). Annual production of 13.4 billion gallons would use approximately 5 billion bushels of corn, or about 36% of the record 13-billion-bushel 2007 crop. The Energy Independence and Security Act of 2007 increased the U.S. renewable fuel standard to a targeted 36 billion gallons by 2022, of which 15 billion gallons can be derived from conventional sources such as corn.

In 2007, the U.S. ethanol industry produced around 14.6 mmt of distillers grains, of which 36% was marketed in wet form and 64% (around 9.3 mmt) as distillers dried grains with solubles (DDGS). Wet or dry distillers grains are a by-product of drymill ethanol production—as distinct from wet milling for which the by-product is corn gluten. Because the recent and likely future expansion in ethanol production capacity is primarily a result of new drymill facilities, production of DDGS is expected to increase in proportion to ethanol production. DDGS production is expected to reach 36 mmt by 2010 (U.S. Grains Council, 2007), and 40 mmt by 2011 (Tokgoz et al., 2007). Under more aggressive assumptions about industry expansion, Tokgoz et al. estimated that production could be as high as 88 mmt by 2016. At a yield of 18 pounds of DDGS per bushel, 40 mmt is the amount of DDGS attainable from 5 billion bushels of corn.

Currently, most of the DDGS produced in the United States is absorbed by the domestic livestock feed market. Exports have increased in re-

---

John A. Fox is a professor of agricultural economics at Kansas State University.

The author gratefully acknowledges assistance and input from Dr. Brad Johnson (Texas Tech University), Drs. Kevin Dhuyvetter and Hikaru Peterson (Kansas State University), Terry Garvert (Cargill) and Dan Keefe (USGC), and research assistance provided by Jen Schlegel and Peggy Roths (Kansas State University).

cent years, and, as production continues to increase over the coming years, the ability to exploit international markets will be important in maintaining prices and returns to the ethanol sector. After reviewing the domestic market for DDGS, this chapter examines the recent history and future potential for DDGS exports to six different countries/regions: the European Union, Canada, Mexico, Japan, Taiwan, and South Korea. Chapter 7 provides a similar analysis for the rest of the world.

The U.S. Market for Distillers Dried Grains with Solubles

The United States is currently the world's largest producer of ethanol. The next largest producer, Brazil, produces ethanol primarily from sugarcane, leaving the United States far and away the largest producer of DDGS. As noted, U.S. production of distillers grains was approximately 14.6 mmt in 2007. Exports totaled 2.36 mmt, leaving over 85% of production on the domestic market. Livestock accounted for the bulk of domestic consumption, with the distribution across species at approximately 42% for dairy cattle, 42% for beef cattle, 11% for swine, and 5% for poultry.

Clemens and Babcock (2008) reviewed results from several feeding trials on the use of distillers grains in livestock rations and examined how U.S. consumption of DDGS might change as production increases. While estimates of appropriate inclusion rates vary, Clemens and Babcock's summary suggests practical levels of approximately 30% to 50% for beef cattle and cattle on feed, 20% to 25% for dairy cattle, 20% for hogs, and 15% for poultry. In practice, inclusion rates for DDGS fall well short of these levels. A 2006 National Agricultural Statistics Service survey (USDA-NASS, 2007) of Midwest livestock operations found average inclusion rates of 23% for DDGS in feedlot rations and rations for beef cattle. Furthermore, only 36% of responding feedlots and only 13% of responding beef cattle operations reported feeding any type of ethanol co-product, with lack of availability cited as the primary reason for not feeding those products.

However, the same survey found that an additional 34% of feedlot operations and 30% of beef cattle operations were considering using co-products, suggesting substantial potential for the domestic livestock sector to absorb increasing quantities of DDGS. Clemens and Babcock describe a number of technological and management efforts to address nutritional issues with DDGS related to sulphur, phosphorus, and fat content. Those efforts hold the potential to enhance significantly the adoption and inclusion rates of DDGS in animal feed rations.

Even with higher domestic adoption and inclusion rates, it is questionable whether the domestic market can absorb all of the anticipated increase in DDGS production. Dhuyvetter, Kastens, and Boland (2005) used U.S. livestock inventories and production levels to estimate maximum domestic consumption of DDGS. Using inclusion rates that, for some species, were considerably lower than currently accepted levels, they estimated a maximum domestic market uptake of 51.5 mmt—approximately four times as much as was consumed domestically in 2007 and an amount well in excess of current production. The analysis, however, assumed 100% adoption of DDGS in all livestock rations, a scenario that is unlikely to be realized.

Using currently recommended inclusion rates, and adoption rates based on producer intentions reported in the USDA-NASS (2007) survey, Table 6.1 suggests a domestic consumption capacity of 38.8 mmt. Compared to Dhuyvetter, Kastens, and Boland's estimates, potential consumption levels on a per animal basis are substantially higher in this analysis for dairy cows, cattle on feed, and market swine. Nevertheless, given the assumed adoption rates, the aggregate potential of 38.8 mmt suggests that the domestic market alone may not absorb all of the anticipated increase in DDGS production, particularly under the more aggressive expansion scenario considered by Tokgoz et al. Furthermore, the assumed inclusion rate of 35% for cattle-on-feed in this analysis may be optimistic given the widespread use of steam-flaking of grain and the apparent animal performance issues that arise with DDGS inclusion rates over 15% in steam-flaked diets (Clemens and Babcock, 2008).

The foregoing analysis suggests that the ability to market DDGS in international markets may be crucial to maintaining sufficient demand and avoiding stockpiles. Fortunately for the ethanol industry, export markets have been developing rapidly for DDGS in recent years as a result of both high grain prices and aggressive market development efforts of the U.S. Grains Council.

Table 6.1. U.S. potential consumption of distillers dried grains with solubles

Livestock class	Inventory (1,000 hd)[a]	Daily Intake (lbs)	Days on Feed[b]	DDGS Inclusion[c]	DDGS Adoption[d]	DDGS (tons/year)[e]
Beef cows	32,600	24	90	35%	43%	5,298,804
Dairy cows	9,220	42	365	20%	60%	8,480,556
Other cattle	40,580	15	135	20%	43%	3,533,504
Cattle on feed	14,300	22	365	35%	70%	14,066,553
Breeding swine	6,070	8	310	20%	47%	707,519
Market swine	39,005	5	365	20%	47%	3,345,654
Breeding sheep	4,510	4	90	10%	40%	32,472
Lambs	4,120	4	90	10%	40%	25,956
Broilers	8,900,000	0.2	56	10%	40%	1,993,600
Layers	344,000	0.2	365	15%	40%	753,360
Turkeys	272,000	0.7	151	10%	40%	575,008
Total						**38,812,985**

Sources:

[a] Jan. 1, 2008, U.S. inventory except broilers, turkeys, and lambs, which represent 2007 U.S. production. Data from USDA-NASS, 2007.

[b] Days fed are as used by Dhuyvetter, Kastens, and Boland, 2005.

[c] Inclusion rates taken from U.S. Grains Council, 2007.

[d] Adoption rates based on USDA-NASS (2007) survey, and assumed 40% for sheep and poultry.

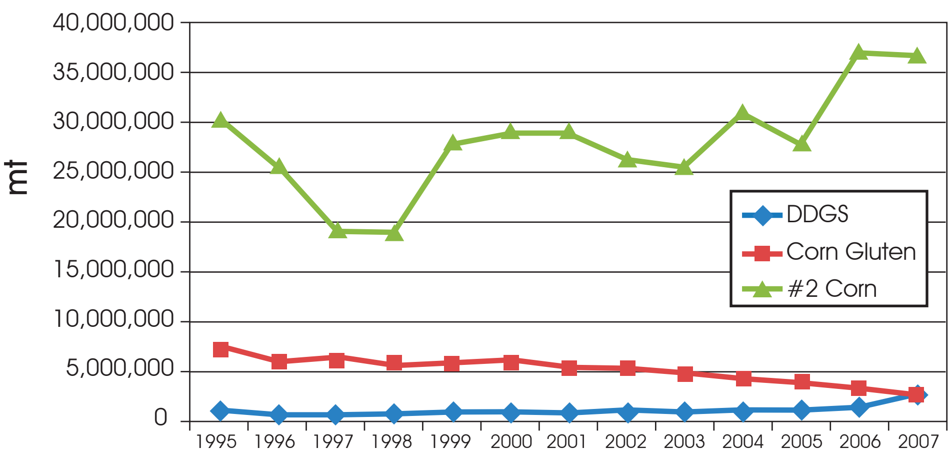
[e] Adapted from Tables 2 and 3 of Dhuyvetter, Kastens, and Boland, 2005.

U.S. Feed Grain Exports

With a relative abundance of arable land, the United States has long been and remains the world's dominant exporter of feed grains. During the 2006-07 and 2007-08 crop marketing years (Sept. 1–Aug. 31), U.S. corn exports of 53.9 and 62.2 mmt accounted for 58% and 63%, respectively, of total world exports. As of June 10, 2008, projected exports for the 2008-09 crop year were 50.8 mmt, accounting for 55% of world trade (USDA, 2008). For the same period, the market share of the second-largest exporter, Argentina, ranged from 15% to 17%.

Figure 6.1 shows the recent history of U.S. exports of #2 corn (the dominant grade), corn gluten (combining corn gluten meal and corn gluten feed), and DDGS. Exports of #2 corn ranged from less than 20 mmt in 1997 to over 36 mmt in 2007. Relative to corn, exports of corn gluten and DDGS are small. Exports of corn gluten fell from over 7 mmt in 1995 to 2.5 mmt in 2007 while exports of DDGS, after remaining stagnant at around 0.6 mm between 1995 and 2004, have grown rapidly over the past three years and almost doubled, from 1.3 mmt to 2.4 mmt, between 2006 and 2007.

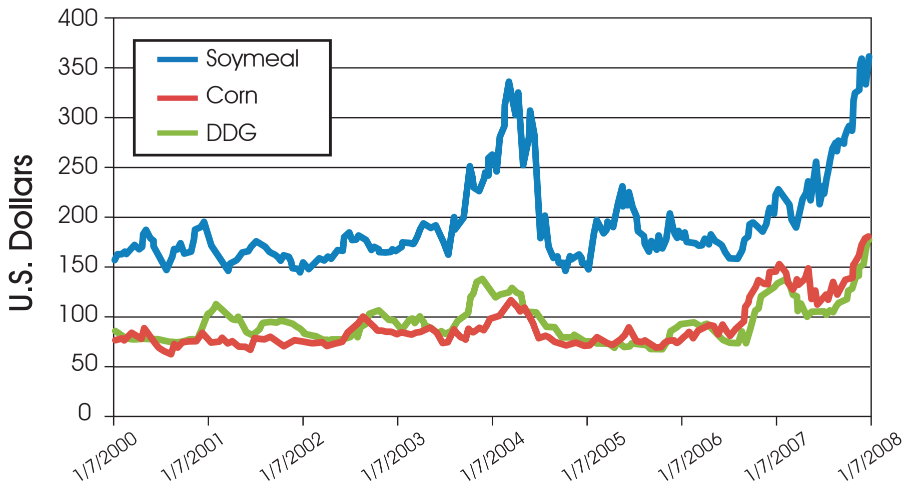
Because DDGS readily substitutes for corn as an energy source in livestock feed rations, and because prices for DDGS have tracked and



Source: USDA-FAS, U.S. Trade Exports - HS 10-Digit Codes database.

Figure 6.1. U.S. feed exports

appear likely to continue to track corn prices[1] (see Figure 6.2), it seems reasonable to assume that the most likely potential export markets for DDGS will be countries that currently import U.S. corn. According to the USDA (2008), the world's leading corn importers for the 2007-08 crop year, with estimated market shares in parentheses, are Japan (17.2%), the European Union–27 (13.7%), Mexico (10.2%), South Korea (9.3%), Taiwan (5.9%), Egypt (4.4%), and Canada (2.6%).



Source: USDA.

Figure 6.2. Nearby Chicago Board of Trade corn, soymeal, and Chicago distillers dried grains weekly prices

Focusing on U.S. (as opposed to world) corn exports, the pattern of buyers is somewhat similar, with the important exception that, as a result of restrictions on imports of genetically modified crops, the European Union now imports very little corn from the United States. Table 6.2 shows the market shares for six of the seven top corn-importing countries/regions (Egypt is covered in chapter 7) for the periods 1995–97 and 2005–07. Between these two periods, the European Union has, for all practical purposes, been eliminated as an export market for U.S. corn, while Mexico has grown in importance. Between 1995 and 2007, the six countries/regions listed in Table 6.2 accounted for between 44% and 60% of U.S. corn

[1]Tokgoz et al. (2007) conclude that "U.S. and world ruminant demand is strong enough to cause the prices of DG to track corn prices" (p. 17).

Table 6.2. U.S. exports of #2 corn—shares for selected markets

	Share of U.S. Exports (%)					
Country/Region	**1995**	**1996**	**1997**	**2005**	**2006**	**2007**
Taiwan	19.8	21.8	27.6	15.4	9.6	9.8
S. Korea	8	8.1	8.8	1.4	4.5	3.5
Japan	6.3	7.2	8.9	10.5	10.8	5.9
Mexico	5.8	17.4	9.3	20.1	19.8	21.1
EU - 27	3.6	4.3	1.9	0	0	0
Canada	1.1	0.7	1.9	3.2	2.5	3.2
Combined share	**44.6**	**59.5**	**58.4**	**50.6**	**47.2**	**43.5**
U.S. exports(mmt)	**30.35**	**25.42**	**19.17**	**27.76**	**37.04**	**36.65**

Source: USDA-FAS U.S. Trade Exports (http://www.fas.usda.gov/ustrade/USTExHS10.asp).

exports and thus likely represent the bulk of the potential export markets for U.S. DDGS.

U.S. Exports of Distillers Dried Grains with Solubles

As noted earlier, U.S. exports of DDGS have increased dramatically over the past four years—from 0.8 mmt in 2004 to 2.4 mmt in 2007 (Table 6.3). That growth appears to be continuing in 2008. A comparison of exports during the first four months of 2008 versus the same period in 2007 shows an increase of 132%, projecting 2008 exports at over 5.4 mmt (equivalent to 37% of total distillers grains production in 2007).

Table 6.3 shows rapid growth in exports to Canada, with exports tripling between 2005 and 2007. During the same period, exports to Mexico increased more than five times, making Mexico the largest export market in 2007 with a share of approximately 30%. While data for January–April 2008 indicate further growth in exports to Mexico (up 65% compared to 2007), dramatically higher exports to Canada suggest that Canada is about to surpass Mexico in 2008 as the number-one market for U.S. DDGS. Taiwan, Japan, and South Korea are essentially new entrants in the market since 2004, and exports to all three are continuing to grow in 2008. Exports to the European Union meanwhile are 82% lower in 2008 compared to 2007. Combined, the six countries/regions shown in Table 6.3 account for well over half the market for U.S. exports of DDGS. And while ag-

Table 6.3. U.S. exports of distillers dried grains with solubles

Country/Region	2003	2004	2005	2006	2007	2008[a]
	Quantity (mt)					
Canada	30,898	83,984	105,929	123,022	317,580	1,659,743
Japan	15	0	2,824	45,248	83,586	149,327
S. Korea	70	625	4,843	24,587	102,529	249,728
Mexico	45,721	66,894	128,271	367,386	708,216	1,169,901
Taiwan	0	7,431	42,249	92,824	134,404	169,371
EU-27	622,200	568,188	571,850	316,288	264,547	47,997
Sum as % of total DDGS exports	94.2%	92.3%	80.1%	77.3%	68.3%	62.9%
Rest-of-World	43,056	60,584	213,245	284,298	745,921	2,032,258
Total DDGS	**741,960**	**787,706**	**1,069,211**	**1,253,653**	**2,356,783**	**5,478,326**

Source: USDA-FAS (http://www.fas.usda.gov/ustrade/USTExHS10.asp) 10-digit harmonized system code for DDGS is 2303300000.

[a]Projection based on a comparison of Jan.–April 2008 vs. Jan.–April 2007 exports.

gregate exports to these countries have continued to grow, their combined share of U.S. DDGS exports has declined from 94% in 2003 to 68% in 2007. Most of that decline is due to the shrinking E.U. market, but it is important to note the rapid growth in exports to smaller market countries represented by "Rest-of-World" in Table 6.3.

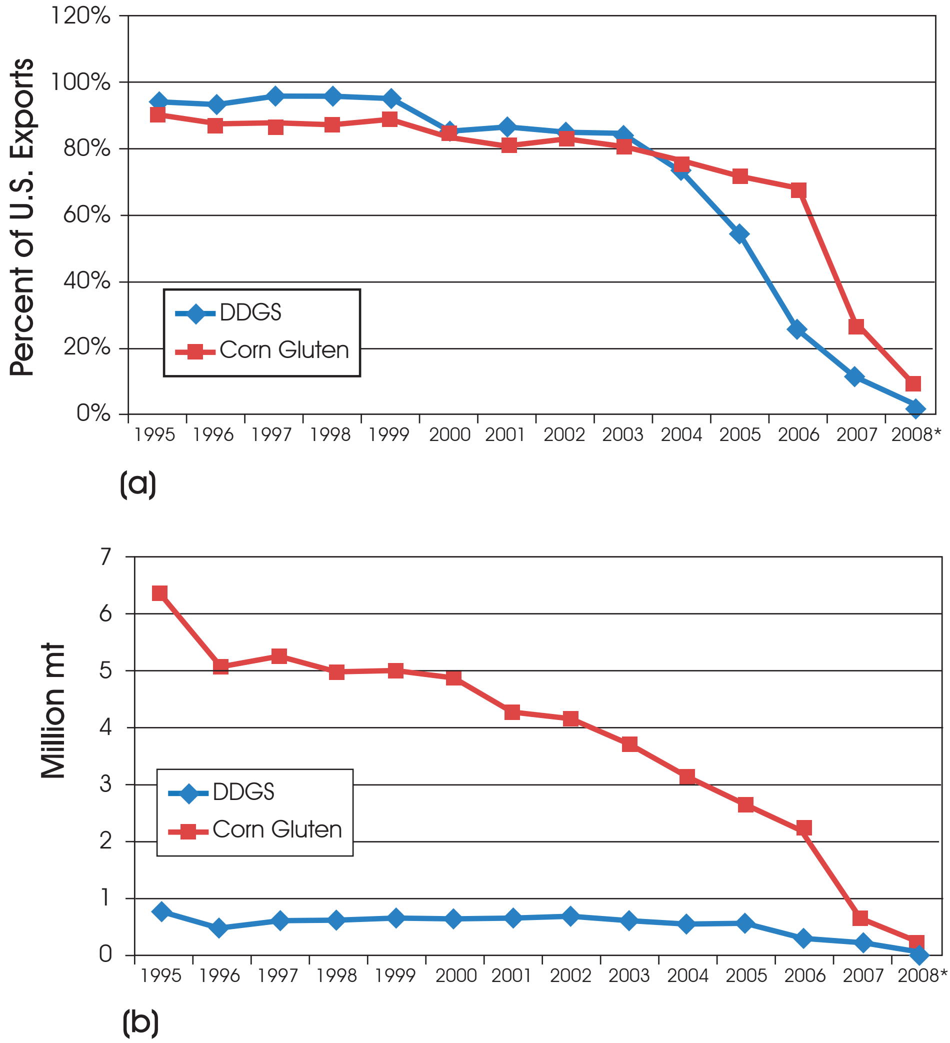
The European Union

During the 1990s the European Union was a reasonably important market for U.S. corn, accounting for 4.3% of U.S. corn exports in 1996 (Table 2) with most of that going to Spain and Portugal. For DDGS and corn gluten, however, the European Union was the dominant export market, taking over 90% of DDGS exports every year between 1995 and 2000, and over 80% of corn gluten exports during the same period (Figure 6.3a). However, as a result of new E.U. labeling requirements introduced in 1997[2] and a 1998 de facto moratorium on the approval of new genetically modified (GM) varieties, Europe has effectively been eliminated as an export market for U.S. corn. Exports of #2 corn fell from over 1 million mt in 1996 to less than 75,000 mt in 1998, a reduction of 93%, and since then corn exports to the European Union have been negligible.

Because E.U. labeling laws did not initially apply to by-products, the European Union continued to be an important market for corn gluten and DDGS. Until 2005, the European Union remained the largest export market for DDGS, with exports of over 571,000 mt that year accounting for 53% of total U.S. shipments. Within the European Union, the largest individual markets were Ireland (36%), the United Kingdom (20%), and Spain (19%). In fact, for the decade between 1995 and 2004, Ireland was consistently the largest individual-country export market for U.S. DDGS, with exports as high as 297,000 mt (33% of total U.S. exports) in 2002. With the introduction of new labeling and traceability requirements for animal feed in 2004,[3] exports to the European Union declined rapidly. Be-

[2]Regulation (EC) No. 258/1997, "Regulation on Novel Foods and Novel Food Ingredients."

[3]Regulation (EC) No. 1830/2003, "concerning the traceability and labeling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms and amending Directive 2001/18/EC," went into effect in April 2004.



Source: USDA-FAS, U.S. Trade Exports.

Figure 6.3. U.S. exports of distillers dried grains with solubles and corn gluten to the European Union

tween 2005 and 2007, shipments fell from 572,000 mt to 265,000 mt, and they are projected at only 48,000 mt for 2008. The pattern for corn gluten exports has been similar (Figure 6.3b), falling from over 2.2 mmt in 2006 to a projected 425,000 mt in 2008, a reduction of 80%.

The primary reason for the loss of the E.U. export market is the fact that GM varieties of corn approved and grown in the United States and other countries have not been approved by the European Union. This problem of "asynchronous approval" is in large part due to the length of the approval process in the European Union, in which approval typically takes about two-and-a-half years compared to fifteen months in the United States (European Commission, 2007). While regulations adopted in 2003[4] provided the framework for a new E.U.-wide GM approval process, that process has encountered problems. Under the new process, applications for approval of new GM crops are first reviewed by the European Food Safety Authority (EFSA), which subsequently conducts a risk assessment and provides an opinion to the European Commission. The Commission then submits a draft of its proposed decision to the Council of Ministers of the member states for a vote. Member countries are divided on the issue of GM approvals, with, typically, representatives from France and Austria voting against approval and representatives from the United Kingdom and some others voting for approval. To date, none of the draft recommendations submitted to the Council of Ministers has received a supporting qualified majority vote, and none has been rejected by a qualified majority vote. What normally happens in these situations is that the matter is sent back to the Commission, which then acts to approve the application in accordance with its original recommendation.

Complicating the picture further is the ability of individual E.U. member states to invoke a "safeguard clause" under which they continue to ban GM feeds or foods that have been approved by the Commission (Pew Trusts, 2005). Member state bans, which have been invoked by Austria, France, Germany, Greece, and other countries, throw into question the ability of the European Union to implement an effective approval process.

In addition to the problems created by delays in the approval process, two additional factors create a significant disincentive for U.S. exports of corn or corn by-products to Europe: (*a*) the fact that the U.S. grain system does not facilitate segregation and that comingling of GM and non-GM varieties is commonplace, and (*b*) the fact that the European Union applies a zero-tolerance for non-approved genetically modified organisms

[4]Regulation (EC) No. 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed.

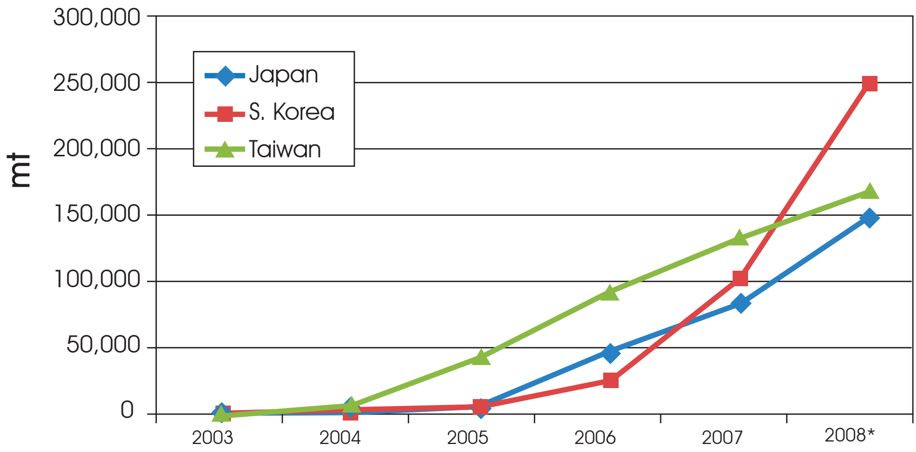
(GMOs). The zero tolerance policy essentially means that if any traces of a non-approved GMO are found in a shipment, the full shipment can be rejected. Such an incident occurred in April 2007 when traces of an E.U. non-approved GM variety, *Herculex RW (59122)*, were found in a shipment of DDGS unloaded at Dublin port (see Greenpeace, 2007). Herculex has been approved in the United States since 2005 and was first grown commercially in 2006. It was submitted for E.U. approval in January 2005 but was not finally approved by the E.U. Commission until October 2007. Even if the U.S. grain system did facilitate segregation, the zero-tolerance standard would probably still be impossible to meet. Seed purity laws cannot even guarantee 100% non-GM seed, and testing procedures have margins of error that can lead to false-positive test results.

As of July 2008, the Web site GMO Compass (www.gmo-compass.org) listed 54 varieties of maize for which E.U. approval had been sought under the new GM approval regulations. The list includes 25 varieties, many already approved for cultivation in North America, at the "application submitted" stage for which an EFSA risk assessment has not yet been completed. While EFSA typically recommends approval of GM applications,[5] given the length of the approval process and the continuous development of new GM varieties, it appears unlikely that the E.U. market will be open to significant U.S. export shipments of corn, corn gluten, or DDGS in the near term.

Japan, Taiwan, and South Korea

Japan, Taiwan, and South Korea are heavily reliant on imported feed for their livestock and poultry sectors. From 2005 to 2007, their combined corn imports accounted for between 20% and 27% of U.S. exports. The three countries have only recently begun to import DDGS, but since 2004, exports have grown rapidly to all three markets (Table 6.3, Figure 6.4). None of the three has domestic ethanol production capacity, so, apart from some by-products from the brewing and distilling industries, there are no competing domestic supplies of DDGS.

[5]Since 2005, the Commission has authorized the import of 16 GMOs. As of May 2008, EFSA has never given a negative GMO recommendation (Ellinghuysen.com, 2008).



Source: USDA-FAS, U.S. Trade Exports.

Figure 6.4. U.S. exports of distillers dried grains with solubles to Japan, South Korea, and Taiwan

Japan imported 83,000 mt of DDGS in 2007 and is on pace to increase imports by 78% in 2008. Japan has no import duties on DDGS and the product is currently being used in the dairy, poultry, and swine sectors. Livestock numbers in most categories in Japan are steady or in moderate decline. Dairy cow numbers have shown the greatest recent decline, from 964,000 in 2003 to 875,000 in 2008. At the same time, compound feed use for cattle has increased slightly, with total feed use for poultry, swine, and cattle estimated at 23.5 mmt in 2006, over 40% of which goes to poultry (Informa Economics, 2007b). Using livestock inventories, the potential market for DDGS in Japan is estimated at around 2.7 mmt (Table 6.4), or about 11.5% of total feed use.

Taiwan imported over 134,000 mt of DDGS from the United States in 2007, an increase of 45% over 2006. During the first four months of 2008, imports were 26% higher than the corresponding period in 2007, representing the slowest rate of market growth among these three countries. According to Informa Economics (2007b), all sectors of the Taiwanese livestock and poultry industries are using DDGS, with adoption by about 60% of dairy farmers. The hog and poultry sectors, however, are far larger than the beef or dairy sectors, and the hog sector in particular represents the greatest opportunity for DDGS. Tariffs rates on DDGS are low, at approximately 3% (Informa,

Table 6.4. Livestock inventories and potential exports for distillers dried grains with solubles

Livestock Class[a]	Mexico[c]	Canada	E.U.	Japan	South Korea	Taiwan[c]
Calf crop	8,000	5,270	30,470	1,405	860	140
Beef cows	11,800	5,000	12,020	635	762	110
Dairy cows	2,200	1,005	24,344	871	266	51
Breeding swine	955	1,546	15,411	915	1,012	808
Slaughter swine	14,840	21,200	250,745	16,385	13,800	9,370
Broilers	1,145,725	456,392	3,466,078	621,820	220,863	245,882
Turkeys	1,170	12,677	143,546	n/a	n/a	312
Potential DDGS exports (short tons/yr)[b]	3,140,232	3,793,647[d]	51,382,334	2,678,063	1,794,534	1,030,609
Projected imports 2008 (short tons)	1,286,891	1,825,718	52,797	164,260	274,701	186,308
Unexploited potential	59%	52%	100%	94%	85%	82%

Source: USDA PSD Online.

[a]Inventory values for 2007 in 1,000-head units. Production data for broilers and turkeys converted assuming broilers have an average weight of 5.1 lb, and turkeys, 28.2 lb.

[b]Estimated using same rates for intake, DDGS inclusion, and adoption used in Table 1. Resulting assumed average intakes are (lb/hd) calves, 174 (treated as "other cattle"); beef cows, 325; dairy cows, 1,840; breeding swine, 233; slaughter swine, 172; broilers, 0.45; and turkeys, 4.23.

[c]To adjust for less-intensive production practices, Mexican adoption rates are adjusted downward by 50% relative to other countries.

[d]Allowing for 530,000 short tons domestic production from corn and wheat.

[e]Estimates for cattle numbers based on Informa, 2007a.

2007a), and in response to a request from the Taiwan Feed Industry Association, it appears likely that the import tariff on DDGS will be eliminated.

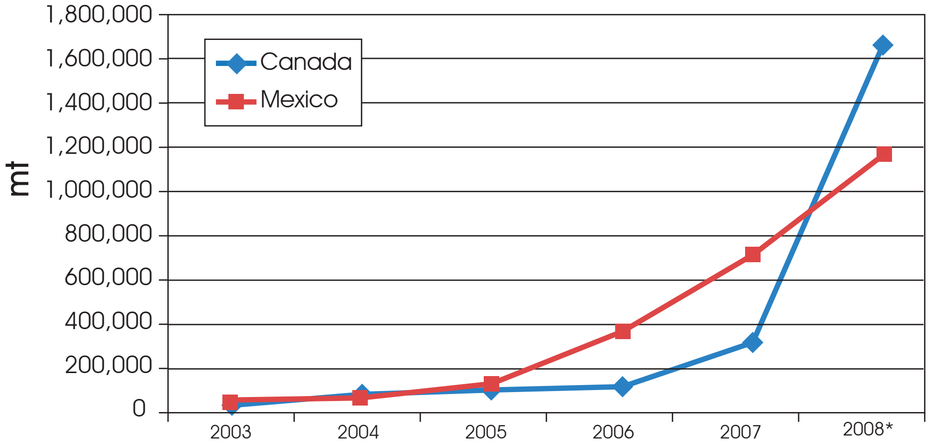
Exports to South Korea grew four-fold between 2006 and 2007 and are on pace to more than double in 2008, indicating that South Korea is set to overtake Taiwan as the largest export market on the Pacific Rim. Interest in DDGS appears to be growing, particularly from the dairy sector, which originated several inquiries to U.S. suppliers during 2007 (B. Johnson, Kansas State University, personal communication, March 2008). The beef sector in Korea has been expanding in recent years, partly a consequence of restrictions on beef imports from the United States because of the discovery of mad cow disease in the United States in 2003. From 2003 to 2008, beef cow numbers increased from 532,000 to 800,000.

Combined, Japan, Taiwan, and Korea accounted for exports of 320,000 mt in 2007, up from 162,000 mt in 2006. Given their livestock inventories, there appears to be substantial potential for exports to increase, with total export potential for the three countries estimated at 5.4 mmt (Table 6.4).[6] To date, most DDGS exports to these countries have been via container shipment, taking advantage of what had previously been the availability of empty containers moving back from the United States to the Pacific Rim. While container shipment has been economical in comparison to recent record high rates for bulk shipment, it has presented some logistical problems. For example, in Japan most of the container traffic goes to major ports that do not routinely handle animal feed or have feed mill facilities, and prices are substantially higher for shipping containers to smaller ports that are closer to feed mills (Informa, 2007a).

Canada and Mexico

In 2006, Mexico surpassed the European Union to become the largest export market for U.S. DDGS, at 367,000 mt. Exports doubled to 708,000 mt in 2007 and are on pace to increase by 65% in 2008 (Figure 6.5). The Mexican livestock and poultry sectors are growing. Between 2003 and 2008, the calf crop increased by 14%, hog slaughter by 9%, and broiler

[6]Informa Economics (2007b) conducted a similar study and estimated market potential for the three countries to be 5.0 mmt.



Source: USDA-FAS, U.S. Trade Exports.

Figure 6.5. U.S. exports of distillers dried grains with solubles to Canada and Mexico

production by 19%. Dairy cow numbers have been steady at around 2.2 million head while beef cow numbers have grown steadily over recent years to reach 11.8 million head in 2007.

Compared to the United States and other countries covered in this chapter, livestock production in Mexico is less reliant on compound feed use. For example, 30% of swine production occurs on what might best be described as subsistence operations, and dairy cow rations typically have a higher percentage of forage compared to operations in the United States and Canada. Total animal feed production is estimated at 25.6 mmt in 2007 (Informa, 2007b), only marginally higher than Japan's even though Mexico has 20 times as many beef cows and 2.5 times as many dairy cows. Thus, when estimating the potential for DDGS exports to Mexico using livestock inventories, potential adoption rates are adjusted downward by a factor of 50% to allow for the effect of less-intensive production practices. Given that adjustment, the potential market is estimated to be around 3.1 mmt, or about 2.5 times more than the projected level of imports for 2008 (Table 6.4).

In 2007, exports to Canada were 2.5 times greater than in 2006, and during the first four months of 2008 they were 5 times the level of the corresponding period in 2007. If exports continue at that pace throughout 2008, Canada will become the largest export market for DDGS, at around 1.6 mmt (Figure 6.5). Canada's livestock production systems are similar to those of the United States in many ways, with most beef production coming from large commercial feedlots. And like the United States, Canada has a growing domestic ethanol sector produced from both corn and wheat. The sector is small compared to that of the United States but utilized around 40 million bushels of corn and 17 million bushels of wheat in 2007 and produced around 530,000 short tons of DDGS (USDA, GAIN reports). After allowing for domestic DDGS supplies, estimates based on livestock inventories suggest a potential export market of around 3.8 mmt.

Exports to both Canada and Mexico are facilitated by the option to ship by rail and by the absence of tariffs under the North American Free Trade Agreement. The combined potential of exports to the two countries, at around 7 mmt, and the pace of U.S. export growth there suggests that the North American market is likely to be the most important destination for U.S. exports of DDGS.

Summary

With expanding global demand for meat, record prices for feed grains, favorable tariff rates, and the lack of domestic supplies of DDGS in importing countries, U.S. exports of DDGS appear likely to continue to grow. The potential level of exports to any market can be estimated using livestock and poultry inventories or production levels and assuming some level of DDGS inclusion and adoption. Using similar assumptions about inclusion and adoption rates to those used to estimate potential domestic consumption (Table 6.1), the potential market for DDGS in the six countries/regions examined in this chapter is estimated in Table 6.4.

Not surprisingly, given its livestock inventories, the largest potential market is the European Union. But given the current difficulties with GM approvals and labeling requirements for that market, it seems unlikely that the European Union will be a significant export market for U.S. exports of DDGS in the near future. Ignoring the European Union, the other five countries analyzed are estimated to have a combined market potential of over 12 mmt, or about 30% of the anticipated 40 mmt level of DDGS production for 2011.

The analysis suggests that under most scenarios the combined potential of the domestic market (39 mmt) and these export markets (12 mmt) can absorb the anticipated increase in U.S. production of DDGS. Furthermore, those estimates do not account for a large number of rapidly growing "smaller" export markets covered in chapter 7, and the estimates are not based on maximum inclusion and adoption levels. While there remains substantial unexploited potential in export markets, particularly in the Pacific Rim countries, the ability to grow exports is likely dependant on continuing efforts by the U.S. Grains Council to educate foreign buyers about DDGS. It also depends upon the ability to address some technical and marketing issues related to the product. Shurson (2005) identified a number of challenges facing the DDGS market, including product definition and the lack of a quality grading system, variable quality, and poor product flowability leading to difficulties in loading and unloading operations.

If the expansion of the U.S. ethanol sector occurs at a more rapid pace than commonly anticipated, and if, for example, DDGS production reaches 88 mmt by 2016 in the scenario described in Tokgoz et al., the ability of the domestic and currently available export markets to absorb the output of DDGS is questionable. In that scenario it will become critical to regain at least partial access to the E.U. market, perhaps through individual plants adopting certification and traceability programs and using only E.U.-approved corn varieties, and with the European Union adopting a non-zero tolerance level for non-approved GMOs.

References

Clemens, R., and B. Babcock. 2008. "Steady Supplies or Stockpiles? Demand for Corn-Based Distillers Grains by the U.S. Beef Industry." MATRIC Briefing Paper 08-MBP 14, Midwest Agribusiness Trade Research and Information Center, Iowa State University, March. http://www.card.iastate.edu/publications/DBS/PDFFiles/08mbp14.pdf

Dhuyvetter, K.C., T.L. Kastens, and M. Boland. 2005. "The U.S. Ethanol Industry: Where Will It Be Located in the Future?" Agricultural Issues Center, University of California, Davis, November. http://www.agmanager.info/agribus/energy/Ethanol%20Industry(AgMRC)--11.25.05.pdf

Ellinghuysen.com. 2008. Web site. "Commission Hesitant to Approve More GM Crops." May 8. http://ellinghuysen.com/news/articles/68883.shtml

European Commission. 2007. "Economic Impact of Unapproved GMOs on EU Feed Imports and Livestock Production" http://ec.europa.eu/agriculture/envir/gmo/economic_impactGMOs_en.pdf

GMO Compass. n.d. Web site, GMO Database, "Genetically Modified Food and Feed: Authorization in the EU." http://www.gmo-compass.org/eng/gmo/db/

Greenpeace, European Unit. 2007. "New Illegal GMO Found in US Shipment to EU." Press release, April 30. http://www.greenpeace.org/eu-unit/press-centre/press-releases2/new-illegal-gmo-found-in-us-sh

Informa Economics. 2007a. "DDGS Transportation Study." Washington, DC.

———. 2007b. *An Independent Review of US Grains Council Efforts to Promote DDGS Exports*. Prepared for the U.S. Grains Council. Washington, DC, September.

Pew Trusts, Initiative on Food and Biotechnology. 2005. *U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Food.* December. http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Food_and_Biotechnology/Biotech_USEU1205.pdf

Renewable Fuels Association. 2008. "Changing the Climate, Ethanol Industry Outlook 2008." http://www.ethanolrfa.org/objects/pdf/outlook/RFA_Outlook_2008.pdf

Shurson, G.C. 2005. "Issues and Opportunities Related to the Production and Marketing of Ethanol By-Products." Presented at the Agricultural Outlook Forum, February 2005. http://www.ddgs.umn.edu/articles-proc-storage-quality/2005-Shurson-%20AgOutlookForum-Feb05.pdf

Tokgoz, S., A. Elobeid, J. Fabiosa, D.J. Hayes, B.A. Babcock, T-H Yu, F. Dong, C.E. Hart, and J.C. Beghin. 2007. "Emerging Biofuels: Outlook of Effects on U.S. Grain, Oilseed, and Livestock Markets." CARD Staff Report 07-SR 101, Center for Agricultural and Rural Development, Iowa State University. http://www.card.iastate.edu/publications/DBS/PDFFiles/07sr101.pdf

U.S. Department of Agriculture. (USDA). 2008. World Agricultural Supply and Demand Estimates, WASDE-459, June 10. Office of the Chief Economist, Washington, DC. http://usda.mannlib.cornell.edu/usda/current/wasde/wasde-06-10-2008.pdf

U.S. Department of Agriculture, Foreign Agricultural Service (USDA-FAS). Various. GAIN reports, Bio-Fuels Production Report, various countries, 2006, 2007. Washington, DC.

———. n.d. U.S.Trade Exports - HS 10-Digit Codes. FASonline database. http://www.fas.usda.gov/ustrade/USTExHS10.asp?QI=

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA-NASS). 2007. Ethanol Co-products Used for Livestock Feed. June. Washington, DC. http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1756

U.S. Grains Council. 2007. DDGS User Handbook. Washington, DC. http://www.grains.org/page.ww?section=DDGS+User+Handbook&name=DDGS+User+Handbook