

## CHAPTER 7

# INTERNATIONAL DEMAND FOR U.S. DISTILLERS DRIED GRAINS WITH SOLUBLES IN SMALL MARKETS

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The United States produced 6.5 billion gallons of ethanol in 2007. The current annual production capacity of existing ethanol plants is over 7 billion gallons, with more than 6 billion gallons of additional capacity currently under construction or planned (RFA, 2008). The Energy Independence and Security Act of 2007 mandates the use of 36 billion gallons of biofuels each year by 2022, with up to 15 billion gallons of that total coming from corn-based ethanol.

Distillers dried grains with solubles (DDGS) are a by-product created from the dry milling ethanol production process.<sup>1</sup> These DDGS can be used as components of feed rations for livestock and poultry production and have predominantly been used as an energy replacement for corn and/or a protein replacement for soybean meal (Markham, 2005). The rates at which DDGS can be used in feed rations, referred to as inclusion rates, vary across livestock species. Each bushel of corn processed into ethanol can yield approximately 18 pounds of DDGS. An estimated 14.6

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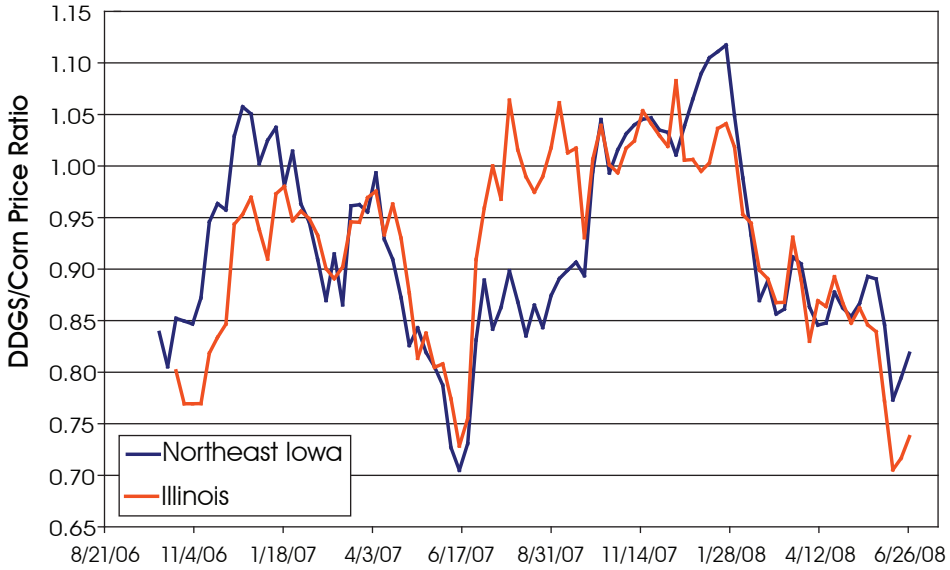
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<sup>1</sup>Distillers grains can be marketed in both wet and dry forms. Currently, about 64% of distillers grains sold are in dry form with the remaining 36% being marketed wet (RFA, 2008). Wet distillers grains have a relatively short shelf life and are generally marketed to buyers close to the production plant. Since the focus of this chapter is on export markets, only DDGS will be discussed. The wet milling production process results in different feed by-products—corn gluten feed and meal—which can also be incorporated into livestock feed rations. Since nearly all industry expansion is expected to be in dry mill plants, the production levels of corn gluten feed and meal are projected to stabilize at 10 mmt and 2 mmt, respectively.

million metric tons (mmt) of DDGS were produced in 2007. The U.S. Grains Council (USGC) projects that DDGS production levels will reach 36 mmt by 2010 (USGC, 2007). Other projections estimate that annual DDGS production in the United States will surpass 40 mmt by 2015 (Informa, 2007b) or as early as 2011 (Tokgoz et al., 2007).

The recent rise in corn prices has squeezed profit margins in the ethanol industry, making the successful marketing and sale of DDGS increasingly more important for ethanol producers to ensure profitability. Dhuyvetter, Kastens, and Boland (2005), using inclusion rates from a variety of feeding trial studies, estimate the domestic feeding potential for DDGS in the United States at more than 50 mmt, which would have replaced about one-third of the amount of corn fed in 2005 (156 mmt). While this would be sufficient to exhaust projected production levels, it assumes all livestock producers fully adopt DDGS into their feed rations at maximum inclusion rates without consideration for the DDGS price that would be needed to clear the market. Because the profitability of ethanol production is directly proportional to the price of both ethanol and the by-products created from the process, ethanol producers need to consider the benefits of developing export markets to enhance demand for the DDGS they produce. Given the average nutrient composition of DDGS, their value as a feed component should be slightly higher than corn and slightly lower than soybean meal when used at inclusion rates recommended from recent feeding trials (USGC, 2007). Historically, the price of DDGS has generally tracked along with corn prices (see Figure 6.2 in Chapter 6). The ratio of DDGS to corn prices (expressed in \$/short ton) from January 2007 through June 2008 in Northeast Iowa and Illinois are reported in Figure 7.1 (USDA-AMS, 2008). The average price ratio over the period was equal to 0.92 in both Iowa and Illinois but varied from 0.7 to 1.1. Tokgoz et al. (2007) conclude that potential demand from ruminants worldwide should be sufficient to maintain a DDGS value close to that of corn.

Figure 7.2 shows U.S. exports of DDGS from 1996 through 2007 (USDA-FAS, 2008b; USITC, 2008). Exports of DDGS slowly increased from 500,000 metric tons (mt) in 1996 to well over 1 mmt in 2005 and 2006. DDGS exports nearly doubled in 2007 to reach 2.3 mmt or more than 15% of total DDGS production. As of June 2008, DDGS exports were on pace to total 3.8 mmt for 2008 (USGC, 2008b). The European



**Figure 7.1. Ratio of price of distillers dried grains with solubles to corn price in Northeast Iowa and Illinois, January 2007 through June 2008**



Sources: USITC, 2008, and USDA-FAS, 2008b.

**Figure 7.2. U.S. exports of distillers dried grains with solubles, 1996-2007**

Union, Mexico, and Canada have been among the largest export markets to date (RFA, 2008). However, recent export history shows the export share of these large markets declining. The focus of this chapter is on the value and potential for DDGS demand in the “small” international markets of Central and South America, the Caribbean, Southeast Asia, Africa, and the Former Soviet Union. Export growth has roughly mirrored the expansion of ethanol production and DDGS while the total export share attributed to small markets has increased from a negligible amount prior to 2000 to nearly 25% of total exports in 2007, or 588,000 mt. The export histories and potential DDGS demand for each of the small market regions are presented individually in the sections that follow, with additional discussion devoted to the challenges faced in export market development. Available information on tariff rates applied<sup>2</sup> to corn, soybean meal, and DDGS imports is also provided and indicates that tariff rates on DDGS imports are in many cases lower than those applied to corn and soybean meal imports (WTO, 2008).

### Estimating Demand Potential for Distillers Dried Grains with Solubles

Data on DDGS export levels to the countries in each region were compiled from the United States International Trade Commission DataWeb (USITC, 2008) and the Foreign Agricultural Service’s U.S. Trade Database (USDA-FAS, 2008b).<sup>3</sup> Estimates of potential DDGS consumption in each small market region were calculated using 2007 animal inventory data (FAOStat, 2008)<sup>4</sup> and inclusion rate assumptions for each livestock species based on (1) maximum recommended rates (USGC, 2007) and (2) typical inclusion rates implemented by U.S. livestock producers based on a recent USDA survey on ethanol co-product use (USDA-NASS, 2007).

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<sup>2</sup>Reported tariff rates are those that have been applied in practice and are often much lower than the bound, or maximum, rates set in each country.

<sup>3</sup>DDGS exports are listed under HTS code 230330 for “brewing or distilling dregs and waste,” which may also include other products. DDGS exports to Egypt were listed under HTS code 230310, “residues of starch manufacturing,” prior to 2007 (Informa, 2007a).

<sup>4</sup>Potential demand is estimated based on 2007 animal inventory data from the Food and Agriculture Organization (FAO). The FAO provides both stock and production animal

While the results of feeding trial studies and the nutrient composition of DDGS vary, the general conclusion is that DDGS provide a feeding value slightly exceeding that of corn up to maximum inclusion rates, which differ by livestock species (USGC, 2007). The first column of Table 7.1 reports the maximum inclusion rates at which DDGS reportedly provide equivalent or even slightly improved feed performance relative to rations without DDGS included. The second column reports the values of potential DDGS consumption used by Dhuyvetter, Kastens, and Boland (2005) to estimate feeding potential for DDGS in the U.S. livestock industry. The inclusion rates that correspond to the Dhuyvetter, Kastens, and Boland feeding values are similar to the maximum recommended inclusion rates reported in the first column. Actual inclusion rates and the corresponding feed amounts consumed per animal from a recent USDA survey of U.S. livestock producers are also reported in Table 7.1 for beef and dairy cattle and market swine (USDA-NASS, 2007). In all three cases, actual inclusion rates being implemented by surveyed livestock producers are well below the maximum rates suggested from feeding trial data, indicating that the assumption of maximum inclusion rates may overstate potential demand even if DDGS inclusion in feed rations were to be fully adopted by U.S. livestock producers.<sup>5</sup>

Data on the amounts of corn and soybean meal fed domestically, net imports, and import levels from the United States in each region were also collected from the USDA-FAS Production, Supply and Distribution Database. This study assumes that net importers of feed products, especially those who depend on U.S. corn and soybean meal, will be most likely to demand DDGS imports as a partial feed replacement if the product is priced competitively with corn and soybean meal. The levels of corn and soybean meal imports from the United States are compared with domestic feed levels to illustrate the relative dependence on U.S. feed sources within each

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inventory data for cattle, swine, chickens, and turkeys. Beef and dairy cattle inventory estimates were taken from FAO production data. Other cattle inventories were defined as total cattle stocks less the beef and dairy production inventories. FAO does not distinguish between market and breeding swine, so all inventories were assumed to be market swine.

<sup>5</sup>Demand potential for DDGS in the U.S. beef industry, specifically, may be overestimated using maximum inclusion rates due to the reliance on steam-flaked rather than dry-rolled corn because feeding research suggests higher inclusion rates can be used in diets based on dry-rolled corn (Clemens and Babcock, 2008).

**Table 7.1. Summary of inclusion rates of distillers dried grains with solubles and average consumption levels by livestock class**

	<b>Maximum Inclusion Rates<sup>a</sup></b>	<b>Average Consumption (lb/animal/yr)<sup>b</sup></b>	<b>Observed Inclusion Rate<sup>c</sup></b>	<b>Average Consumption (lb/animal/yr)<sup>c</sup></b>	<b>Value(s) Used, Average Consumption max/typical (lb/animal/yr)</b>
Beef cattle	40%	650.0	22%	396	720/360
Dairy cattle	20-30%	1520.8	8%	1002	3125/1042
Other cattle	40%	375	nr	nr	375/187.5
Market swine	20%	171.6	11%	82	149/74.5
Breeding swine	20-50%	374.0	nr	nr	374/187
Broilers	10%	1.1574	nr	nr	1.1574
Turkeys	10%	6.3539	nr	nr	6.3539

*Sources:* <sup>a</sup>USGC, 2007; <sup>b</sup>Dhuyvetter, Kastens, and Boland, 2005; <sup>c</sup>USDA-NASS, 1007.

*Note:* nr means not reported in the USDA survey.

region, again assuming that DDGS will experience greater demand potential in areas that are already importing a portion of their feed supply from the United States. Net exporters of corn and soybean meal and importing regions with limited dependence on U.S. feed sources have revealed a shadow value below the price of imported feed sources such as U.S. DDGS, implying limited potential for export market growth and development.

Because DDGS are most commonly used to partially replace corn and/or soybean meal in livestock rations and the composition of livestock rations will vary across regions, domestic feeding rates for corn and soybean meal were also used to derive a third estimate for potential DDGS demand within each region. The estimate for U.S. feed potential of more than 50 mmt given by Dhuyvetter, Kastens, and Boland (2005) would have replaced one-third of all corn fed in the United States in 2005. If DDGS are priced at a level competitive to the value of corn, it is assumed that DDGS could also replace up to one-third of the corn fed in other regions. For DDGS consumption to increase significantly beyond that level, the grains will likely have to be priced below the value of corn. The potential demand for DDGS based on domestic corn feeding is by far the most conservative estimate for all regions considered, with the exception of countries in North Africa, where the potential demand estimate based on typical inclusion rates is the most conservative. This result implies that feed rations in the majority of the small markets considered in this study are less grain intensive than the rations used by U.S. livestock producers. Therefore, potential demand estimates based on inclusion rates experienced in the United States may only apply to these regions if the price of DDGS becomes sufficiently low enough to induce livestock producers in these regions to change the composition of their feed rations to be more grain intensive.

## South America

A handful of countries in South America have been importing U.S. DDGS for the past seven years. In 2000, Colombia became the first South American importer of U.S. DDGS by purchasing 40,000 mt. Although export levels declined significantly in 2003, exports to South American countries have increased each year since 2004. From 2006 to 2007, South American imports of U.S. DDGS increased by nearly five times, to just over 60,000 mt, or 2.5% of total U.S. exports. Furthermore,

South American imports of DDGS for 2008 are on pace to increase by four times their 2007 levels. Chile and Colombia imported 37,500 and 12,500 mt, respectively, in 2007. The balance of imports, roughly 10,000 mt, went to Peru which imported DDGS for the first time in 2007. The start of DDGS imports into Peru is largely attributed to recent feeding research and educational efforts in the country that were spearheaded by the USGC (USGC, 2008a).

The estimates for feeding potential of DDGS in South America by livestock class are reported in Table 7.2. Given the scale of South America's livestock industry, particularly beef and dairy cattle production, the feeding potential for all South American countries would be estimated to be well over 100 mmt at recommended inclusion rates. However, livestock rations in the South American countries of Argentina, Brazil, Paraguay, and Uruguay differ considerably from the more grain and meal intensive rations used in the United States. Figures 7.3 and 7.4 show that South Americans fed only 54 mmt of corn and 17 mmt of soybean meal in 2007. The U.S. livestock industry, which is significantly smaller in scale compared to that of South America, fed more than 150 and 31 mmt of corn and soybean meal, respectively, in 2007. Moreover, the whole of South America has a positive trade balance for both corn and soybean meal, and the limited import levels from the United States represent a very small fraction of the total used for livestock feed.

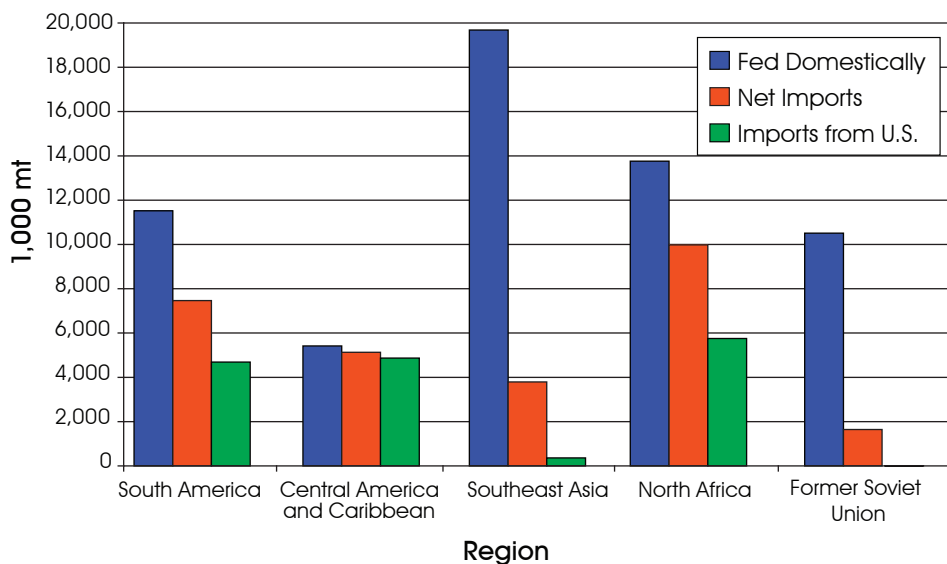
**Table 7.2. Potential consumption of distillers dried grains with solubles in South America based on 2007 livestock inventories**

<b>Livestock Class</b>	<b>2007 Inventories<sup>a</sup> (1000 Head)</b>	<b>Potential Consumption at Max Rates (mt/year)</b>	<b>Potential Consumption at Typical Rates (mt/year)</b>
Beef cows	10,090	3,302,313	1,651,156
Dairy cows	11,740	16,676,080	5,560,472
Other cattle	43,345	7,388,376	3,694,188
Market swine	15,424	1,044,594	522,297
Broilers	1,929,706	1,015,201	1,015,201
Turkeys	28,183	81,396	81,396
<b>Total</b>		<b>29,507,960</b>	<b>12,524,711</b>

<sup>a</sup>Source: USDA-FAS, 2008a.

Note: Excludes Brazil, Argentina, Paraguay, and Uruguay.

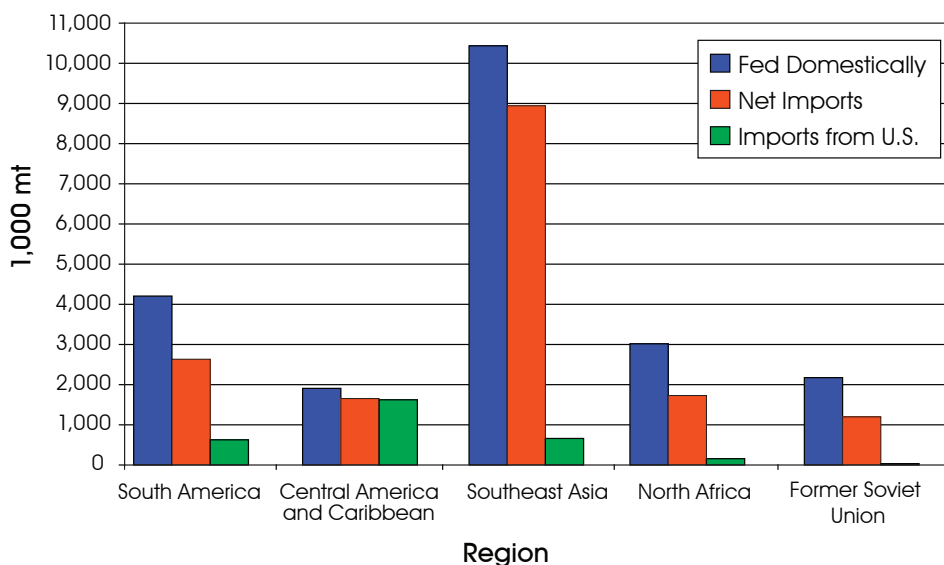




Source: USDA-FAS, 2008a.

Note: South America region excludes Argentina, Brazil, Paraguay, and Uruguay.

**Figure 7.3. Domestic feed use, net imports, and imports of U.S. corn by region for the 2006/07 marketing year**



Source: USDA-FAS, 2008a.

Note: South America region excludes Argentina, Brazil, Paraguay, and Uruguay.

**Figure 7.4. Domestic feed use, net imports, and imports of U.S. soybean meal by region for the 2006/07 marketing year**

The potential DDGS demand estimates for South America reported in Table 7.2 exclude the countries of Argentina, Brazil, Paraguay, and Uruguay because of these countries' differing feeding practices and their status as net corn exporters. Animal inventories outside of these countries are significantly lower and result in potential demand for DDGS of 29.5 mmt at maximum inclusion rates, or 12.5 mmt assuming that the more typical inclusion rates currently being implemented by U.S. producers are also adopted in South America. All of the DDGS importing countries in South America have historically been net importers of corn despite the overall positive trade balance for all countries in South America. These net importing countries are relatively dependent on U.S. corn imports, which represent more than 37% of the total amount of the corn used for feeding purposes from 2000 to 2006. The potential demand estimate for U.S. DDGS based on the domestic feeding rates of corn is even lower at 3.8 mmt per year.

The competitiveness of DDGS as a protein replacement for soybean meal is highly unlikely in South America given the supply of soybean meal generated from the large and continually expanding soybean industries of Argentina and Brazil. DDGS in South American countries will most likely be used as an energy replacement for corn in livestock rations and thus valued similarly to corn in the net importing countries.

Average applied tariff rates on corn and soybean meal imports to South America range from 0% to 15%, with corn imports generally having a higher rate in most South American countries. DDGS tariff rates are equal to those applied on soybean meal in all countries but lower than the applied tariff rates on corn in Argentina, Brazil, Paraguay, and Peru. Free trade agreements between the United States and Colombia and Peru are currently pending. The Colombian agreement would eliminate the 15% tariff currently being applied on corn, soybean meal, and DDGS. Peru has not been applying tariffs on DDGS or soybean meal imports, while a 9% tariff has been applied on U.S. corn imports.

## Central America and the Caribbean

Countries in Central America and the Caribbean began importing U.S. DDGS in 2000 when Guatemala, Honduras, and Jamaica imported a combined total of 8,900 mt. In 2007, five countries in Central America imported

a total of 31,500 mt, led by Costa Rica with just over 15,000 mt. Cuba imported close to 85,000 mt, and Jamaica imported 9,000 mt, to bring total U.S. DDGS exports to the region to more than 125,000 mt, or 5.1% of total U.S. exports. Imports of U.S. DDGS through February 2008 already exceeded the total for 2007 (USDA-FAS, 2008b). The USGC has initiated educational efforts on feeding in Guatemala and El Salvador, which has helped to bring DDGS to those countries and the surrounding regions (USGC, 2008a).

Potential DDGS consumption in Central America and the Caribbean by livestock class is reported in Table 7.3. The combined potential is estimated to be 10.2 mmt at maximum inclusion rates and 4.3 mmt at typical inclusion rates. The livestock industries in the region have undergone expansion over the past four years, leading to increasing amounts of corn and soybean meal being fed each year. Over 5 mmt of corn and nearly 2 mmt of soybean meal were fed to livestock in Central America and the Caribbean during the 2006/07 marketing year. Based on the amount of corn fed each year, the potential DDGS consumption in this region was estimated to be just over 1.8 mmt but should continue to grow with the amount of corn and soybean meal fed in the region if the livestock industries in these countries continue to expand.

Countries in Central America and the Caribbean typically do not generate any corn or soybean meal exports, resulting in the trade deficit

**Table 7.3. Potential consumption of distillers dried grains with solubles in Central America and the Caribbean based on 2007 livestock inventories**

<b>Livestock Class</b>	<b>2007 Inventories<sup>a</sup> (1000 Head)</b>	<b>Potential Consumption at Max Rates (mt/year)</b>	<b>Potential Consumption at Typical Rates (mt/year)</b>
Beef cows	3,371	1,103,371	551,686
Dairy cows	4,163	5,913,142	1,971,678
Other cattle	13,902	2,369,633	1,184,817
Market swine	5,928	401,481	200,741
Broilers	850,434	447,406	447,406
Turkeys	355	1,025	1,025
<b>Total</b>		<b>10,236,059</b>	<b>4,357,352</b>

<sup>a</sup>Source: USDA-FAS, 2008a.

for both commodities trending upwards at the same rate as domestic feeding, which has increased 7%–12% each year since 2003. U.S. imports have historically represented nearly 90% (80%) of all corn (soybean meal) fed in the region. The coupling of high and volatile commodity prices and relatively high dependence on U.S. feed sources makes Central America and the Caribbean an area of high growth potential for DDGS exports.

The average tariff rates applied on DDGS imports to countries within Central America are all well below those applied on corn imports, helping to promote DDGS. Applied rates for soybean meal imports are generally lower than those applied on DDGS imports. In Belize, the tariff rate applied on corn is 40%, whereas no tariff is applied on DDGS and soybean meal imports. Panama applies a 26% tariff rate on corn imports but only a 15% tariff on DDGS and no tariff on soybean meal. Most other Central American countries apply a 5% rate on DDGS imports and a 2.5% rate on soybean meal imports, while corn imports have tariff rates ranging from 9.3% (Costa Rica) to 17.5% (Guatemala). The Central American Free Trade Agreement between the United States, Central American countries, and the Dominican Republic gives the United States preferential tariff rates on many imported goods, making these goods more competitive with imports from other countries. A free trade agreement between the United States and Panama, currently pending, would remove the current tariff rates being applied to corn and DDGS imports.

## Southeast Asia

Countries in Southeast Asia began importing U.S. DDGS on a reasonable scale in 2004 when more than 25,000 mt were imported, mostly by Indonesia and Malaysia. Total exports increased nearly fourfold in 2005 and by more than 50% in both 2006 (193,000 mt) and 2007 (305,000 mt). As of February, export levels for 2008 were on pace to double those of 2007. Indonesia, Thailand, and Vietnam each imported roughly 20% of the total in 2007. The greatest amount of imports, 79,000 mt, went to the Philippines. Malaysia imported 40,000 mt and Singapore also imported a very small amount (150 mt). DDGS exports to Southeast Asia account for 13% of total U.S. exports or more than half of total exports to small markets. USGC education efforts in the Philippines and Malaysia and transporta-

tion economies are attributed as the main causes of the excellent export growth realized in Southeast Asia (USGC, 2008a; Informa, 2007a, b).

Table 7.4 reports the DDGS consumption potential for countries in Southeast Asia, which was estimated to be more than 15 mmt at maximum inclusion rates, or 8.4 mmt at typical inclusion rates. Figures 7.3 and 7.4 show domestic feed consumption, net import levels, and imports from the United States for corn and soybean meal, respectively, for Southeast Asia during the 2006/07 marketing year. The amount of corn fed to livestock in the region has been steadily increasing since 2003 and was close to 20,000 mt in 2007. The amount of soybean meal fed to livestock has also been increasing, with nearly 11,000 mt fed in 2007. The region is highly dependent on soybean meal imports, which represent more than 80% of the total amount of soybean meal fed domestically. Southeast Asian countries are also net importers of corn, with 15%–20% of total corn fed domestically coming from other regions. However, U.S. imports of corn and soybean meal have been historically low and, in the case of soybean meal, declining. Based on the amount of corn fed in the region, a more conservative estimate of DDGS consumption potential was found to be 6.5 mmt per year.

While the ratio of U.S. corn imports to domestic feed use for corn has been historically low for countries in Southeast Asia, transportation economies attributed to the use of container freight options have helped stimulate DDGS export growth to this region. Export growth in Southeast Asia

**Table 7.4. Potential consumption of distillers dried grains with solubles in Southeast Asia based on 2007 livestock inventories**

<b>Livestock Class</b>	<b>2007 Inventories<sup>a</sup> (1000 Head)</b>	<b>Potential Consumption at Max Rates (mt/year)</b>	<b>Potential Consumption at Typical Rates (mt/year)</b>
Beef cows	5,285	1,729,676	864,838
Dairy cows	992	1,408,604	469,685
Other cattle	25,390	4,327,860	2,163,930
Market swine	87,212	5,906,651	2,953,326
Broilers	3,797,627	1,997,897	1,997,897
Turkeys	568	1,640	1,640
<b>Total</b>		<b>15,372,328</b>	<b>8,451,316</b>

<sup>a</sup>Source: USDA-FAS, 2008a.

will likely continue, with the most limiting factors being those of competition from other commodities, procuring containers for transportation, and port capacity limitations (USGC, 2007; Informa, 2007a).

Applied tariff rates on corn, soybean meal, and DDGS vary across the countries in the region. Indonesia has applied tariffs of 5% on corn, soybean meal, and DDGS imports. In the Philippines, a tariff rate of 3% is applied on DDGS and soybean meal while the tariff rate for corn imports is much higher at 30.7%. Thailand applies lower tariff rates on DDGS (9%) and soybean meal (6%) relative to corn imports with a 20% tariff rate. Malaysia and Singapore reportedly do not apply tariffs on corn, soybean meal, or DDGS imports.

## North Africa

African imports of U.S. DDGS have grown from about 546 mt in 2004 to nearly 66,000 mt in 2007. Imports through 2008 were on pace to more than triple the amount in 2007. Morocco and Egypt account for nearly all of the imports of DDGS into Africa each year, importing a combined 64,000 mt in 2007. The growth in exports to Morocco and Egypt is largely attributed to the USGC's recent efforts to educate livestock producers on the benefits of incorporating DDGS into their feed rations (USGC, 2008a; Informa, 2007b).

Table 7.5 reports the estimates of DDGS feeding potential in North Africa by livestock class. At maximum recommended inclusion rates, more than 8.7 mmt of DDGS could be fed in North Africa, while typical inclusion rates result in a potential demand level of 3.5 mmt. Figures 7.3 and 7.4 show the amounts of corn and soybean meal fed domestically, net imports, and imports from the United States for the 2006/07 marketing year. The amount of corn fed in North Africa has been relatively stable at 13 mmt each year while the amount of soybean meal fed has seen a steady increase over the past decade to reach more than 3 mmt in 2006/07. Corn imports from the United States have represented more than 45% of the total amount of corn fed to livestock in North Africa since the year 2000. However, soybean meal imports from the United States have declined since 2000 and now account for less than 5% of the soybean meal fed to livestock in North Africa. North Africa has historically been a net importer

**Table 7.5. Potential consumption of distillers dried grains with solubles in North Africa based on 2007 livestock inventories**

<b>Livestock Class</b>	<b>2007 Inventories<sup>a</sup> (1000 Head)</b>	<b>Potential Consumption at Max Rates (mt/year)</b>	<b>Potential Consumption at Typical Rates (mt/year)</b>
Beef cows	3,278	1,072,800	536,400
Dairy cows	4,759	6,759,943	2,254,035
Other cattle	1,641	279,738	139,869
Market swine	80	5,439	2,719
Broilers	1,118,000	588,170	588,170
Turkeys	15,501	44,769	44,769
<b>Total</b>		<b>8,750,858</b>	<b>3,565,962</b>

<sup>a</sup>Source: USDA-FAS, 2008a.

of both corn and soybean meal, with imports representing 70% (50%) of the corn (soybean meal) fed domestically each year.

The market for DDGS in North Africa should continue to grow based on the region's dependence on feed imports, which are partially fulfilled by the United States. Based on the amount of corn used for feed in North Africa, DDGS demand potential is estimated to be up to 4.6 mmt per year. This DDGS demand potential estimate is larger than that based on typical inclusion rates and animal inventories for North Africa, which implies that feed rations being implemented in the region are more similar to those in used in the U.S. livestock industry compared to the other regions considered in this study.

Morocco applies average tariff rates of 25%, 17.5%, and 35% on soybean meal, corn, and DDGS, respectively. The fact that applied tariff rates on DDGS are higher than those on corn and soybean imports is somewhat surprising considering Morocco is currently the leading importer of U.S. DDGS in North Africa. Egypt applies a 2% tariff on DDGS imports and a 5% tariff on imported soybean meal; a tariff is not applied to Egypt's corn imports. South Africa<sup>6</sup> does not apply a tariff to corn or DDGS imports, but there is a 6.6% tariff rate applied to soybean meal imports from the United States.

<sup>6</sup>South Africa, while not within the region of North Africa, imported a small amount of U.S. DDGS in both 2005 (50 mt) and 2006 (1,100 mt).

## Former Soviet Union

Exports of U.S. DDGS have not yet penetrated any of the countries in the Former Soviet Union (FSU). The estimated feeding potential for DDGS in the FSU by livestock class is reported in Table 7.6. At maximum recommended inclusion rates, the FSU livestock industry could potentially feed more than 30 mmt of DDGS each year, while potential demand at typical inclusion rates was estimated to be much lower at 12.7 mmt.

Corn used for feed in the FSU has increased from less than 6 mmt in 2000 to more than 10 mmt for the 2006/07 marketing year, as shown in Figure 7.3. However, corn imports from the United States to the region have been negligible. FSU countries have shown a steady increase in the domestic feeding of soybean meal since 2003, with more than 2.2 mmt being fed to livestock in the region in 2006/07. Imports of soybean meal from the United States have steadily declined, making up less than 2% of the total soybean meal fed in 2007. Based on the amount of corn fed in the region, a more conservative estimate for DDGS demand potential in FSU countries would be 3.5 mmt, although for any significant amount of U.S. DDGS to be imported, it is likely that DDGS would need to be priced lower than corn given the region's lack of dependence on U.S. corn and soybean meal.

**Table 7.6. Potential consumption of distillers dried grains with solubles in the Former Soviet Union based on 2007 livestock inventories**

<b>Livestock Class</b>	<b>2007 Inventories<sup>a</sup> (1000 Head)</b>	<b>Potential Consumption at Max Rates (mt/year)</b>	<b>Potential Consumption at Typical Rates (mt/year)</b>
Beef cows	13,879	4,542,316	2,271,158
Dairy cows	14,586	20,719,105	6,908,578
Other cattle	24,806	4,228,291	2,114,145
Market swine	30,210	2,046,065	1,023,032
Broilers	649,534	341,714	341,714
Turkeys	14,515	41,921	41,921
<b>Total</b>		<b>31,919,412</b>	<b>12,700,550</b>

<sup>a</sup>Source: USDA-FAS, 2008a.



Applied tariff rate data for the individual countries within the FSU were not reported by the World Trade Organization. A number of the countries, such as the Ukraine, Czech Republic, Poland, and Latvia, are now a part of the European Community. The European Community countries reportedly do not apply tariff rates on soybean meal or DDGS imports, but an E.U.\$94/ton duty has been applied on corn imports.

## Total Small Market Demand and Other Issues

Table 7.7 summarizes the total potential demand for U.S. DDGS in export markets based on (1) maximum inclusion rates, (2) typical inclusion rates being implemented by U.S. livestock producers (USDA-NASS, 2007), and (3) one-third of the level of corn fed domestically during the 2006/07 marketing year. The table also reports the current level of market penetration realized for U.S. DDGS (the ratio of imports of U.S. DDGS in 2007 to the potential demand estimate). The final column in Table 7.7 reports the average ratio of corn imports from the United States to the amount of corn fed domestically in each region from 2000 to 2006 to illustrate each region's dependence on U.S. feed sources.

Total potential demand across all five small market regions is estimated to be nearly 100 mmt at maximum inclusion rates, 42 mmt at typical inclusion rates, and more than 20 mmt based on domestic corn feeding rates. Given the low likelihood of export development to the FSU discussed previously, total DDGS demand potential excluding countries in the FSU is also reported. It is worth noting that even the most conservative estimate of total potential demand of more than 16 mmt could result in consumption of 40% of the projected 40 mmt of DDGS that will be produced in the United States each year over the next three to seven years (Informa, 2007b; Tokgoz et al., 2007).

Market penetration rates for 2007 vary from 0% in the FSU to nearly 7% in Southeast Asia. The markets that have experienced the greatest penetration rates—Southeast Asia, Central America, and the Caribbean—include countries that are net importers of corn and soybean meal and are at least somewhat dependent on feed sources imported from the United States. Additional export growth in these regions can be expected as livestock producers become more familiar with the feeding value of

**Table 7.7. Summary of potential demand of distillers dried grains with solubles (% market penetration) and dependence on U.S. corn imports for domestic feed in small international markets**

Region	Potential	Potential	Potential	Potential	U.S. Corn
	Consumption at Maximum Inclusion Rates (mt/year)	Consumption at Typical Inclusion Rates (mt/year)	Consumption Based on Corn Fed Domestically (mt/year)	Consumption Based on Corn Fed Domestically (2000-2006 avg.)	Imports/Corn Fed Domestically (2000-2006 avg.)
South America <sup>a</sup>	29,507,960 (0.20%)	12,524,711 (0.48%)	3,840,667 (1.56%)	3,840,667 (1.56%)	37.2%
Central America and the Caribbean	10,236,059 (1.22%)	4,357,352 (2.87%)	1,806,000 (6.93%)	1,806,000 (6.93%)	89.6%
Southeast Asia	15,372,328 (1.99%)	8,451,316 (3.61%)	6,560,333 (4.66%)	6,560,333 (4.66%)	2.4%
North Africa	8,750,858 (0.75%)	3,565,962 (1.84%)	4,587,000 (1.43%)	4,587,000 (1.43%)	46.5%
Former Soviet Union	31,919,412	12,700,550	3,503,000	3,503,000	<1%
Total	95,786,617 (0.58%)	41,599,890 (1.34%)	20,297,000 (2.74%)	20,297,000 (2.74%)	-
Total <sup>b</sup>	63,867,205 (0.87%)	28,899,341 (1.93%)	16,794,000 (3.31%)	16,794,000 (3.31%)	-

<sup>a</sup>The South America region excludes Argentina, Brazil, Paraguay, and Uruguay.

<sup>b</sup>Excluding the Former Soviet Union.

DDGS and as increasing commodity prices make DDGS a more competitive and attractive alternative to the more traditional feed sources (corn and soybean meal).

In South America, export markets for U.S. DDGS have been developed in Chile, Colombia, Peru, and, to a more limited extent, Ecuador, where trade deficits prevail for corn at the national level. Export markets for DDGS in the FSU have not yet developed and seem unlikely to develop in the future, given the region's status as a net corn exporter, unless DDGS are priced well below the value of corn and/or large transportation economies develop. Considering that many of the FSU countries are now a part of the European Community, restrictions on food and feeds based on biotechnology regulations are also likely to hinder export market development in the region.

Because DDGS are a relatively new product, there are a number of issues and challenges that must be considered in attempting to develop more markets for DDGS both domestically and internationally. These include product recognition, variation in product quality, a lack of standardized grading and test procedures, transportation methods and costs, and the technical education needed for potential buyers (Shurson, 2005). Since transportation issues are discussed in chapter 9 of this book, they will not be discussed in detail in this chapter. However, the economies of container freight and the resulting implications for the markets in Southeast Asia are worth noting.

DDGS have enjoyed transportation economies in a variety of Asian markets by taking advantage of the recent cost differential between container and bulk freight rates. DDGS, as well as other commodities, have taken advantage of containers carrying imported goods from Asia, which were previously being shipped back empty to their ports of origin. However, demand for containers has increased faster than expansion in capacity, putting limitations on the amount of additional DDGS that can be exported in containers to Asian markets (Informa, 2007b).

Potential buyers need to understand the value of DDGS as a component of their feed ration before widespread adoption of DDGS at higher inclusion rates will take place. The incorporation of DDGS into livestock rations is relatively complex, while international producers often rely on

simple methods for ration calculation. The USGC has made significant efforts to educate livestock producers by introducing them to the benefits of incorporating DDGS into their feed rations. These efforts include feeding trial research studies and educational short courses, which have been conducted and offered in a variety of international locations such as Japan, Egypt, the Philippines, Taiwan, China, Guatemala, El Salvador, South Korea, and Chile (USGC, 2008a). Export markets have successfully developed in these countries and continue to grow each year. As producers become more knowledgeable about the value of DDGS, international demand will continue to grow. However, it is crucial to ensure a high-quality product that can be delivered consistently so that international livestock producers have a good first experience with feeding DDGS. Creating quality grades and standardized testing procedures could go a long way in ensuring that import demand for U.S. DDGS will continue to strengthen.

## Summary

The rapid increase in ethanol production has led to a proportional increase in the amount of by-products created in the production process. Distillers grains, one of these by-products, have been shown to have significant feeding value as an energy replacement for corn and/or a protein replacement for soybean meal in livestock rations. As ethanol production continues to expand and profit margins continue to tighten, the marketing and sale of these distillers grains will become increasingly important to ensure continued profitability in the industry.

While it has been estimated that all DDGS produced could be consumed domestically by the U.S. livestock industry (Dhuyvetter, Kastens, and Boland, 2005), ethanol producers have become increasingly concerned with export market development to increase the total demand for this by-product. Historically, only a handful of markets have imported a significant amount of U.S. DDGS, including Canada, Mexico, and countries in the European Union. More recently, smaller international markets have been developed and account for an increasingly larger share of total U.S. exports of DDGS each year.

The focus of this chapter has been the potential value and demand for DDGS in some of these “small” international markets, especially those regions that have already begun to import U.S. DDGS. Using data on

livestock inventories in each region and inclusion rates from feeding trials and actual feeding practices in the United States, estimates of potential consumption levels of DDGS were derived for each region and compared with actual DDGS import histories. Total potential demand for DDGS was estimated to be more than 95 mmt at maximum inclusion rates, or just over 40 mmt if more typical inclusion rates experienced in the U.S. livestock industry are assumed. Despite impressive export growth over the past two years, actual consumption rates of U.S. DDGS remain well below the total feeding potential (less than 7% market penetration) for all regions considered, implying the potential for significant growth in DDGS exports to these small markets.

Even the most conservative estimates of potential DDGS demand in these small international markets, which were based on domestic feeding rates of corn, total more than 16 mmt per year. Combined with the potential domestic demand for DDGS, which was recently estimated at more than 50 mmt (Dhuyvetter, Kastens, and Boland, 2005), the price of DDGS should easily be supported at or slightly above the level of corn prices into the future as ethanol, and DDGS, production levels continue to increase.

Developing new export markets for DDGS and expanding current ones is challenging because it is a relatively new and seemingly complicated feed source to incorporate into livestock rations. Recent efforts by the USGC have been extremely effective in educating international livestock producers about the feeding benefits of DDGS and should continue to promote rapid growth in existing export markets as well as the development of new export markets in additional countries. Given the demand potential existing both domestically and abroad, DDGS should hold its value as a feed replacement for both energy and protein even as ethanol and DDGS production levels continue to expand to meet mandated biofuel levels. The marketing of DDGS will also be aided by the sharp increase in commodity prices and increasing demand for feed from growing livestock industries, as well as high demand for food use worldwide. The major limitations to continued export growth include the need for more educational efforts; established quality grades and testing standards to ensure a consistent, identifiable, and high-quality product; and logistical concerns related to the interplay between container freight capacity and costly, highly volatile bulk freight rates to guarantee that importers receive shipments in a timely and consistent fashion.

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