Grain and Oilseed Shipment Sizes and Distance Hauled by Rail

Marvin E. Prater, U.S. Department of Agriculture, Marvin.Prater@ams.usda.gov , 202-720-0299
Adam Sparger, U.S. Department of Agriculture, Adam.Sparger@ams.usda.gov , 202-205-8701

ABSTRACT

Grain and railroads have an interdependent relationship. Grain is one of the most important commodities for railroads. It is the primary agricultural commodity moved by rail, comprising 7.9% by tons of all commodities, 94% by tons of all farm commodities, and 8.4% of total rail revenue in 2009. In turn, railroads represent a vital component of the grain network, hauling 33% of all grain transported in the United States in 2007. As domestic and export markets have evolved, railroads have continuously made efficiency strides through shuttle trains and the length of haul. Since 1994, grain and oilseed transportation has moved from small shipment sizes to shuttle-size shipments (75 or more railcars) for many grains and oilseeds, reflecting the lower costs of shuttle-size shipments, more domestic destinations capable of unloading shuttle-size shipments, and increased grain and oilseed exports in some years. In addition, the length of haul has increased for grains and oilseeds, reflecting comparative advantages of rail compared to truck on longer hauls, lower rail tariffs per mile for longer hauls, and changing grain and oilseed markets. However, development of the shuttle market has occurred differently among grain types and has not been explored at the individual commodity level.

This paper uses the Surface Transportation Board Confidential Waybill Samples to quantify the changes in shipment size and length of haul for each major grain and oilseed (corn, soybean, wheat, sorghum, and barley) from 1994 to 2009. Changes in shipment size and length of haul are compared to production and usage changes for each of the major grains and oilseeds to gain more insight into the underlying reasons behind the changes. Categories for changes in shipment size include 1 to 5 railcars, 6 to 49 railcars, 50 to 74 railcars, and 75 or more railcars. Categories for distance shipped include 20 to 500 miles, 501 to 1,000 miles, 1,001 to 1,500 miles, and more than 1,500 miles. This procedure improves upon earlier analyses of the grain shuttle-size market by exploring the changes at the individual commodity level.

INTRODUCTION

Grain and railroads have an interdependent relationship. Grain is one of the most important commodities for railroads. It is the primary agricultural commodity moved by rail, comprising 7.9% by tons of all commodities (AAR, 2010b), 94% by tons of all farm commodities (AAR, 2010a), and 8.4% of total rail revenue in 2009 (AAR, 2010b). In turn, railroads represent a vital component of the grain network, hauling 33% of all grain transported in the United States in 2007 (USDA/AMS, 2011).

As domestic and export markets have evolved, railroads have continuously made efficiency strides through shuttle-size shipments.[1] Since 1994, grain and oilseed transportation has moved from single-car shipment sizes to shuttle-size shipments (75 or more railcars) for some grains and oilseeds, reflecting the lower costs of shuttle-size shipments, more domestic destinations capable of unloading shuttle-size shipments, and increased grain and oilseed exports in some cases. However, development of the shuttle-size market has occurred differently among grain types and has not yet been explored at the individual commodity level.

Railroad promotion of shuttle-size shipments has resulted in shuttle-size shipments becoming the dominant shipment size for the movement of corn, soybeans, and sorghum (STB, 1994-2009). Although shuttle-size shipments of wheat comprise 36% of wheat shipments, the dominant shipment size remains 6 to 49 railcars at 47% of the 2009 wheat tonnage (STB, 1994-2009). Shipment sizes of 6 to 49 railcars for barley are the dominant size of shipment, with shuttle-size shipments ranging from 0% to 4% of total barley tonnage (STB, 1994-2009).

In addition, railroads have gained efficiency by increasing the length of haul for grains and oilseeds, reflecting comparative advantages of rail transportation compared to truck for longer hauls, lower rail tariffs per mile for longer hauls, and changing grain and oilseed markets. In 1994, lengths of haul for corn and soybeans were principally between 20 and 500 miles. However in 2009, the predominant length of haul for these two crops had become greater than 1,500 miles (STB, 1994-2009). In contrast, the primary length of haul for wheat and sorghum has not only stayed the same since 1994, it has become even more predominant. The average length of haul for wheat and sorghum was between 501 and 1,000 miles in 1994, representing 40% and 34% of total movements, respectively, whereas it increased to 51% and 54% of total movements by 2009 (STB, 1994-2009). For barley, the predominant length of haul remains 20-500 miles and lengths of haul of 501-1,000 miles have increased.

OBJECTIVE

While there has been some study into how railroad incentives for shuttle trains have changed the movement of grain, this has been done at an aggregate level. The Association of American Railroads (AAR) publishes the percentage of rail tonnage of grain by movement type (AAR, 2010b). However, this data is for grain as a whole, rather than showing changes by each grain. In addition, it does not distinguish between 50-74 railcar shipment sizes and 75 railcar or more shipment sizes, which includes shuttle trains.

AAR data shows that unit trains (more than 50 railcars) increased from 34% of the grain tonnage in 1985 to 60% in 2008 (AAR, 2010b). The tonnage of grain moved by single-car movements (1 to 5 railcars) has

decreased from 36% in 1985 to only 12% in 2008 (AAR, 2010b). The tonnage of grain moved by multiple-car shipments (6 to 49 railcars) has decreased from 30% in 1985 to 28% in 2008 (AAR, 2010b).

AAR publishes the average length of haul by grain and by year, but does not break the data down by mileage category. The AAR data show that the average length of haul has increased for all the major grains, but the grains differ in the percentage that the length of haul has changed (table 1).

Table 1. Average length of haul by grain type (miles)

	1994	2009	% Change
Corn	660	1,129	71
Soybean	596	1,331	123
Wheat	781	1,037	33
Sorghum	745	1,144	54
Barley	794	738	-7

Source: AAR,2004b, 2011b

This paper analyzes grain movements for individual grains based upon shipment size and length of haul. We explore railroad incentives in the shuttle market and provide background data on grain usage and production in order to gain a better understanding of the development of the grain transportation market between 1994 and 2009.

LITERATURE REVIEW

The partial deregulation of the railroad industry substantially changed railroad regulations, allowing railroads to innovate and change rates to reflect the cost efficiency and market demand of different movements. This partial deregulation facilitated the introduction of new service options (Wilson and Wilson, 2001). Partial deregulation has greatly accelerated the replacement of single-car grain movements with lower-cost multiple-car and unit-train shipments (MacDonald, 1989). In addition, railroads were free to set prices to encourage longer hauls, in which they have a substantial comparative advantage over trucks (Wilson and Wilson, 2001).

Changes in the agricultural industry also have encouraged the trend toward unit- and shuttle-trains, as well as the associated consolidation of grain handling facilities. These factors include investments in processing plants, increased size of livestock and poultry feeding operations, increased economies of scale for unit- and shuttle-train loading facilities, larger farms, and increased producer ownership of semitrailer trucks which allow the producer to haul longer distances (Prater and Klindworth, 2000, pg. 19). Also, shifts that are occurring within the feeding industry are creating greater demand for transportation, especially long-haul transportation (USDA/AMS, 1998).

Multiple car rates were one of the earliest pricing innovations and were responsible for major railroad efficiency gains (Wilson and Wilson, 2001). Prior to the advent of unit trains, most grain was shipped from small country elevators in single or multi-car movements, depending on need. Car tariffs were the

same amount per car no matter how many cars were ordered. These grain cars were then combined with other freight traffic to form a full train. In the early 1960s, Southern Railways began offering lower tariff rates for grain shipped in multi-car units. Other railroads adopted this practice with 26-car units in the late 1970s and 52 car units in the 1990s. Cars ordered in 26- or 52-car units would receive lower per car rates. However, even these larger units still needed to be assembled at rail yards and combined into complete trains (Wilson and Wilson, 2001).

In the 1990s, further innovation took place with unit trains in which an entire unit of 50 or more cars hauling a single commodity would ship from the same origin to the same destination without being split en route. Railroads prefer to assemble full trains before moving because no more labor is required to operate a train of 100 cars than one of 50 cars and switching costs are the same regardless of the number of cars (USDA/AMS, 1998). Recognizing the economies of shipment size, railroads have encouraged the use of shuttle-trains.

Shuttle trains are a further development on the typical unit train, offering improved efficiency to railroads and additional incentives to shippers. In addition to eliminating excess switching, shuttle trains greatly increase the traffic capacity of rail lines which are heavily used because they minimize the amount of time that lines are blocked while picking up shipments (Prater and Klindworth, 2000, pg. 11). Shuttle trains differ from standard unit trains in that they are entire trains, usually between 75 and 120 cars, which haul a single commodity between a single origin and destination and are operated on a continuous cycle for a specified length of time under contract. Since railcars in shuttle trains cycle up to 36 times per year, compared to only 15 times per year for railcars in normal service, the use of shuttle trains increases railcar utilization and is extremely attractive to railroads (Prater and Klindworth, 2000, pg. 19). Rail tariff rates for multiple-car and shuttle-train shipments reflect these labor and efficiency savings (Casavant, et al., 2011) (USDA/DOT, 2010, pg. 253). Railroad promotion of shuttle-train shipments includes lower tariff rates, incentives for rapid loading and unloading, and incentives for the number of annual trips.

Financial incentives from the railroads for unit and shuttle trains have had the effect of consolidating small country elevators into larger capacity facilities capable of loading unit or shuttle trains. In their promotion of unit and shuttle trains, railroads offer incentive rates and economic development incentives to encourage shippers to build train loading stations. A dedicated shuttle loading facility requires a large investment in infrastructure on the part of the shipper organization which is not usually shared by the railroad. For example, Sarmiento and Wilson (2005, pg. 1034) found that the cost of upgrading to a shuttle loading facility was between $5-10 million across nine states in 2001. As such, the associated costs do not always justify the benefits of upgrading to such a facility. In another example, Vachal et al. (1999) analyzed elevators for hard red spring wheat in the Northern Plains based on production density, rail dependence, railroad spreads, and customer desires and found that only elevators which handled in excess of 10 million bushels could justify the $2 million investment to upgrade to a 100 car unit train loading facility.

Based on this evidence, it is likely that the profitability of individual grains and the quantities and proportions handled thereof influence an elevator's decision to upgrade to a shuttle loading facility. This in turn should impact the relative proportions of grain traveling in shuttle-size movements. A final factor affecting shipment size is related to export movements. Kenkel, Henneberry, and Augustini (2004, pg. 3)

state that unit and shuttle trains are most likely destined for large domestic processors and exports while single and multicar shipments are most likely destined to smaller domestic processors.

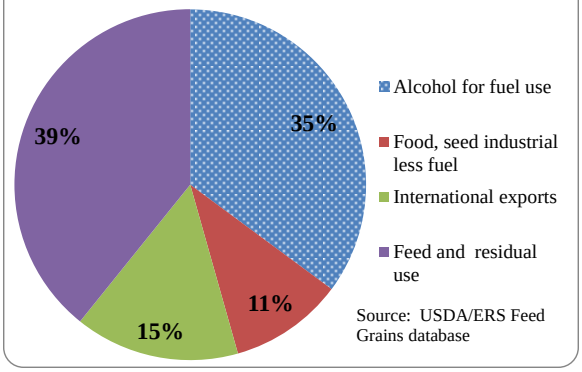
In addition to larger shipment sizes, railroads prefer longer hauls due to the additional cost savings. Class I railroads have encouraged longer hauls following deregulation because their per-mile costs decrease appreciably as the length of haul increases. As long as additional switching is not required, longer hauls tend to result in little additional expense to the railroad (Prater and Klindworth, 2000, pg. 11) (USDA/AMS, 1998).

Changes in Crop Usage

In addition to changes in railroad services, there have also been considerable developments in the way grain is used domestically and abroad, in the international marketplace for grain, and in the amounts that are produced and exported. Corn and soybeans have increased in production whereas wheat, sorghum and barley have declined. As prices have changed to reflect new supply and demand equilibriums, the size and distance of grain shipments has been affected as well.

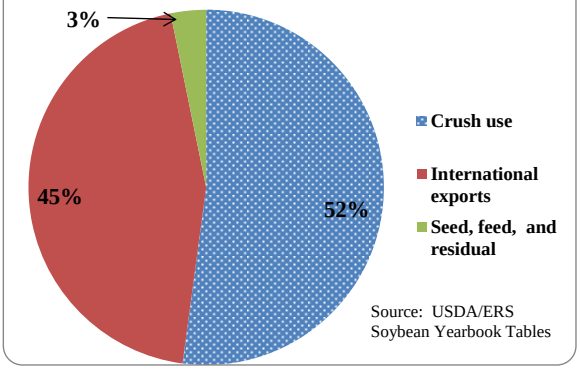
Corn usage has changed markedly since 1994. In 1994, 58% of corn usage was for feed and residual usage, compared to only 39% in marketing year (MY) 2009 (Figure 1) (USDA/ERS Feed Grains Database). Usage for alcohol for fuel use (ethanol) has increased from 6% in 1994 to 35% in 2009. A by-product of ethanol production is distillers' grains (DDGS), which is also used to feed animals, offsetting the reduced corn usage for feed. Food, seed, and industrial use (less fuel usage) has decreased from 13% to 11%. Corn exports have decreased from 23% of usage to 15%, but corn production has increased 30% between 1994 and 2009. The quantity of corn exports decreased only 9%, from 61.0 million tons in 1994 to 55.4 million tons in 2009. The use of corn to produce ethanol does not necessarily reduce the amount of corn available for exports because exports depend on price and production in other countries. For instance, nearly as much corn was exported during 2005 (59.7 million tons) and 2006 (59.5 million tons) as in 1994. In addition, considerably more corn was exported in 2007 (68.2 million tons) than in 1994.

Figure 1: Corn usage, MY 2009



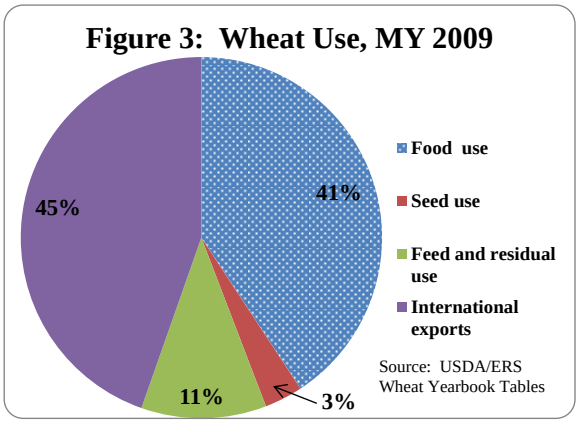
From MY 1994 to MY 2009, U.S. soybean production has increased 34% in response to high world demand for meat, milk, and eggs, which use soybean meal as a high-protein livestock feed. Soybean tonnages exported have increased 79% from 25.2 million tons in MY 1994 to 45.0 million tons in MY 2009 (USDA/ERS Soybean Yearbook Tables). Exports to Asia accounted for much of this with a 259% increase from 7.7 million tons in MY 1994 to 27.8 million tons in MY 2009 (Department of Commerce).

Figure 2: Soybean Use, MY2009

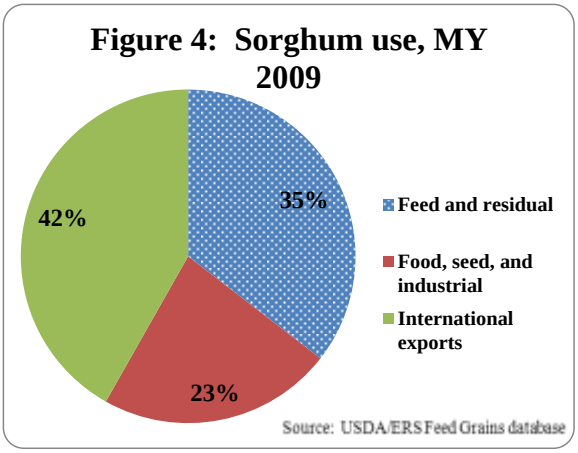


Consequently, export usage increased from 35% of total use in 1994 to 45% in 2009 (Figure 2). Crush use of soybeans decreased from 59% of total use in 1994 to 52% in 2009.

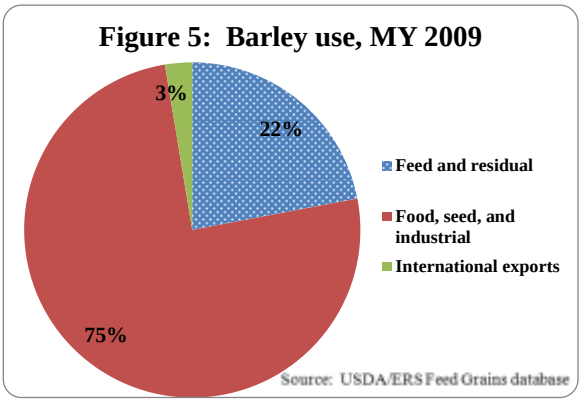
Wheat usage has not changed markedly since 1994. Exports and food are still the primary uses of wheat, comprising 45% and 41%, respectively, of 2009 wheat use (Figure 3) (USDA/ERS Wheat Yearbook Tables). Exports have averaged 48% of U.S. wheat production from 1994 to 2009, but are variable, ranging from 40% to 62% of production because of changes in world markets and world production. Because the wheat fed to livestock tends to be lesser quality and almost all U.S.-grown wheat is food quality, feed use of wheat was only 11% during MY 2009; food quality wheat is considered relatively expensive to use as feed.



Sorghum usage has changed substantially since 1994. In 1994, 61% of sorghum usage was for feed and residual, compared to only 35% in 2009 (Figure 4) (USDA/ERS Feed Grains Database). Sorghum usage for food, seed, and industrial changed from 3% in 1994 to 23% in 2009. A large portion of this change is due to usage of sorghum to produce ethanol. Sorghum exports, as a percentage of usage, have also increased from 36% in 1994 to 42% in 2009, although the tonnage of sorghum exports decreased from 6.2 million tons to 4.6 million tons. The reduction in export tonnage is because sorghum production has decreased 43% during the period 1994 to 2009.



U.S. barley production has decreased 39% from 1994 to 2009 as corn and soybeans have been more profitable to grow. Barley use for feed and residual has decreased from 49% in 1994 to 22% in 2009 (Figure 5) (USDA/ERS Feed Grains Database). Food, seed, and industrial use of barley increased from 37% in 1994 to 75% in 2009. Barley exports have decreased from 14% of use in 1994 to 3% in 2009 due to decreased Asian consumption of U.S. barley.



METHODS

The Confidential Waybill Sample was analyzed between 1994 and 2009 for the five major grains – corn, soybean, wheat, sorghum, and barley. By year and grain type, movements for shipments based upon number of cars were categorized into four categories - 1 to 5 railcars, 6 to 49 railcars, 50 to 74 railcars, and 75 or more railcars. The first category captures single-car movements. The second category captures multi-car and 26-car units. The third category captures the longer 50+ units, and the fourth category captures the shuttle-size movements. Similarly, grain car movements by length of haul were categorized into four categories - 20 to 500 miles, 501 to 1,000 miles, 1,001 to 1,500 miles, and more than 1,500 miles. The Waybill Sample was modified to exclude records that included:

- Shipments originating outside the 48 contiguous United States.
- Shipments with unusually heavy loads (equal to or more than 157.5 tons per car) or extremely light loads (equal to or less than 1 ton per car).
- Trains longer than 150 cars.
- Shipment distances less than 20 miles and more than 3,500 miles for domestic movements or 4,500 miles for export movements to Mexico or Canada.

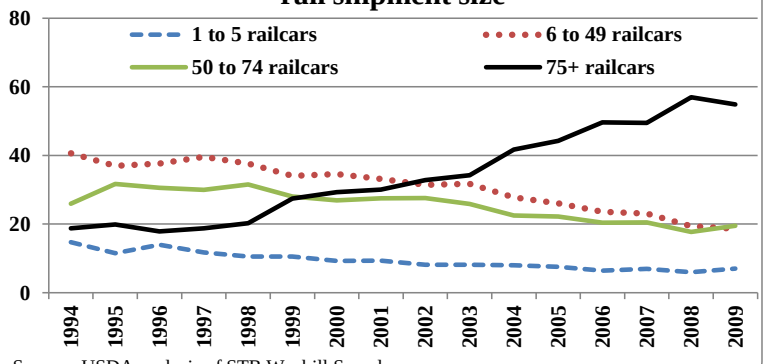
RESULTS

Changes in Rail Shipment Sizes

An analysis of STB waybill samples shows that corn tonnages hauled in shuttle-size shipments increased 275%, from 10.6 million tons in 1994 to 39.6 million tons in 2009. Over the same time period, corn tonnages hauled by 1 to 5 railcar shipments decreased 39%, 6 to 49 railcar shipments decreased 41%, and 50 to 74 railcar shipments decreased 4%.

The percentage of corn moved by shuttle-size shipments increased from 19% of the rail corn tonnage in 1994 to 55% in 2009 (Figure 6). Corn shipments of 1 to 5 railcars decreased from 15% of the rail tonnage in 1994 to 7% of the total in 2009. Corn shipments of 6 to 49 railcars decreased from 41% of the rail tonnage to 19% and corn shipments of 50 to 74 railcars decreased from 26% to 19% of the rail tonnage.

Figure 6: Percentage of corn by rail shipment size

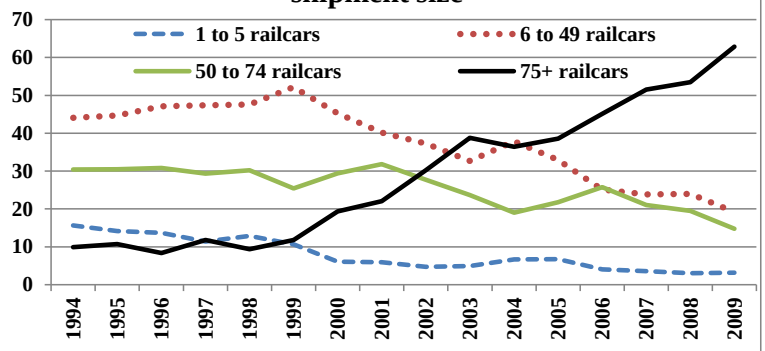


Source: USDA analysis of STB Waybill Samples

Soybean tonnages hauled in shuttle-size shipments increased 1,127%, from 1.49 million tons in 1994 to 18.3 million tons in 2009. Over the same time period, soybean tonnages hauled by 1 to 5 railcar shipments decreased 61%, 6 to 49 railcar shipments decreased 16%, and 50 to 74 railcar shipments decreased 7%.

The percentage of soybeans moved by shuttle-size shipments has increased from 10% of total rail tonnage in 1994 to 63% in 2009 (Figure 7). Soybean shipments of 1 to 5 railcars decreased from 16% of total rail tonnage in 1994 to only 3% of the total in 2009. Soybean shipments of 6 to 49 railcars decreased from 44% of the total tonnage in 1994 to 19% in 2009. Soybean shipments of 50 to 74 railcars decreased from 30% of total rail tonnage in 1994 to 15% in 2009.

Figure 7: Percentage of soybeans by rail shipment size

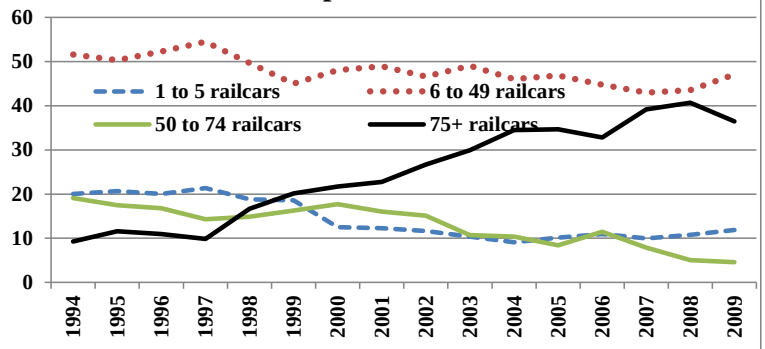


Source: USDA analysis of STB Waybill Samples

Wheat tonnages hauled in shuttle-size shipments increased 272%, from 4.3 million tons in 1994 to 16.1 million tons in 2009. Over the same time period, wheat tonnages hauled by 1 to 5 railcar shipments decreased 44%, 6 to 49 railcar shipments decreased 14%, and 50 to 74 railcar shipments decreased 77%.

Smaller-size shipments of wheat are still an important part of wheat markets. Although the percentage of wheat moved by shuttle-size shipments increased from 9% of the rail wheat tonnage in 1994 to 36% in 2009, shipment sizes of 6 to 49 railcars hauled 47% of the tonnage in 2009 (Figure 8). Wheat shipments of 1 to 5 railcars decreased from 20% of the total tonnage in 1994 to 12% of the total in 2009. Wheat shipments of 50 to 74 railcars decreased from 19% of the total rail tonnage in 1994 to only 5% in 2009.

Figure 8: Percentage of wheat by rail shipment size

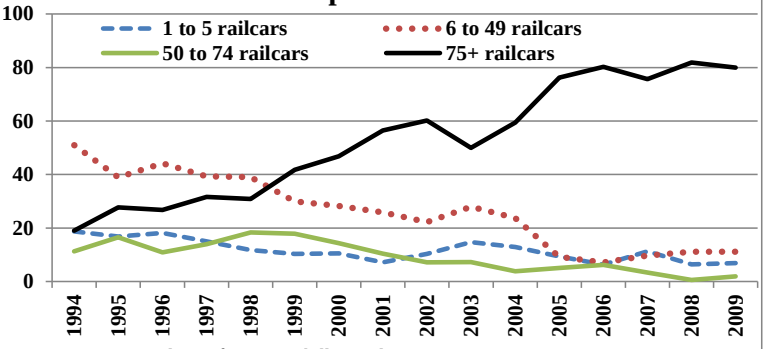


Source: USDA analysis of STB Waybill Samples

Sorghum tonnages hauled in shuttle-size shipments increased 174%, from 1.0 million tons in 1994 to 2.75 million tons in 2009. Over the same time period, sorghum tonnages hauled by 1 to 5 railcar shipments decreased 76%, 6 to 49 railcar shipments decreased by 86%, and 50 to 74 railcar shipments decreased by 89%.

The percentage of sorghum moved by shuttle-size shipments increased from 19% of the rail sorghum tonnage in

Figure 9: Percentage of sorghum by rail shipment size



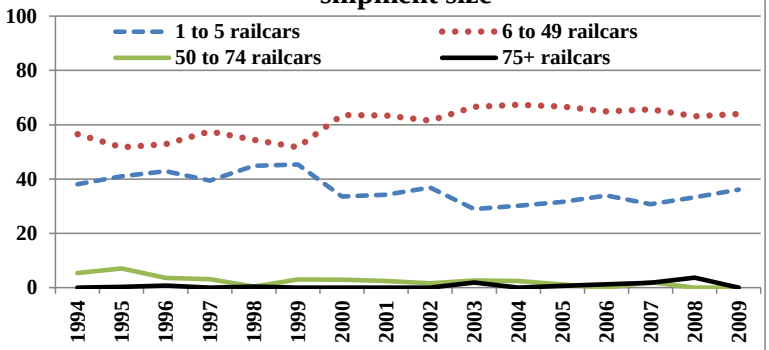
Source: USDA analysis of STB Waybill Samples

1994 to 80% in 2009 (Figure 9). Sorghum shipments of 1 to 5 railcars decreased from 19% of the rail sorghum tonnage in 1994 to 7% in 2009. Sorghum shipments of 6 to 49 railcars decreased from 51% of the rail sorghum tonnage to 11% and sorghum shipments of 50 to 74 railcars decreased from 11% to 2% of the rail sorghum tonnage.

Railroad barley tonnages hauled in mid-size shipments (6 to 49 railcars) decreased 49%, from 4.0 million tons in 1994 to a little more than 2.0 million tons in 2009 due in part to a 39% decrease in production. Over the same time period, barley tonnages hauled in 1 to 5 railcar shipments decreased 57% and tonnages shipped in 50 to 75 railcar shipments decreased 100%.

The percentage of barley moved by 6 to 49 railcar shipments increased from 57% of rail barley tonnage in 1994 to 64% in 2009 (Figure 10). Barley shipments of 1 to 5 railcars decreased from 38% of rail barley tonnage in 1994 to 36% in 2009. Barley shipments of 50 to 74 railcars decreased from 5% of rail barley tonnage in 1994 to 0% in 2009. Shuttle-size movements rose to 4% of rail barley tonnage in 2008 and then returned to 0% in 2009.

Figure 10: Percentage of barley by rail shipment size



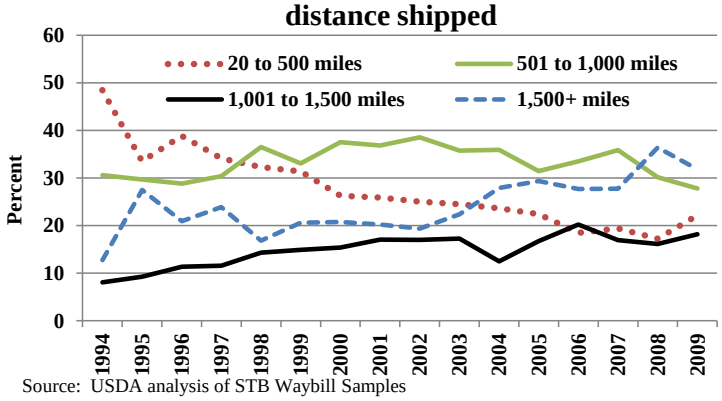
Source: USDA analysis of STB Waybill Samples

Changes in Distance Shipped

The distance grain and oilseeds were shipped increased between 1994 and 2009, reflecting comparative advantages of rail over truck on longer hauls, lower rail costs per mile for longer hauls, and changing grain and soybean markets. The longer hauls often move commodities to export markets and to large animal and poultry feed lots located far from major grain and oilseed production areas.

The distance corn was shipped increased 71% since 1994 (Table 1). Corn shipments between 20 and 500 miles, which are most susceptible to truck competition, decreased from 49% of the rail shipments (27.3 million tons) in 1994 to 22% (16.0 million tons) in 2009, a tonnage decrease of 41% (Figure 11). Corn tonnage moving more than 1,500 miles increased from 13% of the rail movements (7.2 million tons) in 1994 to 32% (23.0 million tons) in 2009, an increase in rail tonnage of 219%. Corn tonnage moving 1,001 to 1,500 miles increased from 8% of the rail movements (4.6 million tons) in 1994 to 18% (13.1 million tons) in 2009, an

Figure 11: Railroad corn movements by distance shipped

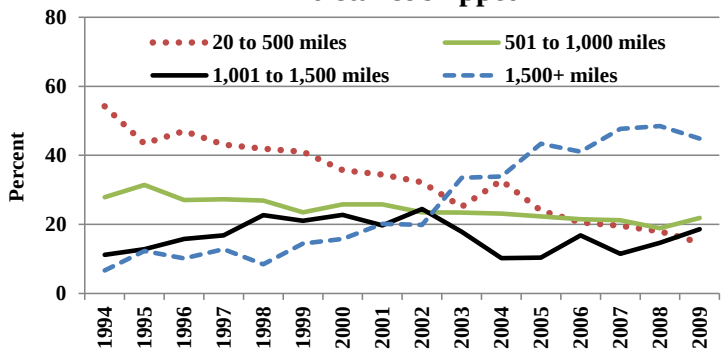


Source: USDA analysis of STB Waybill Samples

increase in rail tonnage of 188%. Corn tonnage moving 501 to 1,000 miles decreased from 31% (17.2 million tons) in 1994 to 28% (20.1 million tons), but rail tonnage increased 16%.

The distance that soybeans are shipped has increased 123% (Table 1), partially in response to a 79% increase in export tonnages since 1994. Soybean rail tonnages hauled more than 1,500 miles increased from 7% of total rail soybean tonnage (1 million tons) in 1994 to 45% (13 million tons) in 2009, a tonnage increase of 1,190% (Figure 12). From 1994 to 2009, the percentage of soybean rail tonnages hauled 1,001 to 1,500 miles increased from 11% of total rail tonnage (1.7 million tons) to 19% (5.4 million tons), a tonnage increase of 221%. The percentage of soybean rail tonnages hauled 501 to 1,000 miles decreased from 28% of total tonnage (4.2 million tons) to 22% (6.4 million tons), but had a 51% increase in rail tonnage. Soybean rail tonnages hauled 20 to 500 miles decreased from 54% of the total rail tonnage (8.2 million tons) to only 15% (4.3 million tons), a decrease in rail tonnage of 48%.

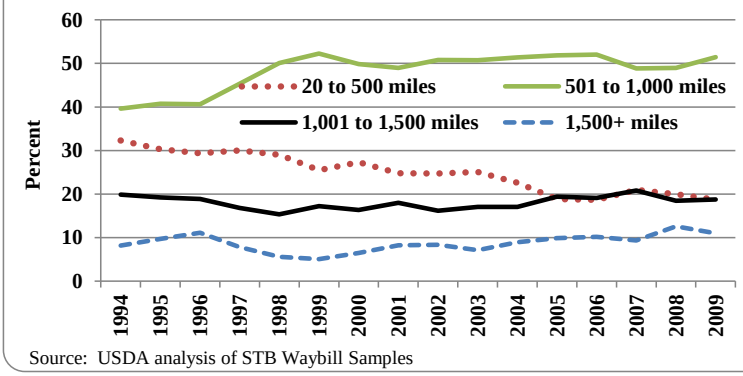
Figure 12: Railroad soybean movements by distance shipped



Source: USDA analysis of STB Waybill Samples

The distance wheat was shipped has increased 33% since 1994 (Table 1). Wheat shipments between 20 and 500 miles, have decreased from 32% of the total in 1994 (15.1 million tons) to only 19% of the total in 2009 (8.3 million tons), a tonnage decrease of 45% (Figure 13). Most wheat is transported 501 to 1,000 miles, which increased from 40% of the total in 1994 (18.5 million tons) to 51% of the total in 2009 (22.7 million tons), a tonnage increase of 23%. The amount of wheat transported 1,001 miles to 1,500 miles has decreased slightly from 20% in tonnage in 1994 (9.3 million tons) to 19% of the total in 2009 (8.3 million tons). Finally, the amount transported more than 1,500 miles has increased from 8% of the tonnage in 1994 (3.8 million tons) to 11% of the tonnage in 2009 (4.9 million tons), a tonnage increase of 27%.

Figure 13: Railroad wheat movements by distance shipped

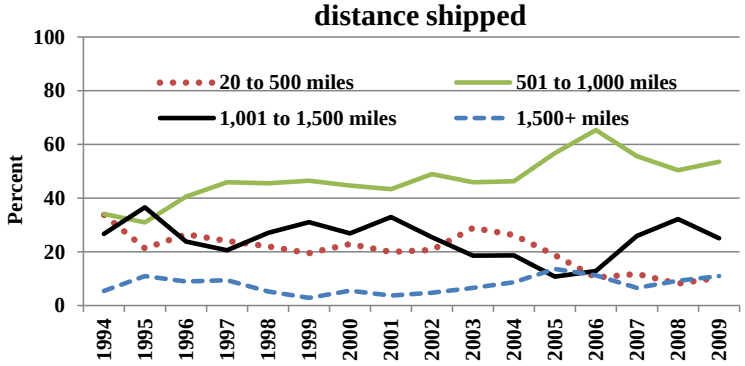


Source: USDA analysis of STB Waybill Samples

The distance sorghum was shipped increased 54% between 1994 and 2009 (Table 1). Sorghum shipments between 20 and 500 miles, which are most susceptible to truck competition, decreased from 34% of sorghum rail shipments (1.78 million tons) in 1994 to 10% (.36 million tons) in 2009, a tonnage decrease of 80% (Figure 14). The percentage of sorghum rail tonnage moving 501 to 1,000 miles increased from 34% (1.8 million tons) in 1994 to 54% (1.84 million tons) in 2009, an increase in rail tonnage of 2%. The percentage of sorghum rail tonnage moving 1,001 to 1,500 miles decreased from 27% (1.4 million tons) in 1994 to 25% (.86 million tons) in 2009, a decrease in rail tonnage of 39%. The

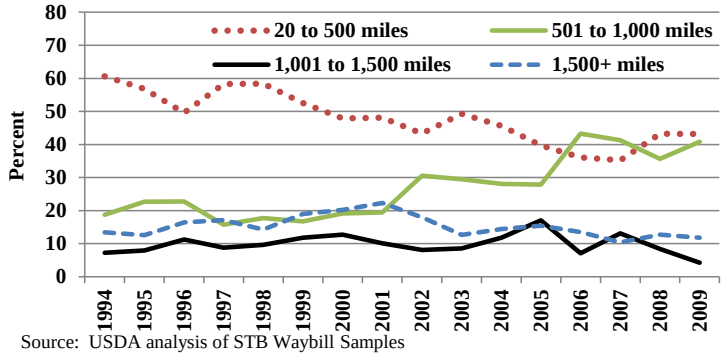
percentage of sorghum rail tonnage moving more than 1,500 miles increased from 5% of the rail sorghum movements (.29 million tons) in 1994 to 11% (.38 million tons) in 2009, an increase of 31% in rail tonnage.

Figure 14: Railroad sorghum movements by distance shipped



Source: USDA analysis of STB Waybill Samples

Figure 15: Railroad barley movements by distance shipped



Source: USDA analysis of STB Waybill Samples

The distance barley was shipped decreased 7% between 1994 and 2009 (Table 1). Barley rail tonnage between 20 and 500 miles decreased from 61% (4.29 million tons) in 1994 to 43% (1.38 million tons) in 2009, a decrease in tonnage of 68% (Figure 15). Tonnage moving between 501 to 1,000 miles increased from 19% of rail barley tonnage (1.32 million tons) in 1994 to 41% in 2009, but barley tonnage in this category still decreased 1%. Rail barley tonnage moving between 1,001 miles to 1,500 miles decreased from 7% (.51 million tons) in 1994 to 4% (.13 million tons) in 2009, a decrease in tonnage of 74%. Rail barley tonnage moving more than 1,500 miles decreased from 13% (.95 million tons) in 1994 to 12% (.38 million tons) in 2009, a tonnage decrease of 60%.

Changes in Market Share of Grain Transportation

Railroads appear to have lost a small amount of the corn market share as U.S. market year[2] corn production increased 30% from 1994 to 2009 while the calendar year tonnage of corn moved by rail increased 28%. Some of this loss in market share may be because truck transportation dominates the delivery of corn to the ethanol plant to be used as a feedstock. From 1994 through 2009, railroads moved an average of 26% of corn production.

Although U.S. soybean production increased 34% from 1994 to 2009, soybean tonnages shipped by railroads have increased 93%. Rail has gained significant market share of soybean transportation, mainly because of a 79% increase in soybean exports. From 1994 through 2009, railroads moved an average of 25% of the soybean production.

Wheat is heavily dependent upon rail transportation as much of it is grown in regions distant from markets and inland waterway transportation. From 1994 to 2009, rail transported an average of 70% of the wheat produced. U.S. wheat production decreased 4% from 1994 to 2009 while the tonnage of wheat moved by rail decreased by 5%. Wheat exports decreased 23% from 1994 to 2009.

U.S. sorghum production decreased 43% from 1994 to 2009 while the tonnage of sorghum moved by rail decreased by only 35%, indicating that railroads have gained market share. From 1994 to 2009, rail transported an average of 31% of the sorghum produced. During the same period, sorghum exports decreased 26%.

U.S. barley production decreased 39% from 1994 to 2009 while the barley tonnage moved by rail decreased 55%, indicating that railroads have lost market share. Barley is still dependent on rail transportation because 68% of the barley produced between 1994 and 2009 moved by rail. During the same period, barley exports have decreased 91%.

CONCLUSIONS

This paper has studied the changes in shipment size and length of haul for five major grains between 1994 and 2009. Despite the overall push towards larger and longer hauls by the railroads in order to maximize efficiency, exports, production, and usage have precluded identical development of the shuttle market for each grain. Interestingly, in 1994, the dominant size of shipment for all five grains was 6 to 49 railcars. However, there were initial differences in the lengths of haul with corn, soybeans, and barley being hauled primarily between 20 and 500 miles in 1994 compared to wheat and sorghum being hauled between 501 and 1,000 miles. By 2009, corn and soybeans were primarily hauled more than 1,500 miles while the predominant category for each of the other grains did not change.

Wheat has been the most consistent of the five grains over the period of study with very little change in exports, production, or usage. As such, it has had the fewest changes in shipment size or length of haul with the dominant shipment size and length of haul remaining the same throughout the time period. In contrast, increased production in corn and soybeans due to corn based ethanol and soybean exports have led to shuttle-sized shipments. Exports, the rise of large dairies, and shift in animal production to regions distant from corn and soybean production regions have resulted in lengths of haul in excess of 1,500 miles becoming the predominant categories. Soybeans have had the most dramatic change in length of haul due mainly to increased exports and shipments to large animal feed regions which are not as susceptible to truck competition, as evidenced by rail's increase in market share. On the other hand, only since 2008 has corn's length of haul been predominantly more than 1,500 miles due to stronger truck competition for movements to ethanol facilities which have taken away some of rail's share.

Shuttle markets have developed differently for sorghum and barley despite decreased production in both. Sorghum for ethanol production and a higher percentage of exports among total usage have led to an increase in shuttle-sized shipments even though less is being exported overall. Barley production has declined due to corn and soybeans being more profitable, and barley exports have declined without a strong export demand. The predominant barley shipment size of 6 to 49 railcars and length of haul between 20 and 500 miles makes rail shipment of barley more susceptible to truck competition and have caused rail to lose market share over the time period.

ENDNOTES

[1] The majority of trains consisting of 75 or more railcars are believed to be shuttle-train movements. Each railroad defines shuttle-train movements a little differently; some require a minimum of 75 railcars, while others require up to 110-120 railcars. A common element is that the locomotives are never detached from the cars as the train moves from origin to destination and then back to the same or another origin. Another common element is the presence of loading and unloading time incentives. Thus, some movements of 75 or more railcars are not shuttle movements. For this reason, we use the term shuttle-size shipment, which includes both shuttle and non-shuttle movements.

[2] The marketing year for corn, soybeans, and sorghum is from September 1 through August 31. The marketing year for wheat and barley is from June 1 through May 31.

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