Grain Sorghum Methodology

Actuarial and Product Design Division

Risk Management Agency

United States Department of Agriculture

Published November 30, 2009

Grain Sorghum Methodology Discussion

RMA proposes a pricing methodology for grain sorghum based on a factor of corn prices. The factor is derived from historical regional weighted grain sorghum prices and corresponding corn prices from the futures market. The same factor would be used for both planting time and harvest time pricing.

The Model A of the Texas A&M submission for grain sorghum pricing methodology uses a six-region weighted average to produce a harvest time price series for grain sorghum and Chicago Board of Trade (CBOT) prices for corn. For grain sorghum, four of these series are average prices in September for each year for four locations in Texas (North of the Canadian River, South of Line, Triangle Area, and Houston/Galveston Port). The other two series are September prices in New Orleans, Louisiana, and October prices in Kansas City, Missouri. Weekly price data for the four Texas locations were provided by Texas AgriLife Extension Service (available at http://agecoext.tamu.edu/resources/basis-data/online.html). The simple average of all September observations in each year was calculated. Monthly New Orleans and Kansas City price series came from ERS/USDA, and the September and October observations, respectively, were extracted from those monthly series to form corresponding annual price series. The corn price for each year is the average settlement price of December corn futures on CBOT during the month of October.

Weights were determined by calculating the proportion of total U.S. grain sorghum production produced in each of six regions in each year. The four Texas price series correspond to regions constituted by portions of Texas, New Mexico, and Oklahoma. New Orleans prices correspond to all of Louisiana, Arkansas, and Mississippi. Kansas City prices correspond to all of Kansas and Nebraska. All annual grain sorghum production data for the states of Louisiana, Arkansas, Mississippi, Kansas and Nebraska, and county-level production data for Texas, New Mexico, and Oklahoma were collected from NASS/USDA. Figures 1 through 3 show the price series for each region, the spatial location of each region, and the regional weights, respectively.

The ratio for each year is then computed by dividing the price of grain sorghum by the price of corn for each year, noted as:

$$\frac{P_{GS}^t}{P_C^t} \tag{1}$$

P_{GS}^t is the weighted price of grain sorghum at time t. P_C^t is the price of corn as derived from futures markets at time t. The most recent 10 year average of the ratios is then computed to produce the price factor.

$$\frac{\sum_{t=y-9}^{y} \frac{P_{GS}^t}{P_C^t}}{10} \tag{2}$$

The year y is defined as the most recent year in the price data series (See Figure 4 and Table 1). On occasion, certain values in the price series may not be reported, therefore it becomes useful to impute

the missing value. In the event that the data is incomplete in a given year, available information will be used to estimate missing values using the general form:

$$\text{Price}_{Local} = f \ (\text{ Production}_{Local} \ , \ \text{Price}^{i}_{Other} \ , \ \text{Production}^{i}_{Other} \ ) \qquad (3)$$

In practice, this usually requires calculating the ratio of the change in price to the change in production of known regions to the ratio of the unknown value(s) to the change in the known production of the region(s) with missing data. The unknown price can then easily be solved algebraically. If missing values are not able to be estimated, then both corresponding prices in that year would be removed from the series. The resulting price factor would then still encompass exactly 10 data points, however the applicable time series would be longer than 10 years.

For Crop Revenue Coverage (CRC), the factor will be applied to relevant futures prices with the price discovery periods using the current methodology. The discovery periods will be differentiated by planting time and harvest time, as well as sales closing date, however each combination will utilize the same price factor (See Table 2). For Actual Production History (APH), this same price factor will be applied to the corn price election for the corresponding year.
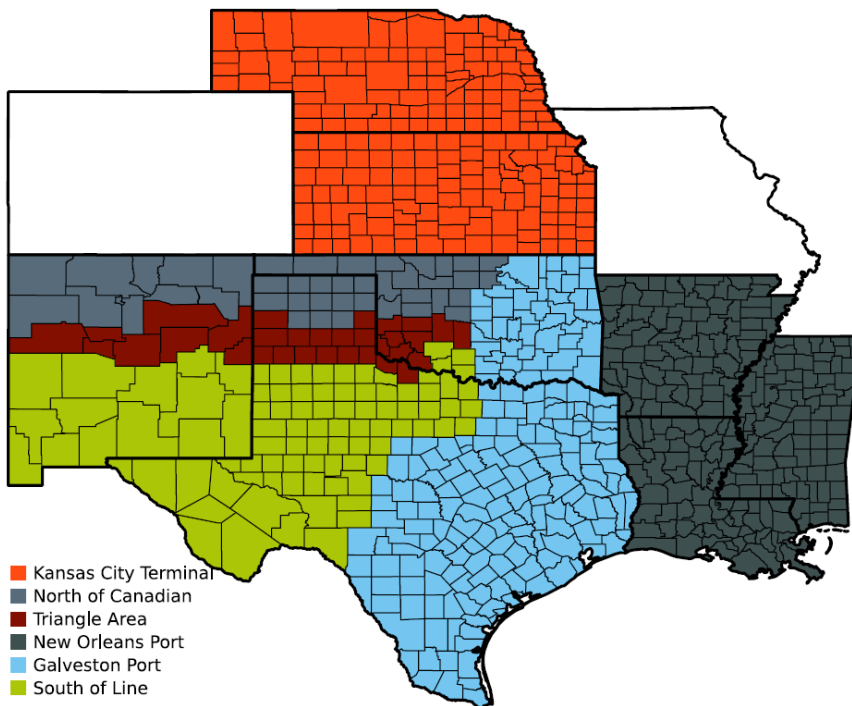
Appendix A. Selected Graphs

Figure 1: Time Series of Regional Harvest Time Grain Sorghum Prices
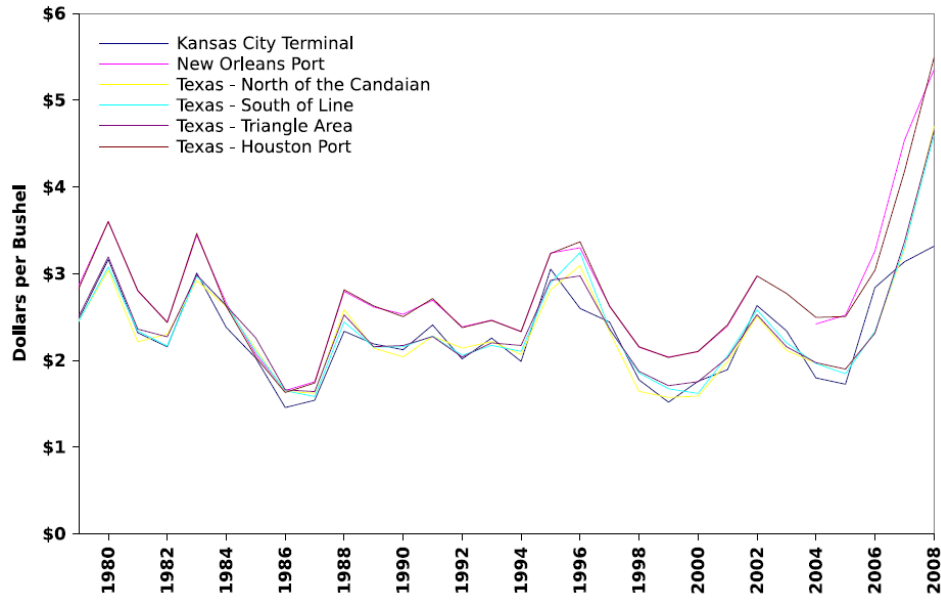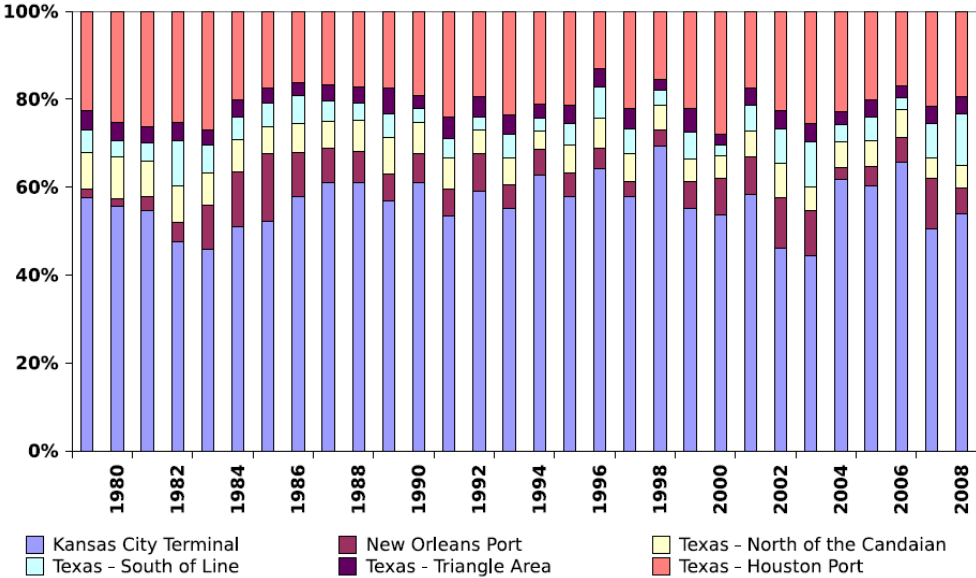

Note: Data for this graph found in Appendix B, Table 3.

Figure 2: Spatial Aggregation of Grain Sorghum Production for Weighting Observed Market Prices
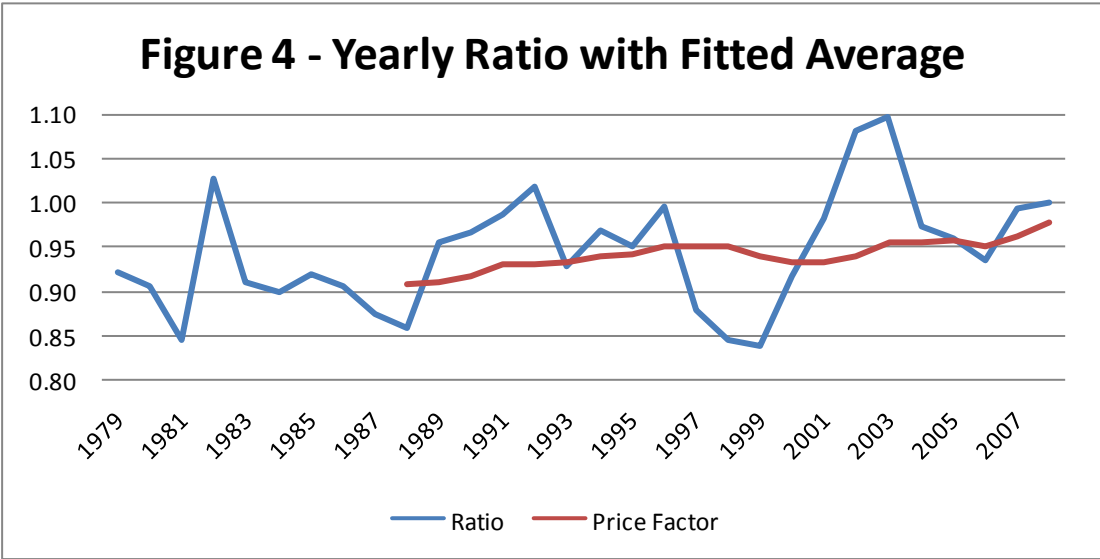

Note: Data for this graph found in Appendix C.

Figure 3: Time Series of Region Weights

Note: Data for this graph found in Appendix B, Table 4.

Note: Data for this graph found in Appendix B, Table 1.

Appendix B. Selected Data Tables

Table 1 - Prices and Ratios

Year	Grain Sorghum	Corn	Ratio	Price Factor
1979	$ 2.56	$ 2.78	92.1%	
1980	$ 3.27	$ 3.61	90.5%	
1981	$ 2.46	$ 2.91	84.5%	
1982	$ 2.26	$ 2.20	102.7%	
1983	$ 3.16	$ 3.48	91.1%	
1984	$ 2.50	$ 2.78	90.0%	
1985	$ 2.05	$ 2.23	91.9%	
1986	$ 1.53	$ 1.69	90.6%	
1987	$ 1.60	$ 1.83	87.4%	
1988	$ 2.48	$ 2.89	85.9%	90.7%
1989	$ 2.28	$ 2.39	95.5%	91.0%
1990	$ 2.22	$ 2.30	96.6%	91.6%
1991	$ 2.48	$ 2.51	98.8%	93.0%
1992	$ 2.13	$ 2.09	101.8%	93.0%
1993	$ 2.31	$ 2.49	92.8%	93.1%
1994	$ 2.09	$ 2.16	96.9%	93.8%
1995	$ 3.07	$ 3.23	95.2%	94.1%
1996	$ 2.83	$ 2.84	99.6%	95.0%
1997	$ 2.47	$ 2.81	87.9%	95.1%
1998	$ 1.85	$ 2.19	84.4%	94.9%
1999	$ 1.69	$ 2.01	83.8%	93.8%
2000	$ 1.87	$ 2.04	91.6%	93.3%
2001	$ 2.05	$ 2.09	98.1%	93.2%
2002	$ 2.73	$ 2.52	108.1%	93.8%
2003	$ 2.48	$ 2.26	109.7%	95.5%
2004	$ 2.00	$ 2.05	97.3%	95.6%
2005	$ 1.94	$ 2.02	96.0%	95.7%
2006	$ 2.84	$ 3.03	93.5%	95.1%
2007	$ 3.55	$ 3.58	99.3%	96.2%
2008	$ 4.13	$ 4.13	100.0%	97.8%

Table 2 - Price Discovery

	Sales Closing Date	Discovery period	Contract
Planting	pre-3/15	Dec 15 - Jan 14	September (U)
	3/15	Feb 1 - Feb 28/29	December (Z)
Harvest	pre-3/15	Aug 1 - Aug 31	September (U)
	3/15	Oct 1 - Oct 31	December (Z)

Table 3 - Harvest Time Spot Price Data

Year	Kansas City	New Orleans	North of Canadian	South of Line	Triangle Area	Houston Port
1979	2.4752	2.8616	2.4584	2.4514	2.5088	2.828
1980	3.164	3.6008	3.0366	3.0758	3.1934	3.5994
1981	2.3184	2.8	2.2134	2.338	2.3604	2.8056
1982	2.156	2.4416	2.30272	2.16608	2.27136	2.436
1983	3.0072	3.444	2.91872	2.968	2.9848	3.46416
1984	2.38	2.66	2.6208	2.639	2.6292	2.6222
1985	2.0272	2.072	2.1308	2.1042	2.2596	2.0384
1986	1.456	1.652	1.6422	1.6492	1.6604	1.6296
1987	1.54	1.7528	1.6198	1.582	1.6394	1.7388
1988	2.3352	2.7944	2.58496	2.44272	2.52448	2.81344
1989	2.1896	2.6152	2.1406	2.1532	2.1574	2.6278
1990	2.1224	2.5312	2.0398	2.1574	2.1714	2.5032
1991	2.408	2.6936	2.2778	2.2792	2.275	2.7132
1992	2.016	2.3856	2.1406	2.058	2.0384	2.3772
1993	2.2568	2.464	2.21648	2.1728	2.20192	2.45952
1994	1.988	2.3296	2.06752	2.10336	2.17168	2.33296
1995	3.052	3.2368	2.814	2.8966	2.9232	3.2326
1996	2.5984	3.2984	3.0926	3.2438	2.9736	3.367
1997	2.4416	2.6264	2.3282	2.3604	2.3618	2.6236
1998	1.7752	2.1504	1.6422	1.855	1.8732	2.1574
1999	1.5176	2.0384	1.57136	1.67216	1.708	2.0328
2000	1.7584	2.1	1.5876	1.6184	1.7542	2.1028
2001	1.8928	2.3968	1.981	2.0538	2.03	2.408
2002	2.632	2.968	2.506	2.5816	2.527	2.9736
2003	2.3408	2.9675	2.114	2.2036	2.1574	2.772
2004	1.7976	2.4192	1.9656	1.96336	1.97344	2.49536
2005	1.7248	2.52	1.8984	1.84576	1.89952	2.5046
2006	2.8392	3.2592	2.3156	2.3338	2.3128	3.038
2007	3.136	4.536	3.283	3.3054	3.3642	4.1748
2008	3.3152	5.348	4.6928	4.5892	4.6424	5.4852

Table 4 - Production Data

Year	Kansas City	New Orleans	North of Canadian	South of Line	Triangle Area	Houston Port
1979	398,010,000	13,048,000	57,258,730	35,366,500	30,908,520	156,057,250
1980	271,440,000	7,693,000	46,975,600	18,494,050	19,615,350	123,215,000
1981	403,320,000	23,738,000	58,788,540	30,282,260	28,052,950	193,211,250
1982	336,180,000	29,770,000	59,093,250	71,975,070	29,930,330	177,827,350
1983	182,690,000	40,055,000	28,969,100	25,277,480	13,770,420	107,663,000
1984	338,350,000	83,645,000	48,763,400	33,731,330	27,060,920	133,194,350
1985	451,100,000	133,800,000	52,169,200	46,906,080	28,549,320	150,695,400
1986	447,420,000	79,120,000	50,254,200	48,413,380	24,265,320	124,739,000
1987	380,350,000	48,489,000	37,576,500	29,656,100	22,451,650	104,105,750
1988	307,960,000	35,610,000	35,841,400	18,806,560	19,553,040	86,149,000
1989	299,810,000	31,760,000	44,191,600	28,101,850	29,976,550	92,170,000
1990	293,370,000	31,995,000	33,535,400	15,573,080	14,273,820	91,517,700
1991	266,850,000	30,270,000	34,880,400	22,549,370	23,608,480	119,861,750
1992	387,820,000	56,892,000	35,475,200	18,727,310	30,773,300	127,508,800
1993	250,150,000	23,895,000	28,316,000	23,681,000	19,621,000	107,057,000
1994	348,600,000	31,989,000	23,691,000	16,616,800	17,517,200	116,985,000
1995	230,440,000	21,680,000	24,709,400	19,788,000	16,772,000	84,490,500
1996	452,050,000	32,948,000	47,224,400	50,609,500	29,038,600	91,862,500
1997	325,950,000	20,175,000	36,136,800	31,334,100	26,773,100	124,094,000
1998	320,400,000	16,730,000	25,280,400	16,621,850	10,789,750	71,333,000
1999	301,170,000	33,892,000	28,404,400	32,349,700	29,411,900	121,109,000
2000	223,800,000	34,493,000	21,341,500	10,777,790	9,766,210	116,769,500
2001	268,200,000	39,604,000	26,100,300	26,980,950	17,975,750	80,363,000
2002	151,000,000	37,312,000	25,724,100	25,627,800	13,288,100	73,710,000
2003	161,500,000	37,377,000	19,399,000	37,556,200	15,196,800	92,672,000
2004	252,770,000	11,326,000	23,993,650	15,961,750	12,571,200	93,205,400
2005	216,750,000	15,336,000	20,992,350	19,401,150	14,173,750	72,317,750
2006	163,720,000	14,318,000	15,475,550	6,619,800	6,765,150	42,439,500
2007	231,910,000	53,690,000	21,434,850	35,808,800	18,144,850	98,964,500
2008	233,610,000	25,512,000	22,312,000	50,417,250	16,821,800	83,827,950

Appendix C. List of Counties in Each Region

Kansas City Terminal

All Kansas

All Nebraska

New Orleans Port

All Louisiana

All Arkansas

All Mississippi

North of Canadian

Texas

Carson, Dallam, Gray, Hansford, Hartley, Hemphill, Hutchinson, Lipscomb, Moore, Ochiltree, Potter, Roberts, Sherman

Oklahoma

Alfalfa, Beaver, Blaine, Canadian, Cimarron, Custer, Dewey, Ellis, Garfield, Grant, Harper, Kay, Kingfisher, Major, Noble, Roger Mills, Texas, Woods, Woodward

New Mexico

Colfax, Harding, Los Alamos, McKinley, Mora, Rio Arriba, San Juan, Sandoval, Santa Fe, Taos, Union

Triangle Area

Texas

Armstrong, Briscoe, Castro, Childress, Collingsworth, Deaf Smith, Donley, Hall, Hardeman, Oldham, Parmer, Randall, Swisher, Wheeler, Wilbarger

Oklahoma

Beckham, Caddo, Grady, Greer, Harmon, Jackson, Kiowa, Tillman, Washita

New Mexico

Bernalillo, Cibola, Curry, Guadalupe, Quay, San Miguel, Torrance, Valencia

South of Line

Texas

Andrews, Archer, Bailey, Baylor, Borden, Brewster, Clay, Cochran, Coke, Cottle, Crane, Crockett, Crosby, Culberson, Dawson, Dickens, Ector, El Paso, Fisher, Floyd, Foard, Gaines, Garza, Glasscock, Hale, Haskell, Hockley, Howard, Hudspeth, Irion, Jack, Jeff Davis, Jones, Kent, King, Knox, Lamb, Loving, Lubbock, Lynn, Martin, Midland, Mitchell, Montague, Motley, Nolan, Palo Pinto, Parker, Pecos, Presidio, Reagan, Reeves, Runnels, Schleicher, Scurry, Shackelford, Stephens, Sterling, Stonewall, Sutton, Taylor, Terrell, Terry, Throckmorton, Tom Green, Upton, Val Verde, Ward, Wichita, Winkler, Wise, Yoakum, Young

Oklahoma

Comanche, Cotton, Jefferson, Stephens

New Mexico

Catron, Chaves, De Baca, Dona Ana, Eddy, Grant, Hidalgo, Lea, Lincoln, Luna, Otero, Roosevelt, Sierra, Socorro

Houston/Galveston Port

Texas

Anderson, Angelina, Aransas, Atascosa, Austin, Bandera, Bastrop, Bee, Bell, Bexar, Blanco, Bosque, Bowie, Brazoria, Brazos, Brooks, Brown, Burleson, Burnet, Caldwell, Calhoun, Callahan, Cameron, Camp, Cass, Chambers, Cherokee, Coleman, Collin, Colorado, Comal, Comanche, Concho, Cooke, Coryell, Dallas, Delta, Denton, DeWitt, Dimmit, Duval, Eastland, Edwards, Ellis, Erath, Falls, Fannin, Fayette, Fort Bend, Franklin, Freestone, Frio, Galveston, Gillespie, Goliad, Gonzales, Grayson, Gregg, Grimes, Guadalupe, Hamilton, Hardin, Harris, Harrison, Hays, Henderson, Hidalgo, Hill, Hood, Hopkins, Houston, Hunt, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Johnson, Karnes, Kaufman, Kendall, Kenedy, Kerr, Kimble, Kinney, Kleberg, Lamar, Lampasas, La Salle, Lavaca, Lee, Leon, Liberty, Limestone, Live Oak, Llano, McCulloch, McLennan, McMullen, Madison, Marion, Mason, Matagorda,

Maverick, Medina, Menard, Milam, Mills, Montgomery, Morris, Nacogdoches, Navarro, Newton, Nueces, Orange, Panola, Polk, Rains, Real, Red River, Refugio, Robertson, Rockwall, Rusk, Sabine, San Augustine, San Jacinto, San Patricio, San Saba, Shelby, Smith, Somervell, Starr, Tarrant, Titus, Travis, Trinity, Tyler, Upshur, Uvalde, Van Zandt, Victoria, Walker, Waller, Washington, Webb, Wharton, Willacy, Williamson, Wilson, Wood, Zapata, Zavala

Oklahoma

Adair, Atoka, Bryan, Carter, Cherokee, Cleveland, Choctaw, Coal, Craig, Creek, Delaware, Garvin, Haskell, Hughes, Johnston, Latimer, Le Flore, Lincoln, Love, Logan, Marshall, Mayes, McClain, McCurtain, McIntosh, Murray, Muskogee, Nowata, Okfuskee, Oklahoma, Okmulgee, Osage, Ottawa, Pawnee, Payne, Pittsburg, Pontotoc, Pottawatomie, Rogers, Seminole, Sequoyah, Tulsa, Wagoner, Washington