

## Nutrient Profile

New generation distillers dried grains with solubles are an excellent source of protein and energy for livestock and poultry. Because the distillers grains from each plant are slightly different in composition and nutritional value, a standard nutrient profile does not exist. However, the profiles below are typical of most new generation distillers grains. The analyses below are representative of DDGS only. For typical analyses of DDG, WDG or WDGS, consult your nutritionist or local extension agency.

**Table 1. Proximate analysis of distiller's dried grains with solubles originating from new ethanol plants in Minnesota and South Dakota compared to a sample from an older Midwestern ethanol plant (OMP) and published reference values<sup>a</sup>**

Sample origin	# of samples	DM (%)	CP (%)	Fat (%)	Fiber (%)	Ash (%)	NFE (%)	ADF (%)	NDF (%)	DE <sup>b</sup> (kcal/kg)	ME <sup>b</sup> (kcal/kg)
MN-SD											
Aberdeen	12	87.4 (1.7)	30.8 (10.2)	10.2 (10.5)	8.9 (11.1)	6.3 (14.8)	43.8 (8.8)	14.2 (8.0)	46.2 (10.0)	3909 (2.9)	3541 (3.2)
Bingham Lk	12	90.2 (1.0)	30.9 (7.6)	10.7 (6.1)	9.1 (6.6)	6.4 (15.1)	43.8 (8.4)	18.1 (7.5)	44.4 (5.0)	3883 (3.9)	3510 (4.0)
Benson	12	88.4 (1.0)	30.1 (2.7)	11.2 (5.0)	8.3 (5.6)	5.4 (11.4)	45.0 (2.9)	14.8 (51.8)	37.0 (19.7)	4020 (1.2)	3645 (1.2)
Claremont	12	89.1 (1.3)	31.4 (2.1)	11.4 (5.5)	9.2 (5.9)	5.6 (8.8)	42.4 (3.2)	13.8 (—) <sup>d</sup>	40.5 (4.9)	3982 (0.9)	3599 (0.9)
Luverne	12	87.2 (1.1)	29.8 (3.3)	11.7 (7.4)	8.3 (8.8)	5.8 (11.6)	44.9 (3.9)	16.0 (55.8)	36.8 (20.6)	4022 (2.1)	3654 (2.2)
Morris	12	90.0 (2.0)	30.7 (6.8)	10.2 (9.1)	8.8 (9.3)	5.5 (16.7)	44.8 (7.2)	15.8 (8.4)	44.5 (4.3)	3945 (1.5)	3568 (1.5)
Preston	11	88.7 (1.5)	28.7 (5.7)	11.4 (7.0)	8.4 (8.9)	6.7 (7.4)	44.9 (4.9)	16.3 (54.2)	36.7 (23.1)	3971 (1.5)	3610 (1.7)
Scotland	11	89.8 (1.4)	31.6 (4.9)	10.8 (4.4)	9.7 (5.2)	5.7 (16.3)	42.2 (5.3)	18.5 (10.1)	49.1 (3.1)	3932 (1.5)	3550 (1.8)
Winnebago	12	90.0 (0.6)	28.7 (4.1)	10.7 (5.9)	8.3 (5.7)	5.4 (12.5)	46.9 (2.8)	15.4 (11.2)	42.8 (3.7)	3995 (1.3)	3629 (1.3)
Winthrop	12	88.7 (0.8)	29.5 (3.3)	10.8 (5.5)	8.7 (4.3)	5.2 (7.6)	45.8 (3.8)	17.1 (6.6)	41.9 (2.4)	3989 (0.7)	3621 (0.7)
1997 – 99	118	88.9 (1.7)	30.2 (6.4)	10.9 (7.8)	8.8 (8.7)	5.8 (14.7)	44.5 (6.1)	16.2 (28.4)	42.1 (14.3)	3965 (2.2)	3592 (2.4)
OMP DDGS	4	88.3 (0.9)	28.1 (2.4)	8.2 (12.6)	7.1 (4.2)	6.3 (17.5)	50.3 (5.9)	16.7 (—) <sup>d</sup>	35.4 (—) <sup>d</sup>	3874 (0.2)	3521 (0.3)
Reference <sup>c</sup>											
NRC		93.0	29.8	9.0	4.8			17.5	37.2	3449	3038
HL		90.8	28.5								
FRI		93.0	29.0	8.6	9.1	4.8					3848

<sup>a</sup> Nutrient values expressed on 100% dry matter basis. Coefficients of variation presented in parenthesis.

<sup>b</sup> DE = [(CP \* 4) + (NFE \* 4) + (Fat \* 9)] \* 4.54; ME = DE \* [(0.96 - (0.2 \* CP))/100].

<sup>c</sup> References are: Nutrient Requirements of Swine, 10<sup>th</sup> ed., 1998. (NRC), Heartland Lysine, Inc. Amino Acid Digestibility Tables, 1998. (HL), and Feedstuffs Reference Issue, Vol. 71 Num. 31, July 30, 1999. (FRI)

<sup>d</sup> Only 1 sample analyzed

**Table 2. Essential amino acid levels of distiller's dried grains with solubles originating from new ethanol plants in Minnesota and South Dakota compared to a sample from an older Midwestern ethanol plant (OMP) and published reference values<sup>a</sup>**

Sample origin	# of samples	Arg (%)	His (%)	Ile (%)	Leu (%)	Lys (%)	Met (%)	Phe (%)	Thr (%)	Trp (%)	Val (%)
MN-SD											
Aberdeen	12	1.31 (6.2)	0.82 (5.3)	1.14 (7.5)	3.69 (5.3)	1.02 (9.6)	0.65 (9.8)	1.53 (5.0)	1.21 (5.6)	0.27 (9.1)	1.56 (6.2)
Bingham Lk	12	1.23 (2.1)	0.78 (2.1)	1.10 (5.4)	3.51 (3.2)	0.91 (2.9)	0.53 (5.1)	1.47 (3.7)	1.12 (2.5)	0.25 (5.9)	1.46 (2.8)
Benson	12	1.15 (11.5)	0.75 (8.6)	1.17 (8.0)	3.62 (6.7)	0.74 (17.8)	0.53 (6.2)	1.50 (7.0)	1.17 (6.3)	0.24 (9.1)	1.55 (8.5)
Claremont	12	2.17 (4.2)	0.77 (4.3)	1.15 (6.0)	3.53 (3.1)	0.91 (10.1)	0.50 (2.5)	1.46 (2.8)	1.12 (3.4)	0.26 (5.8)	1.50 (3.7)
Luverne	12	1.25 (6.5)	0.78 (7.0)	1.07 (8.7)	3.42 (6.3)	0.94 (11.3)	0.58 (9.4)	1.42 (6.7)	1.14 (7.4)	0.25 (7.3)	1.47 (8.3)
Morris	12	1.15 (11.5)	0.73 (9.0)	1.15 (9.7)	3.47 (6.1)	0.79 (25.7)	0.49 (8.7)	1.42 (6.4)	1.12 (6.7)	0.24 (13.9)	1.49 (7.2)
Preston	11	1.18 (5.5)	0.76 (7.8)	1.05 (11.1)	3.43 (7.9)	0.85 (7.2)	0.55 (10.2)	1.43 (7.8)	1.14 (7.9)	0.24 (6.7)	1.43 (10.1)
Scotland	11	1.25 (7.8)	0.79 (7.2)	1.17 (8.2)	3.81 (7.5)	0.78 (11.2)	0.69 (6.4)	1.57 (7.3)	1.14 (6.0)	0.25 (6.9)	1.53 (7.5)
Winnebago	12	1.11 (9.9)	0.75 (7.6)	1.05 (8.3)	3.48 (5.6)	0.72 (19.7)	0.53 (3.9)	1.41 (6.7)	1.07 (6.4)	0.21 (8.4)	1.47 (7.1)
Winthrop	12	1.13 (8.7)	0.72 (8.0)	1.16 (5.6)	3.55 (3.3)	0.80 (16.4)	0.49 (5.4)	1.48 (3.2)	1.12 (3.1)	0.25 (8.9)	1.51 (6.1)
1997 - 99	118	1.20 (9.1)	0.76 (7.8)	1.12 (8.7)	3.55 (6.4)	0.85 (17.3)	0.55 (13.6)	1.47 (6.6)	1.13 (6.4)	0.25 (6.7)	1.50 (7.2)
OMP DDGS	4	0.92 (18.7)	0.61 (15.2)	1.00 (9.1)	2.97 (12.4)	0.53 (26.5)	0.50 (4.5)	1.27 (8.1)	0.98 (7.3)	0.19 (19.8)	1.39 (2.3)
Reference <sup>b</sup>											
NRC		1.22	0.74	1.11	2.76	0.67	0.54	1.44	1.01	0.27	1.40
HL		1.21	0.75	1.09	3.27	0.81	0.63	1.43	1.11	0.20	1.43
FRI		1.08	0.65	1.08	2.90	0.65	0.65	1.29	1.02	0.22	1.43

<sup>a</sup> Nutrient values expressed on 100% dry matter basis. Coefficients of variation presented in parenthesis.

<sup>b</sup> References are: Nutrient Requirements of Swine, 10<sup>th</sup> ed., 1998. (NRC)  
Heartland Lysine, Inc. Amino Acid Digestibility Tables, 1998. (HL)  
Feedstuffs Reference Issue, Vol. 71 Num. 31, July 30, 1999. (FRI)

**Table 3. Mineral composition of distiller's dried grains with solubles originating from new ethanol plants in Minnesota and South Dakota compared to a sample from an older Midwestern ethanol plant (OMP) and published reference values<sup>a</sup>**

Sample origin	# of samples	Ca (%)	P (%)	K (%)	Mg (%)	S (%)	Na (%)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)
MN-SD											
Aberdeen	12	0.03 (44.9)	0.85 (15.3)	0.84 (14.3)	0.32 (14.0)	0.33 (21.8)	0.15 (28.8)	72.1 (39.6)	21.3 (57.5)	6.0 (24.8)	175.7 (60.9)
Bingham Lk	12	0.03 (13.9)	0.94 (6.9)	0.99 (9.5)	0.34 (7.5)	0.68 (23.8)	0.16 (96.2)	56.6 (8.0)	15.5 (9.1)	5.3 (8.8)	98.1 (13.1)
Benson	12	0.08 (17.4)	0.92 (7.1)	0.99 (5.3)	0.35 (6.0)	0.40 (16.4)	0.21 (19.4)	110.0 (31.2)	15.4 (14.2)	6.3 (12.0)	118.7 (5.9)
Claremont	12	0.07 (51.2)	0.95 (4.7)	1.06 (7.1)	0.34 (4.7)	0.38 (40.8)	0.20 (55.2)	130.0 (24.0)	15.3 (11.2)	5.4 (15.2)	144.7 (12.6)
Luverne	12	0.05 (36.6)	0.91 (3.1)	0.97 (7.6)	0.37 (5.2)	0.47 (29.4)	0.20 (24.4)	96.7 (24.2)	17.4 (27.9)	6.3 (15.4)	106.9 (25.2)
Morris	12	0.13 (33.6)	0.82 (12.2)	0.94 (10.9)	0.34 (13.3)	0.74 (21.9)	0.51 (44.8)	44.7 (11.7)	16.0 (15.7)	7.6 (18.9)	156.4 (31.3)
Preston	11	0.06 (50.6)	0.99 (8.2)	1.04 (7.6)	0.36 (6.4)	0.37 (37.9)	0.20 (49.8)	312.1 (18.9)	17.8 (25.5)	5.9 (14.6)	103.2 (16.5)
Scotland	11	0.03 (21.1)	0.70 (6.4)	0.69 (10.6)	0.25 (10.7)	0.46 (6.4)	0.12 (9.4)	60.2 (7.8)	10.7 (12.9)	6.1 (14.8)	90.5 (15.4)
Winnebago	12	0.06 (15.2)	0.89 (5.5)	0.84 (4.4)	0.33 (4.3)	0.54 (14.3)	0.17 (32.8)	52.2 (6.9)	13.8 (4.4)	4.7 (10.8)	75.3 (13.9)
Winthrop	12	0.07 (15.3)	0.94 (5.6)	1.03 (5.5)	0.35 (4.7)	0.36 (9.7)	0.46 (34.4)	55.1 (10.5)	14.7 (9.9)	5.3 (19.0)	124.3 (19.1)
1997 - 99	118	0.06 (57.2)	0.89 (11.7)	0.94 (14.0)	0.33 (12.1)	0.47 (37.1)	0.24 (70.5)	97.5 (80.4)	15.8 (32.7)	5.9 (20.4)	119.8 (41.1)
OMP DDGS	4	0.44 (34.7)	0.90 (7.5)	0.99 (8.7)	0.40 (3.3)	0.51 (43.5)	0.28 (65.2)	80.2 (30.5)	49.5 (66.6)	13.5 (63.6)	219.2 (52.5)
Reference <sup>b</sup>											
NRC		0.22	0.83	0.90	0.20	0.32	0.27	86.0	26.0	61.0	276.0
FRI		0.38	1.02	1.08	0.38	0.32	0.86	91.0	32.0	54.0	323.0

<sup>a</sup> Nutrient values expressed on 100% dry matter basis. Coefficients of variation presented in parenthesis.

<sup>b</sup> References are: Nutrient Requirements of Swine, 10<sup>th</sup> ed., 1998. (NRC)  
Feedstuffs Reference Issue, Vol. 71 Num. 31, July 30, 1999. (FRI)

Source: Dr. Gerald Shurson, University of Minnesota

## Dry-Grind Ethanol Production Coproduct Definitions

Source: Association of American Feed Control Officials (AAFCO) Feed Ingredient Definitions

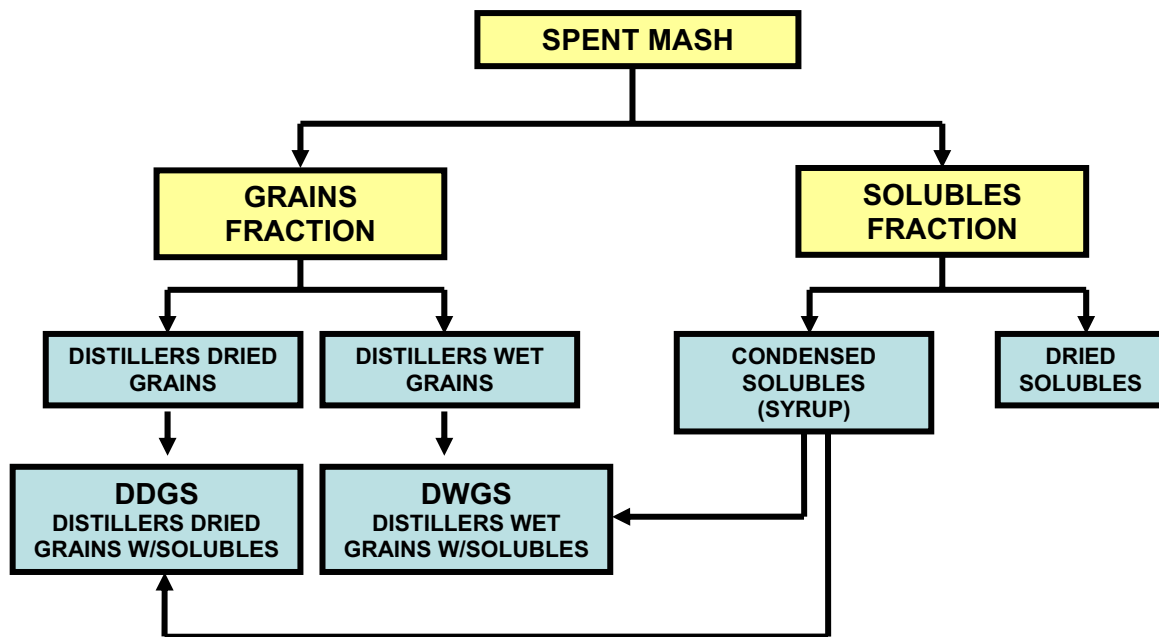
**Corn Distillers Dried Grains (DDG)** is obtained after the removal of ethyl alcohol by distillation from the yeast fermentation of corn by separating the resultant coarse grain fraction of the whole stillage and drying it. (27.5)

**Corn Distillers Dried Grains with Solubles (DDGS)** is obtained after the removal of ethyl alcohol by distillation from the yeast fermentation of corn by condensing and drying at least  $\frac{3}{4}$  of the solids of the resultant whole stillage. (27.6)

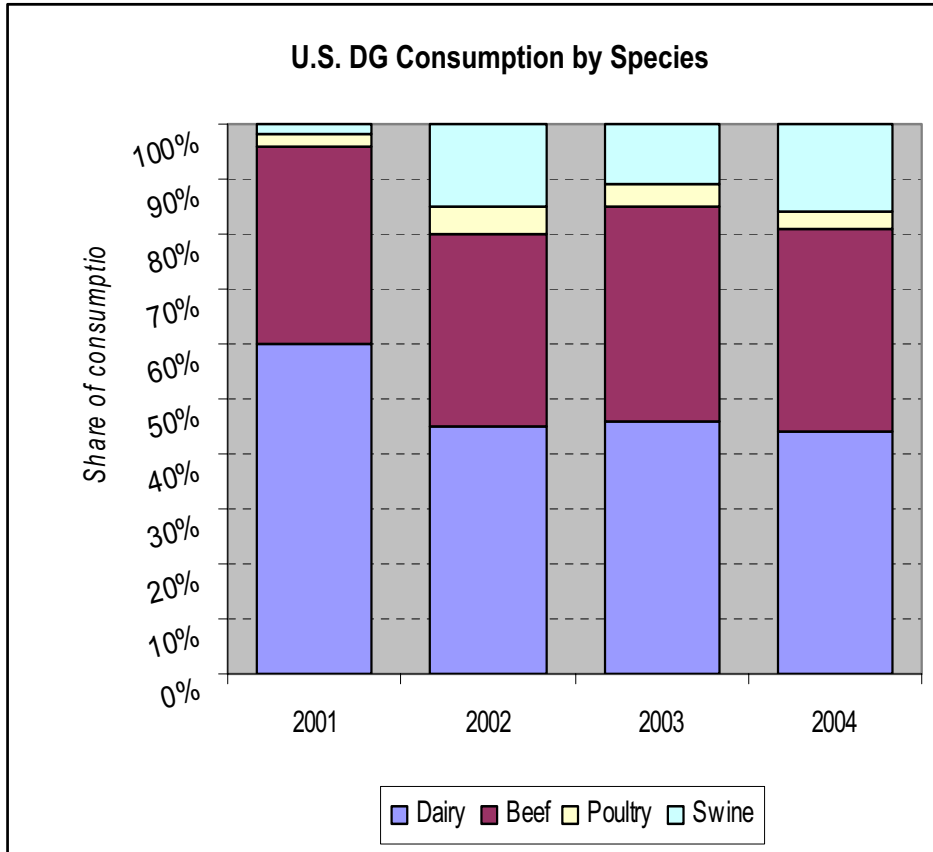
**Corn Distillers Wet Grains (DWG)** is the product obtained after the removal of ethyl alcohol by distillation from the yeast fermentation of corn. (27.8)

**Corn Condensed Distillers Solubles (CDS)** is obtained after the removal of ethyl alcohol by distillation from the yeast fermentation of corn by condensing the thin stillage fraction to a semi-solid. (27.7)

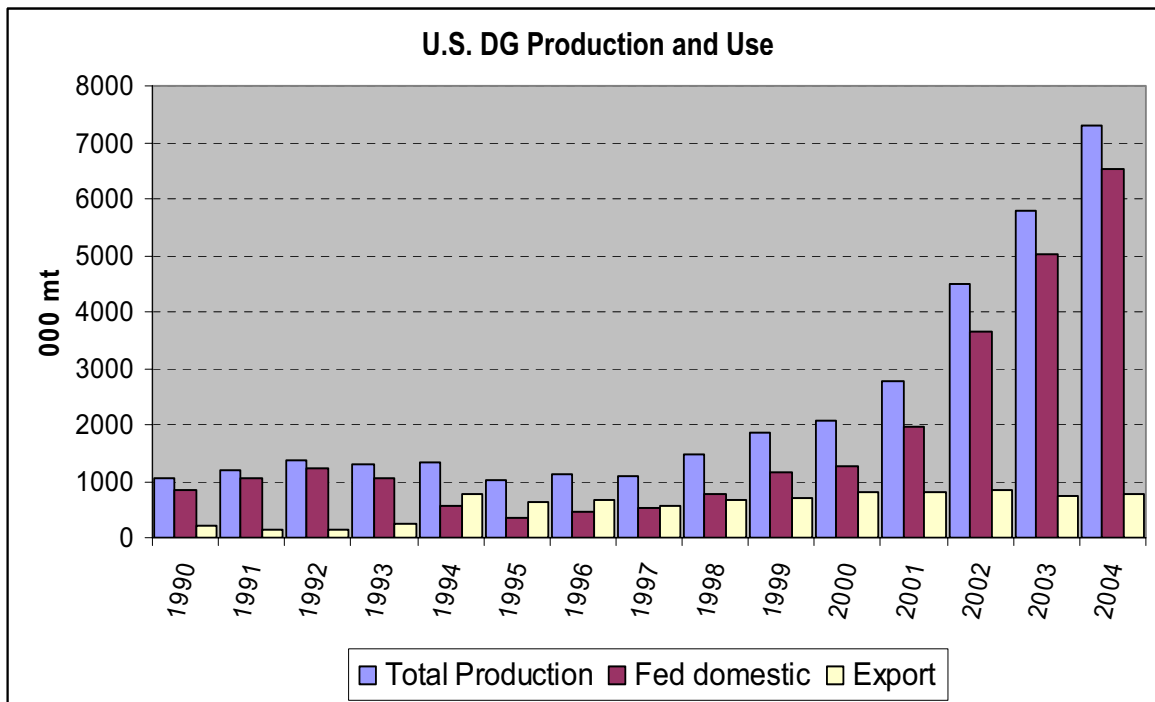
**NOTE:** Official AAFCO definitions do not exist for Distillers Wet Grains with Solubles (DWGS) and the variety of “modified” distillers grains products currently on the market.



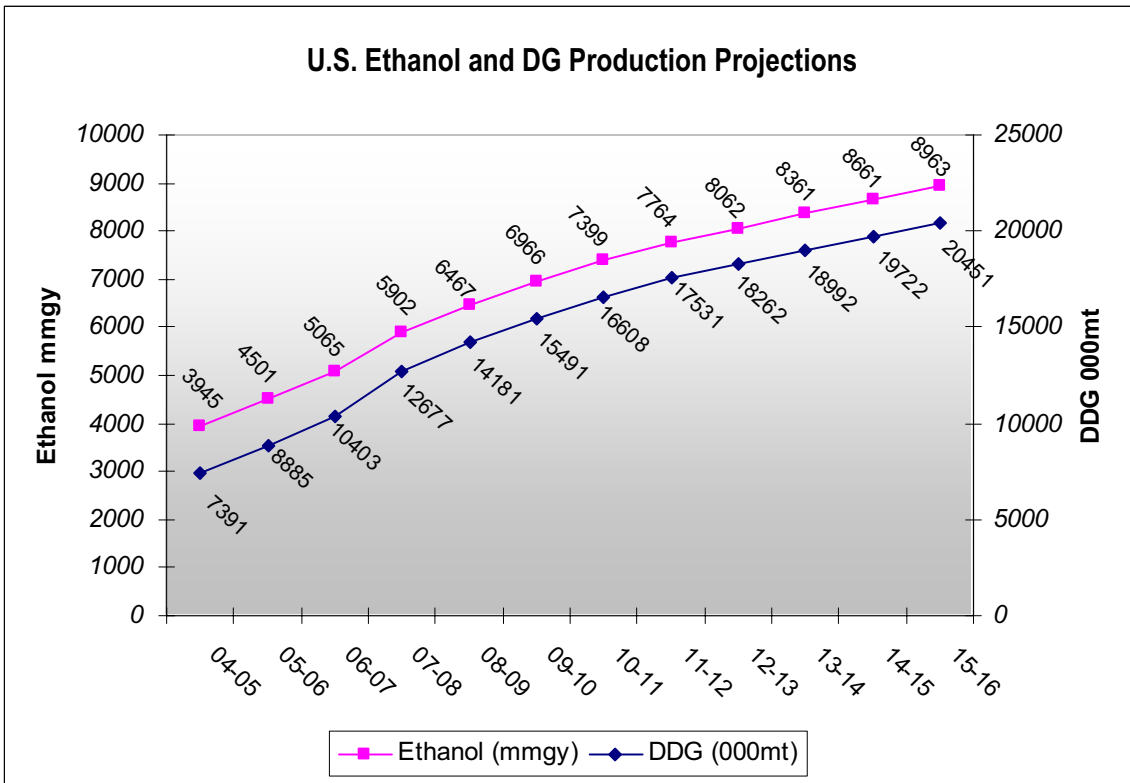
## General Reference Data



Source: Commodity Specialists Company



Sources: ProExporter Network; Foreign Ag Service



Source: ProExporter Network

## **Additional Information**

The following web-based resources provide extensive information on the use of distillers grains in livestock and poultry rations:

- University of Minnesota Distillers Grains Web Site: "The Value and Use of Distillers Dried Grains with Solubles (DDGS) in Livestock and Poultry Feeds," <http://www.ddgs.umn.edu/>
- Distillers Grains Technology Council, <http://www.distillersgrains.org/index.html>
- Iowa Department of Agriculture and Land Stewardship, Office of Renewable Fuels and Coproducts, <http://www.distillersgrains.com/>
- Distillers Feeds: Using Illinois By-Product Feeds in Livestock Feeding Programs, <http://ilift.trail.uiuc.edu/distillers/>
- Feedstuffs Magazine, <http://www.feedstuffs.com>

Additionally, most university extension services offer educational tools and services related to use of distillers grains. Many state corn grower associations also offer information on the use of distillers grains.

## **Acknowledgements**

The NCGA Ethanol Committee and Production and Stewardship Action Team would like to thank the following individuals for reviewing these feeding recommendations and providing input on this book's content:

- Dr. Sally Noll, University of Minnesota
- Dr. Terry Klopfenstein, University of Nebraska
- Dr. David Schingoethe, South Dakota State University
- Dr. Allen Trenkle, Iowa State University
- Brett Lumpkins, University of Georgia
- Greg Lardy, North Dakota State University
- Dr. Hans Stein, South Dakota State University
- John Goihl, Agri-Nutrition Services

The photographs used in this document are courtesy of USDA-ARS and Dr. Sally Noll, University of Minnesota, and are used by permission.

## **Solicitation**

It is NCGA's intention to update this document periodically with new feeding recommendations as they become available. Distillers grains feeding recommendations may be submitted to NCGA at [corninfo@ncga.com](mailto:corninfo@ncga.com) for consideration in future volumes. For more information, call (636) 733-9004.