CORN SOY REPORT 2019

AMINO*NIR*®

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POWER TO CREATE



Dear Customer,

In continuation of our long-term commitment to our customers, Evonik Nutrition & Care has compiled a comprehensive report characterizing the amino acids, crude fat, crude fiber, sugar, and ash contents of corn, soybean meal, and corn-based dried distiller's grains with solubles (DDGS) for 2019. The data presented for corn and soybean meal are representative of the current U.S. crops and are segmented by region.

The 2019 corn crop reported lower crude protein content (7.23 vs. 7.43 %) compared to the 2018 corn crop. In addition, higher values of oil (3.47 vs. 3.42 %) and sugar (1.85 vs. 1.34 %) were observed compared to the previous harvest year.

For the 2019 soybean meal crop, there was a slight decrease in crude protein compared to the 2018 harvest (46.66 vs. 46.98 %). Consistent with previous years, the soybean meal from this year's crop shows regional differences in crude protein content. Samples originating from Mid-West, North-East, South-East, and West reported 46.47, 47.16, 47.54, and 44.27 % of crude protein, respectively.

In 2019, the average crude protein content for DDGS was 27.23 %, which is very similar to the previous year (27.28 %). No difference was observed in oil content (8.81 %). In addition, lower values of sugar (1.23 vs 1.36 %) and starch (4.55 vs. 4.87 %) were observed compared to the previous year.

This year, we included one more section in our crop report where we assessed the processing condition of soybean meal and DDGS. Based on the processing condition indicator (PCI), an Evonik-created parameter, 7 % of the soybean meal showed over-processing, suggesting heat damage to the protein. The remaining 93 % had a good processing condition, and no samples fell into the under-processing condition. For DDGS, minor heat damage was observed in 34 % of the samples.

While we take the responsibility to generate this report, we feel that what makes it so successful is that it is entirely based on samples collected by our customers and analyzed through Evonik's AMINONIR® laboratory service. By compiling the report as presented, we believe we can provide information that is pertinent to our customers and their operations, as well as give insight into general trends that are occurring in each year's crops.

Thank you to our customers who participated in the 2019 crop report. Without your participation, this report would not be possible.

Ken O'Halloran

Regional Vice President Animal Nutrition

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CORN

Region	n	STAT		Crude Protein	Oil (EE)	Starch (Ewers)	Sugar	Ash	Crude Fiber	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
All Regions	472	Mean	(%)	7.23	3.47	65.87	1.85	1.16	1.76	0.15	0.16	0.31	0.23	0.26	0.06	0.34	0.25	0.86	0.34	0.21	0.35
		SD		0.50	0.24	0.98	0.31	0.07	0.09	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.02	0.08	0.02	0.01	0.03
		CV	(%)	6.90	6.96	1.48	16.79	5.68	5.18	7.69	5.49	6.56	5.26	6.63	4.74	6.92	7.72	8.92	6.79	6.63	8.70
		Min	(%)	5.80	2.70	62.40	0.30	0.90	1.50	0.12	0.14	0.27	0.21	0.21	0.05	0.28	0.19	0.59	0.27	0.17	0.25
		Max	(%)	8.90	4.50	67.90	2.80	1.30	2.00	0.18	0.18	0.37	0.27	0.32	0.07	0.41	0.32	1.15	0.42	0.25	0.46
Mid-West	324	Mean	(%)	7.16	3.44	66.05	1.83	1.16	1.75	0.15	0.16	0.30	0.23	0.26	0.06	0.34	0.24	0.86	0.34	0.21	0.35
(IL, IN, IA,		SD		0.44	0.21	0.89	0.28	0.06	0.09	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.02	0.07	0.02	0.01	0.03
KS, KY, MN,		CV	(%)	6.19	6.04	1.35	15.38	5.30	4.88	7.34	5.19	6.17	5.03	6.00	4.45	6.46	6.87	7.86	6.06	5.89	7.69
MO, NE, ND,		Min	(%)	6.05	2.70	63.40	0.30	1.00	1.50	0.12	0.14	0.27	0.21	0.22	0.05	0.28	0.20	0.69	0.29	0.18	0.28
OH, WI)		Max	(%)	8.38	3.90	67.90	2.80	1.30	2.00	0.17	0.18	0.35	0.27	0.30	0.07	0.40	0.29	1.03	0.40	0.24	0.42
North East	68	Mean	(%)	7.37	3.50	65.62	1.70	1.15	1.74	0.15	0.16	0.32	0.24	0.27	0.06	0.35	0.25	0.89	0.35	0.21	0.36
(DE, MD,		SD		0.50	0.32	1.07	0.33	0.08	0.10	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.02	0.08	0.02	0.01	0.03
NJ, PA)		CV	(%)	6.83	9.26	1.62	19.62	6.81	5.54	6.40	4.78	5.28	5.34	6.62	5.02	6.79	7.74	8.59	6.96	6.77	8.49
		Min	(%)	6.31	3.00	62.80	0.90	0.90	1.60	0.13	0.15	0.28	0.21	0.23	0.05	0.30	0.21	0.68	0.30	0.19	0.28
		Max	(%)	8.42	4.50	67.50	2.60	1.30	2.00	0.18	0.18	0.35	0.27	0.31	0.07	0.40	0.29	1.07	0.40	0.24	0.43
South East	21	Mean	(%)	8.04	3.60	64.33	1.76	1.17	1.79	0.17	0.17	0.34	0.25	0.29	0.06	0.38	0.28	0.97	0.38	0.23	0.40
(GA, NC)		SD		0.36	0.15	0.90	0.32	0.07	0.08	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.06	0.02	0.01	0.02
		CV	(%)	4.42	4.17	1.40	18.05	6.26	4.64	4.82	3.19	3.59	3.95	4.50	3.55	4.04	4.97	5.92	4.50	4.42	5.71
		Min	(%)	7.29	3.40	62.40	0.90	1.00	1.60	0.15	0.16	0.31	0.24	0.27	0.06	0.36	0.25	0.85	0.35	0.21	0.35
		Max	(%)	8.69	3.90	65.50	2.40	1.30	1.90	0.18	0.18	0.36	0.27	0.31	0.07	0.41	0.30	1.10	0.41	0.25	0.44
South West	22	Mean	(%)	7.01	3.71	65.93	2.20	1.19	1.87	0.15	0.16	0.31	0.24	0.25	0.06	0.35	0.23	0.80	0.33	0.20	0.33
(AR, TX)		SD		0.52	0.25	0.84	0.24	0.06	0.08	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.02	0.09	0.02	0.02	0.03
		CV	(%)	7.43	6.72	1.27	10.77	5.12	4.49	6.22	5.09	5.97	4.20	6.88	3.84	6.30	8.96	11.31	7.38	7.58	10.26
		Min	(%)	5.80	3.10	63.20	1.80	1.10	1.70	0.14	0.14	0.27	0.22	0.21	0.06	0.30	0.19	0.59	0.27	0.17	0.25
		Max	(%)	8.28	4.10	67.30	2.80	1.30	2.00	0.18	0.17	0.35	0.26	0.30	0.07	0.39	0.28	0.99	0.39	0.24	0.41
West	32	Mean	(%)	7.24	3.52	65.46	2.15	1.13	1.73	0.15	0.16	0.32	0.23	0.26	0.06	0.34	0.25	0.87	0.34	0.21	0.35
(CA, CO, WA)		SD		0.55	0.28	0.58	0.21	0.07	0.09	0.01	0.01	0.02	0.01	0.02	0.00	0.01	0.02	0.10	0.02	0.01	0.04
		CV	(%)	7.62	7.89	0.89	9.97	5.97	5.20	6.24	3.75	5.18	3.89	7.33	3.73	4.36	9.55	11.07	7.28	5.75	10.69
		Min	(%)	6.42	3.00	64.00	1.60	1.00	1.60	0.14	0.15	0.29	0.22	0.23	0.06	0.32	0.21	0.73	0.31	0.19	0.29
		Max	(%)	8.90	4.10	67.20	2.70	1.20	1.90	0.18	0.18	0.37	0.26	0.32	0.07	0.39	0.32	1.15	0.42	0.25	0.46
Crop Year																					
2015	634	Mean	(%)	7.37	3.70	65.35	1.43	1.19	1.90	0.15	0.17	0.32	0.22	0.27	0.06	0.33	0.25	0.92	0.35	0.21	0.36
2016	433	Mean	(%)	7.60	3.71	64.63	1.43	1.15	1.84	0.15	0.17	0.32	0.23	0.27	0.06	0.35	0.26	0.93	0.36	0.22	0.37
2017	475	Mean	(%)	7.52	3.39	65.45	1.25	1.15	1.72	0.15	0.17	0.32	0.24	0.27	0.06	0.36	0.26	0.91	0.36	0.22	0.37
2018	311	Mean	(%)	7.43	3.42	65.59	1.34	1.13	1.72	0.15	0.16	0.31	0.24	0.27	0.06	0.35	0.26	0.89	0.36	0.22	0.37
2019	472	Mean	(%)	7.23	3.47	65.87	1.85	1.16	1.76	0.15	0.16	0.31	0.23	0.26	0.06	0.34	0.25	0.86	0.34	0.21	0.35

Digestibility Coefficients (%)											
	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	87	83	85	75	80	77	89	86	89	85	87	87
Poultry	95	89	92	91	89	83	89	98	93	95	97	93

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Region	n	STAT	Crude Protein	Oil (EE)	Sugar	Ash	Crude Fiber	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
All Regions	366	Mean (%)	46.66	2.15	10.11	6.40	3.88	0.62	0.66	1.28	2.86	1.80	0.63	3.38	2.10	3.52	2.21	1.20	2.35
		SD	1.10	1.00	0.46	0.16	0.42	0.01	0.01	0.03	0.06	0.04	0.01	0.09	0.06	0.09	0.05	0.03	0.07
		CV (%)	2.36	46.58	4.52	2.43	10.87	1.89	2.14	2.01	2.08	2.10	2.27	2.79	2.65	2.52	2.38	2.33	2.94
		Min (%)	34.90	1.40	8.70	5.00	2.80	0.51	0.53	1.04	2.20	1.40	0.48	2.49	1.57	2.62	1.66	0.92	1.72
		Max (%)	49.13	18.50	10.90	6.90	6.80	0.64	0.71	1.35	2.99	1.89	0.66	3.58	2.23	3.73	2.34	1.27	2.52
Mid-West	281	Mean (%)	46.47	2.00	10.24	6.41	3.93	0.62	0.66	1.28	2.86	1.80	0.63	3.36	2.09	3.50	2.20	1.20	2.34
(IL, IN, IA, KS, KY, MN, NE, OH, SD)		SD	1.08	1.04	0.40	0.14	0.36	0.01	0.01	0.02	0.06	0.04	0.01	0.09	0.05	0.08	0.05	0.03	0.07
		CV (%)	2.33	51.89	3.86	2.16	9.02	1.83	2.05	1.92	1.98	1.99	2.24	2.66	2.53	2.42	2.29	2.20	2.81
		Min (%)	34.90	1.40	9.10	5.00	3.00	0.51	0.53	1.04	2.20	1.40	0.48	2.49	1.57	2.62	1.66	0.92	1.72
		Max (%)	49.13	18.50	10.90	6.70	5.00	0.64	0.71	1.35	2.99	1.88	0.66	3.58	2.22	3.71	2.33	1.26	2.52
North East	33	Mean (%)	47.16	2.93	9.92	6.25	3.61	0.62	0.67	1.28	2.85	1.81	0.64	3.43	2.12	3.54	2.22	1.22	2.38
(MD, PA, VA)		SD	0.88	0.63	0.31	0.12	0.65	0.01	0.02	0.03	0.07	0.05	0.02	0.09	0.06	0.09	0.06	0.03	0.07
		CV (%)	1.88	21.43	3.15	1.93	17.88	2.23	2.51	2.66	2.59	2.58	2.70	2.54	2.66	2.54	2.57	2.39	2.98
		Min (%)	43.93	2.10	8.90	5.90	3.10	0.58	0.62	1.18	2.63	1.67	0.58	3.13	1.95	3.26	2.06	1.13	2.18
		Max (%)	48.29	4.70	10.40	6.50	6.80	0.63	0.70	1.34	2.94	1.86	0.65	3.51	2.18	3.64	2.29	1.24	2.46
South East	52	Mean (%)	47.54	2.49	9.51	6.43	3.69	0.62	0.67	1.29	2.90	1.83	0.64	3.47	2.16	3.59	2.25	1.23	2.42
(AL, GA, NC, TN)		SD	0.64	0.63	0.32	0.21	0.39	0.01	0.01	0.02	0.05	0.03	0.01	0.06	0.03	0.05	0.03	0.02	0.04
		CV (%)	1.34	25.32	3.37	3.22	10.61	1.62	2.09	1.74	1.84	1.46	1.29	1.64	1.61	1.51	1.44	1.56	1.51
		Min (%)	45.99	1.70	8.70	6.00	2.80	0.59	0.62	1.23	2.68	1.76	0.62	3.32	2.08	3.47	2.17	1.18	2.33
		Max (%)	49.10	4.90	10.30	6.90	4.80	0.64	0.70	1.34	2.99	1.89	0.66	3.58	2.23	3.73	2.34	1.27	2.51
West	2	Mean (%)	44.27	2.25	9.90	6.25	5.35	0.58	0.63	1.22	2.75	1.72	0.60	3.16	1.99	3.34	2.11	1.15	2.23
(WA)		SD	0.39	0.92	0.14	0.07	0.07	0.02	0.02	0.03	0.02	0.02	0.00	0.00	0.01	0.02	0.02	0.00	0.01
		CV (%)	0.88	40.86	1.43	1.13	1.32	2.80	2.81	2.85	0.62	0.94	0.23	0.04	0.67	0.74	0.87	0.12	0.48
		Min (%)	43.99	1.60	9.80	6.20	5.30	0.57	0.62	1.19	2.74	1.71	0.60	3.16	1.98	3.32	2.09	1.15	2.22
		Max (%)	44.54	2.90	10.00	6.30	5.40	0.59	0.64	1.24	2.76	1.74	0.60	3.16	2.00	3.35	2.12	1.15	2.23
Crop Year																			
2015	433	Mean (%)	46.51	2.05	10.61	6.40	3.70	0.63	0.68	1.31	2.87	1.81	0.64	3.41	2.12	3.56	2.21	1.22	2.37
2016	238	Mean (%)	46.54	2.03	10.66	6.63	3.43	0.64	0.68	1.31	2.88	1.82	0.64	3.43	2.13	3.57	2.22	1.21	2.38
2017	253	Mean (%)	46.12	2.01	10.80	6.58	3.63	0.62	0.67	1.30	2.87	1.79	0.64	3.38	2.11	3.50	2.21	1.20	2.32
2018	218	Mean (%)	46.98	2.16	9.96	6.62	3.77	0.62	0.67	1.28	2.90	1.82	0.64	3.41	2.12	3.55	2.23	1.21	2.38
2019	366	Mean (%)	46.66	2.15	10.11	6.40	3.88	0.62	0.66	1.28	2.86	1.80	0.63	3.38	2.10	3.52	2.21	1.20	2.35

Digestibility Coefficients (%)	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	92	85	88	90	88	89	95	90	89	90	91	90
Poultry	90	79	84	89	83	89	92	87	88	87	90	89

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DDGS

	n	STAT	Crude Protein	Oil (EE)	Starch (Ewers)	Sugar	Ash	Crude Fiber	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
	2745	Mean (%)	27.23	8.81	4.55	1.23	4.81	7.15	0.52	0.51	1.03	0.81	1.01	0.22	1.22	0.98	3.02	1.30	0.72	1.30
		SD	1.59	0.91	1.39	0.53	0.38	0.53	0.04	0.04	0.07	0.06	0.06	0.01	0.09	0.07	0.19	0.08	0.04	0.10
		CV (%)	5.85	10.38	30.52	43.08	7.97	7.34	7.77	6.85	6.32	7.12	5.63	6.69	7.58	6.92	6.35	6.21	5.54	7.39
		Min (%)	22.05	6.40	1.70	0.10	3.60	5.60	0.41	0.41	0.82	0.53	0.80	0.17	0.91	0.73	2.47	1.00	0.58	1.00
		Max (%)	36.84	13.10	9.60	5.30	6.00	9.10	0.75	0.68	1.41	1.00	1.32	0.28	1.61	1.32	4.09	1.74	0.92	1.78
Crop Year																				
2015	2296	Mean (%)	26.68	9.15	5.20	1.27	4.36	6.36	0.52	0.50	1.02	0.78	0.98	0.21	1.16	0.95	2.97	1.25	0.69	1.26
2016	1008	Mean (%)	26.66	8.73	4.92	1.19	4.41	6.36	0.50	0.49	1.00	0.77	0.98	0.22	1.13	0.95	2.99	1.24	0.69	1.26
2017	2667	Mean (%)	27.12	8.80	4.48	1.36	4.47	6.61	0.52	0.51	1.02	0.79	1.00	0.22	1.17	0.97	3.00	1.27	0.70	1.28
2018	1687	Mean (%)	27.28	8.81	4.87	1.36	4.58	6.96	0.51	0.51	1.03	0.80	1.00	0.21	1.18	0.97	3.02	1.30	0.72	1.29
2019	2745	Mean (%)	27.23	8.81	4.55	1.23	4.81	7.15	0.52	0.51	1.03	0.81	1.01	0.22	1.22	0.98	3.02	1.30	0.72	1.30

Digestibility Coefficients (%)	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	83	75	76	63	72	76	80	78	85	57	79	82
Poultry	86	82	85	65	72	81	82	80	86	78	74	80

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Soybean meal and DDGS processing condition report

Processing condition of SBM and DDGS can be assessed by measuring Protein Dispersibility Index (PDI), Protein Solubility in KOH, Trypsin Inhibitor Activity, Reactive Lysine, and Reactive Lysine/Lysine ratio. Evonik has added to its near-infrared spectroscopy (NIRS) portfolio a service, based on those traditional laboratory assays, that predicts the quality of heat-exposed soy products and corn-based DDGS – AMINORed® 2.0. Moreover, the Processing condition indicator (PCI) is an Evonik-created parameter that incorporates all parameters aforementioned to provide an overall picture of the quality of the processed raw material. However, Reactive lysine is the parameter that has more weighted in the estimation of PCI. Reactive lysine is not involved in a Maillard reaction and it is available to the animal. For SBM, PCI values between 10 and 20 are optimal, and for DDGS, PCI values equal or greater than 14 are optimal. This report was developed using the parameter measured in AMINORed® 2.0 from SBM and DDGS samples scanned during 2019. The low number of samples in DDGS is due to a late release of the service in the year.

Material	N Obs	Variable	N	Mean	Std Dev	CV	Minimum	Maximum
DDGS, Corn	71	Protein Dispersibility Index (PDI)	71	15.4	4.5	29.1	8.9	27.5
		Protein Solubility in KOH	71	27.7	4.7	17.0	22.1	38.1
		Reactive Lysine	71	0.6	0.1	8.2	0.5	0.8
		Reactive Lysine/Lysine ratio	71	75.1	3.8	5.1	67.3	84.5
		Processing Conditions Indicator (PCI)	71	13.6	0.9	6.3	12.0	16.0
Soybean Meal	2712	Protein Dispersibility Index (PDI)	2666	15.6	4.1	26.0	2.0	26.7
		Protein Solubility in KOH	2712	81.9	3.7	4.5	66.5	95.6
		Trypsin Inhibitor Activity	2646	4.1	1.7	40.1	0.1	10.4
		Reactive Lysine	2712	2.6	0.1	3.1	2.0	2.9
		Reactive Lysine/Lysine ratio	2708	90.2	1.6	1.8	83.5	94.7
		Processing Conditions Indicator (PCI)	2712	12.8	1.7	13.0	6.0	19.0

Figure 1 Histogram of processing condition indicator of Soy bean meal in 2019.

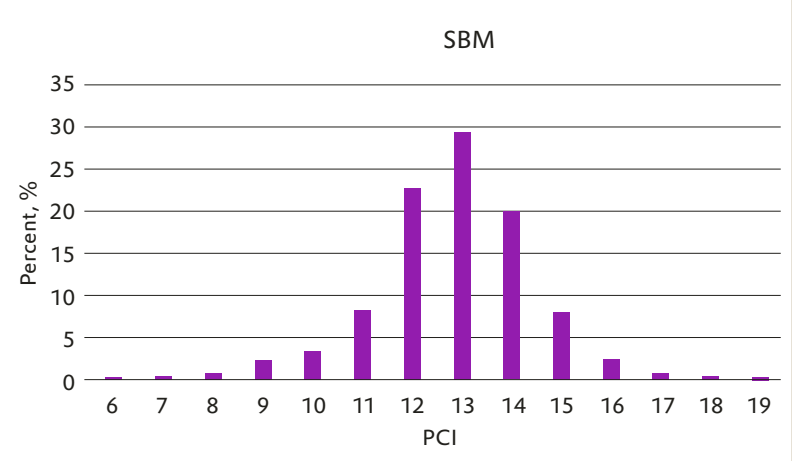
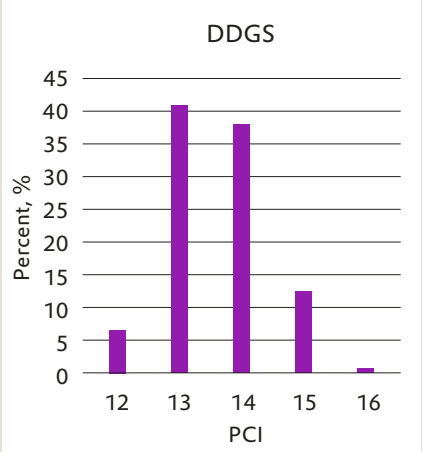


Figure 2 Histogram of processing condition indicator of DDGS in 2019.



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