

# CORN SOY REPORT 2020

AMINO NIR®





## 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 2020. The data presented for corn and soybean meal are representative of the current U.S. crops and are segmented by region.

The 2020 corn crop reported higher crude protein content (7.37 vs. 7.23 %) than the 2019 corn crop. Also, slightly lower values of starch (65.07 vs. 65.87%) and sugar (1.66 vs. 1.85 %) were observed compared to the previous harvest year.

For the 2020 soybean meal crop, there was a slight decrease in crude protein compared to the 2019 harvest (46.20 vs. 46.66 %). Consistent with previous years, the soybean meal from this year's crop shows regional differences in crude protein content. Samples originating from Western Corn Belt, Eastern Corn Belt, Midsouth, Southeast, East Coast, and West Coast reported 45.74, 46.38, 48.05, 46.61, 46.12, 46.67% of crude protein, respectively.

In 2020, the average crude protein content for DDGS was 28.08 %, higher than the previous year (27.23 %). Lower values of oil (8.68 vs. 8.81 %) and crude fiber (6.93 vs. 7.15 %) were observed compared to the previous year.

Processing conditions of soybean meal and DDGS were evaluated by using the processing condition indicator (PCI), an Evonik-created parameter. The PCI provides a degree of availability of the protein based on over-processing or under-processing parameters. For SBM and DDGS, 1 % and 8 % of the samples had some degree of being over-processed, respectively.

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 and give insight into general trends that are occurring in each year's crops.

Thank you to our customers who participated in the 2020 crop report. Without your participation, this report would not be possible.

Yours sincerely,

**Ken O'Halloran**

Regional Vice President Animal Nutrition

# AMINONIR®

## 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		
<b>All Regions</b>	552	Mean (%)	7.37	3.47	65.07	1.66	1.18	1.79	0.15	0.16	0.32	0.24	0.27	0.06	0.36	0.25	0.87	0.35	0.21	0.36		
		SD	0.46	0.21	0.93	0.25	0.07	0.14	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.02	0.07	0.02	0.01	0.03		
		CV (%)	6.24	6.12	1.42	14.96	5.78	7.59	7.00	4.98	5.86	5.13	6.07	4.35	6.05	7.04	8.26	6.26	5.94	7.66		
		Min (%)	6.01	2.70	60.40	0.70	1.00	1.40	0.12	0.13	0.27	0.21	0.22	0.05	0.29	0.20	0.67	0.28	0.17	0.28		
		Max (%)	9.64	4.40	67.80	2.40	1.40	2.30	0.20	0.20	0.40	0.29	0.35	0.07	0.45	0.34	1.26	0.46	0.28	0.50		
<b>Western Corn Belt</b> (IA, KS, MN, MO, ND, NE, SD)	244	Mean (%)	7.22	3.42	65.22	1.76	1.18	1.78	0.15	0.16	0.31	0.24	0.26	0.06	0.35	0.25	0.86	0.34	0.21	0.35		
		SD	0.41	0.17	0.88	0.22	0.06	0.13	0.01	0.01	0.02	0.01	0.01	0.00	0.02	0.02	0.07	0.02	0.01	0.02		
		CV (%)	5.66	5.05	1.34	12.37	5.01	7.09	6.83	4.73	5.75	4.51	5.48	3.85	5.37	6.42	7.72	5.65	5.41	7.04		
		Min (%)	6.01	2.70	62.20	1.30	1.00	1.50	0.12	0.13	0.27	0.21	0.22	0.05	0.29	0.20	0.67	0.28	0.17	0.28		
		Max (%)	8.77	4.00	67.80	2.40	1.30	2.30	0.18	0.18	0.36	0.28	0.32	0.07	0.42	0.31	1.07	0.41	0.24	0.44		
<b>Eastern Corn Belt</b> (IL, IN, MI, OH)	73	Mean (%)	7.24	3.49	65.42	1.58	1.15	1.72	0.15	0.16	0.31	0.23	0.26	0.06	0.35	0.25	0.87	0.34	0.21	0.35		
		SD	0.29	0.19	0.60	0.17	0.07	0.11	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.04	0.01	0.01	0.02		
		CV (%)	4.06	5.50	0.91	11.01	6.13	6.31	4.26	2.68	3.38	3.42	3.93	3.17	3.69	4.81	5.05	4.13	3.36	5.03		
		Min (%)	6.66	3.10	62.60	1.20	1.00	1.40	0.14	0.15	0.29	0.22	0.24	0.06	0.32	0.22	0.76	0.31	0.20	0.31		
		Max (%)	8.00	4.30	66.70	2.00	1.40	2.00	0.17	0.17	0.35	0.26	0.29	0.07	0.39	0.27	0.97	0.38	0.23	0.39		
<b>Midsouth</b> (KY, TN, TX, MS, LA)	65	Mean (%)	7.60	3.53	65.02	1.62	1.18	1.83	0.16	0.17	0.33	0.25	0.28	0.06	0.37	0.26	0.89	0.36	0.22	0.37		
		SD	0.40	0.16	0.72	0.23	0.07	0.16	0.01	0.01	0.02	0.01	0.01	0.00	0.02	0.02	0.07	0.02	0.01	0.03		
		CV (%)	5.22	4.56	1.10	14.19	5.58	8.63	5.20	4.13	4.84	3.75	4.73	3.41	4.33	6.29	7.80	5.10	4.81	6.84		
		Min (%)	6.75	2.90	63.40	1.20	1.00	1.50	0.14	0.15	0.30	0.23	0.25	0.06	0.33	0.23	0.76	0.32	0.20	0.32		
		Max (%)	8.67	4.00	66.50	2.40	1.30	2.20	0.18	0.18	0.36	0.27	0.31	0.07	0.41	0.30	1.07	0.41	0.24	0.44		
<b>Southeast</b> (AL, GA, FL, NC, SC)	69	Mean (%)	7.53	3.52	64.73	1.56	1.22	1.86	0.16	0.16	0.32	0.25	0.27	0.06	0.37	0.25	0.86	0.36	0.22	0.36		
		SD	0.41	0.15	0.62	0.27	0.07	0.11	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.07	0.02	0.01	0.03		
		CV (%)	5.44	4.21	0.95	17.59	6.06	6.17	5.02	4.05	4.19	3.62	4.96	3.34	4.46	6.62	8.18	5.49	4.75	7.35		
		Min (%)	6.45	3.30	63.10	0.70	1.10	1.70	0.14	0.15	0.30	0.23	0.24	0.06	0.33	0.21	0.68	0.31	0.19	0.29		
		Max (%)	8.65	4.00	66.10	2.30	1.30	2.20	0.18	0.19	0.36	0.27	0.31	0.07	0.41	0.30	1.04	0.41	0.25	0.43		
<b>East Coast</b> (DE, MD, NJ, PA, VA)	47	Mean (%)	7.81	3.45	64.36	1.49	1.22	1.75	0.16	0.17	0.34	0.25	0.28	0.06	0.38	0.27	0.93	0.37	0.23	0.38		
		SD	0.63	0.28	1.46	0.26	0.07	0.17	0.01	0.01	0.03	0.02	0.02	0.00	0.03	0.02	0.10	0.03	0.02	0.04		
		CV (%)	8.05	8.12	2.27	17.41	6.00	9.52	8.90	6.19	7.49	7.55	8.09	6.65	7.64	8.72	10.26	7.86	7.60	9.55		
		Min (%)	6.50	2.70	60.40	0.70	1.10	1.50	0.13	0.15	0.28	0.22	0.24	0.06	0.32	0.22	0.75	0.31	0.19	0.31		
		Max (%)	9.64	4.00	66.70	1.90	1.40	2.10	0.20	0.20	0.40	0.29	0.35	0.07	0.45	0.34	1.26	0.46	0.28	0.50		
<b>West Coast</b> (AZ, CA, UT, CO, WA, OR)	36	Mean (%)	7.46	3.50	65.09	1.74	1.14	1.81	0.16	0.17	0.33	0.24	0.27	0.06	0.35	0.25	0.89	0.35	0.22	0.36		
		SD	0.46	0.39	1.18	0.27	0.06	0.11	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 (%)	6.13	11.10	1.81	15.77	5.63	6.06	6.54	4.68	5.58	4.32	5.90	3.71	4.46	7.30	8.65	6.18	6.70	7.81		
		Min (%)	6.38	2.90	62.40	1.10	1.00	1.60	0.14	0.15	0.29	0.21	0.23	0.06	0.32	0.21	0.68	0.30	0.19	0.29		
		Max (%)	8.67	4.40	67.40	2.20	1.30	2.00	0.18	0.19	0.39	0.27	0.31	0.07	0.40	0.30	1.06	0.41	0.24	0.43		
<b>Crop Year</b>																						
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			
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			
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			
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			
552	Mean (%)	7.37	3.47	65.07	1.66	1.18	1.79	0.15	0.16	0.32	0.24	0.27	0.06	0.36	0.25	0.87	0.35	0.21	0.36			

Dry matter of corn is standardized as 88 %.

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

# AMINONIR®

## SBM

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	351	Mean (%)	46.20	2.46	10.16	6.33	3.98	0.61	0.66	1.26	2.81	1.79	0.63	3.34	2.08	3.49	2.19	1.19	2.34
		SD	1.24	1.10	0.57	0.19	0.52	0.02	0.02	0.03	0.07	0.04	0.02	0.10	0.06	0.10	0.06	0.03	0.07
		CV (%)	2.69	44.70	5.56	2.94	13.11	2.49	2.45	2.46	2.48	2.46	2.68	3.04	2.83	2.82	2.70	2.47	3.12
		Min (%)	37.95	1.40	7.90	5.50	3.00	0.52	0.56	1.06	2.33	1.49	0.52	2.65	1.69	2.83	1.79	1.00	1.86
		Max (%)	49.00	12.40	11.10	6.80	6.40	0.65	0.72	1.37	2.94	1.89	0.66	3.54	2.22	3.71	2.32	1.26	2.50
Western Corn Belt	150	Mean (%)	45.74	2.33	10.40	6.32	4.05	0.61	0.65	1.26	2.80	1.78	0.62	3.30	2.06	3.45	2.17	1.19	2.31
(IA, KS, MN, MO, NE, SD)		SD	1.35	1.38	0.33	0.17	0.53	0.02	0.02	0.03	0.08	0.05	0.02	0.11	0.06	0.11	0.07	0.03	0.08
		CV (%)	2.95	59.29	3.15	2.64	13.08	2.76	2.51	2.64	2.82	2.80	2.99	3.48	3.07	3.13	3.01	2.80	3.45
		Min (%)	37.95	1.50	9.20	5.50	3.00	0.52	0.56	1.06	2.33	1.49	0.52	2.65	1.69	2.83	1.79	1.00	1.86
		Max (%)	48.08	12.40	11.10	6.60	6.20	0.64	0.69	1.33	2.94	1.86	0.66	3.47	2.19	3.65	2.29	1.25	2.45
Eastern Corn Belt	74	Mean (%)	46.38	2.21	10.34	6.26	4.00	0.61	0.66	1.26	2.84	1.80	0.63	3.36	2.09	3.50	2.20	1.20	2.35
(IL, IN, OH)		SD	0.56	0.37	0.31	0.11	0.45	0.01	0.01	0.02	0.04	0.02	0.01	0.05	0.03	0.04	0.03	0.02	0.03
		CV (%)	1.21	16.62	2.95	1.82	11.30	1.36	1.54	1.38	1.53	1.22	1.84	1.40	1.36	1.23	1.24	1.30	1.23
		Min (%)	44.76	1.70	9.30	6.00	3.10	0.59	0.63	1.22	2.75	1.74	0.60	3.23	2.03	3.36	2.12	1.17	2.26
		Max (%)	47.46	3.70	10.90	6.60	5.30	0.62	0.68	1.30	2.93	1.83	0.65	3.46	2.14	3.57	2.24	1.23	2.39
Midsouth	13	Mean (%)	48.05	2.23	8.55	6.60	4.03	0.63	0.67	1.29	2.88	1.85	0.65	3.47	2.17	3.63	2.27	1.23	2.44
(KY, MS)		SD	0.65	0.43	0.89	0.22	0.44	0.01	0.01	0.02	0.04	0.03	0.01	0.05	0.04	0.06	0.04	0.02	0.04
		CV (%)	1.35	19.40	10.39	3.27	10.97	1.38	1.28	1.35	1.47	1.65	1.60	1.47	1.75	1.63	1.56	1.71	1.51
		Min (%)	46.92	1.60	7.90	6.20	3.60	0.61	0.66	1.27	2.80	1.79	0.63	3.36	2.11	3.52	2.21	1.19	2.37
		Max (%)	49.00	3.20	10.20	6.80	5.20	0.64	0.69	1.33	2.93	1.89	0.66	3.54	2.22	3.71	2.32	1.26	2.50
Southeast	79	Mean (%)	46.61	2.48	9.83	6.42	3.91	0.61	0.66	1.27	2.82	1.80	0.63	3.38	2.10	3.52	2.20	1.20	2.36
(AL, GA, NC)		SD	1.02	0.42	0.53	0.18	0.55	0.01	0.02	0.03	0.06	0.04	0.01	0.08	0.05	0.02	0.06		
		CV (%)	2.19	16.98	5.38	2.82	14.18	2.23	2.59	2.39	2.09	1.97	1.95	2.48	2.40	2.40	2.23	2.08	2.66
		Min (%)	42.72	1.40	8.30	6.10	3.10	0.56	0.60	1.16	2.60	1.65	0.57	3.08	1.90	3.18	2.01	1.11	2.13
		Max (%)	48.05	4.00	10.70	6.80	6.40	0.63	0.68	1.31	2.90	1.85	0.65	3.49	2.18	3.65	2.28	1.24	2.46
East Coast	33	Mean (%)	46.12	3.68	10.12	6.15	3.73	0.60	0.65	1.25	2.78	1.78	0.63	3.34	2.08	3.47	2.18	1.19	2.33
(MD, PA, VA)		SD	1.44	1.32	0.39	0.15	0.51	0.02	0.02	0.04	0.07	0.05	0.02	0.10	0.07	0.11	0.07	0.03	0.08
		CV (%)	3.13	35.96	3.81	2.48	13.73	3.23	3.36	3.38	2.50	2.88	3.28	3.13	3.17	3.19	3.15	2.69	3.54
		Min (%)	41.23	2.30	8.50	5.60	3.00	0.54	0.60	1.13	2.53	1.59	0.56	3.00	1.84	3.08	1.93	1.07	2.06
		Max (%)	48.09	8.80	10.70	6.40	5.40	0.65	0.72	1.37	2.85	1.84	0.65	3.49	2.16	3.61	2.26	1.23	2.45
West Coast	2	Mean (%)	46.67	1.95	10.25	6.55	3.60	0.62	0.67	1.29	2.88	1.82	0.64	3.40	2.13	3.55	2.22	1.21	2.37
(WA)		SD	0.30	0.07	0.35	0.21	0.14	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01
		CV (%)	0.64	3.63	3.45	3.24	3.93	1.36	0.21	0.55	0.59	0.74	0.99	0.25	0.50	0.68	0.76	0.47	0.48
		Min (%)	46.46	1.90	10.00	6.40	3.50	0.62	0.67	1.28	2.87	1.81	0.64	3.39	2.12	3.53	2.21	1.20	2.36
		Max (%)	46.88	2.00	10.50	6.70	3.70	0.63	0.67	1.29	2.89	1.83	0.65	3.40	2.13	3.56	2.23	1.21	2.38
Crop Year																			
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
2020	351	Mean (%)	46.20	2.46	10.16	6.33	3.98	0.61	0.66	1.26	2.81	1.79	0.63	3.34	2.08	3.49	2.19	1.19	2.34

Dry matter of soybean meal is standardized as 88 %.

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

## 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	
1952	Mean (%)	28.08	8.68	3.93	1.17	4.74	6.93	0.51	0.51	1.03	0.81	1.02	0.23	1.25	0.99	3.04	1.30	0.72	1.32	
	SD	1.56	0.90	1.75	0.48	0.31	0.44	0.03	0.03	0.07	0.06	0.05	0.02	0.10	0.06	0.16	0.07	0.04	0.08	
	CV (%)	5.57	10.35	44.44	41.42	6.51	6.32	6.70	6.54	6.50	7.11	5.11	7.06	7.96	6.38	5.15	5.61	5.15	6.22	
	Min (%)	22.11	5.70	0.70	0.20	3.70	5.10	0.36	0.39	0.78	0.50	0.77	0.17	0.89	0.72	2.42	0.97	0.53	0.98	
	Max (%)	36.70	12.10	9.50	5.00	6.10	9.10	0.65	0.71	1.39	1.21	1.32	0.38	2.16	1.36	3.87	1.70	0.90	1.77	
Crop Year																				
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
2020	1952	Mean (%)	28.08	8.68	3.93	1.17	4.74	6.93	0.51	0.51	1.03	0.81	1.02	0.23	1.25	0.99	3.04	1.30	0.72	1.32
Dry matter of DDGS is standardized as 88 %.																				
								MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE	
								83	75	76	63	72	76	80	78	85	57	79	82	
								86	82	85	65	72	81	82	80	86	78	74	80	

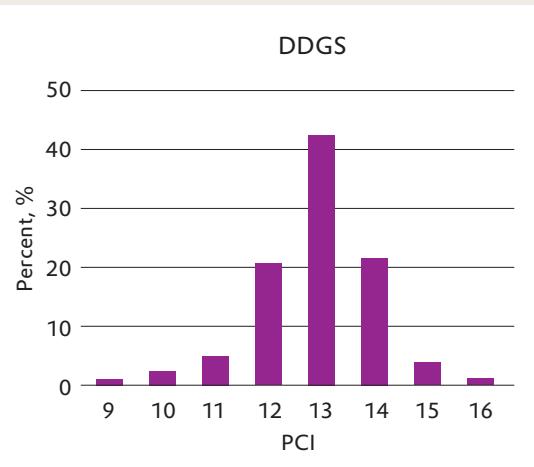
# AMINONIR®

## Soybean meal and DDGS processing condition report

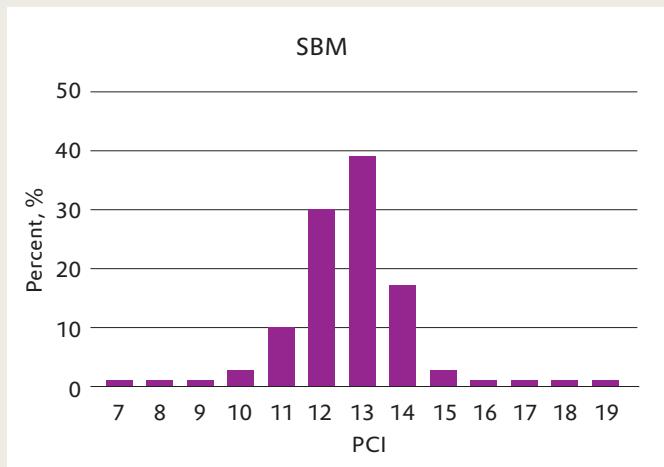
Processing condition of SBM and DDGS can be assessed by measuring Protein Dispersibility Index (PDI), Protein Solubility in KOH, Trypsin Inhibitor Activity, Reactive Lysine, and Reactive Lysine/Lysine ratio. Evonik has added to its near-infrared spectroscopy (NIRS) portfolio a service, based on those 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 2020.

Material	N Obs	Variable	N	Mean	Std Dev	CV	Minimum	Maximum
DDGS, Corn	661	Protein Dispersibility Index (PDI)	661	16.2	3.0	18.2	9.4	28.7
		Protein Solubility in KOH	661	27.9	5.0	17.8	17.5	37.3
		Reactive Lysine	661	0.6	0.1	10.8	0.3	1.0
		Reactive Lysine/Lysine ratio	661	73.7	4.2	5.7	57.2	85.3
		Processing Conditions Indicator (PCI)	661	12.9	1.1	8.3	9.0	16.0
Soybean Meal	4242	Protein Dispersibility Index (PDI)	4233	12.3	3.0	24.7	2.0	23.1
		Protein Solubility in KOH	4242	81.9	3.2	3.9	60.1	93.8
		Trypsin Inhibitor Activity	4205	3.3	1.3	39.6	0.1	14.5
		Reactive Lysine	4242	2.6	0.1	2.6	2.1	3.0
		Reactive Lysine/Lysine ratio	4242	90.2	1.5	1.7	81.3	93.4
		Processing Conditions Indicator (PCI)	4242	12.6	1.2	9.2	7.0	19.0

**Figure 1** Histogram of processing condition indicator of DDGS in 2020



**Figure 2** Histogram of processing condition indicator of Soy bean meal in 2020



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**Evonik Operations GmbH**

Nutrition & Care  
Animal Nutrition Business Line

[animal-nutrition@evonik.com](mailto:animal-nutrition@evonik.com)  
[www.evonik.com/animal-nutrition](http://www.evonik.com/animal-nutrition)