

# CORN SOY REPORT 2021

AMINONIR®





## 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 2021. The data presented for corn and soybean meal are representative of the current U.S. crops and are segmented by region.

The 2021 corn crop reported the same crude protein content (7.37%) as the 2020 corn crop. Slightly lower values of starch (65.01 vs. 65.07%) and sugar (1.64 vs. 1.66%) were observed compared to the previous harvest year.

For the 2021 soybean meal crop, there was a slight increase in crude protein compared to the 2020 harvest (46.63 vs. 46.20%). 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, and East Coast reported 46.19, 47.12, 48.30, 46.88, 44.19% of crude protein, respectively.

In 2021, the average crude protein content for DDGS was 28.53%, higher than the previous year (28.08%). Lower values of oil (8.39 vs. 8.68%) and crude fiber (6.83 vs. 6.93%) were observed compared to the previous year.

Processing condition of soybean meal, soy expeller and DDGS were reported. Based on the processing

condition indicator (PCI), an Evonik-created parameter, 81% of the soy product samples showed optimal processing conditions (PCI between 12 and 14). 10% of the soy samples could be overcooked (PCI < 12) and 9% of the samples could be undercooked (PCI > 14). For DDGS, 37% of the samples showed optimal processing condition (PCI  $\geq$  14). 9% of the samples showed medium to severe heat damage (PCI  $\leq$  11).

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 2021 crop report. Without your participation, this report would not be possible.

Yours sincerely,

**Paulo Sergio Teixeira**

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>	743	Mean (%)	7.37	3.47	65.01	1.64	1.18	1.87	0.15	0.16	0.32	0.24	0.26	0.06	0.35	0.25	0.85	0.35	0.21	0.35
		SD	0.46	0.21	0.92	0.24	0.07	0.15	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 (%)	6.18	6.00	1.42	14.86	6.26	8.24	6.26	4.62	5.26	4.77	5.76	4.23	5.64	7.16	9.02	5.97	5.85	8.29
		Min (%)	6.08	2.80	60.90	0.90	1.00	1.50	0.12	0.14	0.26	0.20	0.22	0.05	0.28	0.19	0.60	0.29	0.17	0.25
		Max (%)	9.16	4.80	68.00	2.60	1.40	2.50	0.19	0.19	0.38	0.28	0.32	0.07	0.42	0.32	1.11	0.42	0.25	0.44
<b>Western Corn Belt</b> (IA, KS, MN, MO, ND, NE, SD)	228	Mean (%)	7.29	3.43	65.10	1.77	1.17	1.87	0.15	0.16	0.31	0.23	0.26	0.06	0.35	0.25	0.85	0.34	0.21	0.34
		SD	0.45	0.21	0.90	0.20	0.08	0.13	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 (%)	6.22	6.15	1.38	11.00	6.54	7.04	6.37	4.76	5.52	5.15	5.84	4.60	6.06	7.13	8.93	5.91	5.84	8.11
		Min (%)	6.08	2.80	61.20	1.40	1.00	1.60	0.12	0.14	0.26	0.20	0.22	0.05	0.28	0.21	0.64	0.29	0.18	0.28
		Max (%)	8.85	4.80	68.00	2.30	1.30	2.30	0.17	0.19	0.36	0.27	0.31	0.07	0.41	0.31	1.10	0.42	0.25	0.44
<b>Eastern Corn Belt</b> (IL, IN OH, WI)	98	Mean (%)	7.16	3.38	65.36	1.53	1.19	1.92	0.15	0.16	0.31	0.23	0.26	0.06	0.35	0.24	0.83	0.34	0.21	0.34
		SD	0.44	0.16	0.88	0.17	0.08	0.17	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.08	0.02	0.01	0.03
		CV (%)	6.11	4.59	1.34	11.35	6.94	8.89	6.60	4.28	4.88	5.09	5.33	4.33	5.74	7.01	9.48	5.69	5.63	8.36
		Min (%)	6.45	3.00	63.50	1.10	1.00	1.50	0.12	0.14	0.27	0.21	0.24	0.05	0.31	0.21	0.65	0.31	0.18	0.27
		Max (%)	8.72	3.60	67.40	2.10	1.40	2.40	0.17	0.18	0.35	0.26	0.31	0.06	0.40	0.30	1.09	0.41	0.25	0.43
<b>Midsouth</b> (AR, KY, LA, MS, OK, TN, TX)	224	Mean (%)	7.35	3.53	64.90	1.61	1.18	1.90	0.15	0.16	0.32	0.24	0.26	0.06	0.35	0.25	0.84	0.35	0.21	0.34
		SD	0.46	0.20	0.93	0.25	0.08	0.17	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 (%)	6.20	5.70	1.43	15.76	6.42	9.23	6.01	4.49	5.08	4.37	5.70	3.97	4.84	7.21	9.35	5.97	5.69	8.45
		Min (%)	6.30	2.80	60.90	1.00	1.00	1.50	0.13	0.14	0.27	0.22	0.22	0.05	0.31	0.19	0.60	0.29	0.17	0.25
		Max (%)	9.16	4.10	68.00	2.60	1.30	2.50	0.19	0.19	0.38	0.28	0.32	0.07	0.42	0.32	1.11	0.42	0.25	0.44
<b>Southeast</b> (AL, GA, FL, NC, SC)	95	Mean (%)	7.72	3.48	64.62	1.54	1.18	1.80	0.16	0.17	0.33	0.24	0.28	0.06	0.37	0.26	0.90	0.36	0.22	0.37
		SD	0.36	0.20	0.84	0.16	0.06	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 (%)	4.63	5.76	1.30	10.54	4.98	6.25	5.01	3.92	4.41	3.56	4.98	2.88	4.17	6.38	7.89	5.25	5.53	6.96
		Min (%)	6.17	3.20	62.50	1.30	1.00	1.50	0.13	0.14	0.28	0.22	0.22	0.05	0.32	0.20	0.63	0.29	0.17	0.27
		Max (%)	8.36	4.10	66.70	2.20	1.30	2.10	0.17	0.18	0.35	0.26	0.30	0.06	0.40	0.29	1.02	0.39	0.24	0.41
<b>East Coast</b> (DE, MD, NJ, NY, PA, VA)	63	Mean (%)	7.52	3.48	65.18	1.40	1.18	1.80	0.15	0.17	0.32	0.24	0.27	0.06	0.36	0.26	0.88	0.36	0.22	0.36
		SD	0.37	0.23	1.01	0.20	0.06	0.13	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 (%)	4.99	6.53	1.55	14.24	5.24	7.36	4.81	3.76	3.89	4.89	4.75	4.16	5.26	5.69	6.84	4.84	4.70	6.34
		Min (%)	6.46	3.00	62.30	0.90	1.10	1.50	0.13	0.15	0.29	0.22	0.23	0.05	0.32	0.21	0.70	0.31	0.19	0.29
		Max (%)	8.42	4.00	66.90	1.80	1.30	2.10	0.17	0.18	0.35	0.27	0.30	0.07	0.40	0.29	1.06	0.40	0.24	0.42
<b>West Coast</b> (UT, CO, WA)	35	Mean (%)	7.46	3.39	64.89	1.89	1.16	1.81	0.15	0.17	0.32	0.24	0.26	0.06	0.35	0.26	0.88	0.35	0.21	0.35
		SD	0.27	0.19	0.81	0.16	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 (%)	3.62	5.69	1.24	8.45	5.61	5.85	3.56	2.86	3.25	3.52	3.62	3.31	3.98	4.08	4.46	3.58	3.22	4.80
		Min (%)	6.96	2.90	62.40	1.60	1.00	1.60	0.14	0.16	0.30	0.22	0.25	0.05	0.33	0.24	0.80	0.33	0.20	0.32
		Max (%)	8.15	3.80	66.60	2.40	1.30	2.00	0.16	0.18	0.34	0.27	0.29	0.06	0.40	0.28	0.99	0.38	0.23	0.39
<b>Crop Year</b>																				
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
2020	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
2021	743	Mean (%)	7.37	3.47	65.01	1.64	1.18	1.87	0.15	0.16	0.32	0.24	0.26	0.06	0.35	0.25	0.85	0.35	0.21	0.35

Dry matter of corn is standardized as 88 %.

Standardized Ileal Digestible Coefficients, %												
	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	87	81	84	74	78	73	88	85	88	82	86	87
Poultry	94	87	91	88	86	84	89	96	92	93	95	92

Source: AMINODat 6.0®

# 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
<b>All Regions</b>	400	Mean (%)	46.63	2.25	10.36	6.66	3.77	0.61	0.66	1.27	2.85	1.81	0.63	3.39	2.12	3.53	2.21	1.20	2.37
		SD	1.04	0.87	0.65	0.25	0.42	0.01	0.01	0.03	0.06	0.04	0.01	0.09	0.05	0.08	0.05	0.03	0.06
		CV (%)	2.23	38.80	6.26	3.72	11.19	1.94	2.12	2.06	2.20	2.11	2.19	2.61	2.56	2.37	2.24	2.24	2.62
		Min (%)	39.66	1.30	8.40	5.50	2.70	0.52	0.59	1.09	2.44	1.56	0.53	2.89	1.81	3.00	1.89	1.05	2.00
		Max (%)	49.99	10.90	11.60	8.50	6.10	0.64	0.71	1.33	3.06	1.93	0.67	3.70	2.29	3.80	2.37	1.30	2.59
<b>Western Corn Belt</b> (IA, KS, MN, MO, NE, SD)	220	Mean (%)	46.19	2.09	10.72	6.59	3.78	0.61	0.66	1.26	2.84	1.79	0.63	3.35	2.09	3.49	2.19	1.19	2.34
		SD	0.74	0.74	0.45	0.16	0.43	0.01	0.01	0.02	0.05	0.03	0.01	0.06	0.04	0.06	0.04	0.02	0.04
		CV (%)	1.60	35.28	4.20	2.41	11.38	1.55	1.79	1.69	1.73	1.64	1.65	1.87	1.93	1.76	1.65	1.70	1.87
		Min (%)	43.88	1.30	9.40	5.80	2.70	0.58	0.63	1.21	2.64	1.71	0.60	3.14	1.98	3.29	2.08	1.13	2.20
		Max (%)	48.14	6.60	11.60	6.90	5.10	0.64	0.69	1.32	2.97	1.87	0.66	3.51	2.21	3.66	2.28	1.25	2.47
<b>Eastern Corn Belt</b> (IL, IN, MI, OH)	94	Mean (%)	47.12	2.29	10.21	6.73	3.72	0.62	0.67	1.28	2.88	1.82	0.64	3.44	2.14	3.57	2.23	1.22	2.40
		SD	0.45	0.35	0.30	0.24	0.26	0.01	0.01	0.02	0.03	0.02	0.01	0.04	0.02	0.03	0.02	0.01	0.03
		CV (%)	0.96	15.26	2.94	3.62	6.99	1.41	1.43	1.49	1.11	0.91	1.38	1.22	1.09	0.95	0.93	1.12	1.10
		Min (%)	45.93	1.50	9.50	6.30	3.10	0.60	0.64	1.22	2.79	1.78	0.62	3.34	2.08	3.48	2.18	1.19	2.33
		Max (%)	48.12	3.70	11.00	7.40	4.40	0.64	0.69	1.32	2.95	1.86	0.66	3.54	2.21	3.65	2.29	1.25	2.46
<b>Midsouth</b> (AR, KY, MS)	30	Mean (%)	48.30	2.60	9.16	6.92	3.51	0.62	0.68	1.29	2.94	1.87	0.65	3.53	2.21	3.66	2.29	1.24	2.47
		SD	0.84	0.63	0.52	0.39	0.22	0.01	0.02	0.02	0.07	0.03	0.01	0.09	0.04	0.07	0.04	0.03	0.06
		CV (%)	1.74	24.39	5.70	5.65	6.40	1.32	2.35	1.73	2.39	1.76	1.44	2.63	1.88	1.97	1.67	2.33	2.30
		Min (%)	46.83	1.80	8.40	6.50	3.10	0.60	0.64	1.24	2.82	1.81	0.64	3.36	2.14	3.54	2.22	1.20	2.36
		Max (%)	49.99	4.50	10.10	8.50	4.10	0.63	0.71	1.33	3.06	1.93	0.67	3.70	2.29	3.80	2.37	1.30	2.59
<b>Southeast</b> (AL, GA, NC)	50	Mean (%)	46.88	2.24	9.86	6.68	3.88	0.61	0.66	1.27	2.85	1.81	0.63	3.41	2.13	3.55	2.22	1.20	2.39
		SD	0.78	0.49	0.57	0.24	0.50	0.01	0.01	0.03	0.05	0.03	0.01	0.06	0.04	0.06	0.04	0.02	0.05
		CV (%)	1.66	22.02	5.73	3.58	12.77	1.85	1.99	2.19	1.66	1.64	1.95	1.87	1.87	1.80	1.75	1.68	1.95
		Min (%)	44.39	1.50	8.40	6.20	3.10	0.57	0.61	1.17	2.67	1.71	0.59	3.21	2.00	3.33	2.09	1.15	2.23
		Max (%)	48.38	3.10	10.70	7.50	6.10	0.64	0.69	1.31	2.94	1.87	0.65	3.56	2.20	3.69	2.29	1.25	2.47
<b>East Coast</b> (PA)	6	Mean (%)	44.19	5.78	9.53	6.15	4.45	0.58	0.64	1.21	2.70	1.72	0.60	3.22	2.01	3.34	2.10	1.14	2.24
		SD	3.32	3.63	0.50	0.48	0.98	0.04	0.03	0.08	0.18	0.12	0.05	0.23	0.15	0.25	0.15	0.07	0.17
		CV (%)	7.52	62.74	5.29	7.75	22.10	7.08	5.32	6.35	6.60	6.98	8.00	7.23	7.40	7.51	7.39	6.34	7.67
		Min (%)	39.66	3.20	8.80	5.50	3.60	0.52	0.59	1.09	2.44	1.56	0.53	2.89	1.81	3.00	1.89	1.05	2.00
		Max (%)	46.57	10.90	10.00	6.60	5.80	0.61	0.66	1.27	2.83	1.81	0.63	3.39	2.12	3.52	2.21	1.20	2.36
<b>Crop Year</b>																			
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
2021	400	Mean (%)	46.63	2.25	10.36	6.66	3.77	0.61	0.66	1.27	2.85	1.81	0.63	3.39	2.12	3.53	2.21	1.20	2.37

Dry matter of soybean meal is standardized as 88 %.

Standardized Ileal Digestible Coefficients, %												
	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	91	85	88	90	87	89	96	90	89	90	91	90
Poultry	90	78	84	89	83	89	91	87	87	86	89	88

Source: AMINODat 6.0®

## 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	
2533	Mean (%)	28.53	8.39	4.07	1.10	4.77	6.83	0.53	0.52	1.06	0.84	1.04	0.22	1.26	1.01	3.09	1.32	0.73	1.35	
	SD	1.76	0.85	1.72	0.61	0.49	0.52	0.04	0.04	0.08	0.08	0.06	0.02	0.12	0.07	0.19	0.09	0.05	0.09	
	CV (%)	6.16	10.19	42.42	55.28	10.20	7.58	7.71	7.55	7.19	9.60	5.87	7.60	9.16	6.89	6.23	6.66	6.48	6.81	
	Min (%)	19.56	5.90	0.50	0.20	2.60	5.20	0.31	0.33	0.65	0.36	0.67	0.15	0.80	0.58	2.23	0.82	0.48	0.81	
	Max (%)	52.57	12.80	10.50	8.60	23.10	9.80	0.99	0.93	1.86	2.97	1.80	0.42	3.47	1.88	5.16	2.47	1.28	2.44	
<b>Crop Year</b>																				
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
2021	2533	Mean (%)	28.53	8.39	4.07	1.10	4.77	6.83	0.53	0.52	1.06	0.84	1.04	0.22	1.26	1.01	3.09	1.32	0.73	1.35

Dry matter of DDGS is standardized as 88 %.

Standardized Ileal Digestible Coefficient, %												
	MET	CYS	M+C	LYS	THR	TRP	ARG	ILE	LEU	VAL	HIS	PHE
Swine	83	75	76	63	72	76	81	78	85	77	79	82
Poultry	83	78	81	61	69	81	80	77	84	75	71	78

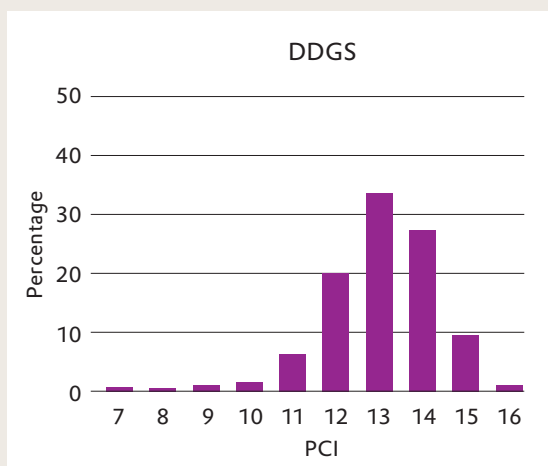
Source: AMINODat 6.0®

## Soybean meal and DDGS processing condition report

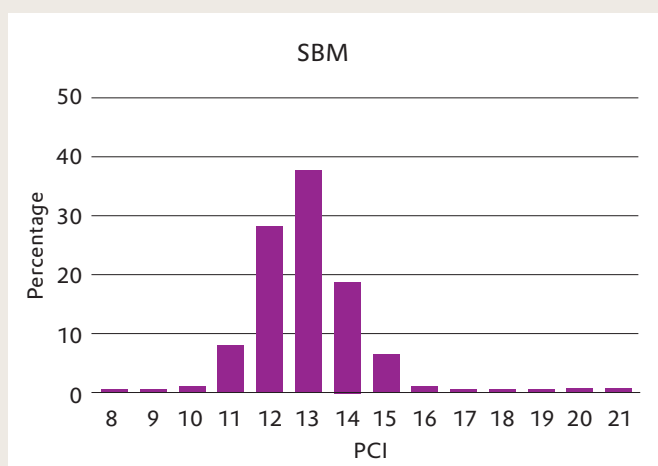
Processing condition of SBM and DDGS can be assessed by measuring Protein Dispersibility Index (PDI), Protein Solubility in KOH, Trypsin Inhibitor Activity, Reactive Lysine, and Reactive Lysine/Lysine ratio. Evonik has added to its near-infrared spectroscopy (NIRS) portfolio a service, based on those traditional laboratory assays, that predicts the quality of heat-exposed soy products and corn-based DDGS—AMINONIR® RED 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 12 and 14 are optimal, and for DDGS, PCI values equal or greater than 14 are optimal. This report was developed using the parameter measured in AMINONIR® RED 2.0 from SBM and DDGS samples scanned during 2021.

Material	N Obs	Variable	N	Mean	Std Dev	CV	Minimum	Maximum
DDGS, Corn	806	Protein Dispersibility Index (PDI)	806	16.5	3.1	18.8	7.3	30.2
		Protein Solubility in KOH	806	29.8	3.9	13.1	14.5	41.4
		Reactive Lysine	805	0.6	0.1	13.5	0.1	0.9
		Reactive Lysine/Lysine ratio	806	72.7	5.4	7.5	41.8	87.2
		Processing Conditions Indicator (PCI)	806	13.0	1.2	9.5	7.0	16.0
Soybean Meal and Expeller	6135	Protein Dispersibility Index (PDI)	6108	12.3	3.8	31.0	4.0	55.6
		Protein Solubility in KOH	6135	80.6	3.0	3.7	58.0	92.9
		Trypsin Inhibitor Activity	6135	2.7	1.2	44.5	0.2	10.6
		Reactive Lysine	6135	2.6	0.1	3.1	1.8	3.1
		Reactive Lysine/Lysine ratio	6134	90.4	1.2	1.4	79.5	94.1
		Processing Conditions Indicator (PCI)	6135	12.9	1.2	9.5	8.0	21.0

**Figure 1** Histogram of processing condition indicator of DDGS in 2021



**Figure 2** Histogram of processing condition indicator of soybean meal and expeller in 2021



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