Cottonseed Meal Trace Element Survey by Atomic Absorption Spectrophotometry

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Abstract

Cottonseed meal from 14 states and Mexico was analyzed for calcium, phosphorus, iron, magnesium, potassium, sodium, copper, manganese, zinc, and cobalt.

These ten elements are of general interest to animal nutritionists and feed manufacturers. The data show surprising uniformity of these elements regardless of the area in which the seed was grown and type of processing used.

Introduction

FIFTY-ONE SAMPLES of cottonseed meal from 14 states and one from Mexico were obtained for analysis. In Table I, each is identified by state and the type of process used in manufacture. The samples were composites of the 1964 crop, taken over a period of several weeks to several months. They were compiled by the individual mills and are roughly divided among the states according to 1963 crop production figures. Further, the type of processing used for the samples

TABLE I

Cottonseed Meal Data[a]

State	Sample number	Type process	% Ca	% Fe	% Mg	% K	% Na	% P	ppm Cu	ppm Mn	ppm Zn	ppm Co
Alabama	10	SP	.114	.0113	.368	1.17	.032	1.06	15	24	55	2.7
	19	PPS	.147	.0126	.415	1.36	.047	1.02	17	25	42	1.0
	25	SP	.118	.0085	.411	1.22	.033	1.00	12	25	56	2.7
		Average	.126	.0108	.398	1.25	.037	1.03	14.7	24.3	51	2.1
Arizona	1	SO	.180	.0117	.450	1.14	.058	.93	18	22	64	2.0
	30	PPS	.168	.0104	.492	1.24	.050	.97	17	17	61	1.7
	37	SP	.179	.0110	.390	1.25	.057	.87	18	21	68	1.9
		Average	.176	.0110	.444	1.21	.055	.92	17.7	20	64.3	1.9
Arkansas	4	SP	.192	.0095	.614	1.38	.045	1.08	19	24	64	0.8
	6	SO	.187	.0148	.521	1.29	.032	1.13	19	23	63	1.8
	16	SP	.150	.0129	.504	1.17	.046	1.07	25	28	62	3.4
	23	PPS	.165	.0151	.436	1.23	.038	1.08	19	23	308	4.5
	24	PPS	.147	.0151	.240	1.19	.038	1.06	18	25	70	3.5
		Average	.168	.0135	.463	1.25	.040	1.08	20	24.6	113.4	2.8
Calif.	2	SP	.212	.0138	.542	1.30	.063	.99	25	22	70	1.6
	3	PPS	.151	.0152	.404	1.22	.233	1.12	18	21	67	1.9
	31	PPS	.148	.0104	.489	1.29	.045	1.15	20	20	103	2.3
	38	SP	.179	.0117	.525	1.40	.053	.92	20	20	65	1.8
	46	PPS	.158	.0117	.481	1.35	.042	1.06	18	22	64	1.5
	47	SP	.164	.0038	.401	1.20	.045	.97	18	21	71	2.0
		Average	.169	.0111	.474	1.29	.080	1.04	19.8	21	73.3	1.9
Georgia	9	SO	.151	.0117	.399	1.35	.044	1.06	13	22	55	1.3
	14	SP	.135	.0117	.375	1.26	.067	.89	17	22	49	1.8
		Average	.143	.0117	.387	1.31	.056	.98	15	22	52	1.6
Louisiana	17	SP	.137	.0132	.447	1.30	.039	1.13	13	24	60	2.0
	45	PPS	.149	.0041	.601	1.36	.041	1.10	19	23	65	1.6
		Average	.143	.0087	.524	1.33	.040	1.12	16	23.5	62.5	1.8
Miss.	2	PPS	.425	.0183	.506	1.24	.052	1.08	18	25	64	1.9
	8	SO	.127	.0117	.371	1.09	.027	1.06	19	22	65	1.4
	11	SP	.152	.0107	.519	1.30	.046	1.02	19	26	61	1.9
	15	SO	.142	.0117	.370	1.11	.040	1.02	16	20	63	2.6
	27	SP	.165	.0135	.567	1.29	.041	1.03	18	23	62	1.9
	39	SP	.181	.0135	.525	1.35	.041	1.03	18	24	221	3.2
	49	SP	.151	.0104	.450	1.28	.056	.97	21	27	60	1.4
		Average	.192	.0128	.473	1.24	.043	1.03	18.4	23.9	85.1	2.0
Missouri	48	SP	.184	.0142	.401	1.13	.045	1.04	23	26	73	1.2
	52	SP	.148	.0139	.456	1.07	.029	.94	24	23	61	1.8
		Average	.166	.0141	.429	1.10	.037	.99	23.5	24.5	67.1	1.5
New Mexico	44	SP	.165	.0117	.452	1.29	.056	.89	18	24	90	1.3
No. Carolina	12	SP	.163	.0110	.449	1.33	.052	1.02	20	23	63	2.8
Oklahoma	28	SP	.171	.0076	.425	1.15	.051	.91	19	20	73	1.1
	33	SP	.240	.0161	.526	1.31	.076	.95	18	20	61	1.7
	35	SP	.226	.0145	.375	1.33	.070	.87	18	22	55	1.6
		Average	.212	.0127	.442	1.26	.066	.91	18.3	20.7	63.0	1.5
So. Carolina	13	SP	.122	.0120	.483	1.26	.037	1.10	17	22	136	2.4
	22	SO	.148	.0035	.624	1.45	.049	1.14	19	23	56	2.5
		Average	.135	.0078	.554	1.36	.043	1.12	18	22.5	96.0	2.5
Tenn.	5	SP	.143	.0107	.513	1.21	.033	1.03	18	24	60	1.6
	26	SP	.148	.0142	.532	1.21	.038	1.07	9	25	61	2.4
		Average	.146	.0125	.523	1.21	.036	1.05	13.5	24.5	60.5	2.0
Texas	18	SP	.121	.0129	.358	1.03	.044	.84	19	20	61	0.9
	20	SP	.176	.0126	.413	1.37	.045	1.00	18	19	314	2.9
	21	SP	.155	.0110	.404	1.20	.059	.83	19	20	70	2.9
	29	SO	.179	.0104	.385	1.21	.178	.89	19	21	53	1.9
	34	PPS	.163	.0123	.324	1.08	.047	.82	23	17	51	1.0
	36	SP	.222	.0113	.429	1.35	.066	.88	20	22	53	0.8
	40	SP	.164	.0025	.368	1.12	.043	.93	19	23	69	1.3
	41	PPS	.218	.0135	.491	1.27	.058	.88	19	22	75	1.2
	42	SP	.191	.0139	.436	1.21	.050	.87	19	20	52	1.9
	43	SP	.167	.0139	.441	1.14	.043	.89	17	21	53	2.0
	50	PPS	.292	.0173	.396	1.25	.063	.91	24	21	108	1.9
	51	SP	.230	.0161	.489	1.37	.056	.88	19	23	64	2.5
		Average	.190	.0123	.411	1.22	.063	.89	19.6	20.8	85.3	1.8
Mexico	32	PPS	.180	.0132	.463	1.35	.060	1.01	16	19	112	0.9
		Average all samples	.164	.0116	.459	1.26	.050	1.01	18.0	22.8	73.3	2.0

[a] Process key: SP, screw press; PPS, prepress solvent; SO, solvent.

TABLE II
Average Metal Content According to Process[a]

Type process	No. samples		% Ca	% Fe	% Mg	% K	% Na	% P	ppm Cu	ppm Mn	ppm Zn	ppm Co
SP	32	Average	0.168	0.0117	0.456	1.25	0.049	0.97	18.5	22.8	77.9	1.94
SP		High	0.240	0.0161	0.614	1.40	0.076	1.13	25	28	314	3.4
SP		Low	0.114	0.0025	0.358	1.03	0.029	0.83	9	19	49	0.8
PPS	13	Average	0.193	0.0130	0.441	1.26	0.063	1.02	18.9	21.5	91.5	1.92
PPS		High	0.425	0.0183	0.601	1.36	0.233	1.15	24	25	308	4.5
PPS		Low	0.147	0.0041	0.240	1.08	0.038	0.82	16	17	42	0.9
SO	7	Average	0.159	0.0108	0.446	1.23	0.061	1.03	17.6	21.9	59.9	1.93
SO		High	0.187	0.0148	0.624	1.45	0.178	1.14	19	23	65	2.6
SO		Low	0.127	0.0035	0.370	1.09	0.027	0.93	13	20	53	1.3

[a] Process key: SP, screw press; PPS, prepress solvent; SO, solvent.

is in close ratio to that which exists in the domestic processing of cottonseed in the United States.

Methods and Equipment

Duplicate samples of meal were ashed at 500C, double extracted with hot HCl, taken to near dryness, redissolved in 0.5 N HCl, filtered and prepared to definite volume. Aliquots of this solution were diluted with a 1% lanthanum solution before proceeding with the analysis for calcium and magnesium in order to prevent interference from phosphorus. The measurements were made with a Model 303 Perkin-Elmer Atomic Absorption Spectrophotometer equipped with a digital concentration readout unit. Instrumental conditions were generally those recommended by the manufacturer. The burner employed air and acetylene.

To minimize any absorption interferences, standard solutions were prepared from carefully purified salts or ultrapure metals and were adjusted to approximate the metal concentrations of the unknown solutions. The metal concentrations of the solutions were obtained by plotting the absorbance readings against those of the standard solutions. Blanks were used for correction for metal contaminations in reagents.

Phosphorus analyses were performed by the molybdo-vanadate colorimetric method (1).

All data are calculated on an 8% moisture basis.

ACKNOWLEDGMENTS

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REFERENCE

1. A.O.A.C. Methods of Analysis, Tenth Edition, Method 22.073.

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