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Cottonseed Feed Products Guide



Cottonseed ~ Meal ~ Hulls

The cotton industry has been an integral part of U.S. agriculture for more than two centuries. Cotton, America's Food and Fiber Crop, has expanded into new markets for lint as well as for food and feed products from the cottonseed as technology and processing innovations have been utilized. Cottonseed feed products have been used for the feeding of livestock for more than 150 years. This guide provides official definitions, product descriptions, and nutrient composition data for cottonseed feed products.

Cottonseed Meal, Cottonseed Hulls and Whole Cottonseed are natural sources of protein, fiber and energy. Cottonseed meal is the most abundant plant protein feed available throughout the U.S., after soybean meal. It can be used in both ruminant and monogastric rations. Cottonseed hulls are a valuable source of roughage for ruminant feeds and fiber for monogastric rations. Whole and delinted cottonseed are

concentrated sources of protein and energy for ruminant rations. An understanding of the various characteristics of these feeds can assist astute buyers in selecting those products which best meet their animal's requirements and thereby gain the most for each dollar invested in feedstuffs. Basic physical characteristics are given in Table 1. Nutritional values are provided in Tables 2, 3, and 4.

Products described are traded under National Cottonseed Products Association (NCPA) Trading Rules and are subject to state feed control regulations as described by the Association of American Feed Control Officials (AAFCO) in their Official Publication.

Table 1

Basic Handling Properties of Cottonseed and Cottonseed Products

Product	Bulk Density (lb/ft ³)	Volume (ft ³ /ton)	Weight (lb/bu)	Specific Count (seed/lb)
Whole Cottonseed				
Loose on Conveyor <24 feet deep	20	100		
	25	80	32	1,800-2,400
Machine Delinted	35	57	44	2,400-3,200
Acid Delinted	34-37	54	42-46	4,800-5,600

Meals (extracted)	38	53
Hulls	12	167

Cottonseed Meal is normally sold as a 41% protein product but is available as 35% cottonseed cake, 38% and 44% protein meals. They contain over 1% phosphorus and 70-80% TDN. Cottonseed meal is an excellent source of protein for a variety of animal species. Meals are often further processed into pellets of varying size (1/4", 3/8", 1/2", 3/4" and 7/8") depending on the application. Cottonseed meal can be used alone in many diets or in combination with other plant and animal protein sources to complete a balanced ration. The characteristics of a particular meal are largely determined by the type of oil extraction process from which the meal was derived - mechanical (screwpress) or expander solvent extraction.

AAFCO defines Cottonseed Meal, Mechanical Extracted, as the product obtained by finely grinding the cake which remains after removal of most of the oil from cottonseed by a mechanical extraction process. It must contain not less than 36% crude protein. The words "mechanical extracted" are not required when listing as an ingredient in a manufactured feed.

Most of the mechanical extracted meal is screwpress meal. It is obtained when dehulled, cooked, flaked, cottonseed kernels are subjected to high pressure by a revolving screw inside a barrel which forces out the oil through small openings in the barrel. The de-oiled cake which remains moves out the end of the barrel and is ground into meal.

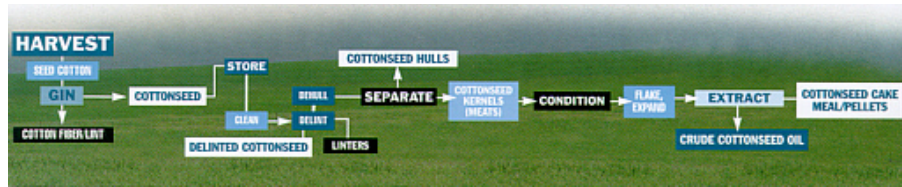
AAFCO defines Cottonseed Meal, Solvent Extracted, as the product obtained by finely grinding the flakes which remain after removal of most of the oil from cottonseed by a solvent extraction process. It must contain not less than 36% crude protein. The words "solvent extracted" are not required when listing as an ingredient in a manufactured feed.

Cottonseed meal solvent extracted is produced by forcing the cottonseed kernel initially through an expander and then using solvent to extract most of the oil. Most cottonseed meal produced in the U.S. today is manufactured using this process (see figure below). This method utilizing an expander helps to increase production efficiency as well as binding much of the free gossypol found in cottonseed meal.

Solvent extracted meals normally have a minimum fat content of 0.5% while mechanical meals usually have a minimum of 2.0%. Maximum fiber levels for 36, 41 and 43% protein meals are 17, 14 and 13% respectively. Descriptions of quality include: Prime Quality - must be free of mold, excess lint, and sour, musty, or burnt odors; Off Quality - shall be that which does not meet the prime quality requirements (AAFCO definition).



Cottonseed Hulls are the outer covering of the cottonseed and are separated from the kernel prior to the oil extraction process. Cottonseed hulls contain 3-8% highly digestible cotton linters (nearly 100% cellulose). Cottonseed hulls are an exceptional roughage with a high level of effective fiber and are very palatable. They are commonly used in feedlot and dairy rations since they require no grinding and mix well with other feed ingredients. They can be pelleted for ease of handling and to lower transportation cost. Cottonseed hulls are comparable in nutritive value to good quality grass hay and are valuable digestive aides to concentrate rations. They can also serve to limit intake of concentrate when feeding on pasture.

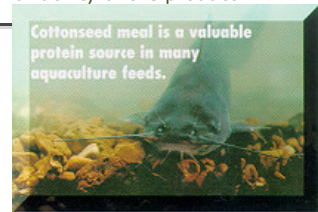


Linted Cottonseed, often referred to as "fuzzy seed" or "whole cottonseed" is the seed left after ginning the long fibers from upland varieties of cotton. The short fibers remaining on the seed are called linters and are a source of readily digestible cellulose for ruminants. The amount of linters left on the seed varies from 4-8%. Whole linted cottonseed contain approximately 18% ether extract and about 20% crude protein on an as fed basis. Whole cottonseed is a source of protein, energy and fiber for ruminant animals.

Pima Cottonseed is the seed from pima varieties of extra long staple cotton. Pima seed is naturally devoid of linters.

Delinted Cottonseed is seed which has been processed to remove the linters. Most delinted seed uses a mechanical method for removing linters which usually leaves about 1-2% residual linters on the seeds. Acid delinting is a chemical process which removes all linters and is used for the preparation of planting seed. Caution should be exercised when accepting cull planting seed for feeding. Verification that no seed treatment chemicals are present should be obtained before using cull planting seed for feed. Utilization of both pima and acid-delinted seed can be improved by rolling or cracking before feeding. Delinting increases nutrient density and flowability of the product.

Gossypol is a pigment found naturally in many *gossypium* species including cotton and is located in glands throughout the plant. Gossypol is in the free state in the whole seed and is bound to lysine or other components during processing into meal. Gossypol bound in this way has generally been considered unavailable to the animal. Animal sensitivity to gossypol is considerably different between species and classes of animals. The amount of free gossypol has been the guide used by many nutritionists to make recommendations on feeding of cottonseed products. Table 2. contains representative values for gossypol in various cottonseed products.



All data and figures are provided here for informational use only and are not intended as recommendations. If unsure how cottonseed feed products will work into specific rations contact a qualified nutritionist.

Nutrient Composition Of Cottonseed Feed Products on a Dry Matter Basis

ME CSM=mechanical extracted cottonseed meal; ES CSM=expander solvent cottonseed meal;
WCS=whole cottonseed;DCS=delinted cottonseed;CSH=cottonseed hulls

Table 2
Major Components

Item	ME CSM ^a	ES CSM ^a	WCS ^a	DCS ^b	CSH ^c
Dry Matter, %	92.3	89.1	91.6	90	89.9
Crude Protein, %	46.1	47.6	22.5	25	5

Acid Detergent Fiber, %	18.1	17.3	38.8	26	67
Neutral Detergent Fiber, %	32.3	24.5	47.2	37	86.9
Crude Fiber, %	11.4	11.2	29.5	17.2	48.6
Ether Extract, %	4.6	2.2	17.8	23.8	1.9
Ash, %	7.2	7.5	3.8	4.5	2.8
Gossypol ^{de} -Total	1.09	1.16	0.66	-	0.107
Gossypol ^{de} -Free	0.06	0.14	0.68	-	0.049

Table 3
Minerals

Item	ME CSM ^a	ES CSM ^a	WCS ^a	DCS ^b	CSH ^c
Calcium, %	0.21	0.22	0.14	0.12	0.15
Magnesium, %	0.65	0.66	0.35	0.41	0.15
Phosphorus, %	1.14	1.2	0.56	0.54	0.08
Potassium, %	1.68	1.72	1.14	1.18	1.13
Sodium, %	0.0007	0.14	0.0008	0.01	0.0009
Sulfur, %	0.43	0.44	0.2	-	0.05
Copper, mg/kg	10.9	12.5	7	11	3.6
Iron, mg/kg	106	126	50	108	30.1
Manganese, mg/kg	18.7	20.1	15	14	16.8
Molybdenum, mg/kg	2.4	2.5	1.6	-	0.37
Zinc, mg/kg	62.8	63.7	33	36	9.9

* To convert the above information to As Fed basis, multiply nutrient by Dry Matter Value and divide by 100(e.g. ME CSM Crude protein as fed = $46.1 \times 92.3 \div 100 = 42.55$)

Table 4
Amino Acids *fg*

Item	ME CSM ^a	ES CSM ^a
Alanine, %	1.81	1.79
Arginine, %	4.4	4.86
Aspartic Acid, %	4.02	4.27
Cystine, %	0.64	0.69
Glutamic Acid, %	8.47	9.15
Glycine, %	1.83	1.87
Histidine, %	1.45	1.5
Isoleucine, %	1.27	1.29
Leucine	2.55	2.62
Lysine (Total), %	1.57	1.96
Methionine, %	0.7	0.78
Phenylalanine, %	2.23	2.35
Proline, %	1.62	1.63
Serine, %	2.04	2.15
Threonine, %	1.52	1.58
Tryptophan, %	0.51	0.53
Tyrosine, %	0.98	1.04
Valine, %	1.8	1.83

^a Values are on a 100% dry matter basis for 83 samples collected at 31 cottonseed oil mills during 1993-95.

^b Values from Nutrient Requirements of Dairy Cattle. 1989.

^c Values are on a 100% dry matter basis for 83 samples submitted by 31 cottonseed oil mills. These were compositated to provide a single sample for analysis from each mill.

d Values whole cottonseed were calculated by multiplying the % of gossypol in decorticated seed (seed without hulls and lint) by 0.55

e Free and total gossypol were determined by the official method of the American Oil Chemists' Society (AOCS, 1985a, 1985b).

f Amino Acid % on 100% dry matter basis.

g Amino Acid analysis are based on sample form 2 mils for ME CSM and 15 mills for ES CSM.

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