



WHOLE COTTONSEED

A SUPER FEED FOR DAIRY COWS

Whole Cottonseed has **energy**, **protein** and **fiber** in greater concentrations than many other feedstuffs. That's why it's recognized by dairy producers nationwide as a **cost-effective** premier feedstuff for lactating cows of high genetic merit. In fact, more than 50% of the annual supply of whole cottonseed is consumed by dairy cattle. Producers have found that whole cottonseed is ideal for mixing with less nutrient-dense feed ingredients. The result is a **competitively priced, balanced ration**.



← ENERGY ← PROTEIN ← FIBER

*To get the most out of your feed,
just add cottonseed.*



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What Is Whole “Fuzzy” Cottonseed?

When cotton plants are harvested by a gin, more seed than cotton is produced. For each 480-pound bale of cotton produced, there's an average of about 700 pounds of seed. Depending on the size of the nation's crop, more than 6 million tons of cottonseed are harvested annually. Texas is the largest cotton producing state, followed by California, Mississippi, Arkansas and Georgia. The special qualities of whole cottonseed as a feedstuff became known in the 1980s.

Whole cottonseed's energy and protein are found in the seed's meaty kernel. Its fiber is found in the short, white, hair-like strands remaining on each seed after the cotton is removed - the reason cottonseed is often referred to as “fuzzy.” The fuzz, however, is not residual cotton. These strands are cellulose, a highly effective source of fiber and are known as “linters.”

Will Cottonseed Work For You?

Dairy producers of all sizes are effectively using whole cottonseed (WCS), especially in the diet of the early-lactation cow. WCS can increase milk output and boost butterfat. That's why many producers build their herd's diet around the valuable nutrients of



cottonseed. WCS is convenient and does not need to be processed before feeding. Since WCS should be mixed with other components of the dairy cow diet, producers with large herds buy WCS in bulk and add it to their total mixed ration (TMR). Small herd owners ask their feed dealer to include it in their pre-mix.

On average, a truckload of cottonseed weighs 23 tons, enough for 100 cows for 100 days.

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High Energy and High Fiber

Whole cottonseed has high protein (23%), high energy in the form of fat (20%), and crude fiber (24%) on a dry matter basis. Compared with other commonly available protein supplements, whole cottonseed is the only one with both additional high energy and high fiber. This combination is especially attractive when feeding the high producing, early lactation dairy cow in negative energy balance – a cow in need of both energy and fiber. Also, the energy (fat) content of WCS makes it a valuable addition for cows under heat stress who may have a reduced appetite.

WCS has a value similar to a 20% protein mixture of corn and soybean meal, making it worth around \$250/ton with current feed prices. Whole cottonseed has a good balance of crude protein and energy, so it makes a complete supplement in many situations. The “crude protein” in WCS is “true protein” which makes it better for supplementing high forage diets compared to supplements with non-protein nitrogen (urea).

The energy in WCS is primarily from fat, which if fed at a reasonable level, won’t interfere with forage digestion the way the starch in corn can. Research has also shown that the fat in WCS improves reproductive performance.

An Economical Feedstuff

Adding WCS to the diet of early-lactation dairy cows usually increases total energy intake, which often boosts milk yields. And WCS usually



has a positive effect on milk fat test, while slightly reducing milk protein. Overall, the effect on milk price is positive. If you’re using a computer program to evaluate the dollar value of WCS in your cows’ feed, make sure it includes WCS’s positive influence on milk production and milk price.

Feeding 5 to 8 pounds of WCS per cow per day is generally regarded as economical, effective, and safe. (Five pounds is approximately 25,000 seeds.) If greater amounts are fed, careful calculations of gossypol intakes based on the whole seed analysis should be done, especially if more than the recommended amount is fed for extended periods. (See page 10.)



Reliable Distribution Channels

Cotton is the leading cash crop in the United States and more than 50% of the WCS produced each year is sold specifically for livestock feed. Of this amount, about half is distributed by companies associated with cottonseed oil mills, and the other half enters the feed trade directly from cotton ginner.

As with corn, soybeans and other feedstuffs, traditional forces of supply and demand determine the price of WCS. Marketers of WCS include commodity dealers, brokers, feed dealers, truckers and others; and distribution channels continue to evolve every year.

In the past, some mild swings occurred in the WCS market, largely the result of inadequate storage capacities, particularly in the Southeast and the West. But as storage capacities increased, price and availability of WCS stabilized. And as more storage capacity has been created throughout the country, the market has become increasingly reliable. To find a source near you, visit the Cotton Incorporated Web site, www.wholecottonseed.com or call 800-334-5868. You can also visit www.cottonseed.com.

Purchasers of feed grade WCS are advised to deal only with reputable distributors and merchandisers who are experienced in the business of storing and handling WCS.



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Value and Pricing

The true economic value of WCS can only be established by its use in your individual dairy situation. Here is a suggested starting point for your calculations.



The dollar value of any feed ingredient should reflect the nutrients it contains relative to the cost of nutrients in other available feedstuffs. The most comprehensive way to do this is with a computer that solves simultaneous equations given an array of available feedstuffs and

their costs. However, these programs often have limitations, especially in the case of special ingredients, such as WCS, which supplies energy in the form of fat, plus protein and a digestible fiber. Also, the use of WCS will often increase milk fat test, although a small depression in milk protein often occurs. The net effect on milk price, however, has usually been positive. This means that the value of WCS is often more per ton than a least-cost computer formulation that ignores milk revenues.

A simple relative dollar value of WCS can be obtained by using a substitution formula. Consider:

- 1) Corn to represent the value of energy
- 2) Soybean meal (44%) to represent the value of protein
- 3) A good Coastal Bermuda grass hay (CBH) to represent the value of fiber.

Use the values in the following formula.

Add the three totals of

- A) Price of corn times .90*
- B) Price of soybean meal (44%) times .25*
- C) Price of CBH times .50*

Example:

<i>A) \$140/ton X .90 =</i>	<i>126.00</i>
<i>B) \$300/ton X .25 =</i>	<i>75.00</i>
<i>C) \$100/ton X .50 =</i>	<i>50.00</i>
	<i><u>\$251.00</u></i>

This value incorporates the contribution of fiber, which is crucial to the producing cow in the first trimester of lactation. During the last half of lactation, fiber is usually not a constant, and the value of fiber in the formula should be discounted by at least half.



The type, amount and quality of your homegrown forage must also be considered. One very important logistical advantage in using WCS is a reduced number of feed ingredients – the high nutritional quality of WCS often reduces the total number of other feedstuffs needed in the ration. Thus, farmers require less ingredient storage and less management time spent with purchasing and inventory control.

Variation in the Nutrient and Gossypol Content of Whole and Processed Cottonseed

NUTRIENT VALUES FOR WHOLE, LINTED SEED OF UPLAND COTTONS (*Gossypium hirsutum*).¹

Item	Calhoun et al. (1995)			DAIRY ONE ²			2001 DAIRY NRC ³		
	N	Mean	SD ⁴	N	Mean	SD	N	Mean	SD
Dry matter, %	83	91.6	0.89	1034	91.4	3.0	1059	90.1	4.6
Crude protein, %	83	23.0	0.98	859	25.0	6.1	1124	23.5	2.6
Sol. protein, % of CP				413	27.5	12.8			
Degrad. protein, % of CP				57	47.3	6.2			
ADICP, %				136	1.96	0.58	4	1.9	0.1
NDICP, %				137	2.55	0.69	71	2.4	1.2
ADF, %	83	38.9	3.59	782	38.1	9.93	1024	40.1	4.4
NDF, %	83	47.3	3.54	790	49.6	10.94	953	50.3	5.8
Crude fiber, %	83	29.5	2.07	89	23.7	7.08			
Crude fat, %	83	20.1	0.95	456	22.5	4.65	27	19.3	1.4
Ash, %	83	3.8	0.23	227	4.4	0.56	193	4.2	2.1
Calcium, %	83	0.14	0.016	603	0.20	0.057	928	0.17	0.08
Phosphorus, %	83	0.56	0.055	603	0.76	0.187	928	0.60	0.08
Magnesium, %	83	0.35	0.020	602	0.40	0.073	928	0.37	0.04
Potassium, %	83	1.14	0.067	602	1.21	0.103	928	1.13	0.07
Sodium, %	83	0.008	0.007	602	0.024	0.009	928	0.02	0.02
Chloride, %				136	0.09	0.018	148	0.06	0.03
Sulfur, %	83	0.20	0.023	417	0.25	0.069	424	0.23	0.04
Copper, ppm	83	7	1.3	600	7	2.4	928	7	3
Iron, ppm	83	50	11.5	600	85	73.3	928	94	185
Manganese, ppm	83	15	2.2	600	17	9.0	928	18	13
Zinc, ppm	83	33	3.5	600	37	12.7	928	37	18
Molybdenum, ppm	83	1.6	0.52	600	0.58	0.47	919	1.3	0.6

*¹ Values are on a 100% dry matter basis.

*² Information accessed at <http://www.dairyone.com> on February 20, 2004.

*³ National Research Council, Nutrient Requirements of Dairy Cattle 6th Revised Edition, 2001.

*⁴ Standard deviation.

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SAMPLE RATIIONS

Developed by Dairy Profit Weekly, DPW Publishing Co., and Trilogic Systems, St. Paul, Minnesota

WESTERN WASHINGTON

Western Washington producers generally pay more for feed while receiving lower milk prices. Yet they manage to keep their production levels higher than most other parts of the country. They also take advantage of Canadian feeds and ship in cottonseed from as far away as Arkansas. Whole cottonseed used in conjunction with homegrown feeds or purchased feeds helps Pacific Northwesterners keep their rolling herd averages well above the national average. Cottonseed, because of its high nutrient density, becomes a more economical feed to ship than some of the other dairy staples.

Washington Sample Rations

	100 lbs./Milk
Corn Silage	23.3 lbs.
23% CP Alfalfa	15.8 lbs.
1:1 Barley/Corn	14.2 lbs.
Wheat Midds	10.9 lbs.
Whole Cottonseed	6.5 lbs.
48% Soybean Meal	3.9 lbs.
Vitamin/Mineral Mix	

CENTRAL CALIFORNIA

Whole cottonseed is well positioned in the California market and is priced favorably to other feedstuffs. Of all the feeds offered in these comparative rations, whole cottonseed is one of only two feeds that remain at maximum usage across all three production strings.

California Sample Rations

	100 lbs./Milk	80 lbs./Milk	60 lbs./Milk
23% CP Haylage	33.0 lbs.	23.6 lbs.	24.0 lbs.
1:1 Barley/Corn Mix	15.0 lbs.	11.8 lbs.	9.7 lbs.
Dried Citrus Pulp	10.0 lbs.	10.0 lbs.	10.0 lbs.
Cottonseed	8.0 lbs.	8.0 lbs.	8.0 lbs.
48% Soybean Meal	7.6 lbs.	6.3 lbs.	3.5 lbs.
Vitamin/Mineral Mix			



"Whole cottonseed has the protein, energy and fiber our cows need. Sometimes we reduce the amount we feed, but we'll never stop using it."



WAYSIDE DAIRY, LLC
Dan Natcke, Greenleaf, WI

WESTERN NEW YORK

Cottonseed proves both cost-effective and nutritionally effective for high-production strings in New York. Balancing for 100 pounds of daily milk at maximum dry matter intake levels, gives all energy sources an even chance. Still, cottonseed is the best choice for high-energy rations in New York. Supporting high levels of production can be accomplished using either cottonseed or another high-energy source.

New York Sample Rations

	100 lbs./Milk
23% CP Haylage	32.0 lbs.
Hominy	15.0 lbs.
Corn Silage	14.5 lbs.
48% Soybean Meal	9.5 lbs.
Cottonseed	8.0 lbs.
Vitamin/Mineral Mix	

SOUTHEASTERN WISCONSIN

In the heart of dairyland, where most producers grow a large share of their feed, imported feeds still play a critical role. Whole cottonseed, because of its unique nutrient profile, is cost competitive and nutritionally effective for high-producing cows. At lower-production levels, cottonseed has a more difficult time competing with on-farm feeds.

Wisconsin Sample Rations

	100 lbs./Milk	75 lbs./Milk
Haylage	35.5 lbs.	12.3 lbs.
Corn Silage	32.3 lbs.	57.0 lbs.
Rolled Corn	14.5 lbs.	7.3 lbs.
44% Soybean Meal	10.5 lbs.	11.0 lbs.
Whole Cottonseed	3.3 lbs.	0.0 lbs.
Vitamin/Mineral Mix		

CENTRAL FLORIDA

Dairying in Florida, a forage deficit state, can be a real challenge. High feed costs, especially for premium-quality alfalfa, and hot humid summers, cut into profits. Despite those hardships, Floridians have two advantages: lower whole cottonseed prices and higher milk prices. Even for lower-producing strings in the heat of summer when feed intakes are low, cottonseed in Florida is a good low-cost ingredient because it provides an array of nutrients, such as fiber, energy, and protein. Cottonseed meal is also priced right in the South; however, special attention should be paid to gossypol levels when cottonseed is fed in conjunction with cottonseed meal or cottonseed hulls. (See page 10.)

Florida Sample Rations

	75 lbs./Milk
Hominy	15.0 lbs.
Citrus Pulp	10.0 lbs.
Cottonseed	8.0 lbs.
Bermuda Grass	7.0 lbs.
48% Soybean Meal	3.8 lbs.
Cottonseed Meal	1.4 lbs.
Vitamin/Mineral Mix	

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Feeding Limitations

When WCS is a particularly good buy, a reasonable question is: how much can one feed?

Most dairy producers in the South and West feed from 5 to 8 lb. per cow per day. This is about 15% of the total diet dry matter in a TMR. But if fed for extended periods (more than 6 months), producers need to be aware of the safe levels of a compound called gossypol.

Research conducted at Auburn University suggests that 24 grams of free gossypol is the approximate upper limit for the lactating cow, allowing up to 10 lbs. of WCS per cow per day if the free gossypol is 0.50% or less in the whole seed (22.7 grams). A gossypol analysis is recommended to determine the exact amount of free gossypol if feeding more than 8 lb. of WCS per cow per day.

Analyses are usually expressed as a percentage of the kernel (meal plus oil); to convert the percentage of gossypol in the kernel to the percentage present in the whole seed, multiply by .68. For example, if a kernel contains 0.92% gossypol, the equivalent amount in the whole seed would be 0.63%. If cottonseed meal and/or cottonseed hulls are also being fed, their contribution to the total free gossypol intake needs to be included also, though they may have much less free gossypol than WCS.

Whole cottonseed, as with many other feedstuffs, may have problems with aflatoxin produced by molds, developed in either the field or from poor storage of the cottonseed. Purchasing agreements should state clearly that the WCS have less than some specific amount of aflatoxin (20 ppb is the legal limit for feeds used in dairy rations). Storing WCS on a well-drained pad protected from rain is a necessity.



Storage and Handling

The bulk density of WCS averages about 22 lb./ft.³ and requires about 80 ft.³ of storage space per ton. WCS is hygroscopic and therefore absorbs moisture from, or gives up moisture to, the surrounding air. Storage temperatures below 60°F (15°C) and below 10% moisture content wet basis provide the best conditions to avoid developing molds and reduce insect activity within the seed.

Whole, fuzzy cottonseed has some unique characteristics requiring special attention when using common grain-handling facilities. Unlike grain, WCS has a variable angle of repose. The angle of repose in an unrestricted pile of WCS is about 45°. However, after the seeds have settled, they will bridge – an indication that the angle of repose is greater than 90°. Extreme caution must be exercised when handling large volumes of WCS to ensure that hazardous situations do not jeopardize worker safety.



As with feedstuffs such as corn and soybeans, WCS should not be stockpiled for extended periods unless you are thoroughly familiar with proper storage conditions and aeration systems. Over many months of storage, WCS will retain its greatest value under conditions where it is covered and air is drawn through the pile to reduce and control the temperature and moisture level. If you wish to have a guaranteed supply of WCS for several months of a year, it is recommended to forward contract for future delivery. This places the responsibility of proper storage on the supplier.

BASIC PROPERTIES OF COTTONSEED AND COTTONSEED PRODUCTS

Product	Bulk Density (lb./ft. ³)	Volume (ft. ³ /ton)	Weight (lb./bu.)	Count (seed/lb.)
Whole Seed Loose	20 (18-25)* ¹	100	32	1,800-2,400
<24 ft. deep	25	80		
24-50 ft. deep	27	75		
>50 ft. deep	30	70		
Machine Delinted	35 (25-35)* ¹	57	44	2,400-3,200
Acid Delinted	34-37	54	42-46	4,800-5,600
Meal (extracted)	38 (37-40)* ¹	53		
Hulls	12(1)	167		
Oil	57	35		

*¹ Source: 1992 Feedstuffs Reference Issue., Vol. 64, No. 29.

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Specialty Products

Several feed suppliers have recognized the many benefits of feeding whole cottonseed. These suppliers have developed specialty products to better meet the needs of the often widely different feeding practices of dairy producers. One of these products is EasiFlo™ cottonseed. EasiFlo uses a starch coating to improve handling and flow while enhancing whole cottonseed's ability to be augered through traditional grain handling equipment. CottonFlo™, another specialty product, increases nutrient density and flowability. And a pelletized form of whole cottonseed, known as FuzZpellet™, has recently been developed. To learn more about any of these specialty products, visit the Cotton Incorporated Web site.

Easi*flo*™
cottonseed

Cotton*Flo*™

FUZ*Z*PELLET™
The all-natural pelleted cottonseed feed



Trading Rules For Feed Grade Cottonseed

National Cottonseed Products Association (NCPA)

The NCPA is a national trade organization that represents cottonseed crushers, WCS merchandisers, dealers, brokers, chemists, and other allied interests.

National Cottonseed Products Association
866 Willow Tree Circle
Cordova, TN 38018
Phone: 901-682-0800

Chapter XIII Article 2. Grade and Quality

Rule F-4: Prime Feed Grade Cottonseed.

Prime Feed Grade Cottonseed shall meet the following criteria: Foreign substances shall not exceed 2 percent. Moisture shall not exceed 13 percent. Free fatty acids in the oil shall not exceed 3 percent. Crude protein and crude fat (dry matter basis) will be at least 34 percent when the separate totals for each are combined.

Cottonseed of the Pima variety or other varieties of long staple cotton containing 3 percent or less residual lint on seed after ginning, or admixtures containing such seed must be identified as such at the time of sale.

Rule F-5: Delinted Prime Feed Grade Cottonseed.

Delinted prime feed grade cottonseed shall be mechanically delinted. Lint on seed shall not exceed 5 percent. Foreign substances shall not exceed 1 percent. Moisture shall not exceed 13 percent. Free fatty acids in oil shall not exceed 3 percent. Crude protein and crude fat (dry matter basis) will be at least 37-1/2 percent when the separate totals for each are combined.

Rule F-6: Feed Grade Cottonseed, Off Quality.

Feed Grade Cottonseed, off quality, are those that do not meet the specifications of Rule F-4.

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Terms and Definitions

Cottonseed –

Determined by the National Cottonseed Products Association (NCPA), Premium and Prime Feed grades contain, respectively; 1 to 2 percent foreign matter; 11 to 13 percent moisture; 38 to 34 percent crude protein and crude fat (combined totals for each); and 3 percent free fatty acids in the oil.

Delinted Cottonseed –

There are two processes used for delinting cottonseed, mechanical and acid. Mechanically delinted is the most common form of delinted seed available in the feed trade. Mechanically delinted seed retains about 1-2% residual linters which usually appear on the ends of the seeds. Acid delinting is a process that completely removes all linters. This process is used for the production of planting seed. At certain times during the year, quantities of culled, or leftover planting seed, become available to the feed trade. Beware of such planting seed unless you can demonstrate that it does not contain chemical seed treatments.

Gossypol –

A polyphenol ($C_{30}H_{30}O_8$) derived from the cottonseed plant and potentially irritating to gastrointestinal tract.

Lint –

The ginned fibers from harvested cotton bolls.

Linters –

The short fuzz left on the cottonseed after a mechanical delinting process.

NCPA –

National Cottonseed Products Association – The NCPA is a national trade organization representing cottonseed crushers, dealers, brokers, chemists, and other allied interests within the industry: www.cottonseed.com.

Pima Cottonseed –

This is the seed from pima varieties of cotton, also known as extra long staple (ELS) cotton. It represents a small percentage (about 2%) of U.S. cotton. Pima seed is genetically devoid of linters, the fuzz that covers the seed of upland varieties. Some nutritionists recommend that Pima seed be cracked prior to feeding.

Whole Cottonseed (WCS) –

This term refers to fuzzy seed from upland varieties of cotton.



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