

# Whole Cottonseed

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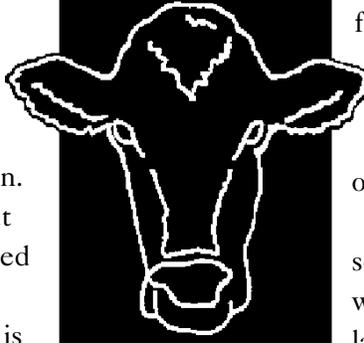
## INTRODUCTION

Cotton is raised for fiber in the southern United States, and represents the ninth largest economic crop in the nation. The United States produces about 6.1 million tons of whole cottonseed annually.

After harvest, cotton is ginned to remove long lint fibers which are then compressed and baled. Ginning produces 1.6 to 1.7 pounds of linted whole cottonseed per pound of cotton lint.

After ginning, whole cottonseed is used in three ways. Linted whole cottonseed is frequently used directly as a protein, forage, or grain replacement in ruminant diets. Secondly, linted whole cottonseed may be run through a finer set of gin saws to remove short cotton fibers. This produces mechanically delinted whole cottonseed, which is usually crushed into meal and oil fractions. The process (solvent extraction) is similar to that used in the soybean, flax, and the canola crushing industry. The meal is used as a protein supplement for dairy, livestock, and poultry. Mechanically delinted whole cottonseed can also be directly fed to ruminants and is preferred by feed manufacturing firms because of ease of mechanical handling. Thirdly, linted whole cottonseed can be delinted by a sulfuric acid solution, leaving a completely slick seed with no usable short fibers. This whole (slick)

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seed is used as seed stock because it flows well in mechanical cottonseed planters. Acid delinted whole cottonseed can be fed to livestock, but is often unpalatable due to odors associated with sulfuric acid.

Whole cottonseed is known by several different names. Fully linted whole cottonseed is called white, upland, or fuzzy. Delinted whole cottonseed is called black, slick, pima, or acid.

## CHEMICAL COMPOSITION

According to the 1989 Feed Industry Red Book, whole cottonseed is the unprocessed and unadulterated oilseed that has been separated from the cotton fiber. It is fed to lactating cows for its dense protein, fat, and highly digestible fiber. Delinted cottonseed is the unprocessed and unadulterated oilseed that has been separated from the cotton fiber, with less than 5% retained lint.

Whole cottonseed is unique in that it represents the chemical composition of forage, grain, and protein supplements. Whole cottonseed can substitute, within limits, for any of these components. The fat in cottonseed, while of benefit to ruminants, also limits its incorporation into ruminant diets. The fat is largely unsaturated, and can reduce fiber digestion and milk fat test if fed at too-high levels. Limit fat supplementation from whole cottonseed to less than 1.5 lbs/day.

Table 1  
 —Nutrient composition of whole cottonseed—  
 (dry matter basis)

	Linted	Delinted
Dry Matter % (as fed)	92.0	90.0
Crude Protein %	23.0	25.0
Fat %	20.0	23.8
Calcium %	.21	.12
Phosphorus %	.64	.54
Potassium %	1.00	1.18
Magnesium %	.46	.41
Acid Detergent Fiber %	34.0	26.0
Neutral Detergent Fiber %	44.0	37.0
Total Digestible Nutrients %	96.0	100.0
Undegraded Intake Protein %	35.0	35.0
Net Energy-Lactation Mcals/lb	1.01	1.06
Nonfiber Carbohydrates %	8.2	9.4

Whole cottonseed also contains a yellow pigment, gossypol, that potentially can poison ruminants. Symptoms of gossypol poisoning include muscular weakness, generalized edema, hemorrhage, and myocarditis. Problems can occur if cattle consume more than 20 to 25 milligrams per pound of body weight per day of “free” gossypol. “Free” gossypol determines potential toxicity problems as total or “bound” gossypol concentrations can be 10-fold higher in the diet without causing problems. Different cottonseed products vary in their ratio of “free” to “bound” gossypol.

Whole cottonseed rarely causes gossypol poisoning in ruminants, because feeding limits based on fat generally supply minor amounts of gossypol. Supplementation of low-protein forages with whole cottonseed

- and large amounts of cottonseed meal would
- likely be the only high risk situation for
- ruminants.

## PROCESSING, HANDLING, AND STORAGE

Handling is perhaps the biggest drawback to linted whole cottonseed as a livestock feed. It does not flow through augers, gravity feed systems, and grinders, and can be difficult to handle in paddle elevators. It does not pack well, but can be bagged (although bags are light and bulky). In contrast, delinted cottonseed handles fairly well in mechanical equipment and can be utilized in small or large scale automated feed operations. While whole cottonseed can be ground, this is not generally recommended. Fat can reduce storage time and palatability.

Whole cottonseed must be kept cool, clean, and dry in storage, because it will mold in warm, damp conditions. Whole cottonseed supports the growth of *Aspergillus flavus*, which is a mold responsible for aflatoxin production. Whole cottonseed containing greater than 20 parts per billion of aflatoxin is considered contaminated and should not be fed to lactating cows. While a level of 20 parts per billion may not hurt animal health or performance, it can contaminate meat and milk.

Linted whole cottonseed may also contain spineless cocklebur fruits that ginning does not remove. These burs contain the toxin hydroquinone, and the burs can cause death at consumption rates of .3% of the animal’s body weight (3 lbs burs/1000 lbs body weight). Poisoning is unlikely at recommended feeding levels. However, cocklebur seed reduces palatability and increases handling problems.

Cotton-plant stems and hulls can cause mouth and throat injury even in small amounts. Proper ginning generally eliminates this problem, however.

## FEEDING RECOMMENDATIONS

### ■ Research

Results of research trials conducted on whole cottonseed are presented in Table 2.

These trials examined various feeding strategies, and data should be interpreted carefully. Results show that whole cottonseed can improve milk production in early lactation, but produces little or no improvement in butterfat test. Conversely, when whole cottonseed replaced grain in mid to late lactation, it significantly improved butterfat test with no response in milk production. Conservative estimates, based on

- research, would indicate a 3 to 4 pound milk
- production response in early lactation and .1 to
- .2 percentage units improvement in fat test
- when grain is replaced in mid/late lactation.
- These responses are based on inclusion rates
- of 15% of the dry matter, or roughly 5 to 7
- pounds per cow/day.

### ■ Linted vs. Delinted

- Fewer trials are available
- comparing linted vs. delinted whole
- cottonseed. Two studies (California, New
- Mexico) have made these comparisons.
- Kutches et al. compared a control diet to one of
- two diets containing either 5 pounds of linted
- or 5 pounds of delinted cottonseed. Milk
- production was not affected, but fat test was
- improved .2 percentage points by both linted
- and delinted whole cottonseed. Kiesling and
- Miller found similar results in their trials. This

Table 2.  
Summary of linted whole cottonseed research

Trial	Cottonseed replaced	Replacement (% of diet dry matter)	Lactation Stage	Milk Response /lbs	Fat Response
Calif/Davis	Forage & Grain	5	Mid	-3.1	-.05
	Forage & Grain	15	Mid	-.5	+.39
	Forage & Grain	25	Mid	-1.3	+.57
Arizona	Grain	5	Mid	0.0	+.10
Texas A&M	Grain	15	Early	+.9	+.41
Alabama	Grain	18.5	Early	0.0	+.12
Utah	Forage & Grain	10	Early	+6.2	-.05
	Forage & Grain	10	Early	+2.62	-.12
Wisconsin	Forage	6	Mid	+1.75	+.06
	Forage	12	Mid	+1.32	+.18
	Forage	18	Mid	-1.32	+.07

