

Role of Cotton seed and Its Byproducts in Livestock Feeding



Prof (Dr). D. Srinivas Kumar

Professor & Univ. Head

Department of Animal Nutrition

NTR College of Veterinary Science, Gannavaram

Cotton Production Statistics



- Cotton is the 5th largest oil crop in the world, after soybean, rapeseed, sunflower and peanuts.
- Cotton is the largest oilseed produced in India followed by soybean, rapeseed and rice bran.
- India is the 2nd largest cotton producer in the world next to china.

- Statista, 2022

Area in lakh hectares	Productin in lakh bales or 170 kgs	Yield kg per hectare	Availability of Cotton seed cake or meal (1000 MT)
130.61	343.47	447.00	4415

Availability of Cotton seed for Processing in India

(In tonnes except cotton)



	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Cotton production (Lakh bales)	351.00	360.4	350.8	365.00	352.48	311.17
Cotton seed production (@333 kg/bales)	116.88	111.7	108.8	121.55	117.38	103.62
Marketable surplus available	111.88	108.7	106.2	116.55	112.38	98.62

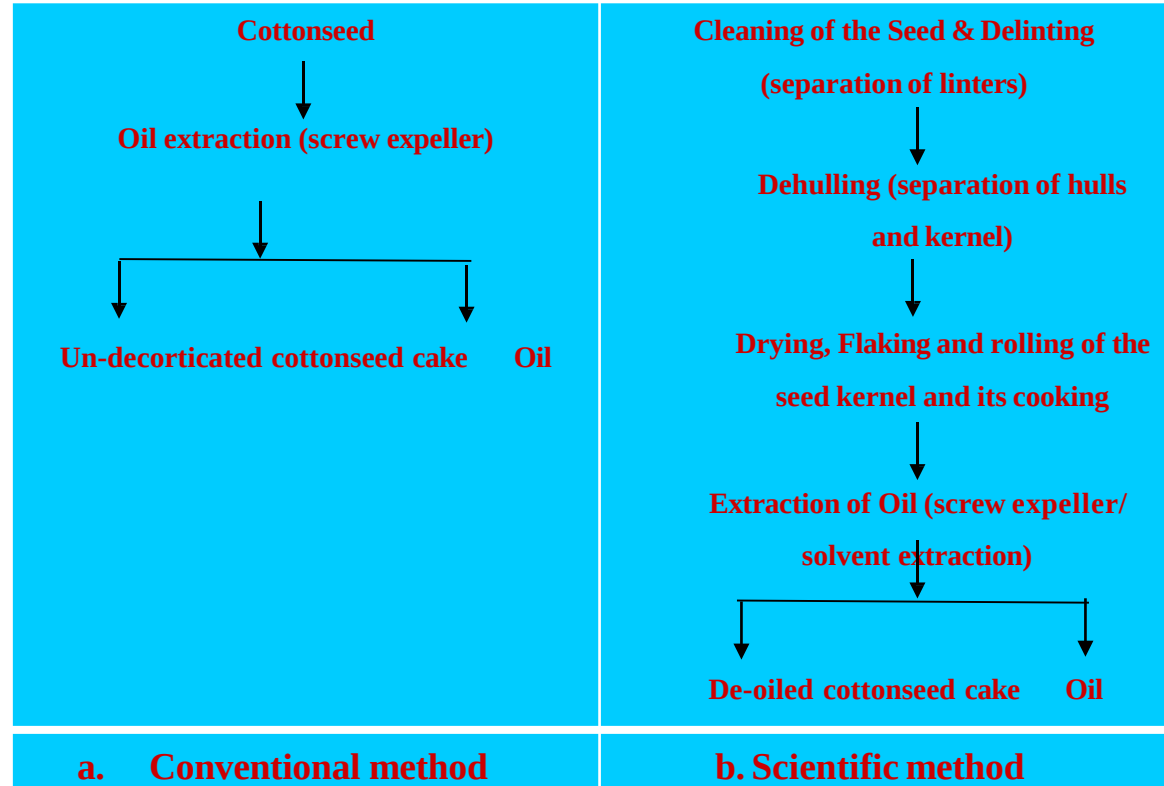
Comparison of schematic diagram of conventional and scientific processing of cottonseed



oil



Un- decorticated cake



linters



hulls



oil

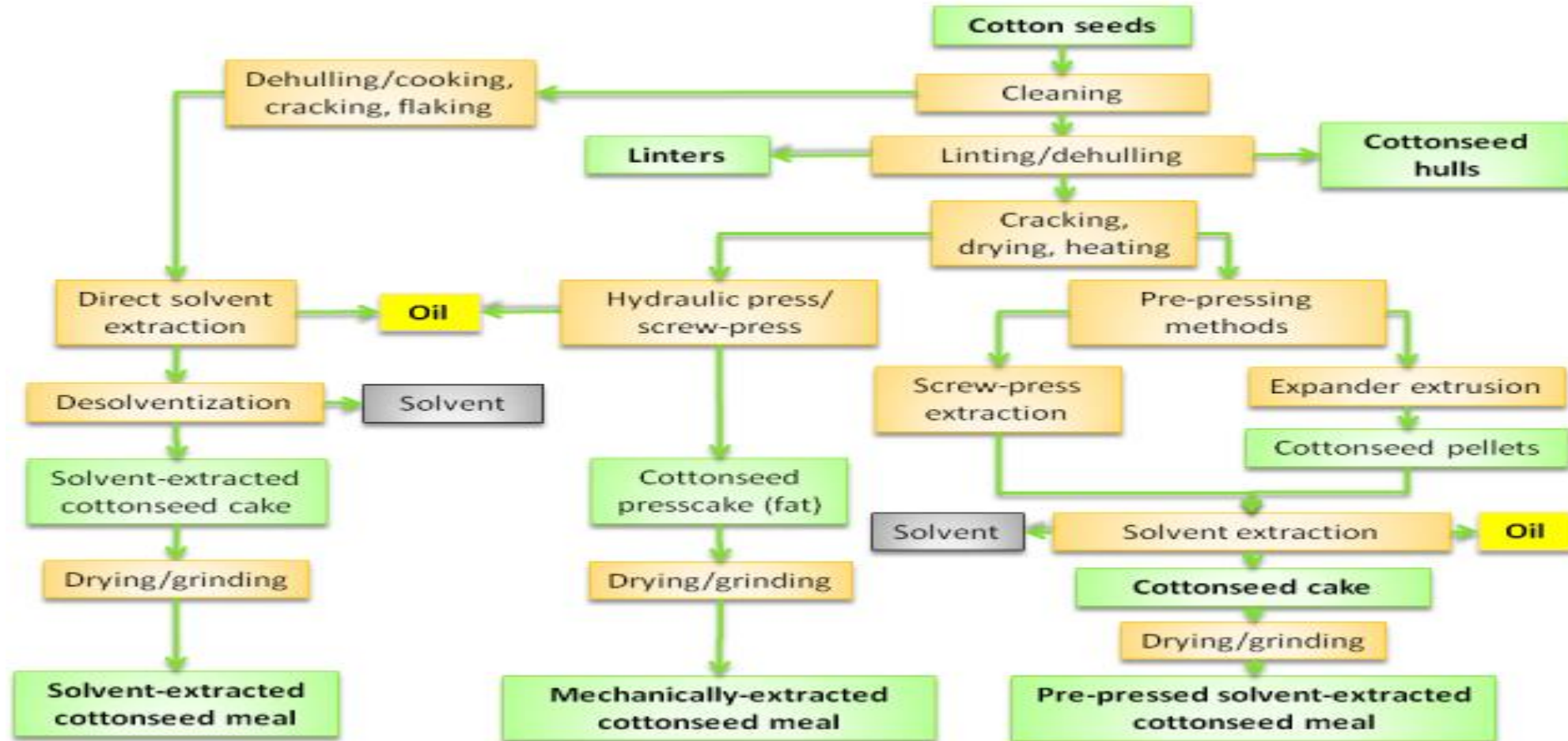


meal

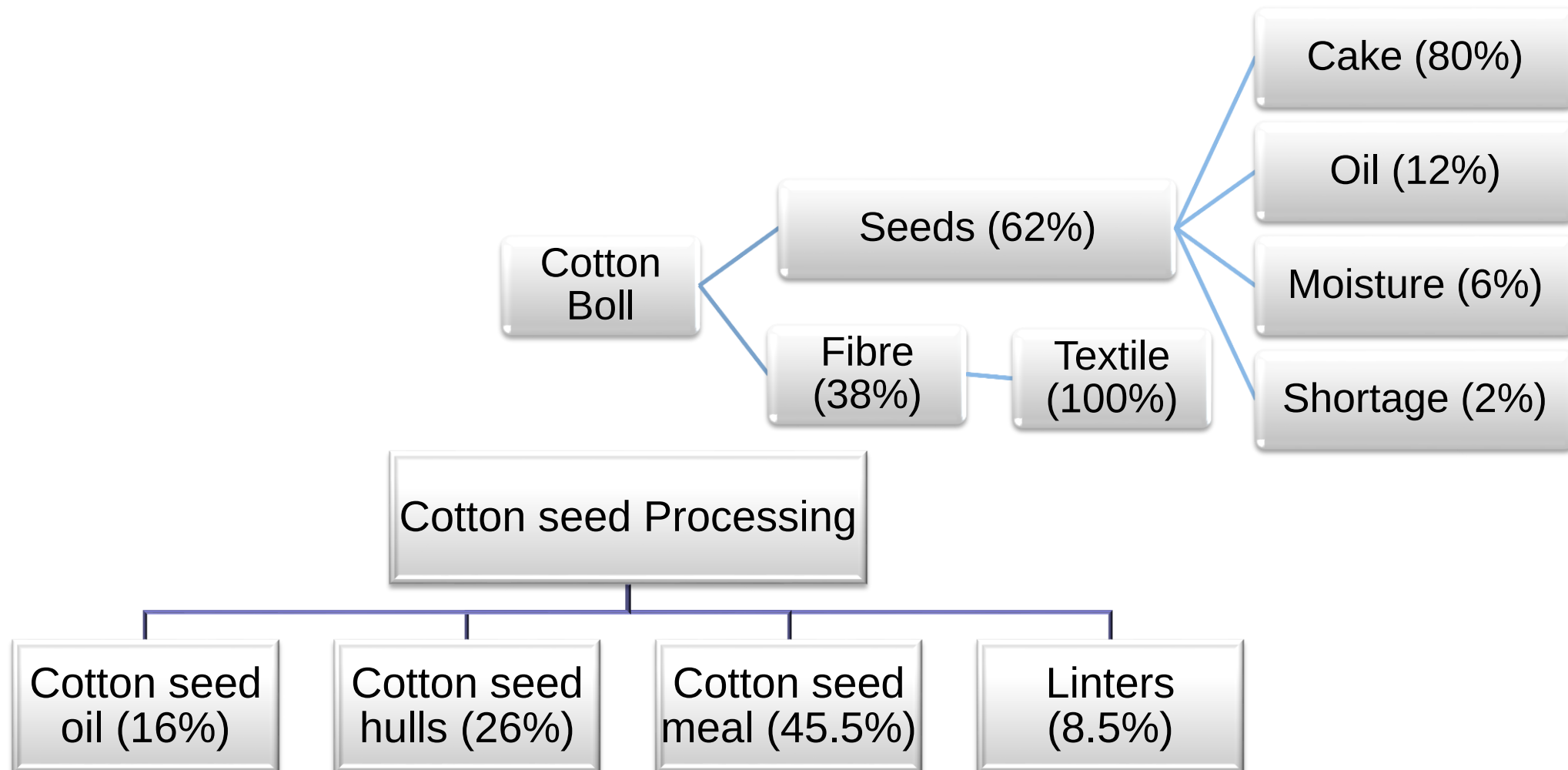


cottonseed

Cottonseed processing



CSM is the by-product of oil extraction from cotton seeds



Cottonseed hulls in Livestock Feeding



- Low in protein (3-9% DM) & high in Fibre
- Low free gossypol (<0.1%DM)
- Included in TMR (5 to 50%) for lactating cows
- can be added in compound feed @ 5 to 10%
- They tend to increase milk fat content without reducing milk yield.

Feeding cottonseed hulls (60%) based complete diets (CP 112%, TDN 55%) in crossbred calves improved growth rate and nutrient utilization compared to WS based complete diet (Ramachandran et al., 2008)

Whole Cottonseed in Livestock Feeding



- Excellent source of protein (20%), oil (22-23%), crude fibre (18%) and TDN (87%)
- Slightly high free gossypol (0.47-0.63%) vs delinted WCS (0.47-0.53%)
- Can be included upto 150 g/kd diet for high yielding dairy cattle
- WCS feeding have low risk for bio-hydrogenation induced milk fat depression compared to other oilseeds.

WCS maintained milk and milk component yield when fed at up to 9.9% of the diet to multiparous cows without concerns of gossypol toxicity (Pierce *et al.*, 2024)

Cottonseed Cake in Livestock Feeding



- Most commonly fed ingredient by small & mid sized farms @ 3 to 4kg / day
- Limited use by pellet compound feed users but used in mash feed
- Can be added upto 10% Aflatoxin concern
- Good source of protein and energy. Contain protein (24%), fat (7-9%), crude fibre (12%) and NDF (31-32%)
- Good source of bypass protein for ruminants

CSC increased milk yield, milk fat and feed intake in dairy cattle (Uddin *et al.*, 2013) & growth in buffalo calves (Barman *et al.*, 2019)

Cottonseed Meal in Livestock Feeding



- Byproduct after extraction of oil from cottonseed
- Most commonly used protein supplement for feeding adult ruminants
- Decorticated CSM contains 41% CP and 78% TDN
- Crude fibre (8-16%) and fat (1-3%)
- Compared to other oilseed cakes, CSM has relatively high P content.
- Lysine is the most limiting amino acid

CSM can replace SBM up to 100% on w/w basis in the concentrate mixture without any adverse effect on growth performance of buffalo calves (Srinath *et al.*, 2023)

Chemical composition of CSM & other Cotton byproducts



Byproduct	DM%	CP%	CF%	NDF%	ADF%	Ca%	P%	TDN
Cottonseed hulls	91	4.1	48	90	64	0.15	0.09	42
Cottonseed	92	23.9	21	39	29	0.16	0.75	96
Cottonseed Cake	90	24	26	38	37	0.02	0.46	71
Cottonseed Meal								
Mech. Ext	93	44.3	13	28	20	0.21	2.82	78
Solvent Ext	91	45.2	13	26	19	0.18	2.75	76

Chemical Composition of Cottonseed Meal vs other cakes



Nutrient	DM	OM	CP	EE	TA	NDF	ADF
Cottonseed Meal	90.17	92.90	44.05	0.70	7.10	31.00	18.00
Cottonseed cake	90.32	94.50	25.55	7.33	5.50	38.70	37.52
Soybean Meal	90.26	94.09	45.11	1.79	5.01	17.49	16.62
GN Cake	91.62	92.74	41.50	7.36	6.07	22.42	14.32
Mustard oil Cake	91.52	93.86	37.30	10.44	6.24	23.32	21.62
Rapeseed Meal	93.85	91.73	35.82	0.62	8.27	-	-



Guaranteed Analysis

Protein	41.0% Min.
Fat	2.0% Max.
Crude Fiber	20.0% Max
Moisture	12.0% Max.

Typical Analysis

Nutrient, based on 90% DM Value

Crude Protein	47.6%
Crude Fat	2.20%
Crude Fiber	11.2%
Ash	7.50%
NDF	24.5%
ADF	17.3%
Gossypol - total	1.16
Gossypol - free	0.14

Energy Profile

Total Sugars	4.6%
Gross energy	21.2 MJ/kg

Amino Acid Profile

Alanine	1.79%
Arginine	4.85%
Aspartic acid	4.27%
Cysteine	0.69%
Glutamic acid	9.15%
Glycine	1.87%
Histidine	1.50%
Isoleucine	1.29%
Leucine	2.62%
Lysine	1.96%
Methionine	0.78%
Phenylalanine	2.35%
Proline	1.63%
Serine	2.15%
Threonine	1.58%
Tryptophan	0.53%
Tyrosine	1.04%
Valine	1.83%

Packaging: Loaded Bulk in 20'/40' containers (at seller's option)

Price per unit protein of commonly used Indian feed ingredients



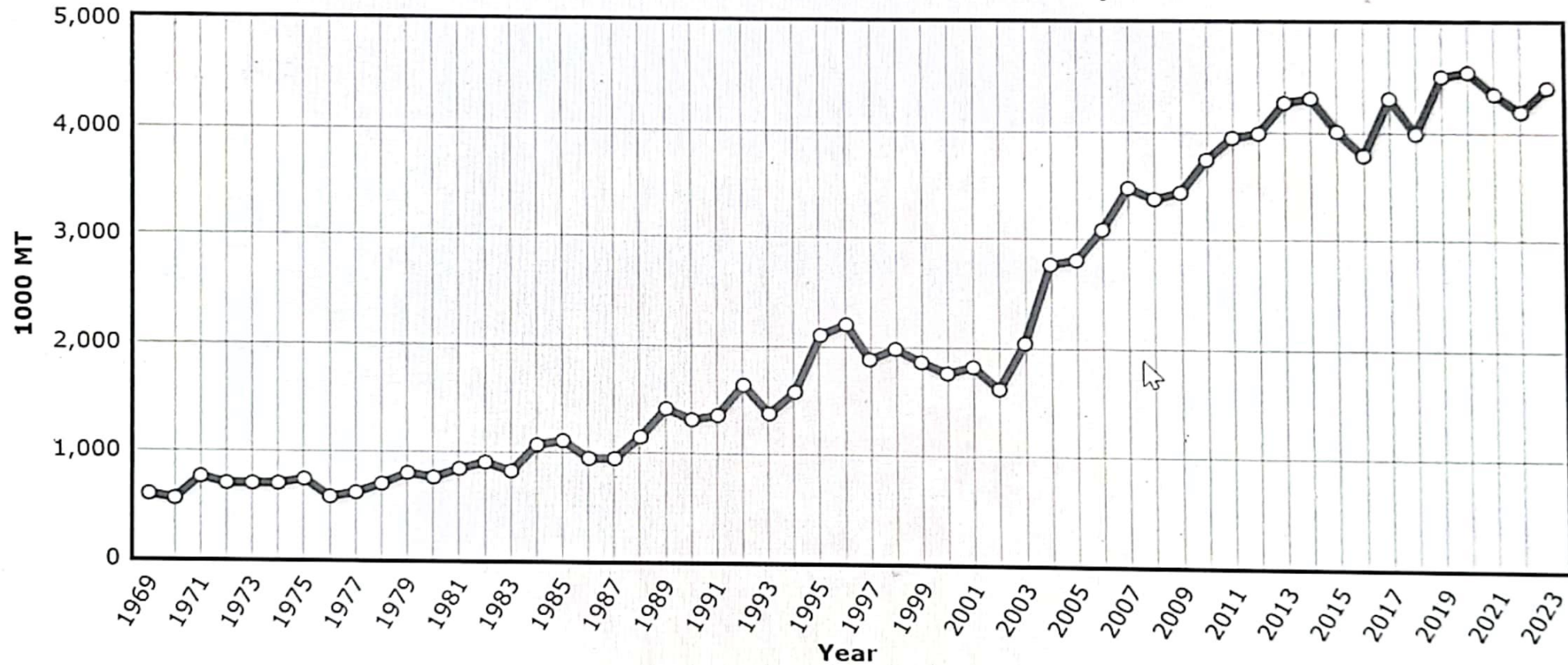
Ingredient	CP%*	Rs/kg**	Rs per unit protein
DORB	14	19.00	1.36
Soybean Meal	45	48.00	1.07
Groundnut Cake	40	42.00	1.05
Cottonseed Meal	36	30.00	0.83
Cottonseed Cake	26	30.00	1.15
Gingelly Cake	36	44.00	1.22
RDDGS	48	40.00	0.83

*CP analysis done at NTR CVSc, Gannavaram **At commodity level (As per the market prices of Vijayawada)

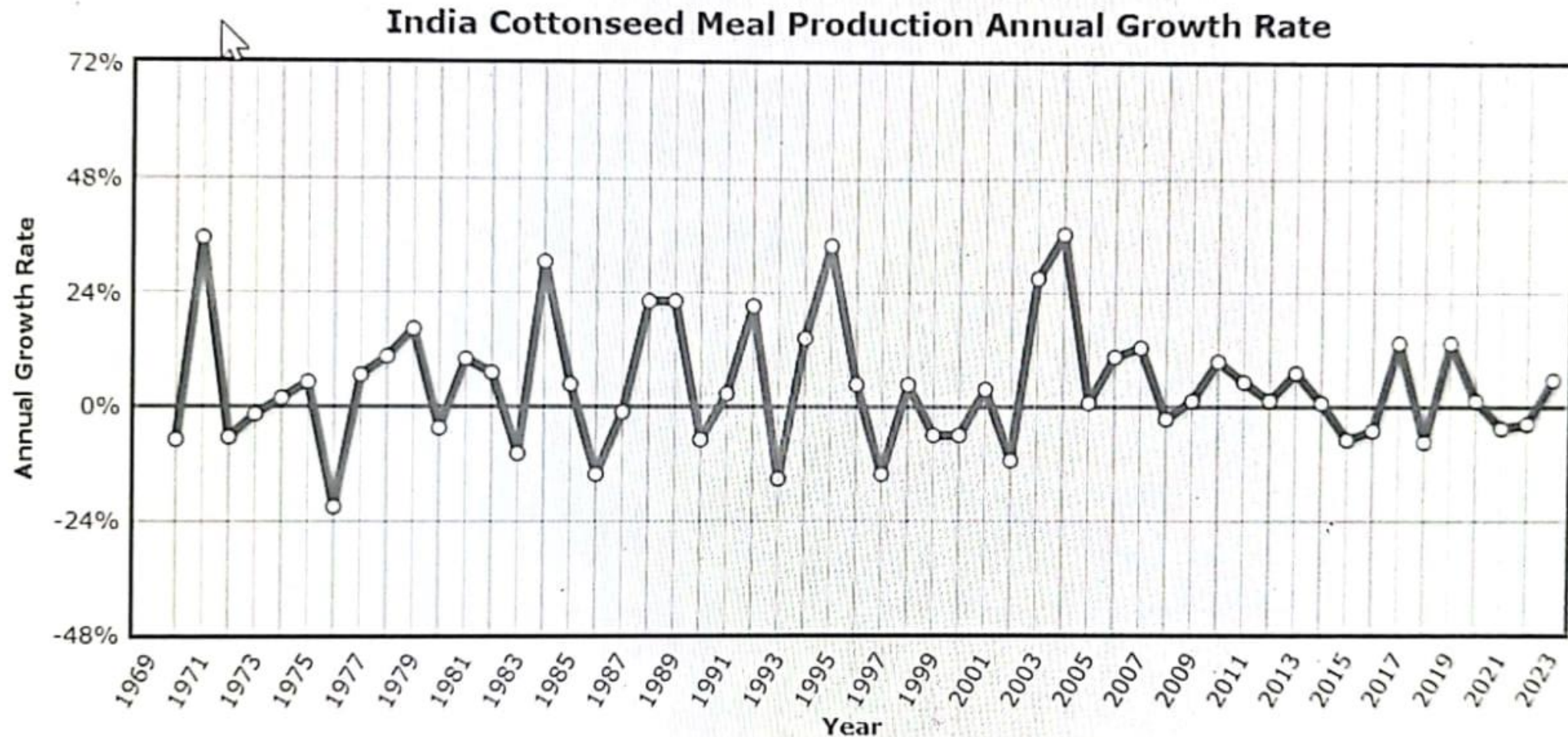
Production status of cotton seed meal in India



India Cottonseed Meal Production by Year



CSM Production Annual Growth Rate



Advantages of Cottonseed meal compared to other protein supplements



- + Good nutrient composition
- + Cheaper source
- + High level of rumen un-degradable protein
- + High acceptance level by farmers
- + Year round availability
- + Ever availability at commercial level

Limitations in utilization of Cottonseed meal



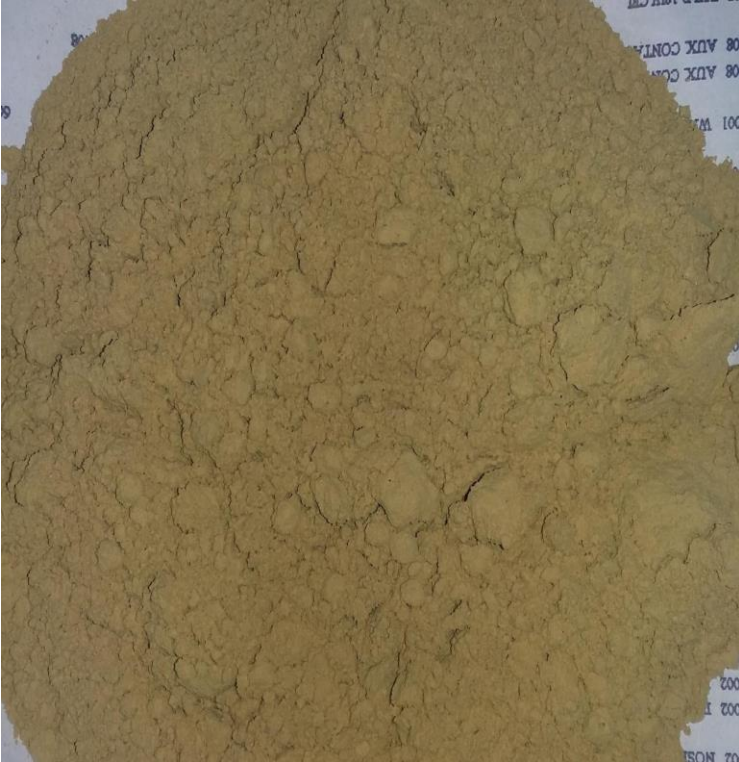
- + Anti-nutrition factors (Gossypol and Cyclopropenoid fatty acids)
- + Low Protein quality (Compared to SBM)
- + Crude fibre quantity (In poultry)
- + Mineral abnormalities
- + Residual oil level
- + Constipatory effect

Cottonseed Meal in Feeding Poultry



- ✦ The general recommendation is to limit CSM to 10% in layer diets, and to add iron when more than 5% CSM is included in the diet.
- ✦ Cyclopropenoic acids can also cause a pinkish coloration of the albumen.
- ✦ The main problem in layers is the effect of gossypol on egg yolk colour (greenish discoloration, mottling), which occurs mainly after a period of storage .
- ✦ Higher levels (15%) can be used when egg yolk coloration problems do not have marketing consequences.
- ✦ Can be included up to 10% level in broiler diets.

De-gossypolized Cottonseed Meal



- ✦ Increased crude protein (> 50%) and decreased crude fibre levels.
- ✦ Decreased free gossypol and bound gossypol content in CSM
- ✦ Increased lysine content.
- ✦ This makes it ideal for feeding non-ruminants
- ✦ Increased growth performance and FCR in broilers as compared to CSM.

Conclusion



- Growing focus on improving the nutritional profile of cottonseed meal through research and development.
- Increased production of DG CSM with reduced free gossypol / bound gossypol is the need of the hour
- Collaborations between cottonseed meal manufacturers and feed manufacturers to meet the growing demand for quality cake / meal.
- CS processors have to overcome the aflatoxin challenge
- Should be price competitive with other oilseed meals

Thank You

