Emerging Role of Cottonseed meal In the evolving Feed Sector

Feed Production in India in last decade

	Feed production in Million Metric Tons			
Year	Total	Layer	Broiler	Ruminants
2012	26.84	7.01	10.46	5.86
2013	26.42	9.00	10.00	6.00
2014	29.43	9.00	11.00	8.20
2016	31.35	NA	NA	NA
2017	34.20	NA	NA	NA
2018	37.74	11.34	13.0	11.84
2019	39	12.5	12.4	11.7
2020	35	12	12	11
2021	36	12	12	12
2022*	40	13	14	13

Steady growth – in line with global growth

Cattle Feed

- Requirements of dairy feeds to produce 210 MMT milk is around 105 MMT.
- But feed penetration is around 13%. Balance is local raw materials including spent wash from beer/wet DDGS.
- Around 14 MMT of compound cattle feed is produced by Cooperatives and private feed millers.
- Major ingredient is De oiled rice bran (50 to 60%).
- Other ingredients are maize, jowar, bajara, mustard cake, cottonseed cake, groundnut cake, etc.

Region-wise Cattle Feed Production (in MMT)

Region	States	Private sector	Milk Cooperative	Total	%
North	Punjab, Haryana, UP, Uttarakhand, Rajasthan	1.9	0.9	2.8	20
East	Bihar, Jharkhand, Odisha, Bengal, Assam	0.4	0.3	0.7	5
South	Karnataka, AP, TN, Kerala, Pondicherry	2.2	2.0	4.2	30
West	Gujarat, Maharashtra, Goa, Madhya Pradesh	3.3	3.0	6.3	45
Total		7.8	6.9	14	

Poultry Sector (Broiler)

- Indian Broiler Sector grew at CAGR of 8 to 10% in last decade.
- Around 5 million MT of poultry meat was produced in 2019 (US$ 11400 Million / Rs. 850 Billion worth), but per capita consumption is still at 3.4 kg Vs. 30 kg in developed countries/Mumbai.
- Major ingredients in broiler feeds are maize, soybean meal and meat and bone meal.
- 75 to 80% of broiler production is done by poultry integrators.
- Pre-starter, starter, grower and finisher are used. Protein level is feeds will go down and ME level will go up.
- Feed Conversion Ratio is around 1.5 to 1.7.

Poultry Sector (Layer)

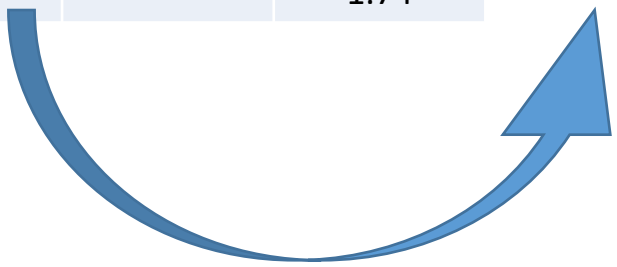
- Indian layer sector grew at CAGR of 4 to 5% in last decade.
- Around 109 billion eggs were produced in 2019 (US$ 6000 Million / Rs. 450 Billion worth), but per capita availability is 80 eggs only Vs. 300 eggs in developed countries/Mumbai.
- Major ingredients in broiler feeds are maize and other grains, soybean meal and other protein meals and animal protein like fish meal and meat & bone meal.
- Sales of commercial layer feed is increasing at CAGR of 10-15%.
- Chick, grower and three types of layer feeds are used.
- Around 100 to 130 gm of feed is needed to produce one egg.

State-wise Layer Bird Placement in millions (2021)

Sr. No	State	Annual
1	Andhra/Telangana (Combined)	80
2	Tamil Nadu	50
3	P & Haryana	40
4	Karnataka	14
5	Maharashtra	10
6	Odisha	10
7	West Bengal	8
8	Chatissgarh	6
9	Gujarat	3.2
10	Rajasthan	2.8
11	U P	5.0
12	M P	0.7
13	Bihar, J’kand	1.0
14	Assam	Ns
15	Kerala	Ns
16	Uttarkant	Ns
17	H P	Ns
18	J K	Ns
19	Others	2.0
	Total	230

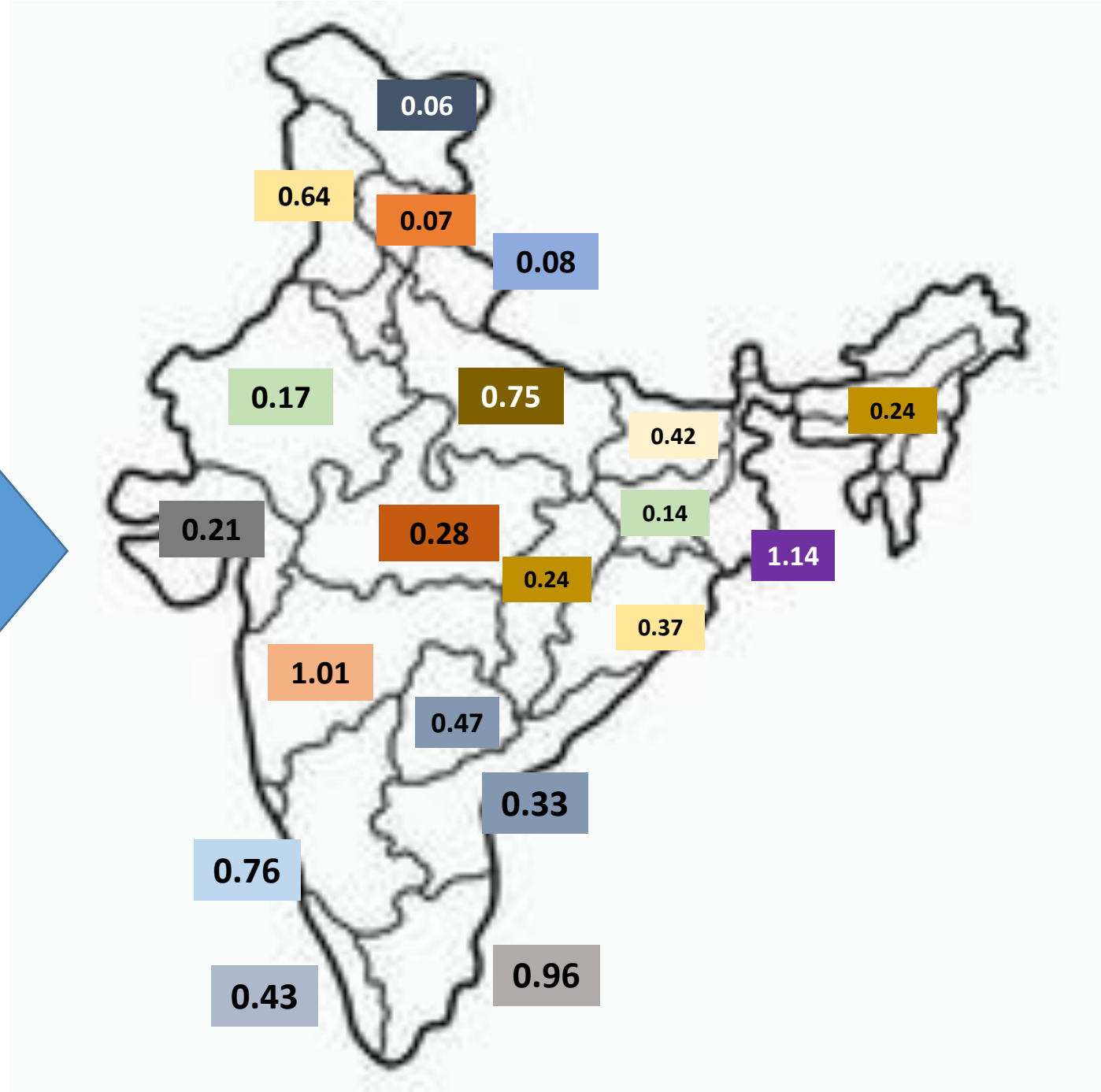
State Wise Broiler Production and Consumption in Million MT

State	Weekly Placements (millions)	Annual Production (million MT)	Annual Demand (million MT)
Tamil Nadu	9.2	0.96	0.83
Kerala	4.1	0.43	0.56
Karnataka	7.3	0.76	0.7
Andhra Pradesh	3.2	0.33	0.44
Telangana	4.5	0.47	0.42
South India	28.3	2.94	2.94
Maharashtra	9.7	1.01	0.69
Gujarat	2	0.21	0.30
Goa	0.1	0.01	0.05
Chattisgarh	2.3	0.24	0.20
Madhya Pradesh	2.7	0.28	0.32
West India	16.7	1.74	1.74

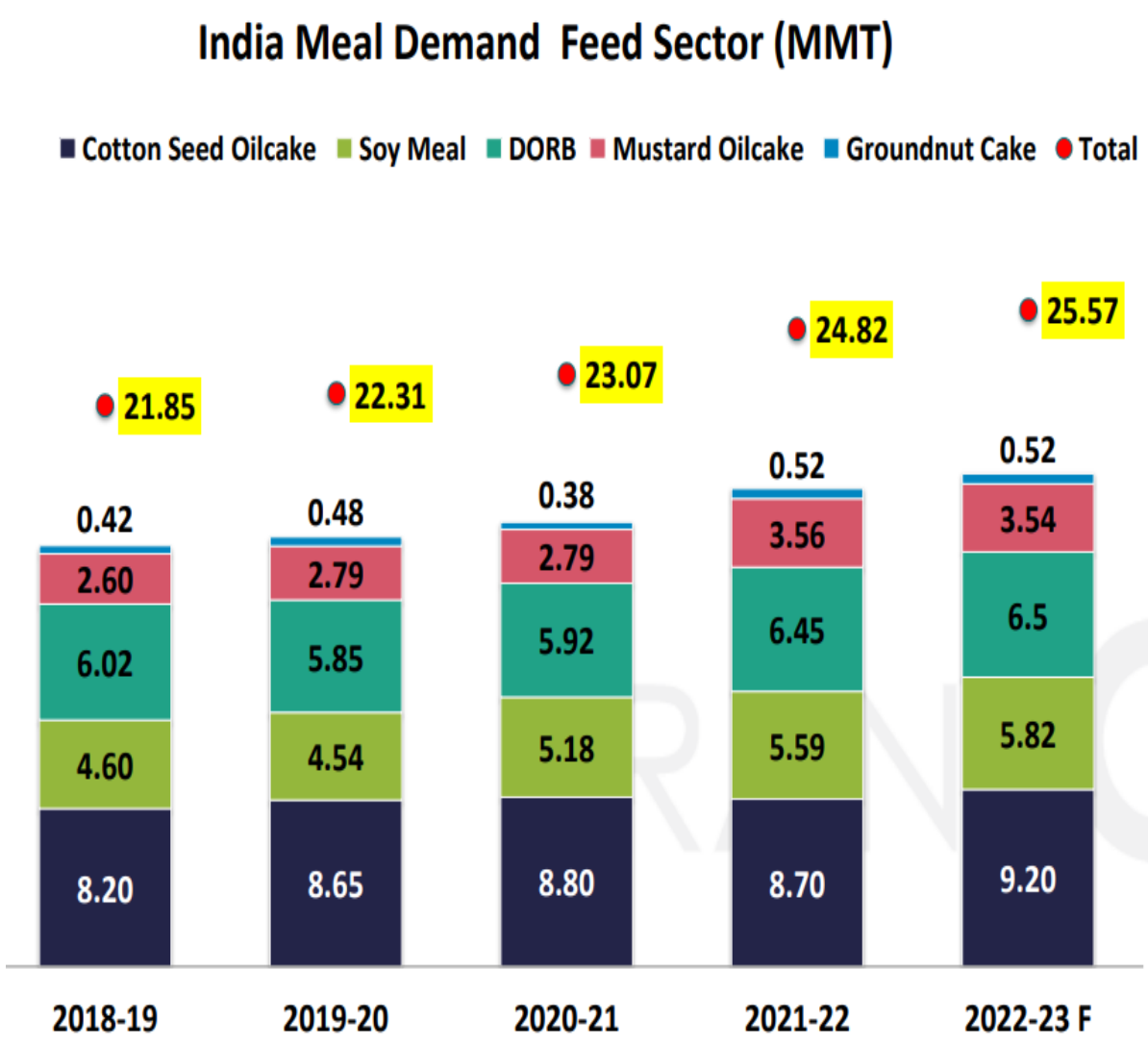


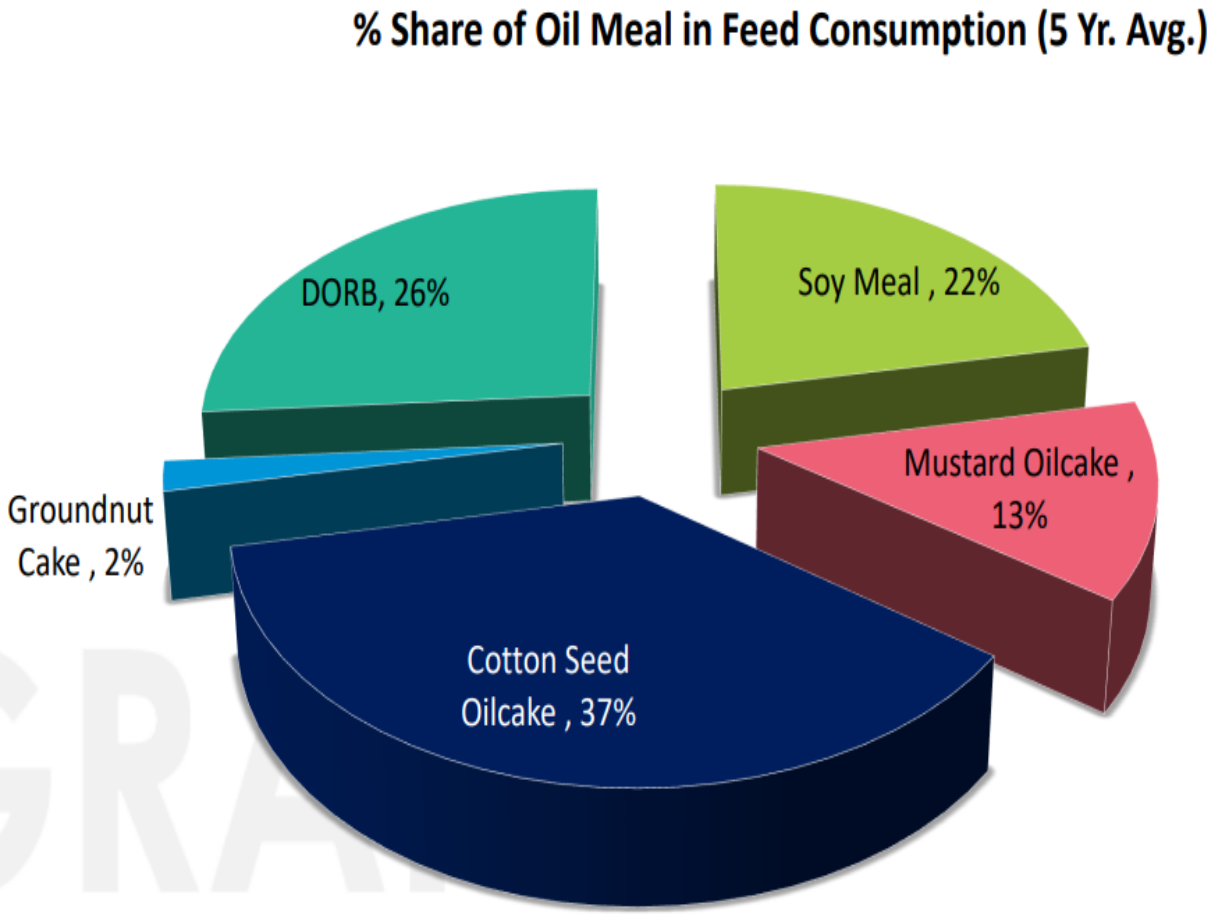
State	Weekly Placements (millions)	Annual Production (million MT)	Annual Demand (million MT)
West Bengal	11	1.14	0.96
Odisha	3.6	0.37	0.40
Assam	2.3	0.24	0.30
Bihar	4	0.42	0.45
Jharkhand	1.3	0.14	0.20
East India	22.2	2.31	2.31
Punjab and Haryana	6.2	0.64	0.20
Delhi	0	0	0.40
Rajasthan	1.6	0.17	0.07
Uttar Pradesh	7.2	0.75	0.80
Uttarakhand	0.8	0.08	0.09
Himachal Pradesh	0.7	0.07	0.09
Jammu and Kashmir	0.6	0.06	0.13
North India	17.1	1.78	1.78
Remaining States	2.5	0.26	0.26
India Total	86.8	9.03	9.03

State-wise Broiler Production (MMT)



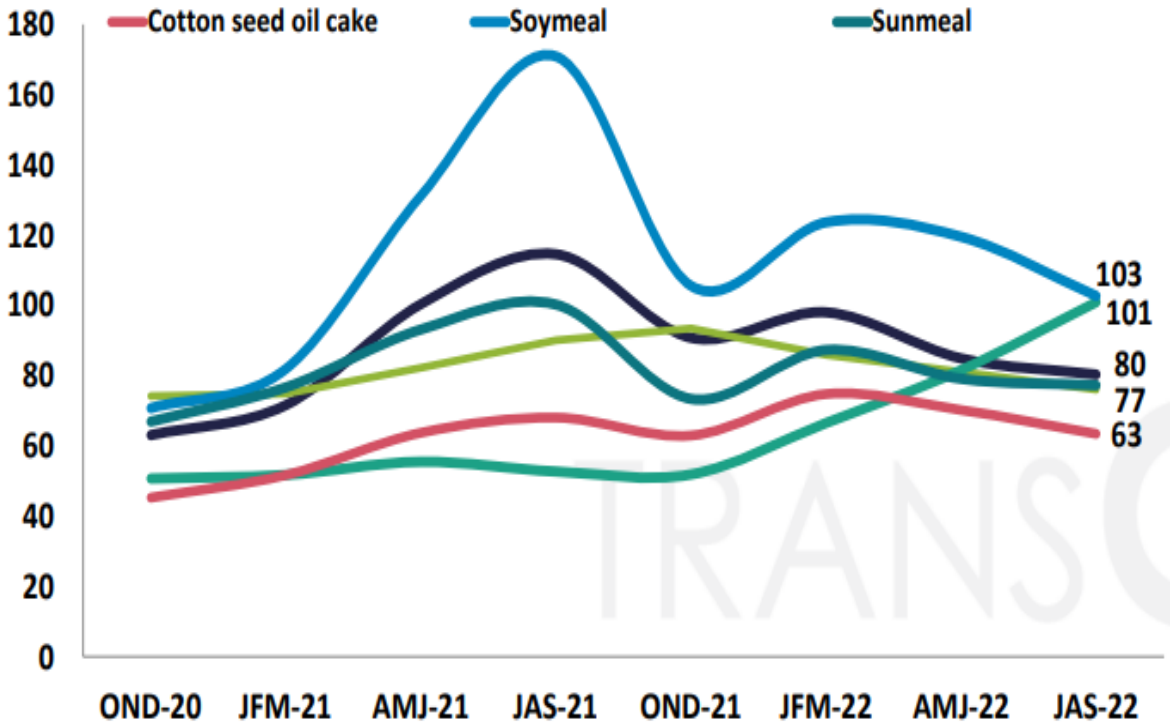
Use of Oilmeals in Animal Feeds



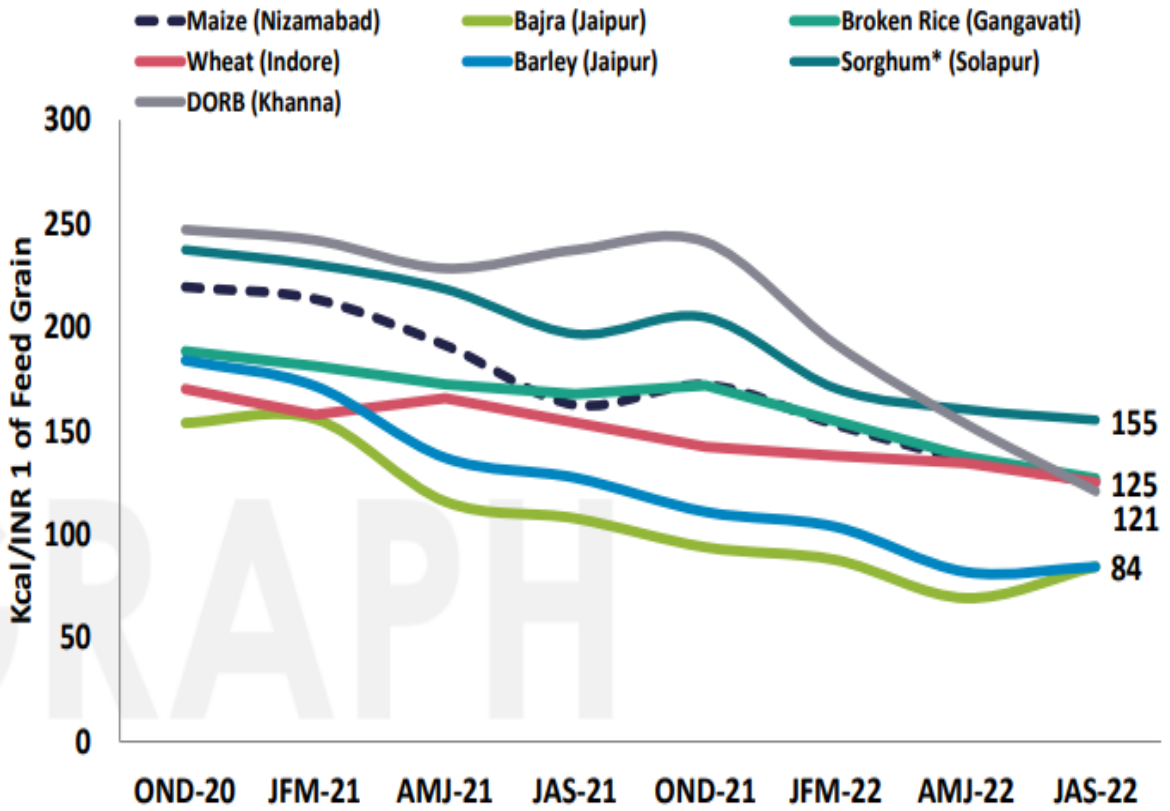


Declining cost of protein whereas rise in energy cost

Major Feed Meal Quarterly Average Unit Cost Of Protein (INR/Kg)



Energy per 1 INR from Various Feed Grains (Kcal/INR)



Cattle Feed Formulation

Ingredient Menu

S.No.	Ingredient Name	Cattle Feed with DDGS
1	Maize	80.000
2	Rice Polish 16% Fat	80.000
3	Cotton Seed Meal Exp.Ext.(dec)	100.000
4	DDGS(Rice)40%	7.000
5	Bypass-Fat	30.000
6	Bypass-Protein (Nesure)	102.997
7	Mustard Oil Cake	125.000
8	DORB-De Oiled Rice Bran	325.420
9	Urea	10.000
10	Molasses	70.000
11	Mineral Mixture-Dairy	25.000
12	Salt	15.000
13	Soda-Sodium bi-carbonate	10.000
14	LSP-Lime Stone Powder	18.583
15	Toxin Binder	1.000
	Total :	1000.000
	Feed Cost :	25141.81

Is this an opportunity?

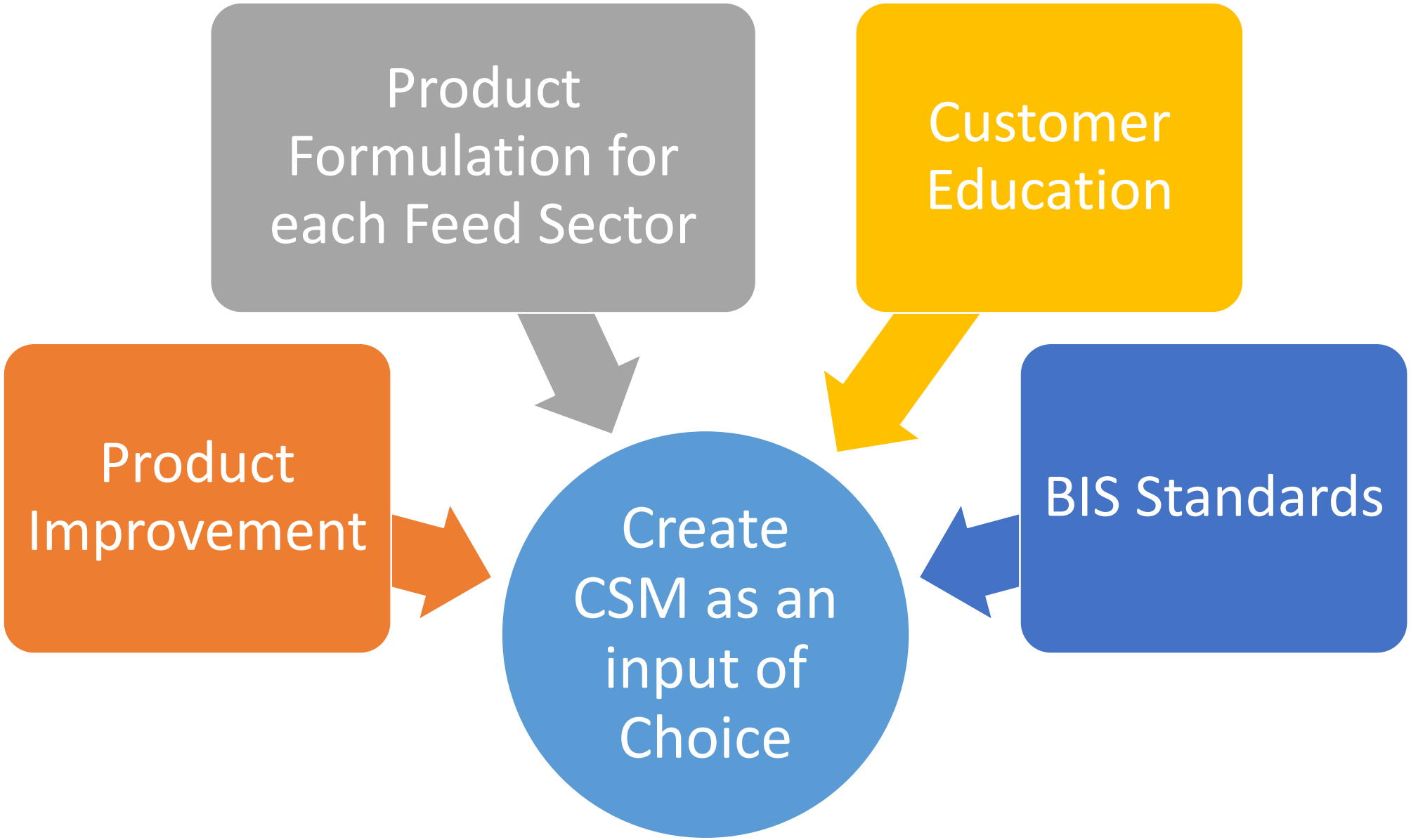
CSM as protein and energy source

- Cottonseed meal is valued as a protein feed, but the protein content is highly variable as it depends on the amount of dehulling and on the efficiency of oil extraction.
- The range of protein content is from 30% DM for non-dehulled cottonseed meal up to 50% DM for fully dehulled meals.
- The fibre content varies accordingly, from 25% (non-dehulled) to 5% (fully dehulled) crude fibre.
- The various methods used for oil extraction also explain the large range of residual oil present in cottonseed meal. Some solvent-extracted meals contain less than 2% oil, like the other major oilseed meals, but many cottonseed meals contain higher oil values, often in the 5-10% range, and over 20% is possible.
- The cottonseed meal protein is less rich in lysine than soybean meal (4% *vs.* 6% of the protein).
- The main constraint of cottonseed meal is the presence of gossypol, which limits its use in non-ruminant animals and in reproductive ruminants.

CSM in Ruminants

- Cottonseed meal is a good protein source for ruminants.
- It is palatable with a nutritive value (for dehulled meals) slightly lower (85-90%) than that of soybean meal.
- It is among the least expensive sources of protein in some regions.
- It is for example the main source of protein for livestock in the cotton growing belt of India.
- However, while gossypol is much less toxic to ruminants than to pigs and poultry, it is still recommended to limit its use to mature and non-reproductive animals, females and males, for short periods only and at relatively low inclusion rates, unless free gossypol content is known to be below the risk level.
- Generally, cottonseed meal can be safely included up to 15% in cattle diets.
- Cottonseed meal is a good protein supplement for poor quality forages and fibrous by-products because of its high protein digestibility.
- Association with a source of degradable energy increases the efficiency of cottonseed meal supplementation since it decreases the urinary nitrogen.
- Most of the cottonseed meal energy comes from its fat content (for cottonseed meals with a high amount of residual oil) that, at high levels, does not contribute to the development of the rumen microbial population.
- Both decorticated and undecorticated cottonseed meal have a constipating effect on cattle, which is beneficial in feeds with a high molasses content.

The Road map

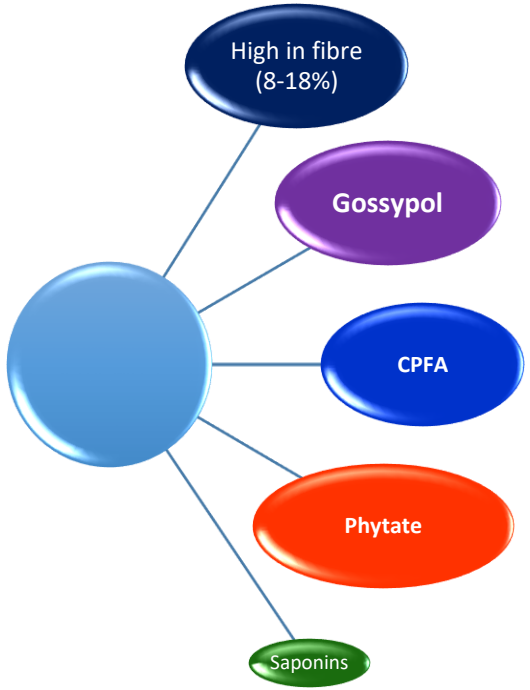

Product Formulation for each Feed Sector
Customer Education
Product Improvement
Create CSM as an input of Choice
BIS Standards

Cotton seed meal in poultry diet

S.V. Rama Rao

Nutritionally …

Protein in CSM = 36-45%



CSM Protein

High	Equal	Deficit	Ideal Iso+Val *vs* Leucine
Methionine	Tryptophan	Lysine	
		Threonine	


CSM 36
SBM
CSM 42

1. CSM 36% in Broilers

SBM:CSM	Starter	Finisher	Body Wyt., g	FCR
	1-21d	22-42d		
100:0	0	0	1930ab	1.711
50:50	23.58	19.95	1890b	1.762
60:40	18.87	15.95	1930ab	1.722
70:30	14.16	11.98	1880b	1.755
80:20	9.42	7.98	1990a	1.694
90:10	4.71	4.00	2000a	1.715

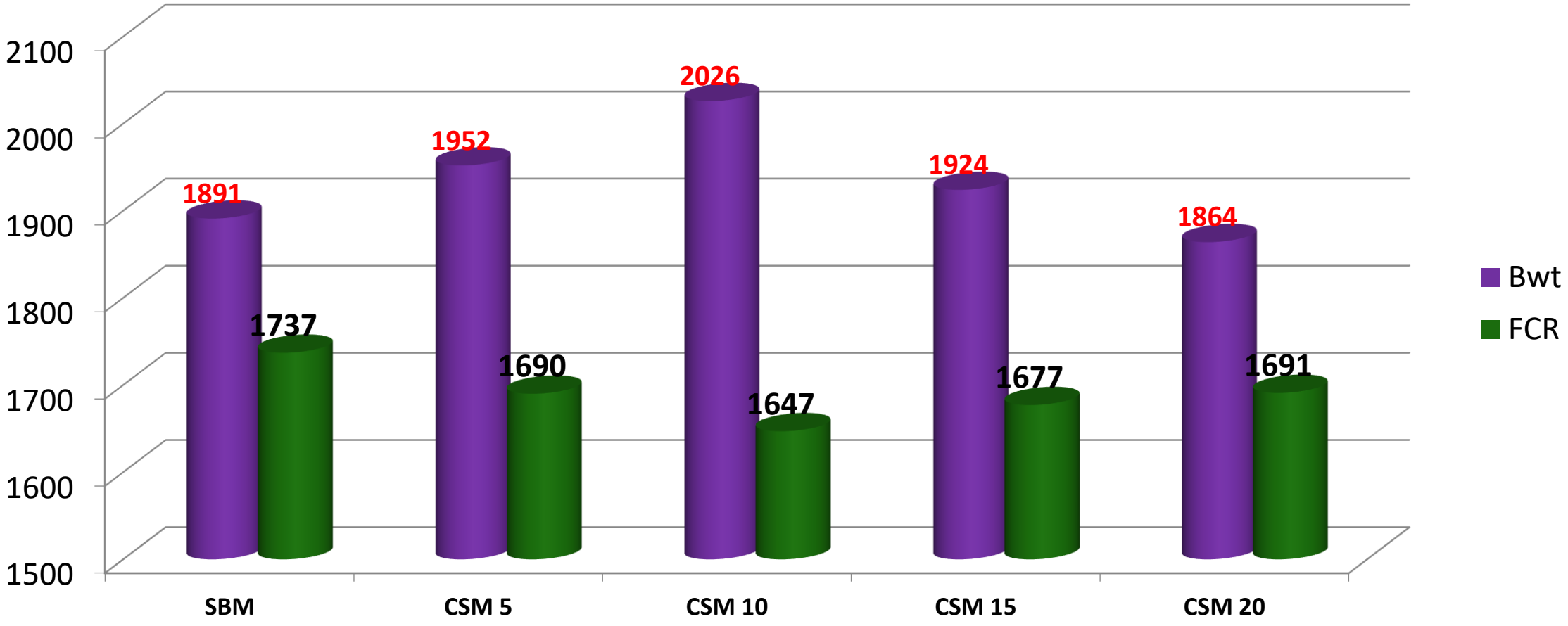
Sept – Oct 2012

2. CSM 44% in Broilers

Treat	Starter, %	Finisher, %	B Wt Gain, g	FCR
SBM 100%	0	0	2390a	1.638c
CSM 25%	9.5	7.41	2319ab	1.662bc
CSM 50 %	19.02	14.74	2179bc	1.697bc
CSM 75%	28.52	22.07	2132c	1.721ab
CSM 100%	38.03	29.40	1946d	1.777a
P			0.001	0.001

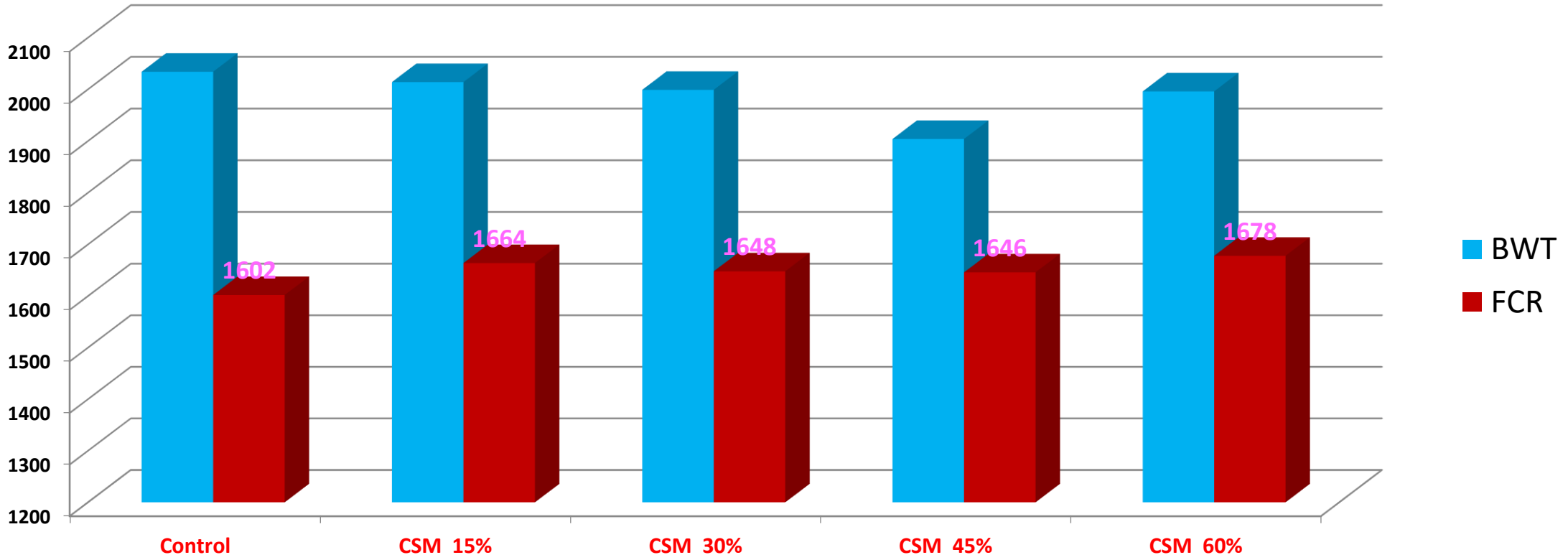
Sept - Oct 2012

3. CSM in Broilers



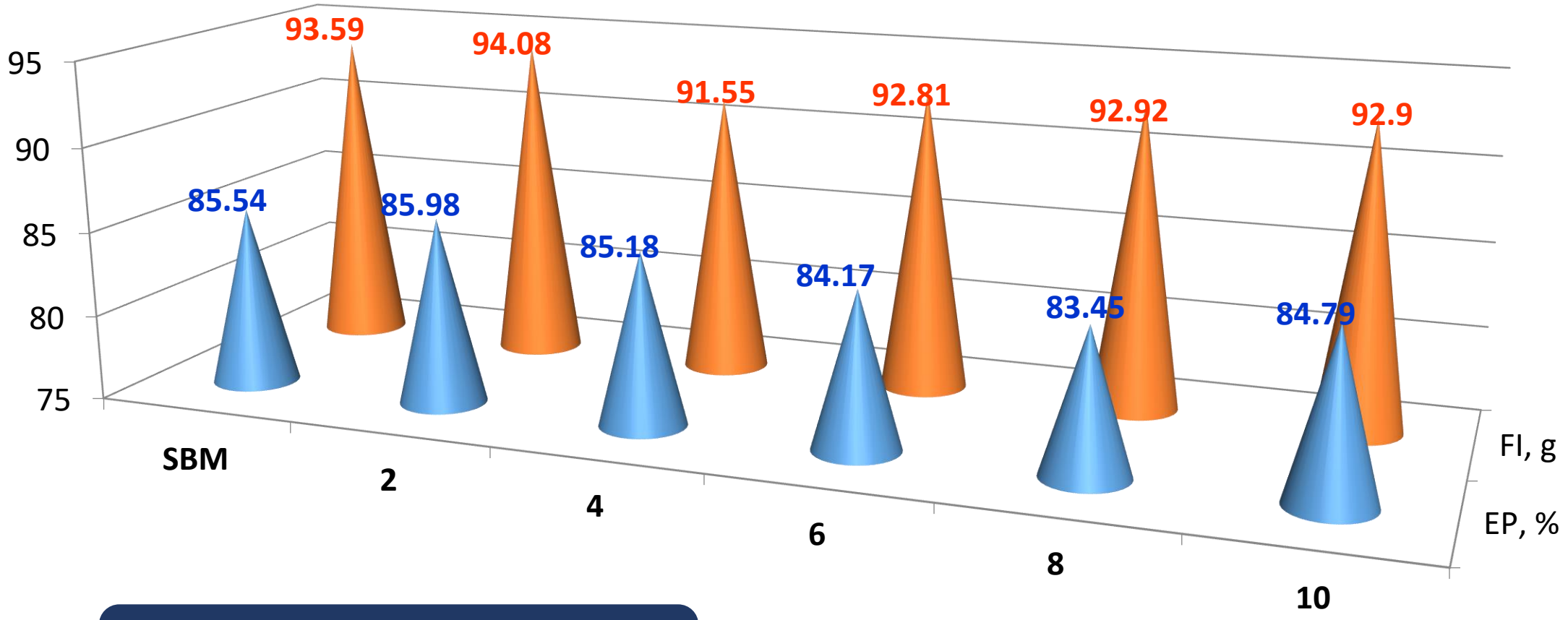
Oct – November 2012

4. CSM 44% in Broilers



CSM Hipro 42%	0.0	66.3	132.3	198.4	264.4
CSM Hipro 42%	0.0	56.7	142.5	191.4	240.2

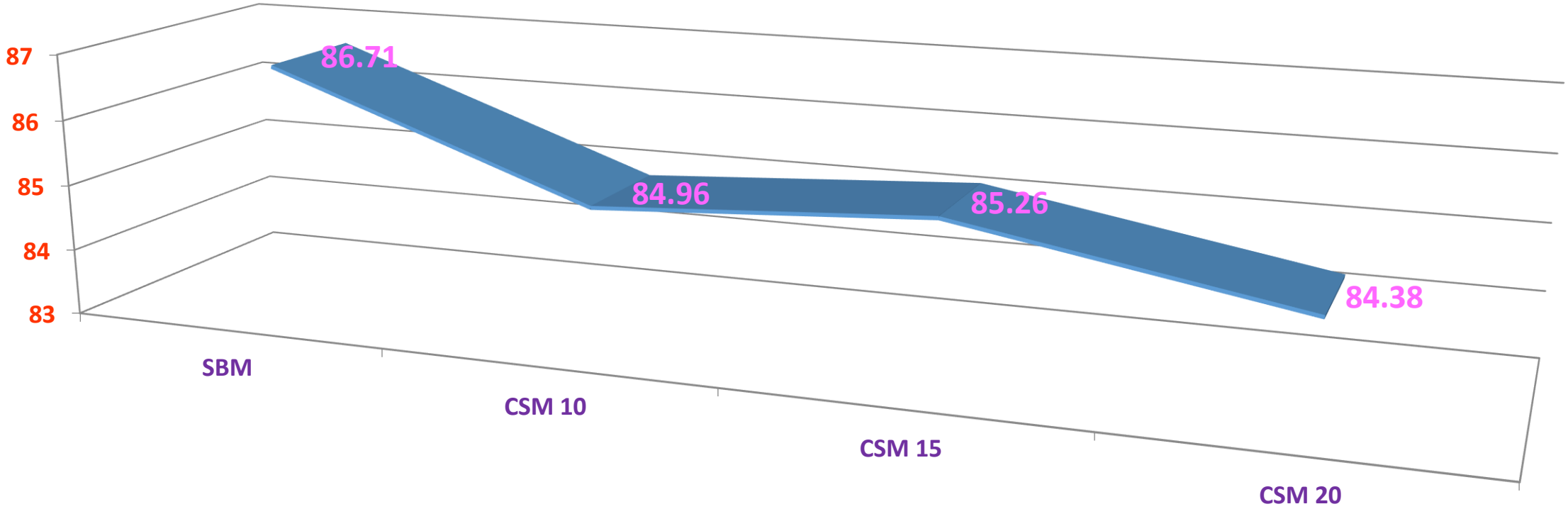
1. CSM Layers (35 to 54 wks)

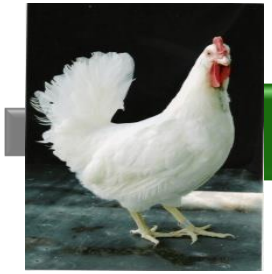


Body weight
Egg weight

March to August 2010

2. CSM in Layers (65-77 wks)





CSM in Layers (65-77 wks)

Source	B. Wt	FI /bird	FI /egg	Egg wt	EM
	g	g	g	g	g
Soya	1447	116	133.5c	58.8	1428a
CSM 10	1466	116	136.5ab	59.2	1408ab
CSM 15	1481	116	135.7bc	59.3	1416ab
CSM 20	1460	117	138.4a	59.0	1394c
N	12	12	12	12	12
P value	0.128	0.345	0.001	0.136	0.050

July – Aug 2010

3. Layers – Iron supplementation

Source	Fe So_4	EP, %	BWt, g	FI, g	FCR	EWt., g	EM, g
Soya	0	88.14	1586	110.3b	125.4	58.48b	1358
CSM 15	0	88.13	1611	110.9ab	126.0	59.00a	1370
CSM 20	0	87.49	1619	111.6a	127.9	58.65ab	1352
CSM 15	**1:4**	**87.49**	1599	111.2ab	127.2	58.46b	1348
CSM 20	**1:4**	**86.68**	1568	110.6b	127.8	58.19b	1330
P value		**0.693**	**0.152**	**0.038**	**0.519**	**0.029**	**0.286**

49 to 60 wk (27/08/2011 to 13/11/2011)
Temperature: Min 19^0c – Max 37^0c

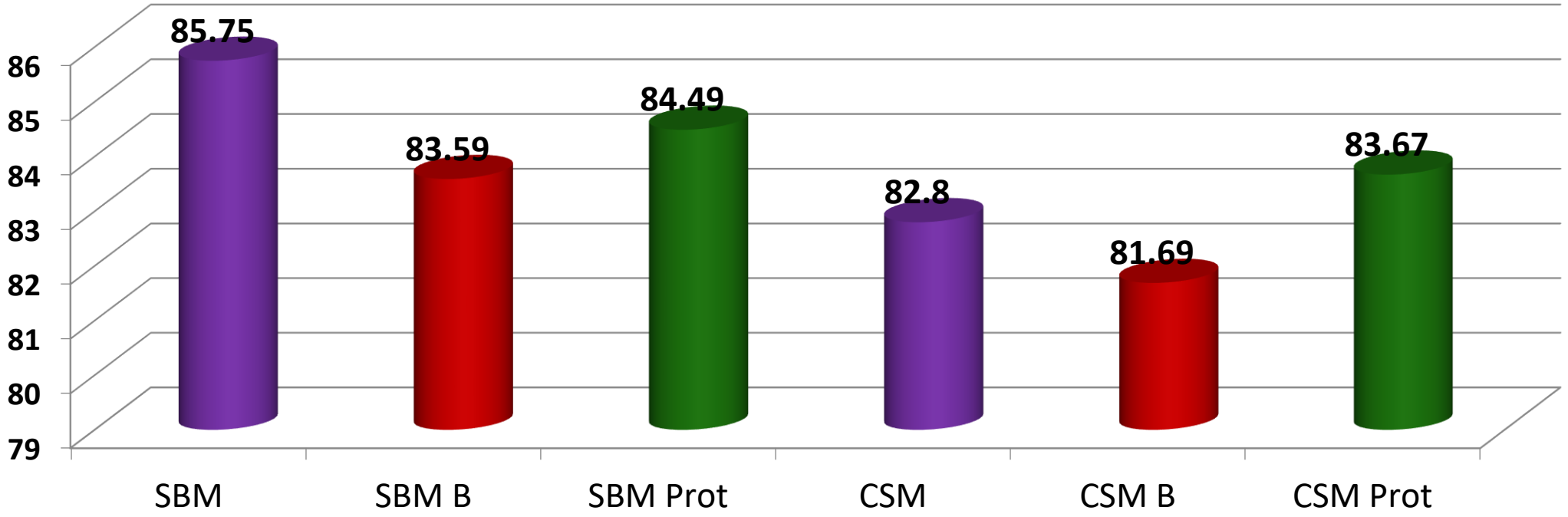
4. Fortified CSM (38%) layers (19 to 28 wks)

SOURCE	Level, %	EP, (%)	Body wt (g)	Egg wt (g)	FI/b/d (g)	F I/ Egg (g)
SBM	0	80.51b	1276b	48.3a	101c	128c
CSM 20	6.8	79.21ab	1280b	48.4a	104ab	133ab
CSM 40	12.4	79.84a	1327a	48.6a	102bc	130bc
CSM 60	18.2	78.38ab	1289b	48.2a	102bc	133ab
CSM 80	24.0	80.47a	1314a	48.2a	105a	133ab
CSM 100	29.8	77.05b	1272b	47.2b	103b	136a
P Value		0.010	0.001	0.001	0.001	0.030

Other UCEI

Aug – Nov 2012

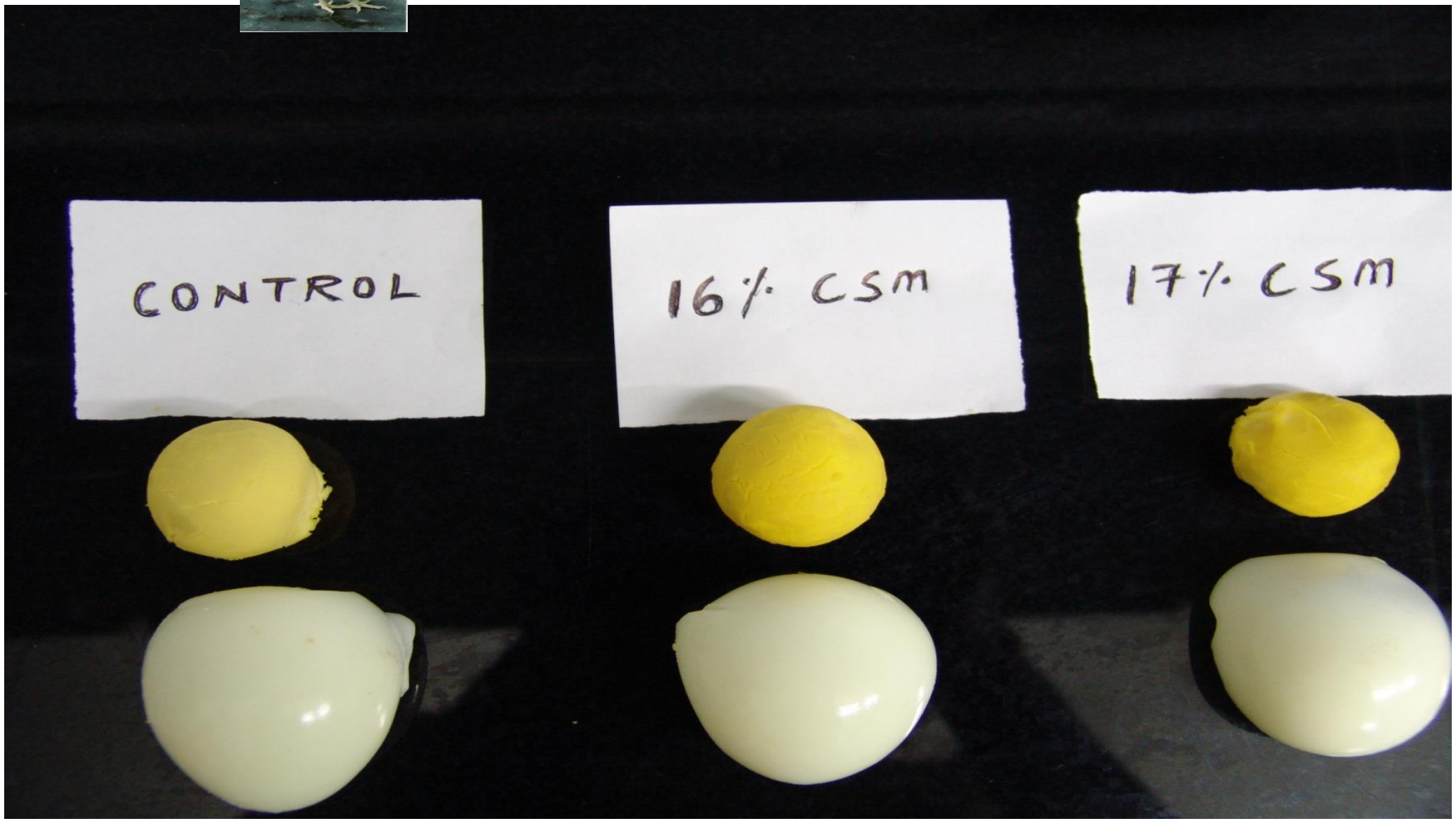
ease in CSM diets (71-74 wks)



SBM	**178.8**	**143.4**	**143.4**	**0**	**0**	**0**
CSM	**0**	**0**	**0**	**216.7**	**172.6**	**172.6**

CP	15.25	14.10	14.10	15.25	14.10	14.10

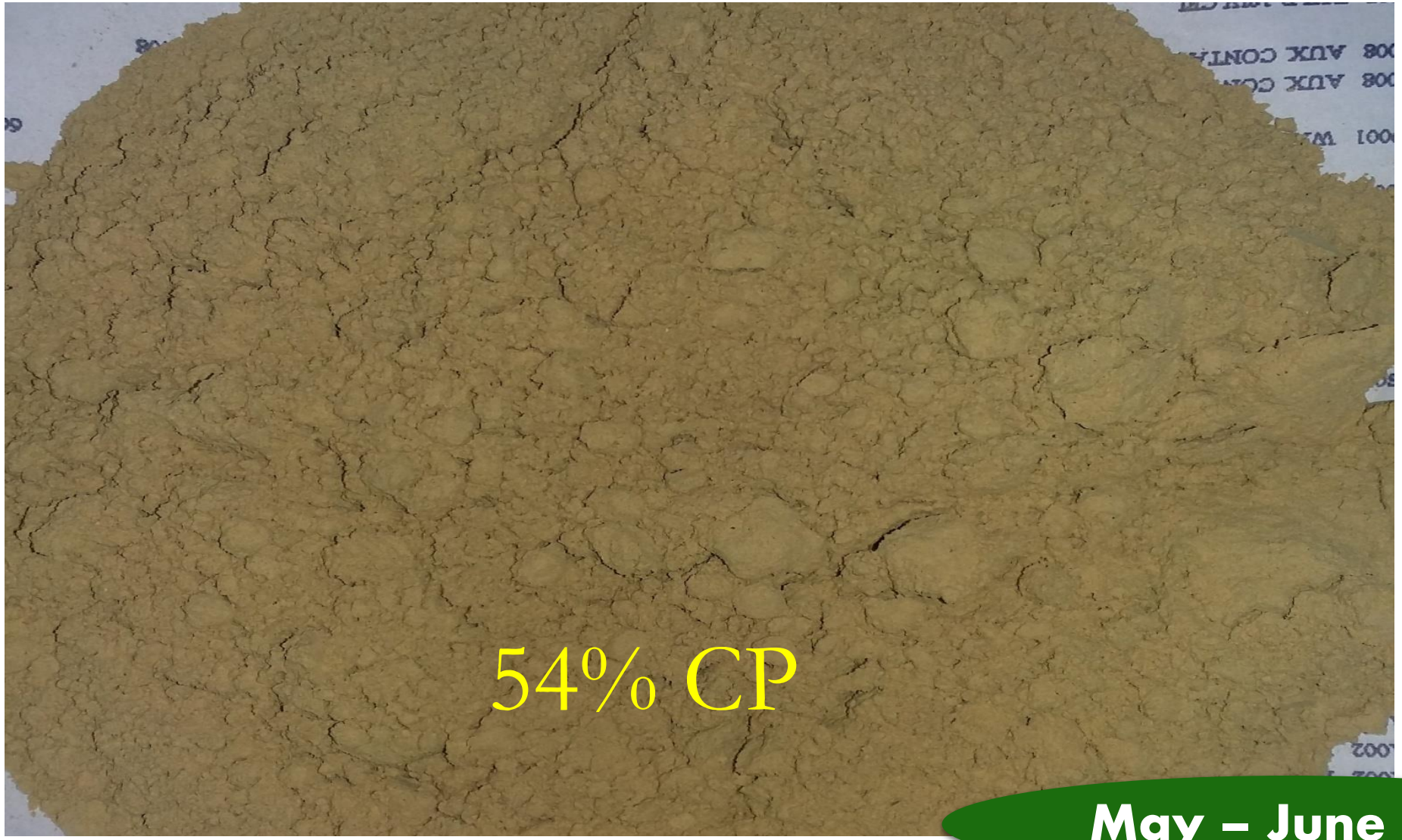
Egg with CSM fed layers



Yolk Texture

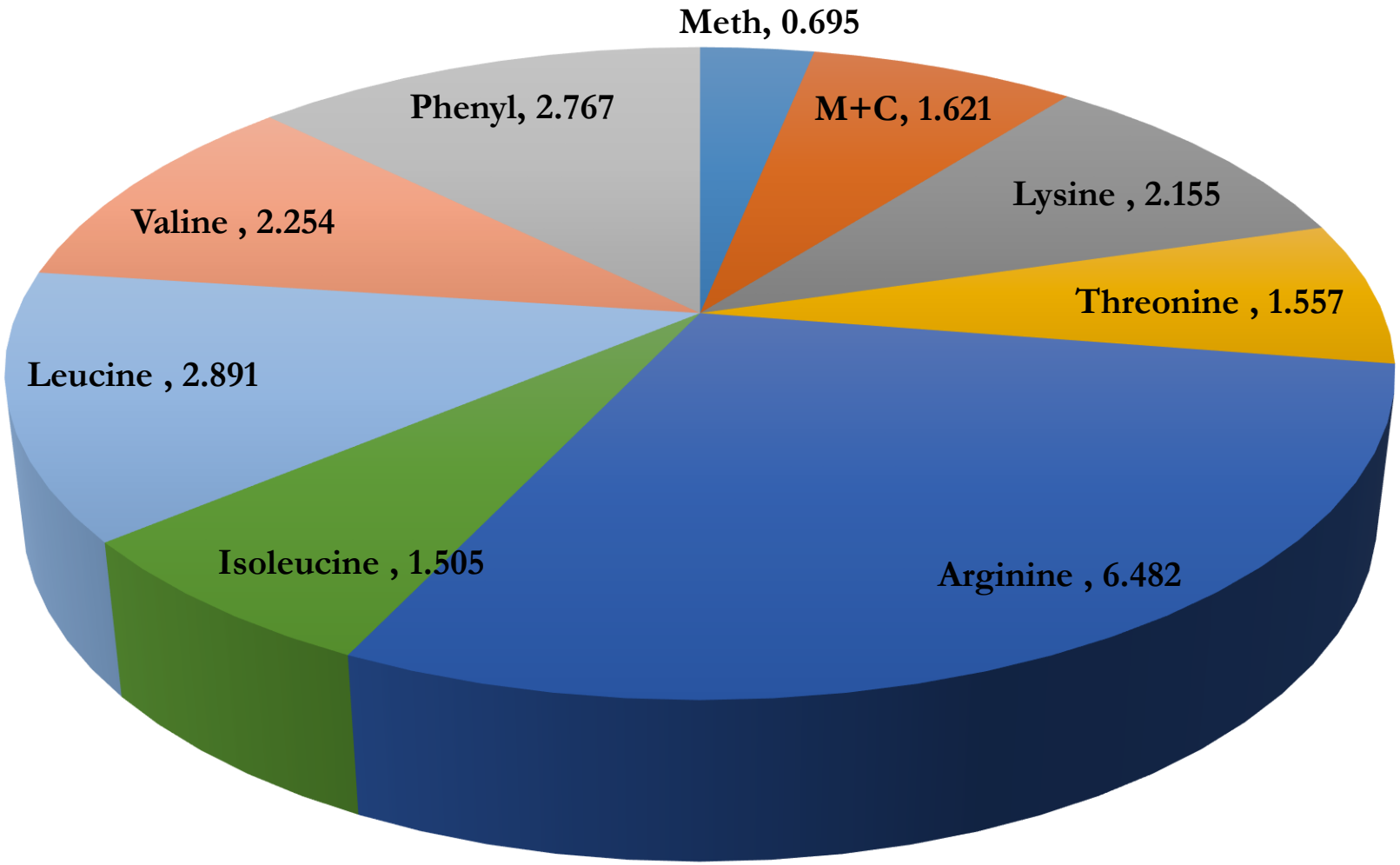
An Issue ????

6. De Gossipolized CSM



May – June 2015

AA Composition of DG CSM



6. DG CSM in broiler diet

DG CSM, %	BWG, g	FI/BW
0	2351^{a}	1.697^{bc}
5	2341^{a}	1.676^{c}
10	2326^{a}	1.712^{b}
15	2328^{a}	1.717^{b}
20	**2249^{b}**	**1.745^{a}**

21b x 10 R/Treat

May – June 2015

APM Mix - Layers

Diet	EP, %	FCR	EW, g
SBM	96.7ab	114.0b	56.2a
APM 15	97.4a	112.9b	55.3a
APM 20	95.2b	114.4a	54.0b
APM 25	89.6c	116.8a	54.3b
P	*	*	*

APM = CSM, DDGS, RSM

Diet	EP, %
SBM	92.5^{b}
CP 14.5	87.6^{c}
CP 15.5	91.1^{b}
CP 16.5	94.5^{a}
P	*

Rama Rao et al., 2020

Conclusions

CSM is a good source of protein for poultry

Less fibre (<8-9%) and gossypol (50 mg/kg) make more safe

Broiler diet - up to 10%

VARIABLE QUALITY, mycotoin and pesticide ?

ME ???

Increase either CP (1%) or AA (10%) at higher levels of APM

Thanks for Your Audience & Time