



**“Few layer nutritional
concepts of economic
importance”**

S V Rama Rao



Standard Body Weight.....



Proper brooding

Adequate space

Require ventilation (Oxygen con $>19.5\%$, $\text{CO}_2 < 3000$ ppm, CO & $\text{NH}_3 < 10$ ppm, Dust $< 3.4\text{mg}/\text{m}^3$)

Ample Water availability, mixed with electrolytes, osmolytes & TM

Maintaining ORP 650- 750mv

Use 40-50-micron water filters

Cool water during hot season

Light intensity of 25 lux at chick height

Crop fill should be 95%

Flock UNIFORMITY

CRITICAL FACTORS TO CONSIDER IN PULLET GROWING

- **Grading during 5, 10 & 15 week**
- **Birds <10% of mean BW - Higher plane of nutrition**





Index ...

- 1-2. Energy and Nutrient density
- 3. Protein and Alternate protein source
- 4. Ca and P nutrition
- 5. Enzymes
- 6. Egg Size

1. Nutrient Density Layers (21-70 wk) Diet

ME, kcal	CP, %	Lysine, %	Met, %	Egg No	Egg wt., g	B Wt., g
2300	15.3	0.704	0.337	304.3	56.5	1.41
2400	16.0	0.736	0.352	315.0	56.5	1.49
2500	16.7	0.770	0.367	323.1	56.1	1.50
2600	17.3	0.820	0.381	325.6	55.8	1.52
2700	18.0	0.909	0.400	327.3	56.3	1.56
2800	18.7	0.964	0.411	329.3	57.1	1.64

9*88 b/R

Rama Rao et al., 2013, APS

2. Brown Layers (20-44 wks)

ME, kcal/kg	EP, %	FI/b/d	BWt, g	Abd fat
2550	91.59	108.9 ^A	1825 ^B	23.48 ^B
2750	91.14	107.9 ^B	1805 ^B	28.90 ^{AB}
2850	90.59	107.1 ^B	1884 ^A	33.93 ^A
P	NS	0.001	0.002	0.001

10R x 20 layers

Vitor & Rama Rao 2022

3. Protein – Young Layers - Winter



CP	20-23	24-27	28-31	32-35
16.34	71.3	93.9	95.8	93.5
15.59	73.3	93.9	95.8	93.8
14.84	69.9	93.8	95.6	93.0
14.11	70.9	92.8	94.8	93.0
P	NS	NS	NS	NS

20 to 35 weeks



3. Lys & Met in layer diet (21 to 72 wks)

Expt 2			Expt 3		
Lysine, %	EP, %	Egg wt, g	Methionine, %	EP, %	Egg wt, g
0.65	85.49	53.24	0.305	84.74	52.83
0.70	85.30	53.45	0.335	85.69	53.08
0.75	86.13	53.72	0.365	84.89	53.04
0.80	85.88	54.05	0.395	85.56	53.34
P	NS	**	P	NS	* NL

Rama Rao et al., 2011, JAPR

8 * 88 layers



3. Balanced Protein for layers (23-40 wks)

Ingredient	94	100	106	112	118	124
Maize	591	579	570	564	555	546
Soybean meal	63	87	105	117	135	153
DL-Met	1.03	1.27	1.55	1.66	1.95	2.12
L-Thre	0.61	0.71	0.79	0.84	0.92	1
L-Lys HCl	1.44	1.24	1.21	1.23	1.21	1.18
L-Tryp	0.19	0.07	0.09	0.13	0.14	0.15
L-Val	0	0	0.02	0.14	0.17	0.3
CP, %	13.58	14.48	15.19	15.67	16.38	17.09
d Lys, %	0.57	0.61	0.65	0.68	0.72	0.76
d M+C, %	0.51	0.55	0.59	0.61	0.65	0.68



3. Balanced protein on Layer (23-40 wks) performance

Protein, %	EP, %	FI, g/b/d	BW, g	EW, g
13.58	91.42	103.4	1391	53.29 ^b
14.48	91.38	104.1	1408	53.16 ^b
15.19	91.07	103.2	1377	54.48 ^a
15.67	90.47	104.0	1402	54.56 ^a
16.38	91.31	103.8	1391	54.61 ^a
17.09	91.22	104.1	1414	55.33 ^a
P value	NS	NS	NS	**

20*20b/R

Giri & Rama Rao 2016

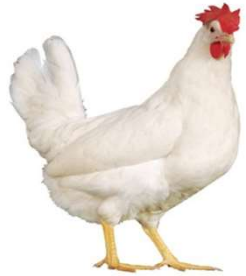


3. Protein– Layer - Summer

CP, %	EP-P1	EP-P2	EP-P3
17.5 (0.77- 0.36%)	93.3^a	94.1^a	92.8
16.5 (0.73-0.34%)	93.2^a	93.5^a	92.3
15.5 (0.68-0.32%)	89.9^b	90.6^b	91.6
14.5 (0.64-0.30%)	82.2^c	****	*****
P	**	**	NS

Rama Rao et al., 2011, JAPR

(34 – 45 wks)

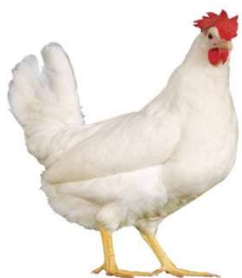


3. DDGS rice, 25-54 wks

Ingredient	0	4%	8%	12%	16%
Wheat	687.2	685.5	683.7	681.9	680.2
Wheat bran	45.0	45.0	45.0	45.0	45.0
Rice DDGS	0	40.0	80.0	120.0	160.0
SBM 47%CP	155.7	116.8	77.8	38.9	0

12*20b/R

Gemma & Rama Rao, 2017



3. DDGS-Rice in layer diet (25-54wk)

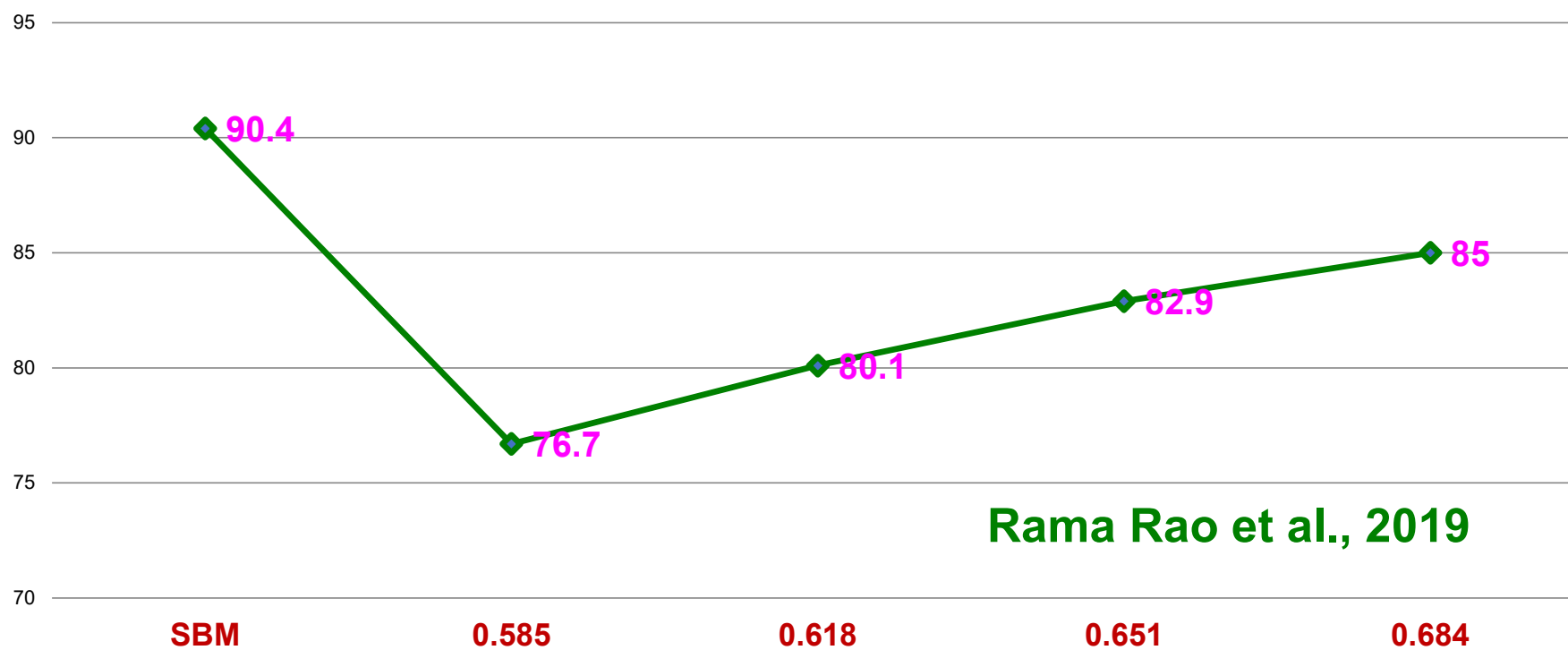
DDGS, %	EP, %	FI/egg	FE	BWG, g	Feather Score
0	96.12 ^{AB}	120.8 ^{AB}	2.057 ^E	152.7	1.278
4	97.01 ^A	119.3 ^{BCDE}	2.053 ^E	150.5	1.337
8	96.19 ^{AB}	120.6 ^{ABC}	2.086 ^D	147.4	1.512
12	96.54 ^A	118.5 ^{DE}	2.117 ^C	96.5	1.627
16	91.58 ^D	121.6 ^A	2.213 ^A	-34	2.288

12*20b/R

Gemma & Rama Rao, 2017



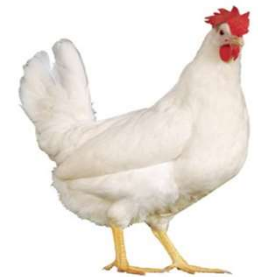
3. Guar meal (10%) vs TSAA (30-48 wks) - EP



Rama Rao et al., 2019

3. 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	*	*	*



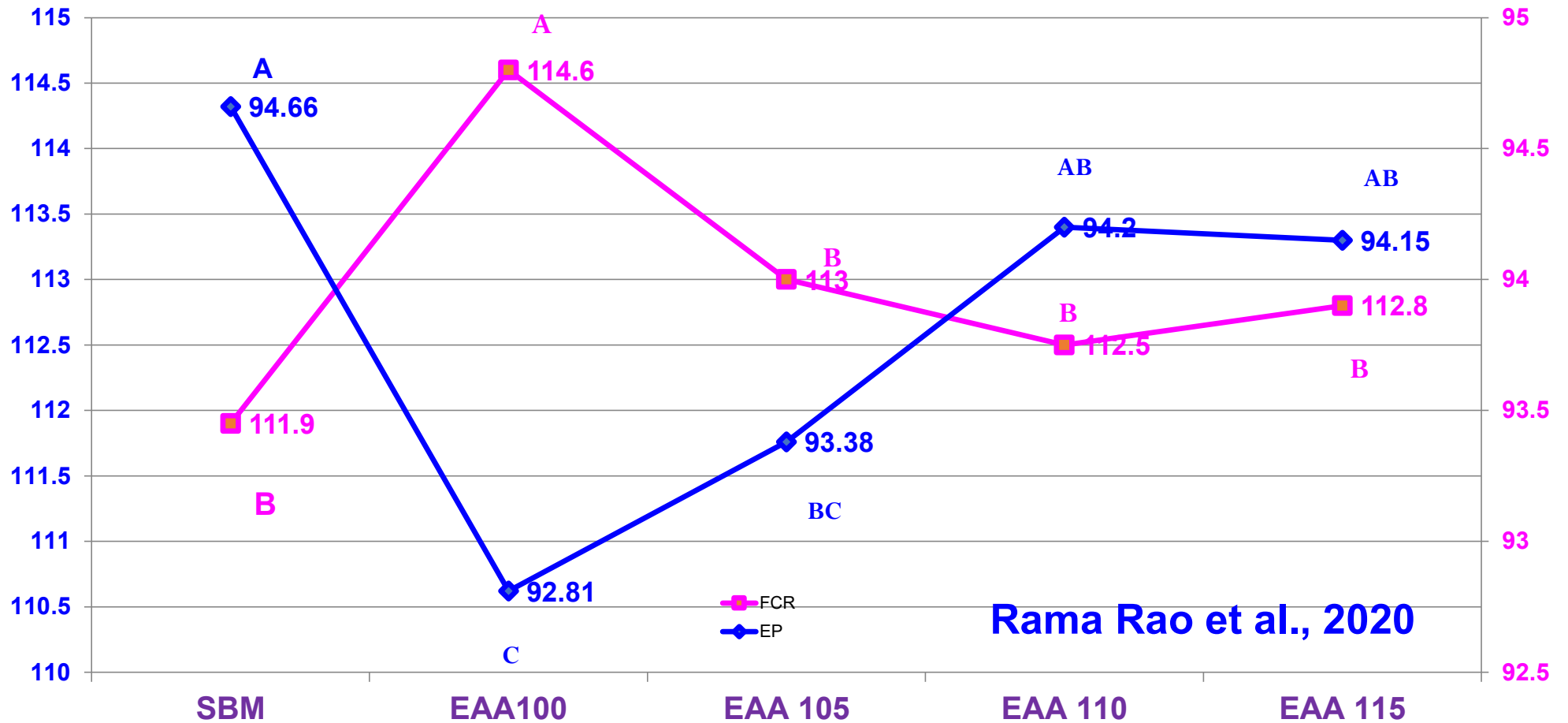
**APM = CSM,
DDGS, RSM**

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

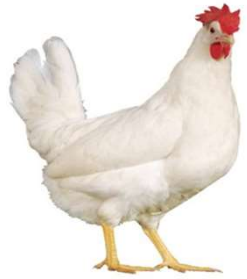
Rama Rao et al., 2020



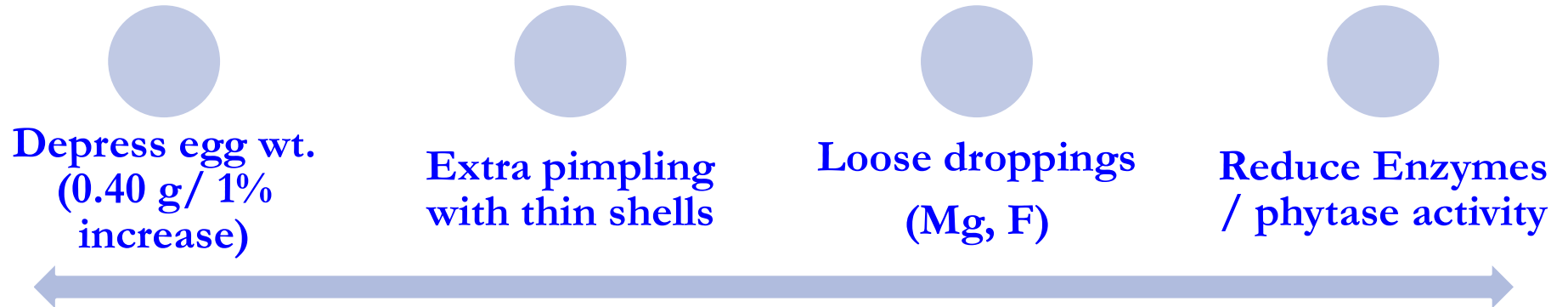
3. APM with graded AA concentrations



Rama Rao et al., 2020



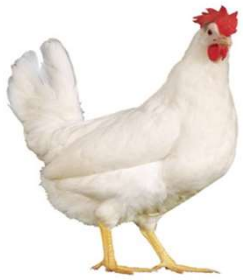
4. Ca.....Excess



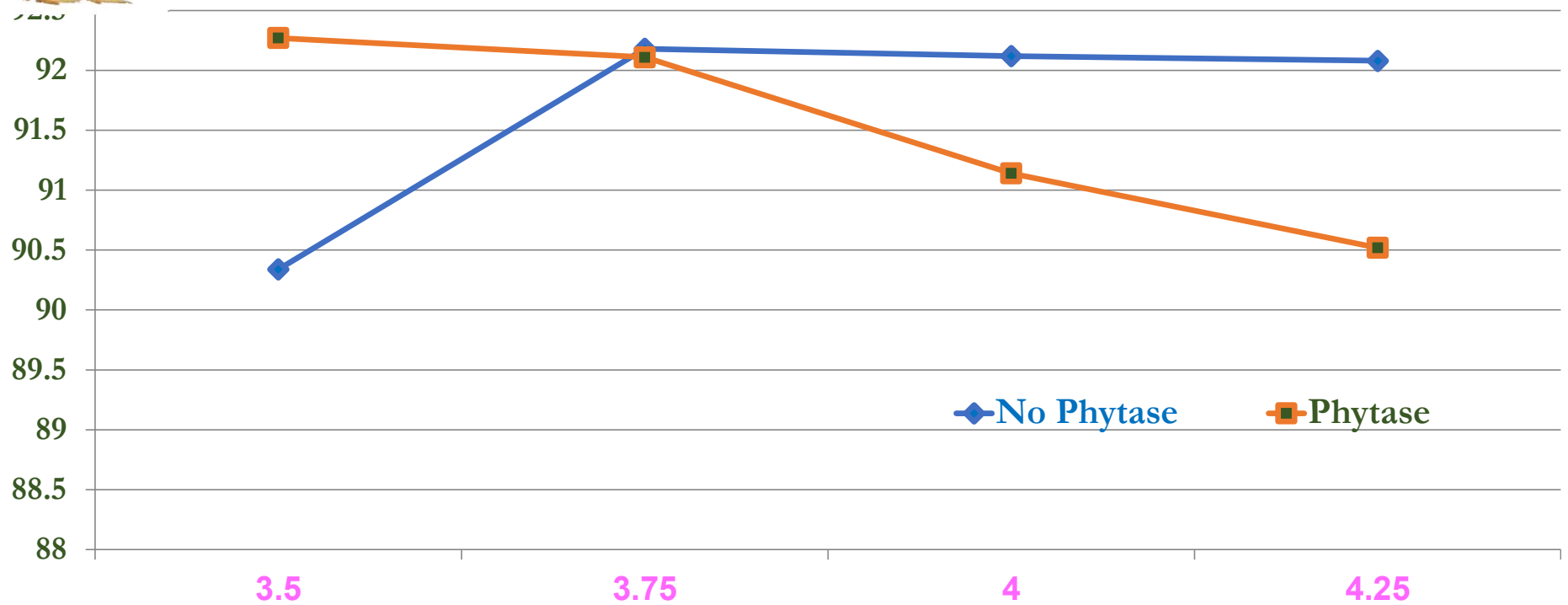
Expensive

0.4% Ca cost

Rs. 70 to 120/-/Ton



4. Ca vs Phytase (25-72wk)



8 * 88 birds

Rama Rao et al., 2014, AFST



4. Ca (%) on layer (20-55 wks)

Trait	3.25	3.5	3.75	4.00	4.25	4.5
EP, %	94.1	93.9	93.5	93.9	93.5	94.2
Shell wt, %	9.81	9.93	9.82	9.89	9.84	9.83
Shell thick, nm	385	379	386	391	386	289
Bone ash, %	51.9	53.2	53.5	53.5	53.6	53.3
Bone stren., N	691	709	721	722	723	719

Expensive by Rs 250 – 310/T

Rama Rao et al., 2003, AFST



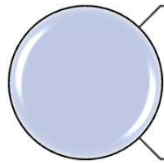
4. P.....Excess

Calcium
phosphate
formation

Acts as
crystal
poison in
shell gland

Decrease
the shell
quality
>0.35%
NPP

Reduces
phytase
activity



4. P in layer (38-50 wks) diet

Attribute	NPP, %			
	0.20	0.25	0.30	0.35
EP, %	94.6	92.2	92.4	91.1
Shell thick., mm	0.379	0.390	0.380	0.378

Rama Rao et al., 1999 AFST



4. NPP in layer diet (22-72 wks)

NPP	EP, %			Shell wt	Shell Thick	Tibia	
%	22-37	38-53	54-72	g	mm	Strength, N	Ash, %
0.15	91.0	88.9	83.4	5.14	0.412	6.54	53.3
0.175	90.4	89.5	82.0	5.31	0.427	6.77	52.6
0.2	91.2	90.3	81.7	5.04	0.422	6.89	54.1
0.225	91.2	90.3	82.1	5.12	0.413	7.11	51.9
0.25	92.0	91.7	84.6	5.09	0.408	6.81	54.1
0.275	92.8	92.0	84.4	5.05	0.421	7.02	53.8
0.3	91.3	89.6	80.5	5.11	0.416	6.74	55.2
0.325	92.2	90.1	81.5	5.04	0.409	7.27	55.6
NPP, %	0.150	0.263	0.240	NS	NS	NS	NS

Rama Rao et al., 2019, BPS

5. Phytase

Minimizes /
removes DCP
levels in diet

Reduces P &
trace mineral
excretion

Improves bone
& egg shell
strength

Sparing of
energy & AA

**Super
dosing
effect**



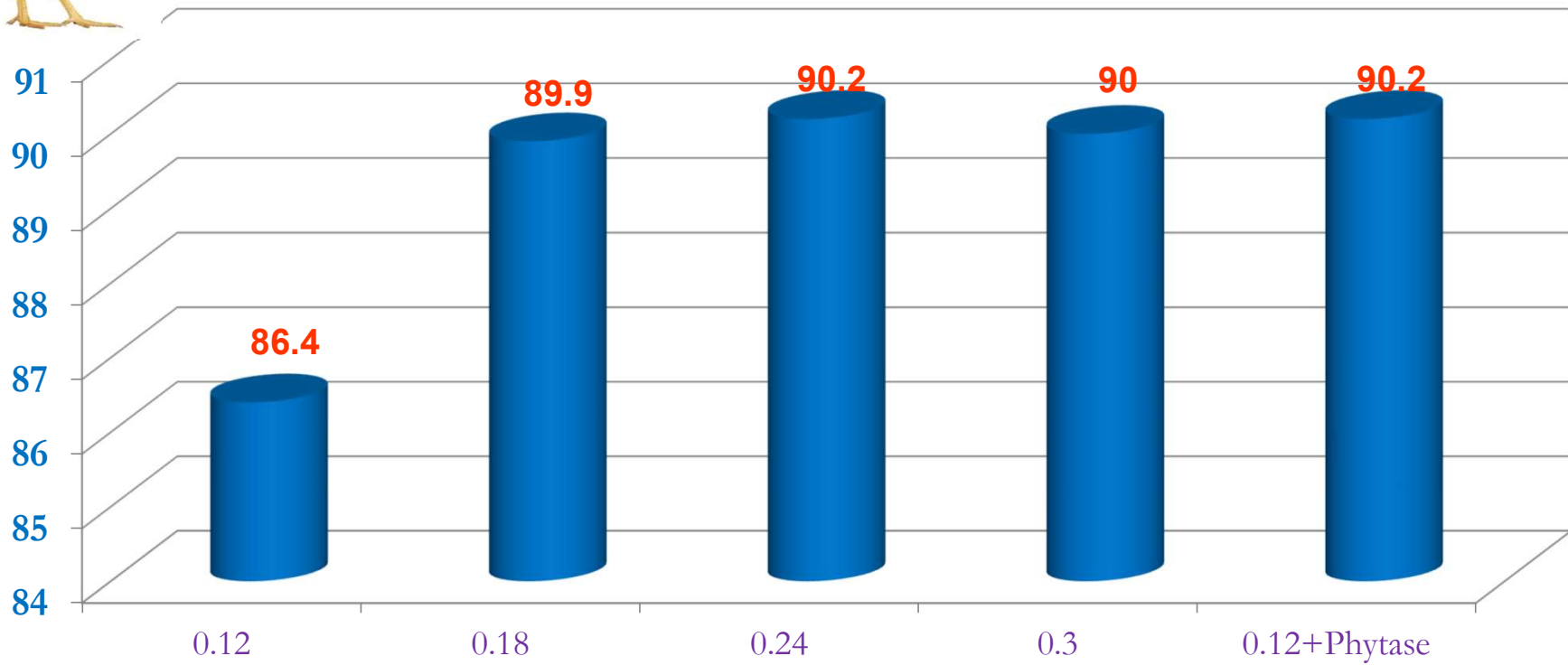
5. Phytase- in layers (338-394d)

Ca	NPP	Phytase, U/kg	EP, %	FI/ 12 eggs
3.60	0.2	-	90.8a	1.535a
3.60	0.11	-	62.8b	1.933b
3.60	0.11	250	91.0a	1.476a

Rama Rao et al., 1999 AFST



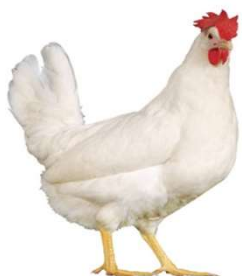
5. Phytase Layers (32-48wk)



Panda et al., 2005, BSP

5. “No to DCP” in layer (28-45 wks) diet ?

Ingredient	0.36	0.24%	0.20%	0.16%	0.12%
	1	2	3	4	5
Maize	533.5	525	524.7	524	523
DORB	122.3	141.5	145.0	149	152.6
Soya doc	123.5	118.0	117.0	116.0	114.4
DDGS 40%	50.0	50.0	50.0	50.0	50.0
RSE	40.0	40.0	40.0	40.0	40.0
LSP	0	0	0	0	0
Stone grit32%	108.0	110.0	110.0	110.0	111.0
DCP	13.94	6.7	4.35	2	0
Ca, %	3.9/3.7	3.9/3.7	3.9/3.7	3.9/3.7	3.9/3.7
NPP, %	0.36	0.24	0.20	0.16	0.12
Phytase (600 FYT/kg)	0	600	600	600	600



5. No to DCP – Layers (25-48 wks)

NPP, %	EP, %	FI, g/d	ST, mm	Tibia ash, %
0.36	88.94	107.5	0.376	41.5
0.24	86.26	106.4	0.375	44.0
0.2	89.80	107.7	0.371	42.6
0.16	89.59	107.5	0.365	44.3
0.12 no DCP	89.83	107.6	0.370	44.7
P	NS	NS	NS	NS

10*20 layers

Nataraja & Rama Rao, 2021

5. Layers Enzymes



Ingredient	Control	Basal
Maize	553.99	485.06
Soybean meal	184.37	143.56
Rape seed meal	32.07	33.23
Deoiled rice bran	109.4	221.4
Monocalcium phosphate	7.14	0
Stone grit	74.41	78.44
LSP powder	30	30
Sodium bi carbinat	2	2
Salt	2.89	2.73
DL Methionine	0.768	0.654

68.9 kg

40.8 kg

7 kg

114 g

Cost Rs/Ton

17358

16182

ME

100 Kcal

CP

0.75%

NPP

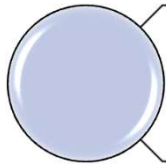
0.10%

5. Enzymes in Layer (55-80 wks) diet

Enzyme	EP, %	FI, g/egg	ESD, %	EM, g/d
Basal + E	88.98 ^a	128.1 ^b	1.218	52.12 ^a
Basal	85.96^b	134.0^a	1.379	50.64^b
Control	90.68 ^a	124.3 ^c	1.397	53.30 ^a

55-80 wks

Rama Rao et al., 2017

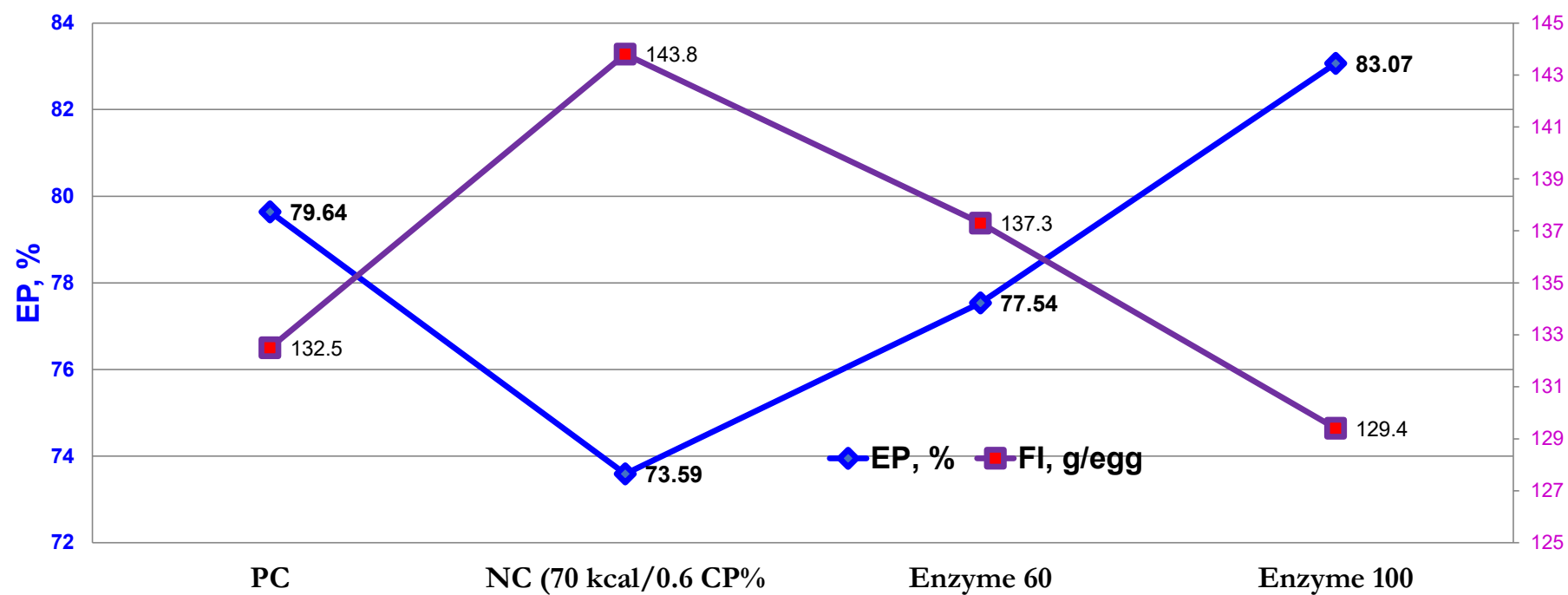


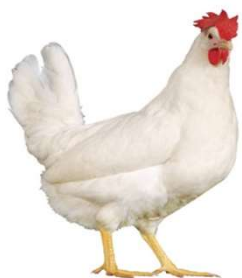
5. Economics.....

Item	Control	Basal	Basal+Enz
Feed intake, g/egg	124.3	134	128.1
Feed cost, Rs/kg	24.61	22.94	23.04
Feed Cost, Rs/egg	3.06		2.95
Savings, Paisa/egg			11.0



5. Enzymes in low ME diets (77-92 wks)





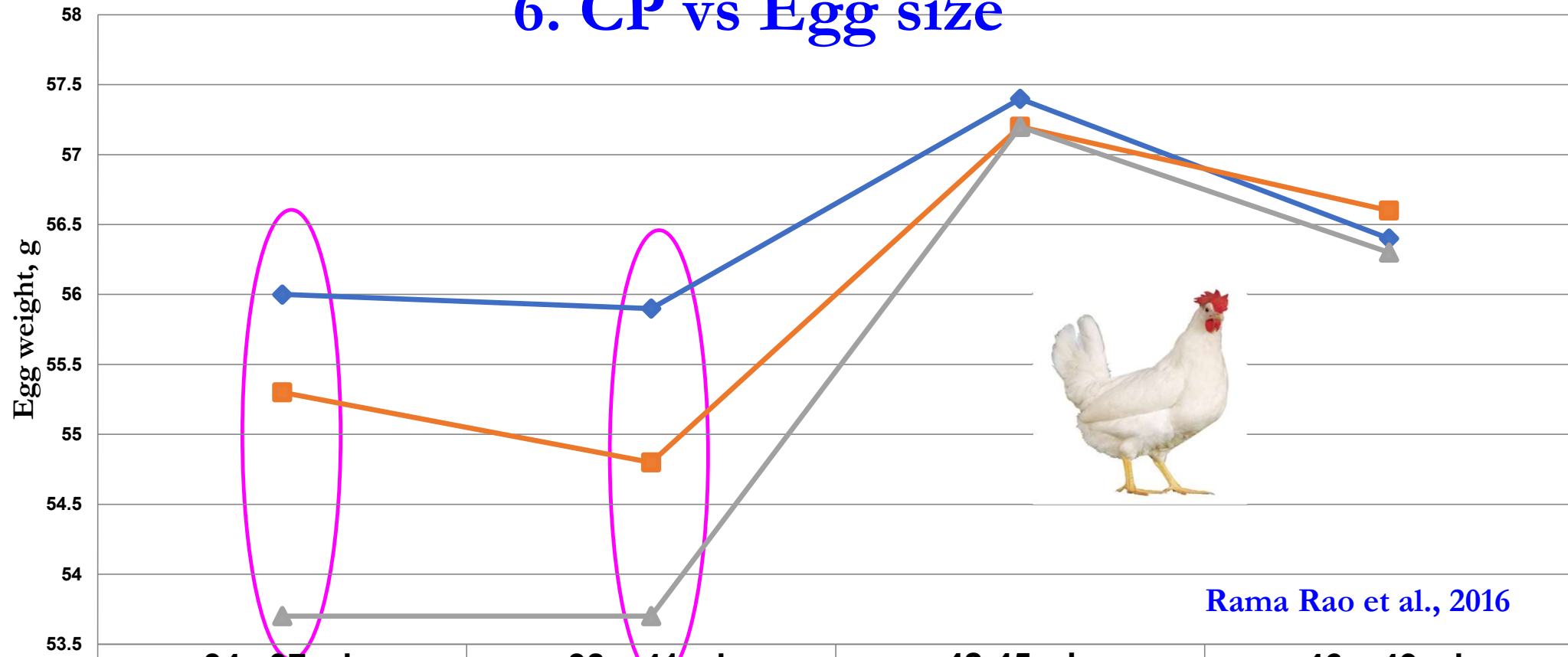
6. Egg size vs CP

CP	EP	FI	Egg Weight, g		
%	%	g/d	P1	P2	P 1-10
18	84.5	102.4	44.14A	48.37A	52.54
16.5	85.1	102.7	44.36A	48.46A	52.59
15	85.1	102.5	43.57B	47.62B	52.22
P	NS	NS	**	**	NS

Rama Rao et al., 2011, APS

(10 months)

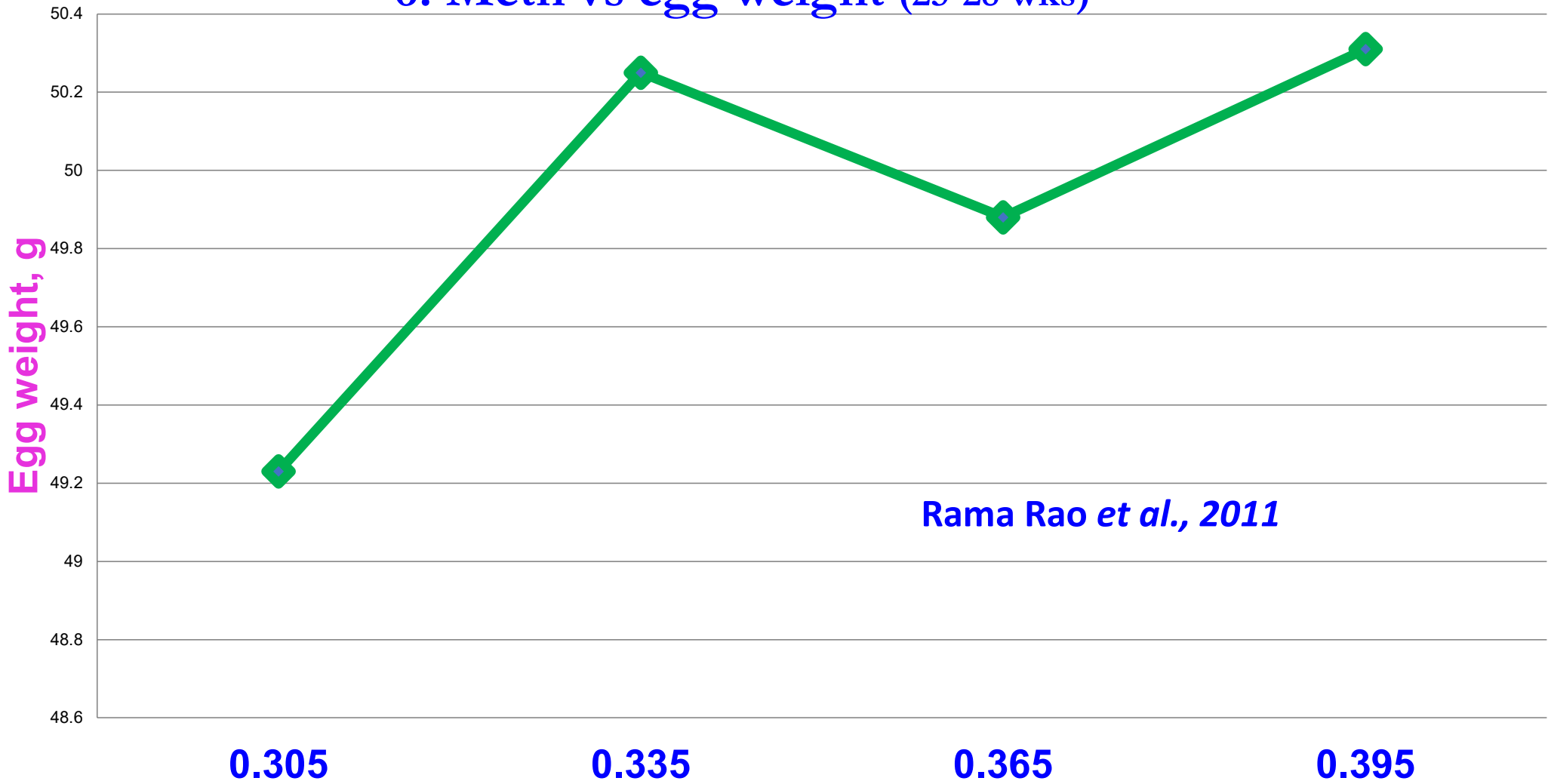
6. CP vs Egg size



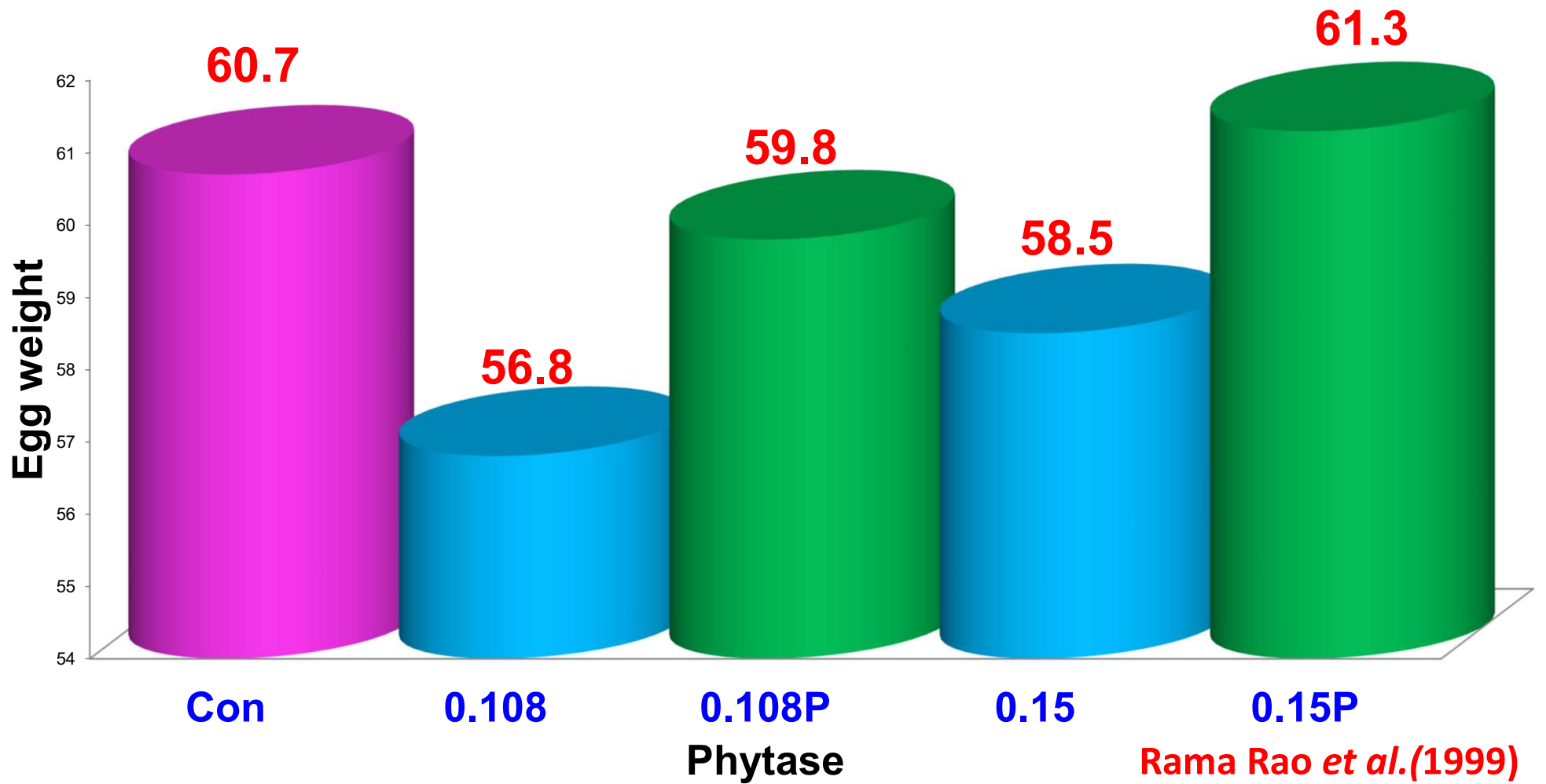
Rama Rao et al., 2016

◆ 17.5	56	55.9	57.4	56.4
■ 16.5	55.3	54.8	57.2	56.6
▲ 15.5	53.7	53.7	57.2	56.3

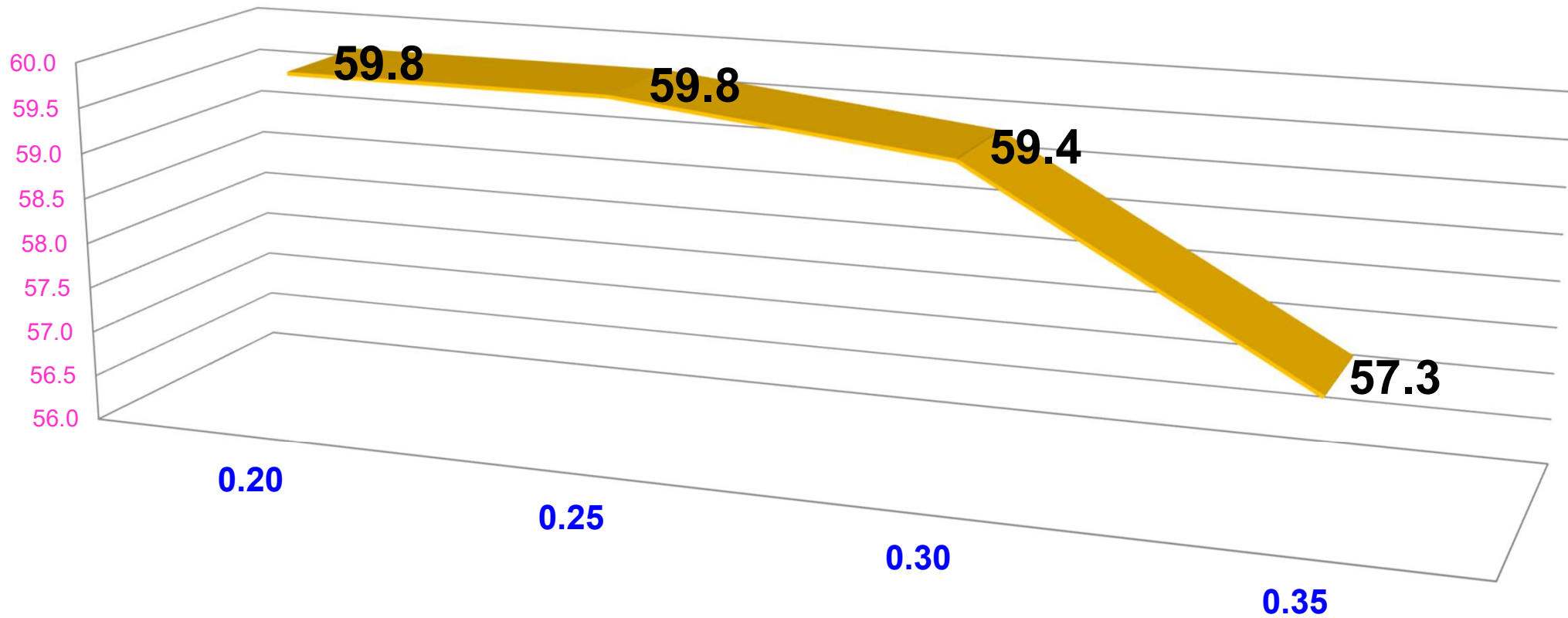
6. Meth vs egg weight (25-28 wks)



6. Phytase vs Egg weight



6. NPP vs Egg weight (38-50 wks)



Rama Rao *et al.*(1999)

6. Ca & Egg weight (25 – 40 wks)

Calcium , %	FI, g/b	EW, g
3.5	96.7 ^a	53.3
3.75	95.4 ^{ab}	53.1
4.0	94.2 ^{bc}	53.0
4.25	93.3 ^c	52.6

Rama Rao et al., 2014



Zist of presentation

- Layers respond to nutrient density in diet
- Consider SEASON, FEED INTAKE, AA inclusion, ME for dietary CP needs
- DDGSr (good quality) can be included up to 12%
- Wheat can be used as total substitute for maize
- Increase CP (1%), EAA (10%) in diets with higher levels of APS (>15%)
- Optimum Ca 3.75-3.85%. Higher levels reduce phytase activity
- No to DCP/MCP with phytase
- Egg size can be modulated (max 2g) with CP, AA and Phytase. Higher Ca and NPP reduce egg size



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**Thanks for Your
Audience & Time**

