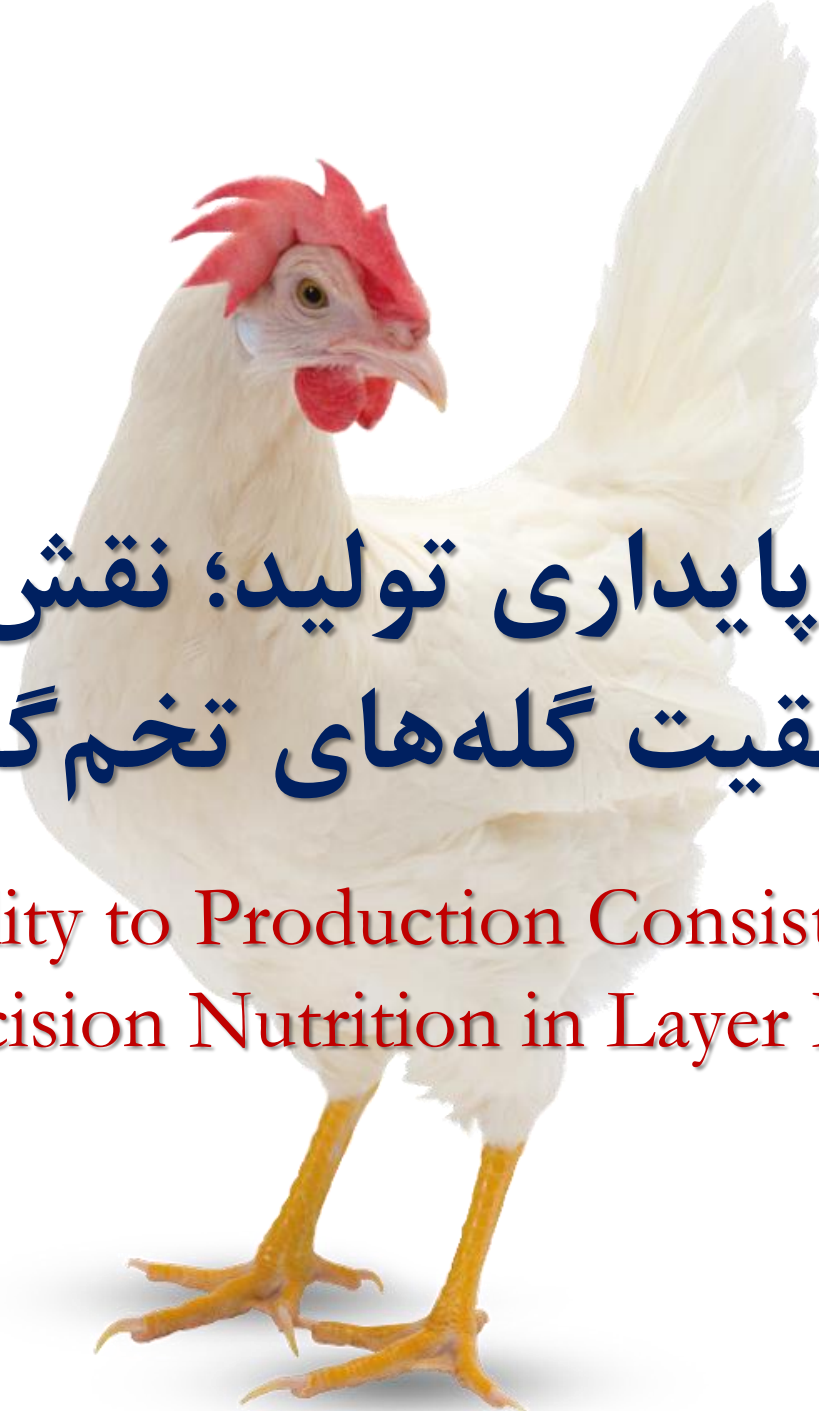




از کیفیت دان تا پایداری تولید؛ نقش تغذیه دقیق در موفقیت گله‌های تخم‌گذار

From Feed Quality to Production Consistency: The Role of
Precision Nutrition in Layer Flocks

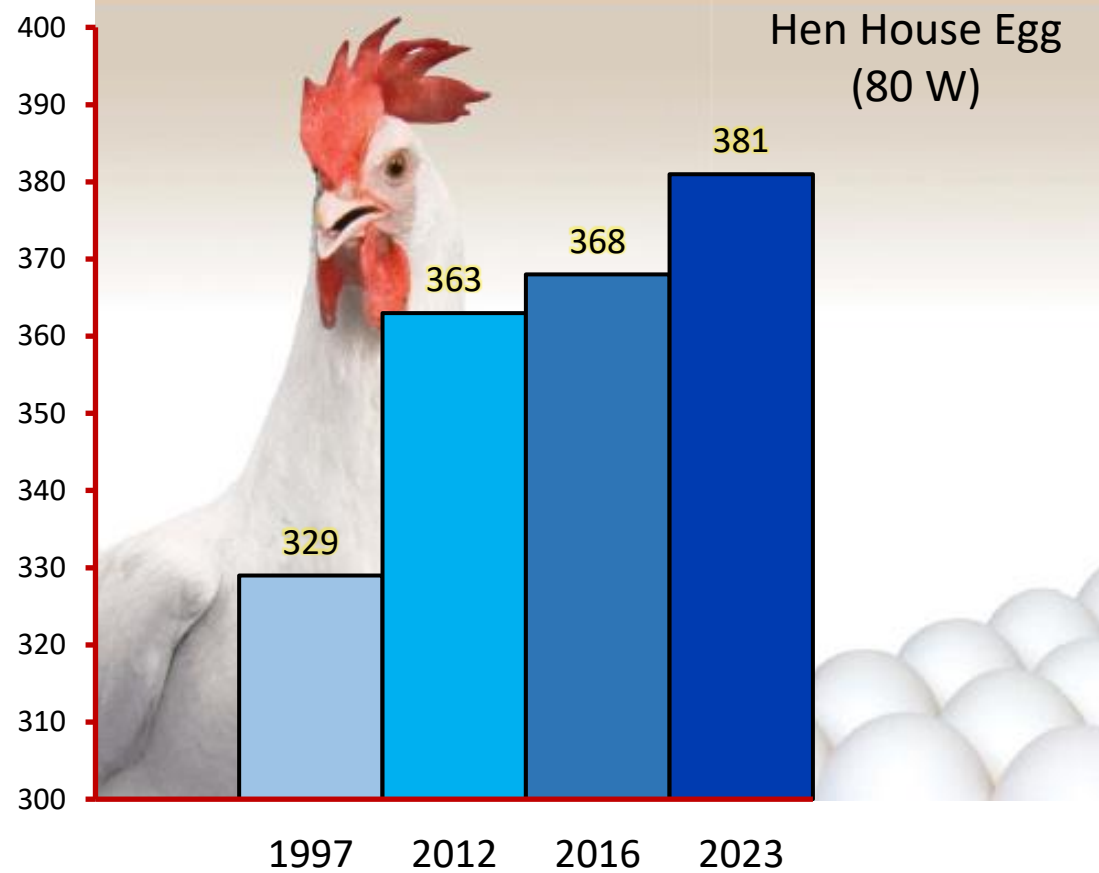
Speaker: M. Zaghari

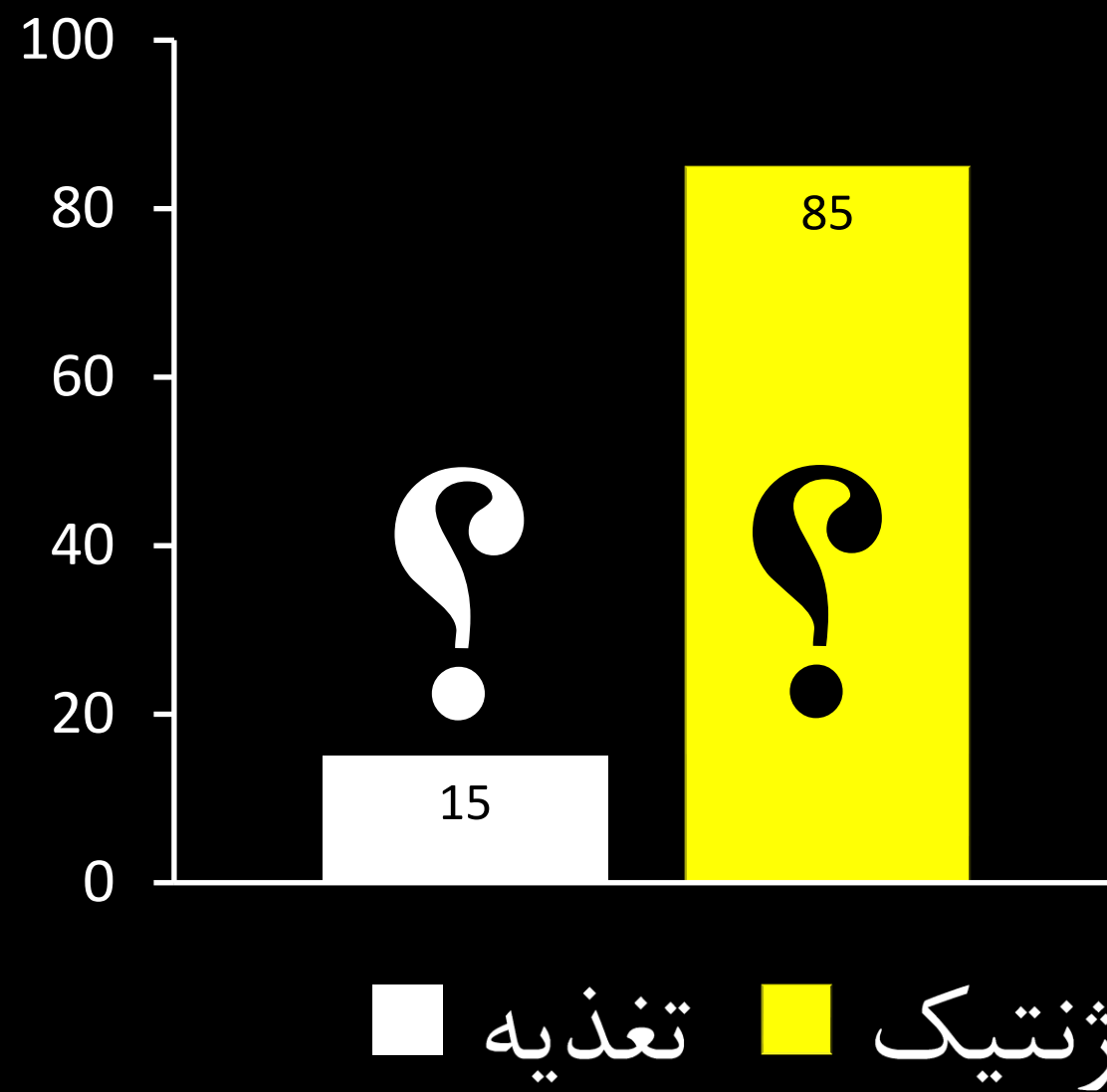
Available at www.minatoyoor.com

Hy-Line®

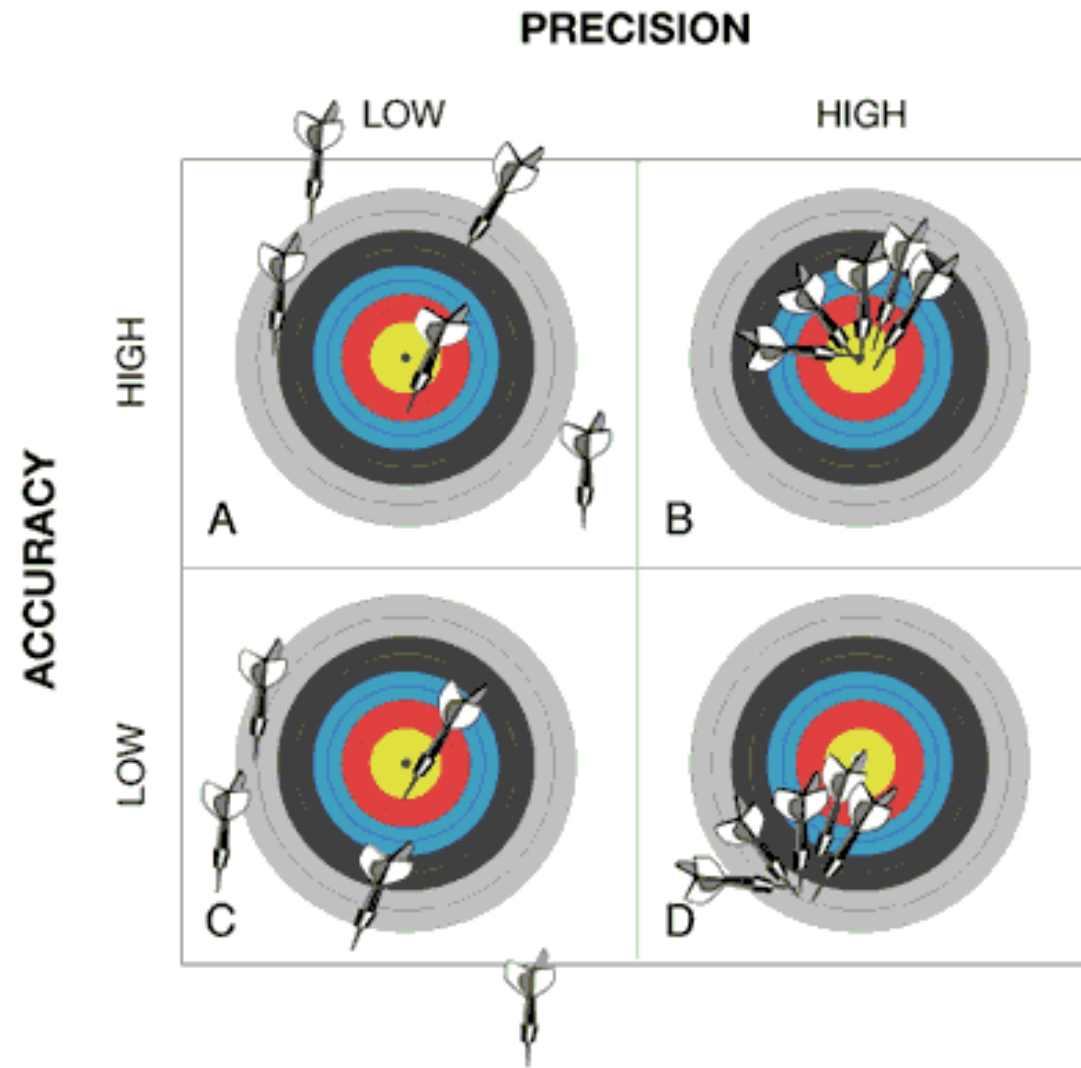
W-36

Performance Standards Manual

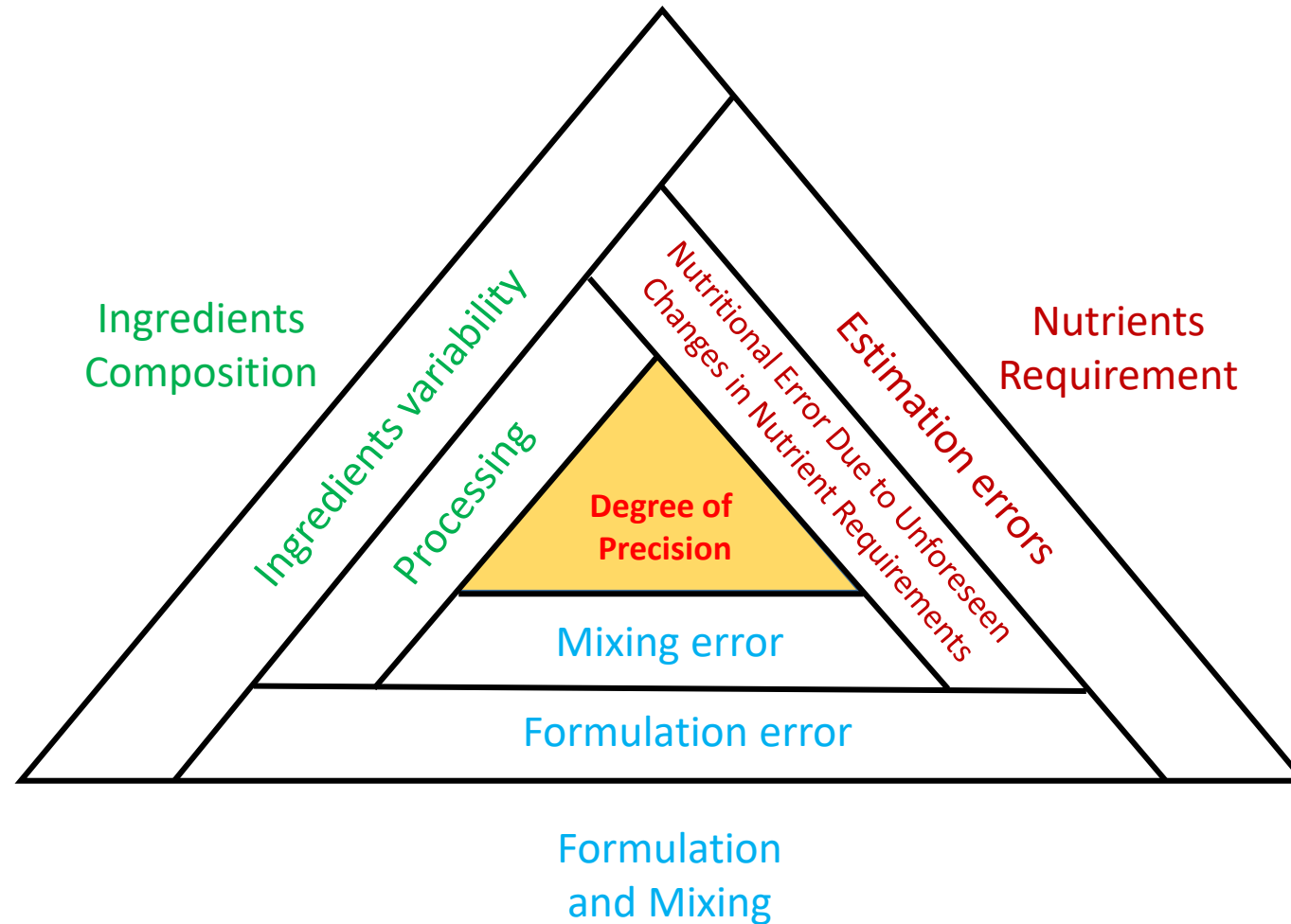








Multiplicative Nature of Precision Feeding



1. برآورد دقیق نیازهای مرغ



تولید تخم مرغ
(تعداد و وزن)



وزن بدن و رشد
(نگهداری و تولید)



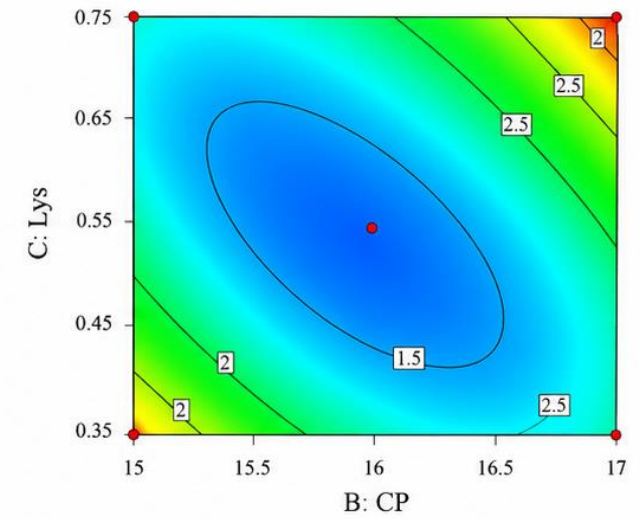
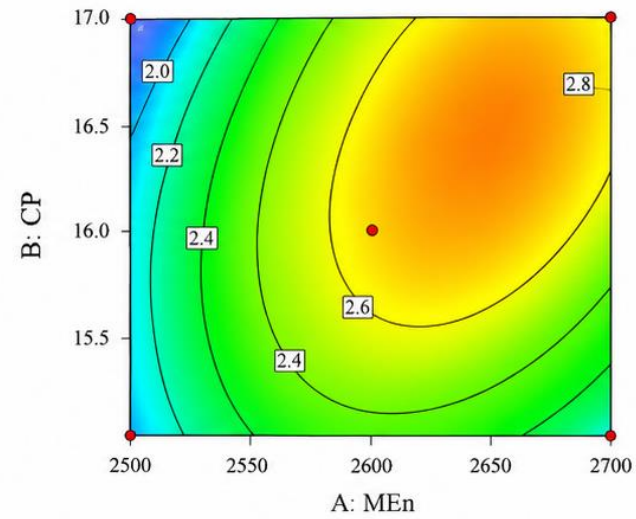
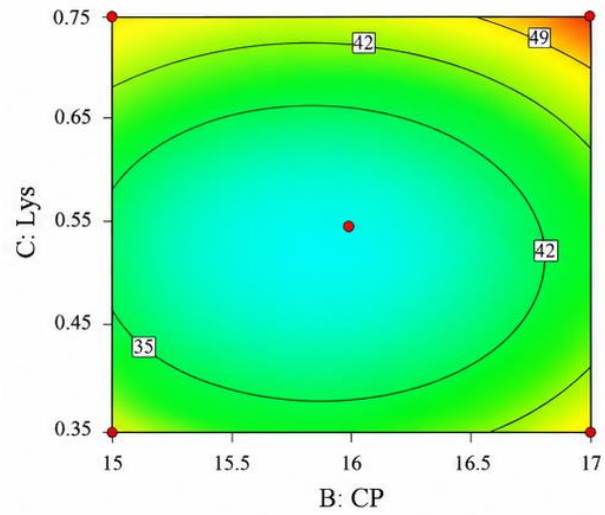
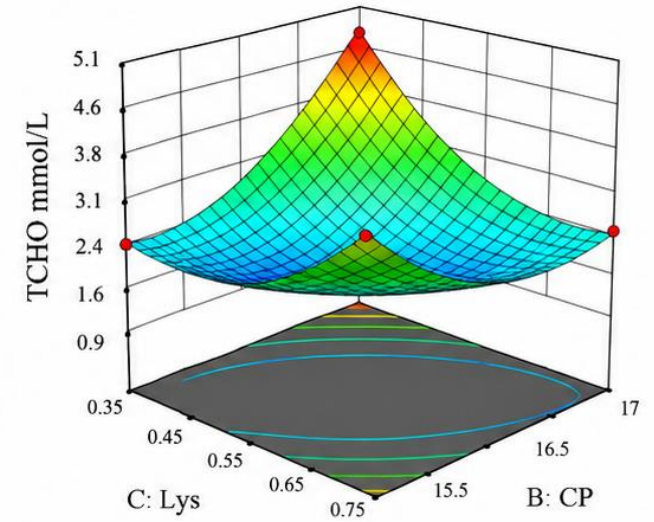
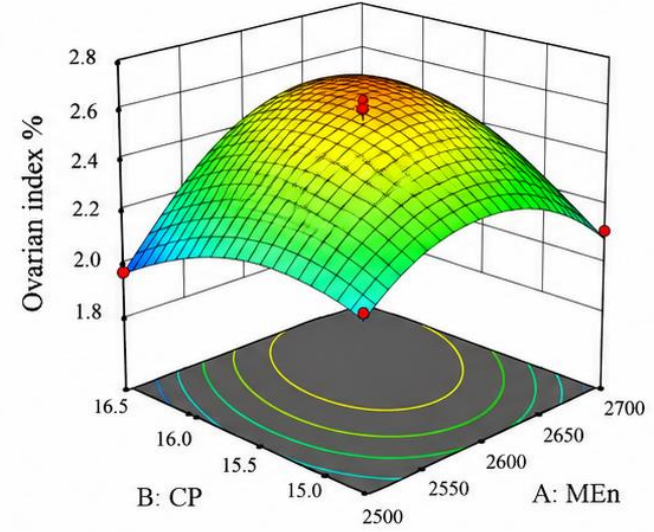
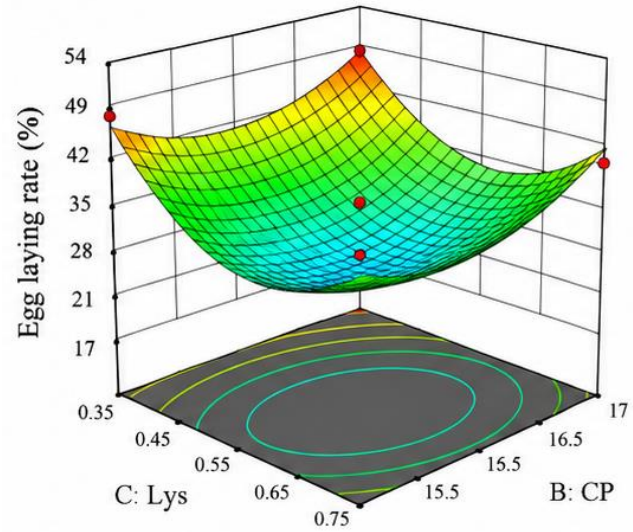
شرایط محیطی
(دما، استرس، سلامت)



مرحله تولید
(اوج تولید، پایان دوره)

تغذیه دقیق
مرغ تخمگذار





مدل انرژی قابل متابولیسم مصرفی (کیلوکالری در روز)

$MEI = W \times (711 - 9.2T) + 8.4EM + 20.9\Delta W$	Emmans (1974) سویه سفید
$MEI = W \times (586 - 8.4T) + 8.4EM + 20.9\Delta W$	Emmans (1974) سویه قهوه‌ای
$MEI = 544W^{0.75} \times 4.3^{\Delta t} + 8.7EM + 23.0\Delta W$	NRC (1981)
$MEI = W \times (1057 - 7.5T - 0.3T^2) + PF \times (-6.2 + 0.06T + 0.004T^2) + 12.0EM + 25.1\Delta W$	Peguri & Coon (1988)
$MEI = W^{0.75} \times (724 - 8.2T) + 8.7EM + 23.0\Delta W$	NRC (1984, 1994)
$ME = W^{0.75} \times (165.74 - 2.37T) + 6.68G + 2.4E$	Sakomura et al. (2005), Model 1
$ME = W^{0.75} \times (163.67 - 2.09T) + 6.68G + 2.4E$	Sakomura et al. (2005), Model 2
$ME = 121.8W^{0.75} + 2.48EM$	De Almeida et al. (2016) مرغ تخم‌گذار آزاد

Prima Donna



Alp
1α

25-Hydroxylase

This enzyme is more bioactive

Vita
& 25

1α-Hydroxylase

This enzyme is less bioactive

Recommended* micronutrients for poultry (/kg feed)

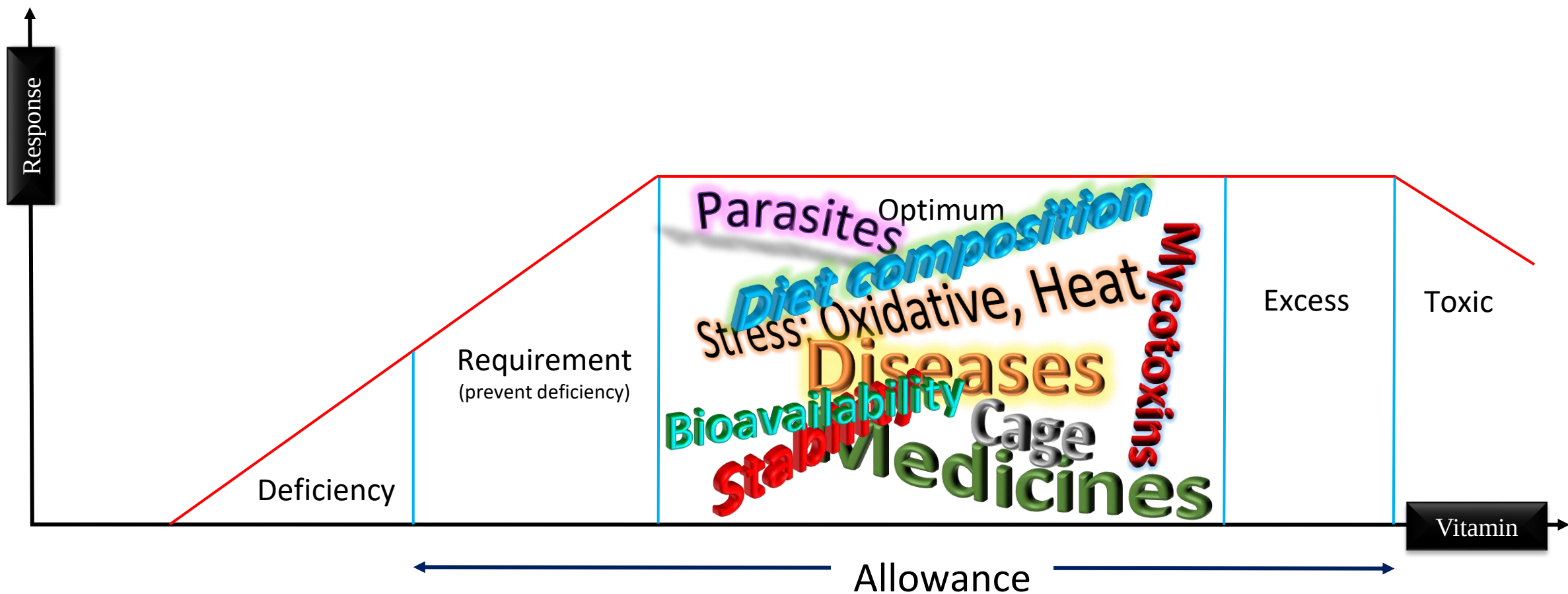
Micronutrients	Broiler	Layer	Breeder	Quail/Turkey	Duck/Goose	Emu/Ostrich
Vitamin-A (IU)	12,500	10,000	14,000	13,000	12,000	15,000
Vitamin-D3 (IU)	4,000	3,000	3,000	4,000	4,000	4,000
Hy-D (mcg)	69	69	69	92	69	69
Vitamin-E (mg)	200	30	100	50	50	50
Vitamin-K3 (mg)	3	2.5	3	3	4	3.5
B-1 (mg)	2.5	2.5	3.5	4	2.5	4
B-2 (mg)	8	6	12	12	8	15
B-6 (mg)	5	5	10	6	6	7
B-12 (mcg)	25	20	35	35	30	80
Niacin (mg)	60	40	45	100	60	80
Pantothenic acid (mg)	15	10	15	20	12	15
Folic acid (mg)	1.5	1	2	3	1.5	3
Biotin (mg)	0.25	0.15	0.25	0.25	0.15	0.30
Choline (mg)	500	400	500	800	400	700
Vitamin-C (mg)	150	150	200	200	150	200
Manganese (mg)	120	110	125	140	100	120
Zinc (mg)	100	100	110	110	100	110
Iron (mg)	40	30	40	40	30	40
Copper (mg)	12	10	15	15	12	15
Iodine (mg)	1.5	1	1.5	2	1.5	2
Selenium (mg)	0.25	0.20	0.25	0.25	0.20	0.25
Cobalt (mg)	0.2	0.2	0.2	0.2	0.2	0.2
Chromium (mg)	0.15	0.15	0.15	0.15	0.15	0.15
Molybdenum (mg)	0.15	0.15	0.15	0.15	0.15	0.15

*According to DSM (Roche), BASF and Provimi recommendations, 2008

(OH)₂-D₃

of vitamin D₃

the target tissues
active form of
are the bones,
and kidneys.

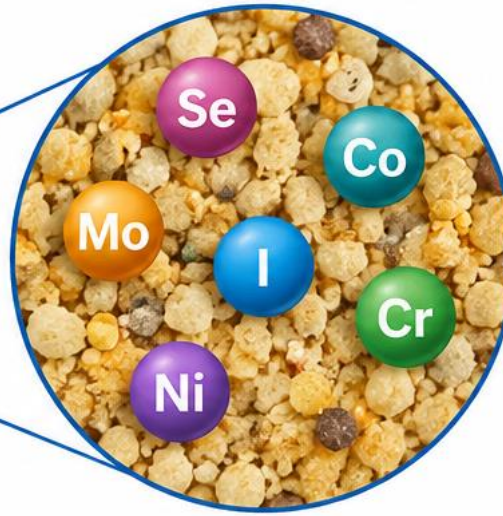


Ultra trace elements

Ultra trace elements are
less than 1 mg/kg diet (<1 ppm, usually few ppb).



Poultry diet
(feed)



Examples of ultra trace elements:

- Selenium (Se)
- Cobalt (Co)
- Iodine (I)
- Chromium (Cr)
- Molybdenum (Mo)
- Nickel (Ni)
- ...

**Concentration
in diet**

< 1 mg/kg
(less than 1 ppm)

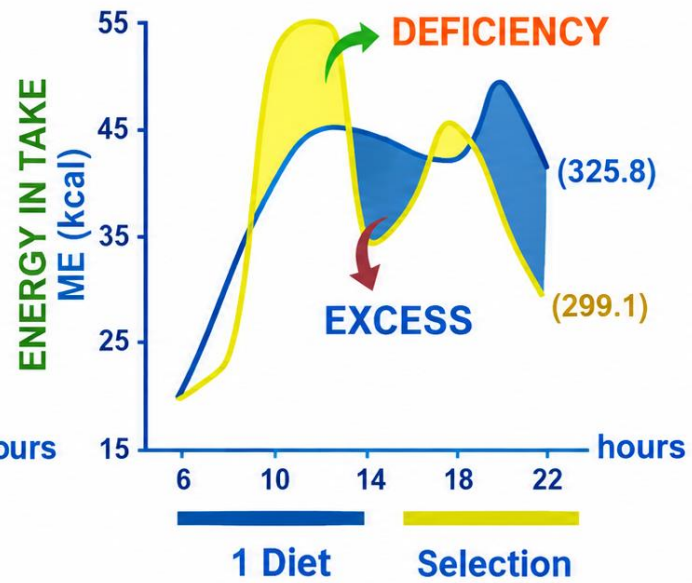
=

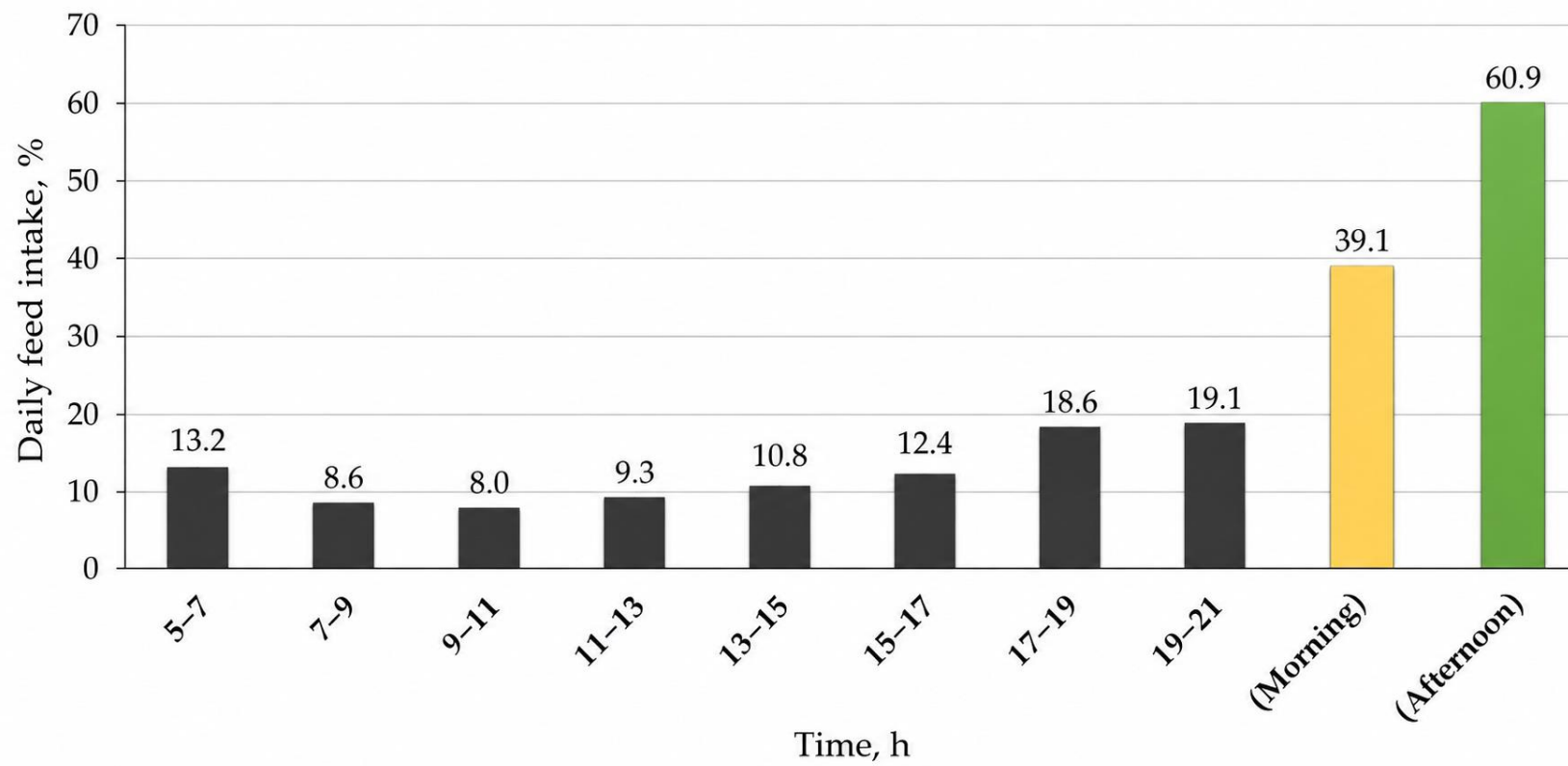
< 1 µg/g
(less than 1 ppm)

=

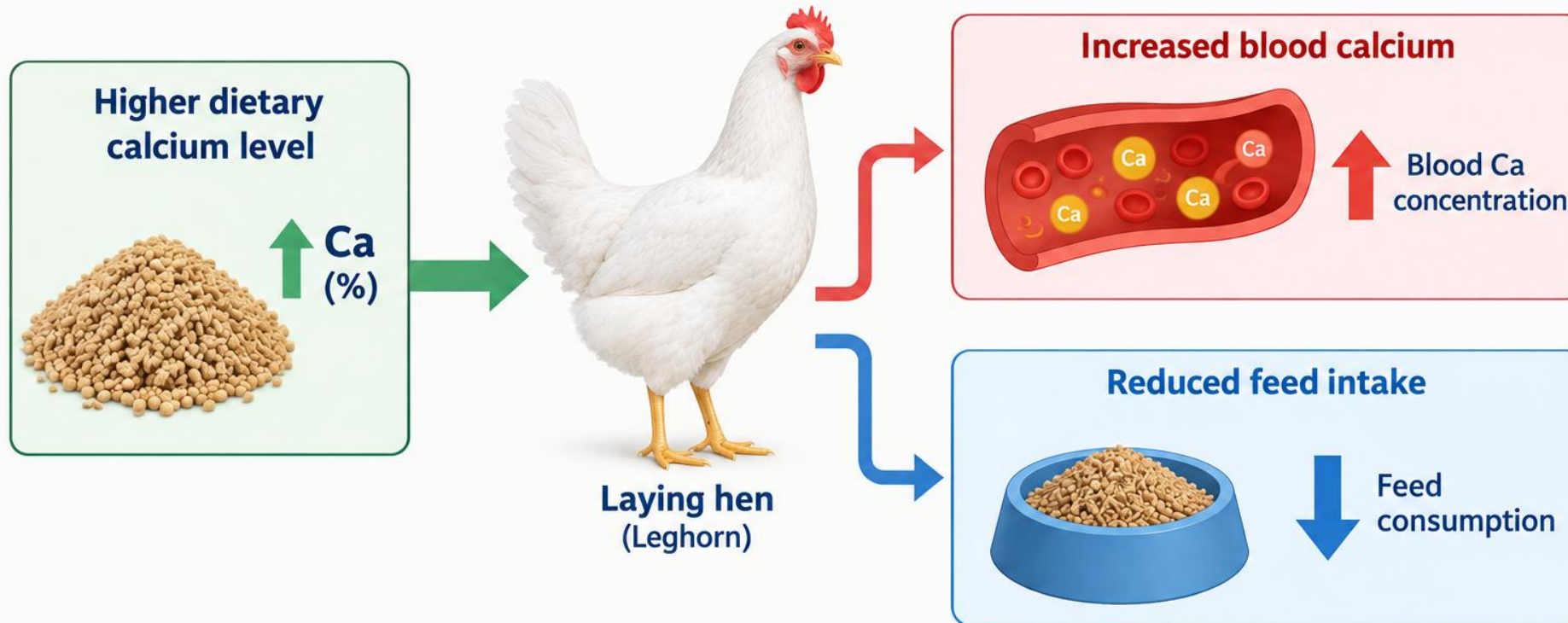
Usually a few ppb
(e.g., 1–10 ppb)

ppb = parts per billion (1 ppb = 1 µg/kg)





Increasing Dietary Calcium in Commercial Laying Hens (e.g., Leghorn)



Result: Higher dietary calcium → higher blood calcium → lower feed intake
(in commercial laying hens, e.g., Leghorn)

۲. برآورد دقیق ترکیب مواد خوراکی



انرژی

(کربوهیدرات‌ها و چربی‌ها)



پروتئین

(منابع گیاهی و حیوانی)



مواد معدنی

(ماکرو و میکرو)

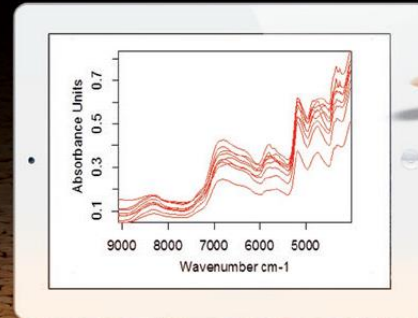


ویتامین‌ها

(A, D, E, K و گروه B)

**تغذیه دقیق
مرغ تخمگذار**



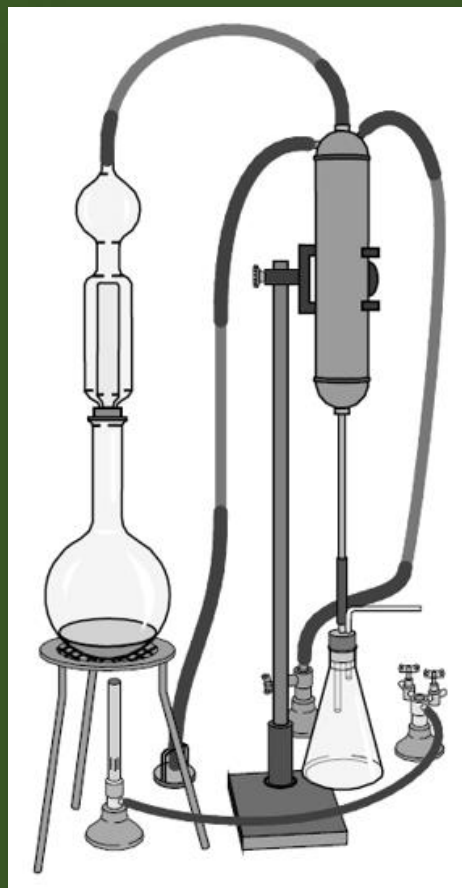


CODE	BID	ASK	LAST	T/VOL	CODE	BID	ASK	LAST	T/VOL
20T	8.00	8.02	8.00	322,000	20P	9.00	9.00	9.00	10,400
20F	10.00	10.02	10.00	10,400	20E	11.00	11.02	11.00	10,400
20D	12.00	12.02	12.00	10,400	20C	13.00	13.02	13.00	10,400
20B	14.00	14.02	14.00	10,400	20A	15.00	15.02	15.00	10,400
20A	16.00	16.02	16.00	10,400	20Z	17.00	17.02	17.00	10,400
20Z	18.00	18.02	18.00	10,400	20Y	19.00	19.02	19.00	10,400
20Y	20.00	20.02	20.00	10,400	20X	21.00	21.02	21.00	10,400
20X	22.00	22.02	22.00	10,400	20W	23.00	23.02	23.00	10,400
20W	24.00	24.02	24.00	10,400	20V	25.00	25.02	25.00	10,400
20V	26.00	26.02	26.00	10,400	20U	27.00	27.02	27.00	10,400
20U	28.00	28.02	28.00	10,400	20T	29.00	29.02	29.00	10,400
20T	30.00	30.02	30.00	10,400	20S	31.00	31.02	31.00	10,400
20S	32.00	32.02	32.00	10,400	20R	33.00	33.02	33.00	10,400
20R	34.00	34.02	34.00	10,400	20Q	35.00	35.02	35.00	10,400
20Q	36.00	36.02	36.00	10,400	20P	37.00	37.02	37.00	10,400
20P	38.00	38.02	38.00	10,400	20O	39.00	39.02	39.00	10,400
20O	40.00	40.02	40.00	10,400	20N	41.00	41.02	41.00	10,400
20N	42.00	42.02	42.00	10,400	20M	43.00	43.02	43.00	10,400
20M	44.00	44.02	44.00	10,400	20L	45.00	45.02	45.00	10,400
20L	46.00	46.02	46.00	10,400	20K	47.00	47.02	47.00	10,400
20K	48.00	48.02	48.00	10,400	20J	49.00	49.02	49.00	10,400
20J	50.00	50.02	50.00	10,400	20I	51.00	51.02	51.00	10,400
20I	52.00	52.02	52.00	10,400	20H	53.00	53.02	53.00	10,400
20H	54.00	54.02	54.00	10,400	20G	55.00	55.02	55.00	10,400
20G	56.00	56.02	56.00	10,400	20F	57.00	57.02	57.00	10,400
20F	58.00	58.02	58.00	10,400	20E	59.00	59.02	59.00	10,400
20E	60.00	60.02	60.00	10,400	20D	61.00	61.02	61.00	10,400
20D	62.00	62.02	62.00	10,400	20C	63.00	63.02	63.00	10,400
20C	64.00	64.02	64.00	10,400	20B	65.00	65.02	65.00	10,400
20B	66.00	66.02	66.00	10,400	20A	67.00	67.02	67.00	10,400
20A	68.00	68.02	68.00	10,400	20Z	69.00	69.02	69.00	10,400
20Z	70.00	70.02	70.00	10,400	20Y	71.00	71.02	71.00	10,400
20Y	72.00	72.02	72.00	10,400	20X	73.00	73.02	73.00	10,400
20X	74.00	74.02	74.00	10,400	20W	75.00	75.02	75.00	10,400
20W	76.00	76.02	76.00	10,400	20V	77.00	77.02	77.00	10,400
20V	78.00	78.02	78.00	10,400	20U	79.00	79.02	79.00	10,400
20U	80.00	80.02	80.00	10,400	20T	81.00	81.02	81.00	10,400
20T	82.00	82.02	82.00	10,400	20S	83.00	83.02	83.00	10,400
20S	84.00	84.02	84.00	10,400	20R	85.00	85.02	85.00	10,400
20R	86.00	86.02	86.00	10,400	20Q	87.00	87.02	87.00	10,400
20Q	88.00	88.02	88.00	10,400	20P	89.00	89.02	89.00	10,400
20P	90.00	90.02	90.00	10,400	20O	91.00	91.02	91.00	10,400
20O	92.00	92.02	92.00	10,400	20N	93.00	93.02	93.00	10,400
20N	94.00	94.02	94.00	10,400	20M	95.00	95.02	95.00	10,400
20M	96.00	96.02	96.00	10,400	20L	97.00	97.02	97.00	10,400
20L	98.00	98.02	98.00	10,400	20K	99.00	99.02	99.00	10,400
20K	100.00	100.02	100.00	10,400	20J	101.00	101.02	101.00	10,400
20J	102.00	102.02	102.00	10,400	20I	103.00	103.02	103.00	10,400
20I	104.00	104.02	104.00	10,400	20H	105.00	105.02	105.00	10,400
20H	106.00	106.02	106.00	10,400	20G	107.00	107.02	107.00	10,400
20G	108.00	108.02	108.00	10,400	20F	109.00	109.02	109.00	10,400
20F	110.00	110.02	110.00	10,400	20E	111.00	111.02	111.00	10,400
20E	112.00	112.02	112.00	10,400	20D	113.00	113.02	113.00	10,400
20D	114.00	114.02	114.00	10,400	20C	115.00	115.02	115.00	10,400
20C	116.00	116.02	116.00	10,400	20B	117.00	117.02	117.00	10,400
20B	118.00	118.02	118.00	10,400	20A	119.00	119.02	119.00	10,400
20A	120.00	120.02	120.00	10,400	20Z	121.00	121.02	121.00	10,400
20Z	122.00	122.02	122.00	10,400	20Y	123.00	123.02	123.00	10,400
20Y	124.00	124.02	124.00	10,400	20X	125.00	125.02	125.00	10,400
20X	126.00	126.02	126.00	10,400	20W	127.00	127.02	127.00	10,400
20W	128.00	128.02	128.00	10,400	20V	129.00	129.02	129.00	10,400
20V	130.00	130.02	130.00	10,400	20U	131.00	131.02	131.00	10,400
20U	132.00	132.02	132.00	10,400	20T	133.00	133.02	133.00	10,400
20T	134.00	134.02	134.00	10,400	20S	135.00	135.02	135.00	10,400
20S	136.00	136.02	136.00	10,400	20R	137.00	137.02	137.00	10,400
20R	138.00	138.02	138.00	10,400	20Q	139.00	139.02	139.00	10,400
20Q	140.00	140.02	140.00	10,400	20P	141.00	141.02	141.00	10,400
20P	142.00	142.02	142.00	10,400	20O	143.00	143.02	143.00	10,400
20O	144.00	144.02	144.00	10,400	20N	145.00	145.02	145.00	10,400
20N	146.00	146.02	146.00	10,400	20M	147.00	147.02	147.00	10,400
20M	148.00	148.02	148.00	10,400	20L	149.00	149.02	149.00	10,400
20L	150.00	150.02	150.00	10,400	20K	151.00	151.02	151.00	10,400
20K	152.00	152.02	152.00	10,400	20J	153.00	153.02	153.00	10,400
20J	154.00	154.02	154.00	10,400	20I	155.00	155.02	155.00	10,400
20I	156.00	156.02	156.00	10,400	20H	157.00	157.02	157.00	10,400
20H	158.00	158.02	158.00	10,400	20G	159.00	159.02	159.00	10,400
20G	160.00	160.02	160.00	10,400	20F	161.00	161.02	161.00	10,400
20F	162.00	162.02	162.00	10,400	20E	163.00	163.02	163.00	10,400
20E	164.00	164.02	164.00	10,400	20D	165.00	165.02	165.00	10,400
20D	166.00	166.02	166.00	10,400	20C	167.00	167.02	167.00	10,400
20C	168.00	168.02	168.00	10,400	20B	169.00	169.02	169.00	10,400
20B	170.00	170.02	170.00	10,400	20A	171.00	171.02	171.00	10,400
20A	172.00	172.02	172.00	10,400	20Z	173.00	173.02	173.00	10,400
20Z	174.00	174.02	174.00	10,400	20Y	175.00	175.02	175.00	10,400
20Y	176.00	176.02	176.00	10,400	20X	177.00	177.02	177.00	10,400
20X	178.00	178.02	178.00	10,400	20W	179.00	179.02	179.00	10,400
20W	180.00	180.02	180.00	10,400	20V	181.00	181.02	181.00	10,400
20V	182.00	182.02	182.00	10,400	20U	183.00	183.02	183.00	10,400
20U	184.00	184.02	184.00	10,400	20T	185.00	185.02	185.00	10,400
20T	186.00	186.02	186.00	10,400	20S	187.00	187.02	187.00	10,400
20S	188.00	188.02	188.00	10,400	20R	189.00	189.02	189.00	10,400
20R	190.00	190.02	190.00	10,400	20Q	191.00	191.02	191.00	10,400
20Q	192.00	192.02	192.00	10,400	20P	193.00	193.02	193.00	10,400
20P	194.00	194.02	194.00	10,400	20O	195.00	195.02	195.00	10,400
20O	196.00	196.02	196.00	10,400	20N	197.00	197.02	197.00	10,400
20N	198.00	198.02	198.00	10,400	20M	199.00	199.02	199.00	10,400
20M	200.00	200.02	200.00	10,400	20L	201.00	201.02	201.00	10,400
20L	202.00	202.02	202.00	10,400	20K	203.00	203.02	203.00	10,400
20K	204.00	204.02	204.00	10,400	20J	205.00	205.02	205.00	10,400
20J	206.00	206.02	206.00	10,400	20I	207.00	207.02	207.00	10,400
20I	208.00	208.02	208.00	10,400	20H	209.00	209.02	209.00	10,400
20H	210.00	210.02	210.00	10,400	20G	211.00	211.02	211.00	10,400
20G	212.00	212.02	212.00	10,400	20F	213.00	213.02	213.00	10,400
20F	214.00	214.02	214.00	10,400	20E	215.00	215.02	215.00	10,400
20E	216.00	216.02	216.00	10,400	20D	217.00	217.02	217.00	10,400
20D	218.00	218.02	218.00	10,400	20C	219.00	219.02	219.00	10,400
20C	220.00	220.02	220.00	10,400	20B	221.00	221.02	221.00	10,400
20B	222.00	222.02	222.00	10,400	20A	223.00	223.02	223.00	10,400
20A	224.00	224.02	224.00	10,400	20Z	225.00	225.02	225.00	10,400
20Z	226.00	226.02	226.00	10,400	20Y	227.00	227.02	227.00	10,400
20Y	228.00	228.02	228.00	10,400	20X	229.00	229.02	229.00	10,400
20X	230.00	230.02	230.00	10,400	20W	231.00	231.02	231.00	10,400
20W	232.00	232.02	232.00	10,400	20V	233.00	233.02	233.00	10,400</



Carlsberg Research Laboratory

MEASURING PROTEIN in LIVESTOCK & POULTRY FEED



1. Kjeldahl Crude Protein
2. Dumas Crude Protein
3. Methods using UV-visible spectroscopy
4. Direct measurement at 280nm
5. Biuret Method
6. Lowry Method
7. Dye binding methods
8. Turbimetric method
9. Instrumental Techniques
10. Measurement of Bulk Physical Properties
11. Measurement of Adsorption of Radiation
12. Measurement of Scattering of Radiation
13. Protein Separation and Characterization
14. Methods Based on Different Solubility Characteristics
15. Salting out
16. Isoelectric Precipitation
17. Solvent Fractionation
18. Denaturation of Contaminating Proteins
19. Separation due to Different Adsorption Characteristics
20. Ion Exchange Chromatography
21. Affinity Chromatography
22. Separation Due to Size Differences
23. Dialysis
24. Ultrafiltration
25. Size Exclusion Chromatography
26. Separation by Electrophoresis
27. Non-denaturing Electrophoresis
28. Denaturing Electrophoresis
29. Isoelectric Focusing Electrophoresis
30. Two Dimensional Electrophoresis
31. Amino Acid Analysis

تغذیه دقیق مرغ تخمگذار



۳. تنظیم دقیق فرمول خوراک

Feed Formulation

Ingredient	%	Nutrient	Target
Corn	58.00	ME (kcal/kg)	11,200
Soybean meal	20.00	CP (%)	16.5
Wheat	5.00	Ca (%)	3.8
Vegetable oil	2.50	Available P (%)	0.45
Premix	0.50	Lys (%)	0.90
Others	14.00	Met + Cys (%)	0.75
Total	100.00		



تبادل مواد مغذی
(مطابق با نیازها)



حداقل سازی هزینه
(با حفظ عملکرد)



اطمینان از سلامت
(بدون کمبود یا مازاد)

$$\left\{ \begin{array}{ll} \text{معادله ذرت} & 85P + 3350E + 1/5M + 2L + 2/46T = 4430 \text{ ریال} \\ \text{معادله کنجاله سويا} & 440P + 2230E + 5/7M + 25L + 15/1T = 5750 \text{ ریال} \\ \text{معادله ال ليزين هيدروکلريد} & 959P + 4600E + 0M + 790L + 0T = 30000 \text{ ریال} \\ \text{معادله دی ال متيونين} & 587P + 3680E + 990M + 0L + 0T = 86000 \text{ ریال} \\ \text{معادله ال ترئونين} & 727P + 3150E + 0M + 0L + 990T = 45000 \text{ ریال} \end{array} \right.$$

جواب حل دستگاه معادلات:

$$\begin{array}{ll} P = 3/24 \text{ ریال} & \text{ارزش یک گرم پروتئين خام} \\ E = 1/15 \text{ ریال} & \text{ارزش یک کیلوکالری انرژی قابل متابولیسم} \\ M = 80/63 \text{ ریال} & \text{ارزش یک گرم متيونين قابل هضم} \\ L = 27/28 \text{ ریال} & \text{ارزش یک گرم ليزين قابل هضم} \\ T = 39/38 \text{ ریال} & \text{ارزش یک گرم ترئونين قابل هضم} \end{array}$$

با ضرب مقادير مواد مغذی در ارزش ریالی آنها قیمت هر کیلو گندم طبق محاسبات زیر ۴۱۶۹٫۵ ریال برآورد می گردد.

$$\text{ریال } 4169/5 = (3100 \times 1/15) + (100 \times 3/24) + (2/57 \times 27/28) + (1/33 \times 80/63) + (2/62 \times 39/38)$$

Please insert the raw material prices



Raw Materials	Last Price Rial	New Price Rial
Corn	110000	530000
Soy bean meal	170000	750000
DCP	300000	2500000
Oyster Shell	7500	30000
DL- Met	910000	24000000
L-Lys	610000	11750000
L-Thr	610000	23000000

Enter

Next

Nutrients	Economic value	Scale
ME	144.0	Rial/kcal
Crude Protein	-1423.5	Rial/g
Calcium	78.9	Rial/g
Av.Phosphorus	13792.4	Rial/g
D. Lysine	16900.8	Rial/g
D. Met	24544.5	Rial/g
D. Cys	80.0	Rial/g
D. Met+Cys	80.0	Rial/g
D. Thr	23886.2	Rial/g

Amino acid standardized ileal digestibility of peak-laying hens fed diets containing corn from different sources (%).

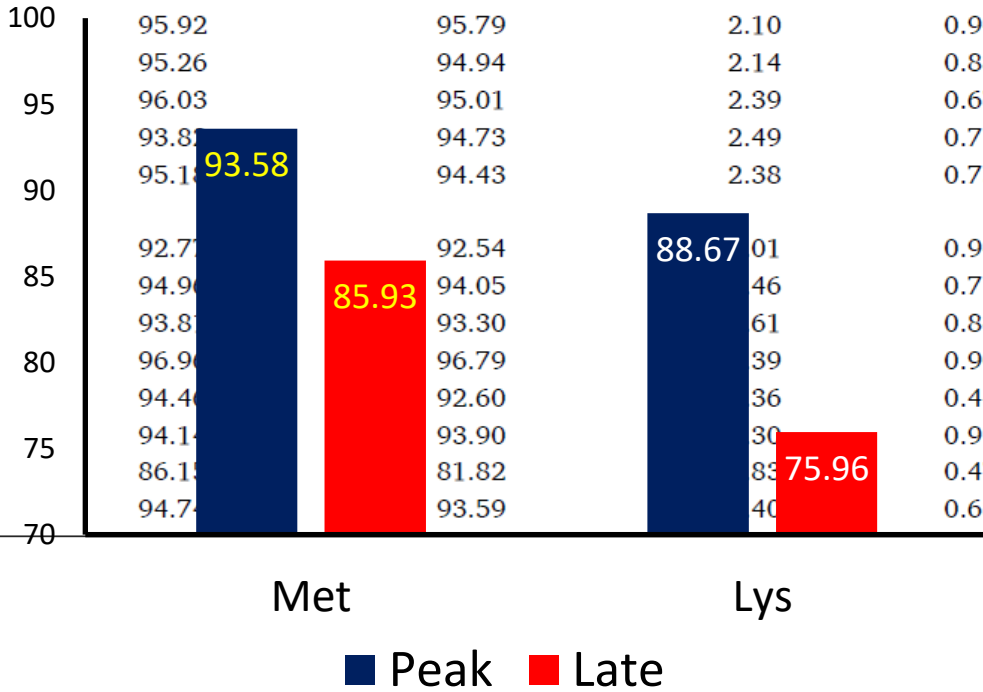
Items	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Mean	CV (%)	P-value
EAA													
Met	83.44 ^b	81.27 ^b	83.90 ^b	98.37 ^a	98.77 ^a	96.95 ^a	99.36 ^a	99.65 ^a	96.14 ^a	97.92 ^a	93.58	11.08	0.005
Lys	72.29 ^{bc}	67.30 ^c	84.81 ^{ab}	93.98 ^a	97.05 ^a	89.36 ^{ab}	97.29 ^a	99.30 ^a	87.56 ^{ab}	97.79 ^a	88.67	15.81	0.001
Thr	81.17 ^{bc}	80.87 ^{bc}	91.06 ^{ab}	95.76 ^a	95.94 ^a	90.36 ^a	98.02 ^a	94.98 ^a	75.27 ^c	96.12 ^a	89.95	11.93	0.003
Trp	64.44 ^c	83.55 ^{ab}	71.54 ^{bc}	93.98 ^a	95.16 ^a	98.61 ^a	95.96 ^a	93.01 ^a	87.46 ^{ab}	95.53 ^a	87.93	15.79	<0.001
Arg	79.31 ^c	80.44 ^{bc}	96.42 ^{ab}	97.71 ^a	99.62 ^a	95.85 ^{abc}	95.66 ^{abc}	99.04 ^a	89.26 ^{abc}	99.73 ^a	93.30	13.82	0.044
Ile	95.34	90.79	96.19	97.82	98.92	92.49	99.26	99.12	90.89	98.40	95.92	18.24	0.989
Leu	93.91	92.43	90.50	93.43	99.71	96.01	98.17	98.87	89.62	99.98	95.26	6.88	0.053
Val	89.38	85.40	97.66	97.22	99.50	98.36	99.74	99.18	93.95	99.87	96.03	12.09	0.383
His	89.07 ^{cde}	87.38 ^{de}	84.87 ^e	94.54 ^{abcde}	99.17 ^{ab}	96.37 ^{abc}	98.58 ^{ab}	99.89 ^a	91.15 ^{bcde}	97.14 ^{ab}	93.82	6.59	<0.001
Phe	93.33	87.12	91.45	98.52	99.01	95.83	98.75	98.76	89.12	99.95	95.18	8.65	0.073
NEAA													
Gly	86.42 ^{cd}	81.90 ^d	86.00 ^{cd}	97.41 ^{ab}	97.69 ^{ab}	92.87 ^{abc}	98.32 ^a	98.85 ^a	88.73 ^{bcd}	99.47 ^a	92.77	7.76	<0.001
Ser	94.33	86.65	95.18	97.23	98.85	94.55	97.34	98.47	87.92	99.11	94.96	9.30	0.177
Pro	88.69 ^{cd}	84.88 ^d	88.04 ^{cd}	96.41 ^{abc}	99.77 ^a	94.74 ^{abc}	97.45 ^{ab}	99.11 ^a	89.77 ^{ab}	99.25 ^a	93.81	6.98	<0.001
Ala	94.47	91.30	95.54	97.23	99.80	97.64	98.96	99.12	96.22	99.28	96.96	5.86	0.256
Asp	86.44 ^b	84.71 ^b	94.19 ^{ab}	96.21 ^{ab}	99.49 ^a	92.74 ^{ab}	99.63 ^a	99.98 ^a	91.56 ^{ab}	99.67 ^a	94.46	9.43	0.025
Glu	91.24 ^{abc}	85.76 ^c	91.21 ^{abc}	94.66 ^{abc}	99.41 ^{ab}	93.87 ^{abc}	97.22 ^{ab}	99.93 ^a	90.06 ^{bc}	98.05 ^{ab}	94.14	7.44	0.016
Cys	76.84 ^b	75.95 ^b	89.45 ^{ab}	94.08 ^a	99.37 ^a	98.05 ^a	99.88 ^a	98.49 ^a	89.46 ^{ab}	99.90 ^a	92.15	14.19	0.007
Tyr	92.71	89.42	91.47	93.05	99.50	91.48	99.79	99.82	90.68	99.50	94.74	10.05	0.288

Amino acid standardized ileal digestibility of late-laying hens fed diets containing corn from different sources (%).

Items	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Mean	CV (%)	P-value
EAA													
Met	78.37 ^c	88.78 ^{ab}	79.24 ^{bc}	88.05 ^{abc}	90.73 ^a	79.62 ^{bc}	92.61 ^a	88.82 ^{ab}	84.41 ^{abc}	88.71 ^{ab}	85.93	8.825	0.010
Lys	68.11	83.40	68.54	69.41	73.27	78.66	94.66	77.55	78.04	68.00	75.96	22.40	0.176
Thr	87.00	98.84	94.37	98.89	98.54	78.75	98.99	99.21	98.37	80.35	93.33	19.34	0.297
Trp	71.65 ^{cd}	78.66 ^{bcd}	69.69 ^d	69.33 ^d	78.11 ^{bcd}	66.27 ^d	90.30 ^{ab}	83.01 ^{abc}	90.63 ^{ab}	92.11 ^a	78.97	12.75	<0.001
Arg	81.21	98.62	94.25	94.53	94.40	87.65	99.17	99.24	97.59	88.09	93.48	14.67	0.346
Ile	91.10	99.05	99.40	97.26	99.95	90.64	99.33	99.65	98.62	82.86	95.79	15.32	0.524
Leu	82.51	99.54	96.09	97.47	96.60	90.03	99.99	98.84	97.88	90.49	94.94	13.13	0.317
Val	85.42	99.25	96.24	98.39	97.98	87.92	99.28	99.07	99.26	87.33	95.01	14.64	0.443
His	82.94	99.88	96.79	97.43	95.61	88.44	99.97	99.50	97.32	89.42	94.73	13.51	0.298
Phe	83.18	99.86	95.36	97.60	97.22	88.07	99.34	98.76	97.53	87.33	94.42	13.63	0.2707
Gly	83.25	99.49	92.58	96.27	96.40	83.67	99.20	96.62	96.29	81.64	92.54	16.00	0.248
NEAA													
Ser	83.78	99.32	94.02	96.29	96.46	84.93	99.99	99.80	98.92	86.98	94.05	15.20	0.313
Pro	79.80	98.35	94.98	93.90	94.09	85.69	99.60	96.89	97.84	91.90	93.30	12.82	0.140
Ala	96.52	99.69	96.47	98.41	97.69	91.36	99.99	99.57	98.34	89.81	96.78	6.911	0.127
Asp	91.72	97.62	90.29	92.99	92.98	83.34	99.90	95.27	95.08	86.85	92.60	11.97	0.330
Glu	81.60	98.54	94.77	96.19	95.68	88.98	99.71	97.26	97.19	89.03	93.89	13.49	0.323
Cys	80.82 ^{abc}	88.22 ^{ab}	75.13 ^{cd}	83.34 ^{abc}	88.49 ^{Aab}	67.48 ^d	91.15 ^a	86.95 ^{abc}	79.26 ^{abc}	77.32 ^{bcd}	81.82	11.12	<0.001
Tyr	82.18	99.18	94.74	96.42	96.32	86.47	99.83	97.73	96.70	86.36	93.59	13.87	0.225

Comparative analysis of ileal digestibility of amino acids of corn in laying hens under different physiological stage (%).

Items	Peak phase Apparent ileal digestibility	Late phase	SEM	P-Value	Peak phase Standard ileal digestibility	Late phase	SEM	P-Value
EAA								
Met	58.53	79.16	4.14	<0.001	93.58	85.93	2.88	0.016
Lys	49.96	47.57	5.38	0.663	88.67	75.96	4.42	0.010
Thr	48.92	55.95	5.09	0.190	89.96	93.33	3.62	0.363
Trp	52.04	76.27	5.40	<0.001	87.92	78.98	4.76	0.076
Arg	71.73	76.43	4.10	0.274	90.90	93.48	3.69	0.495
Ile	61.18	66.28	4.82	0.307	95.92	95.79	2.10	0.949
Leu	76.00	81.45	3.82	0.181	95.26	94.94	2.14	0.883
Val	65.68	73.27	4.63	0.129	96.03	95.01	2.39	0.677
His	72.24	79.86	4.80	0.142	93.81	94.73	2.49	0.718
Phe	69.63	75.49	4.15	0.182	95.18	94.43	2.38	0.754
NEAA								
Gly	56.73	66.14	5.32	0.101	92.71	92.54	0.01	0.941
Ser	61.81	68.84	4.69	0.157	94.96	94.05	0.46	0.714
Pro	72.89	78.06	3.63	0.179	93.81	93.30	0.61	0.848
Ala	73.50	81.80	4.72	0.108	96.96	96.79	0.39	0.903
Asp	57.89	64.10	5.22	0.255	94.44	92.60	0.36	0.441
Glu	76.55	81.18	3.32	0.189	94.14	93.90	0.30	0.916
Cys	45.26	66.50	4.79	0.001	86.13	81.82	0.83	0.472
Tyr	67.96	75.34	4.62	0.136	94.74	93.59	0.40	0.637



Prediction equations of standardized ileal digestibility of amino acids based on the conventional chemical components of corn sources for peak-laying hens.

Items	SID Prediction equations	R ²	P-value
Met	$-515.03 + 0.60\text{Gln} - 918.42\text{Ca} + 3.26\text{TS} + 0.57\text{BD}$	0.843	0.030

Prediction equations of standardized ileal digestibility of amino acids based on the conventional chemical components of corn sources for late-laying hens.

Items	SID Prediction equations	R ²	P-value
Met	$-397.88 + 18.90\text{EE} + 15.34\text{GE} + 1.20\text{TS} + 0.10\text{BD}$	0.979	<0.001
Lys	$434.07 - 5.12\text{DM} + 31.05\text{EE} - 6.07\text{Gln} + 8.17\text{Glo}$	0.936	0.004
Trp	$-699.72 + 7.68\text{CP} - 783.32\text{Ca} + 5.81\text{TS} + 0.54\text{BD}$	0.827	0.038
Arg	$-38.34 - 15.09\text{CF} + 3.16\text{TS} - 10.49\text{Alb} + 10.12\text{Glo}$	0.974	<0.001
Leu	$30.19 + 25.86\text{EE} - 3.93\text{Alb} + 3.04\text{Glo}$	0.704	0.050
Val	$-188.08 + 29.12\text{EE} + 19.79\text{GE} - 0.23\text{BD}$	0.684	0.060
His	$-208.83 + 32.36\text{EE} + 20.24\text{GE} - 0.23\text{BD}$	0.781	0.021
Phe	$-224.09 + 32.14\text{EE} + 20.84\text{GE} - 0.22\text{BD}$	0.718	0.044

تغذیه دقیق
مرغ تخمگذار



۴. فناوری و ساخت خوراک



فرآیندهای تولید

(آسیاب، اختلاط، پلت و ...)



کنترل کیفیت

(GMP و HACCP)



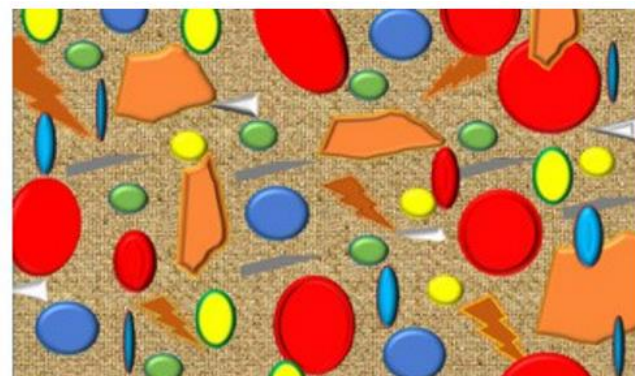
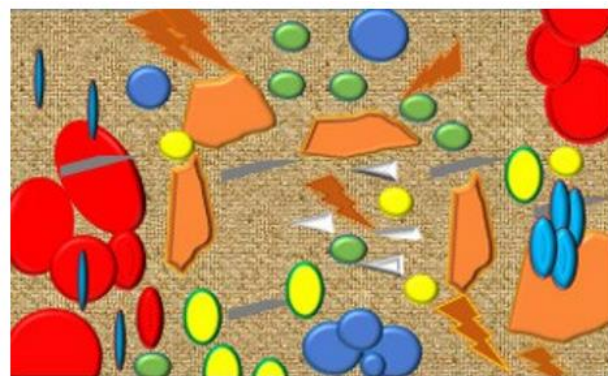
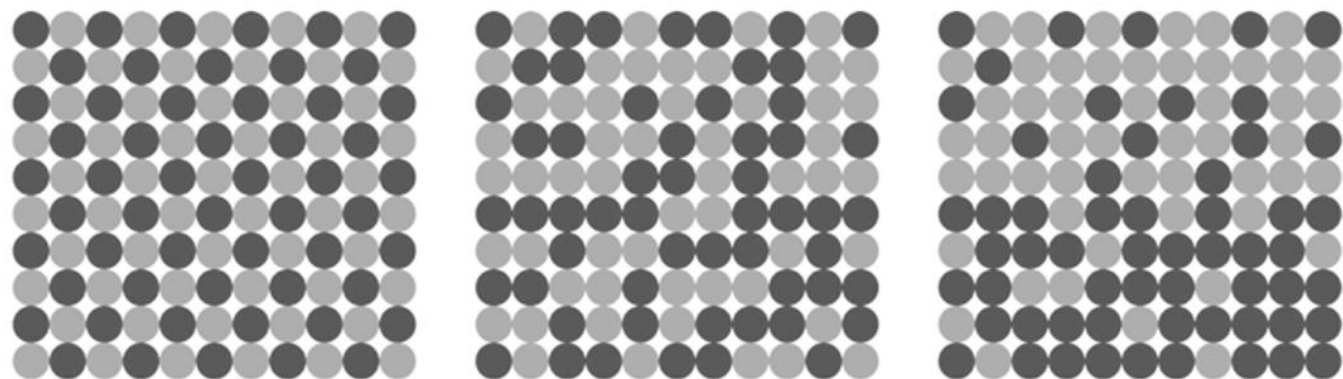
حفظ پایداری مواد مغذی

(از تولید تا مصرف)



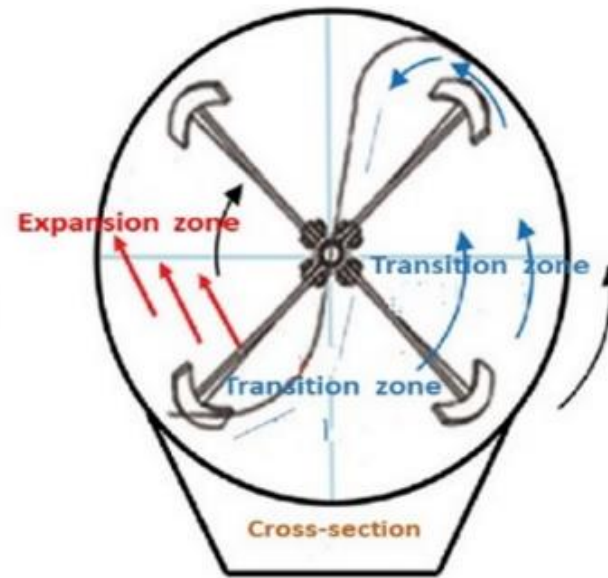
بسته‌بندی و نگهداری

(حفظ کیفیت و اطمینان)





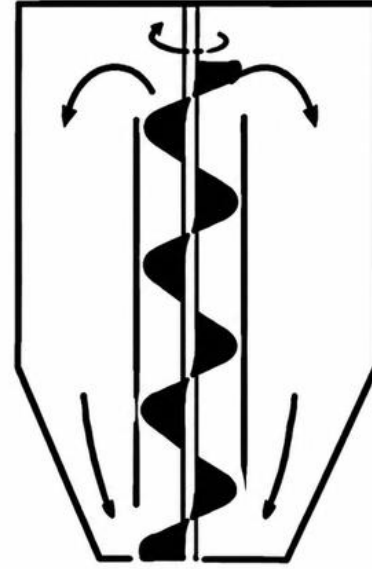
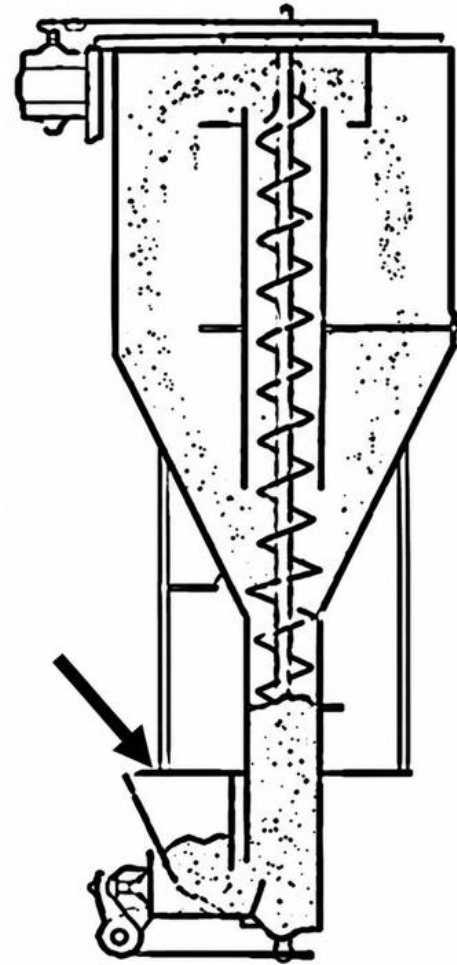
Diffusion

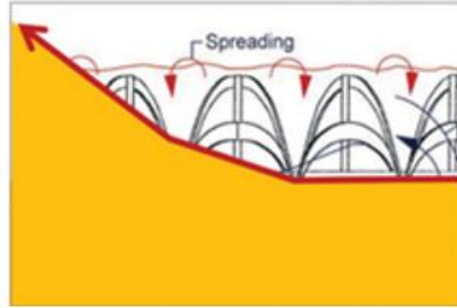


Convection

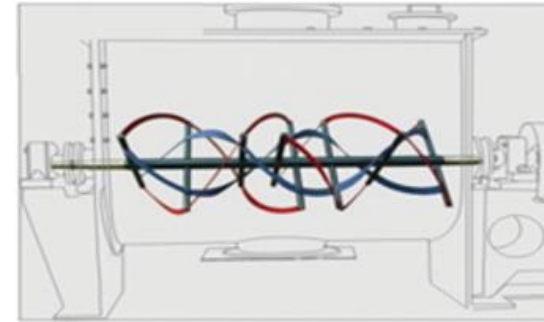


Shear

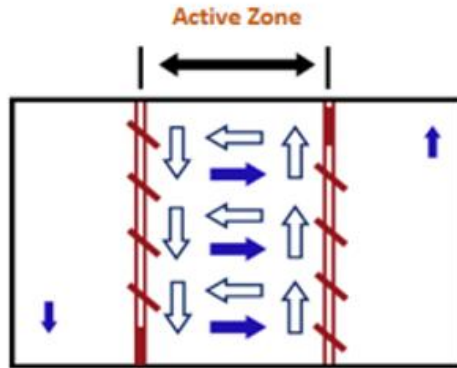




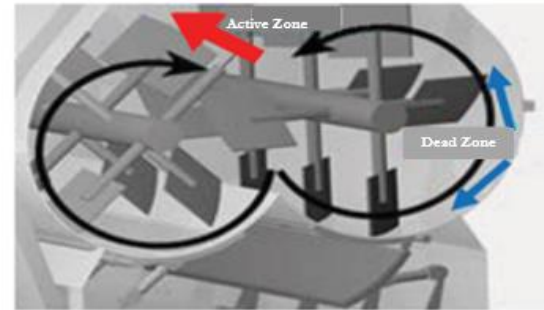
Ribbon mixer (conventional)



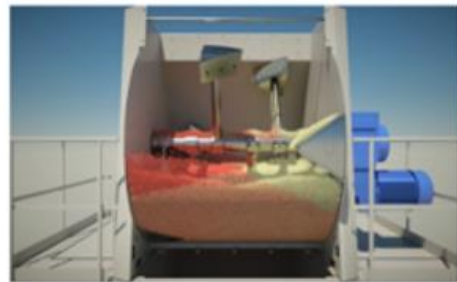
Ribbon mixer (modified)



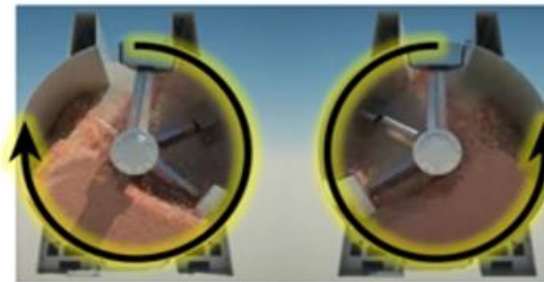
Twin-shaft paddle mixer (conventional)



Twin-shaft paddle mixer (modified)

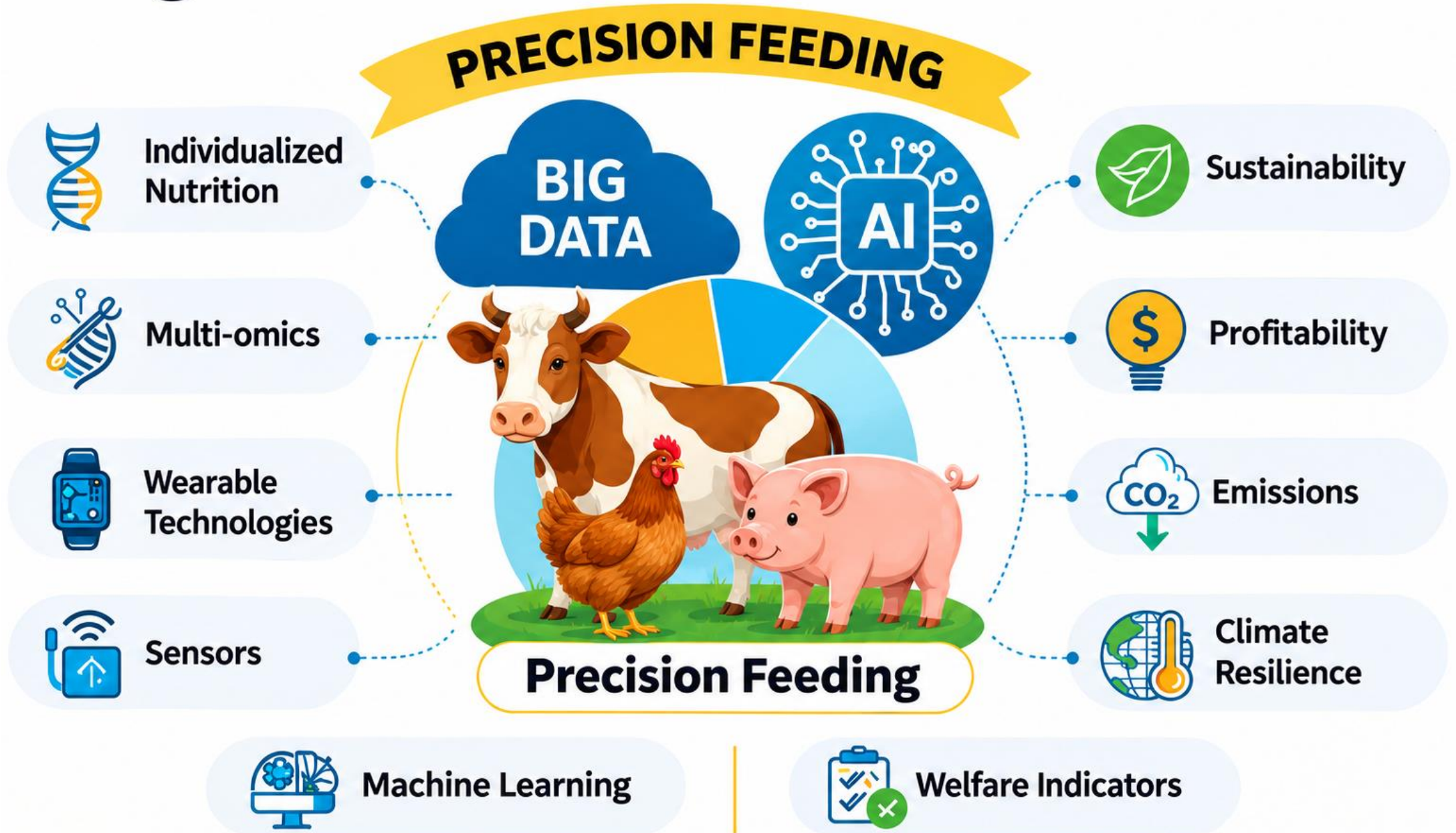


Single-shaft triangular-paddle
(three-dimensional paddle)



Single-shaft triangular-paddle
(counter-rotating)

Big Data and AI in Animal Nutrition





آیا مرغداری ما می‌تواند همان سطح
از کنترل، دقت، یکنواختی، آزمایش
و ردیابی را که یک کارخانه خوراک
مجهرز باید داشته باشد، به‌طور
مستمر اجرا کند؟

Selected References

- Sakomura, N.K., et al. Modeling poultry growth and requirement for energy and essential amino acids. Poultry Science. 2026
- Cui, X., et al. Effects of dietary metabolizable energy, crude protein and lysine levels on production performance and egg quality of Jingfen laying hens based on response surface methodology. Poultry Science. 2026
- Determination and stage-specific prediction models for standardized ileal amino acid digestibility of corn in peak- and late-laying hens. Poultry Science. 2026
- Comparison of apparent and standardized ileal digestibility of amino acids in corn-soybean meal-based diets for laying hens at different ages. Poultry Science. 2026
- Validating energy systems for the formulation of laying hen diets. Applied research note. Poultry Science. 2026
- Split feeding for laying hens: A step beyond precision nutrition. Poultry Science. 2025
- Optimization of split feeding strategy for laying hens through a response surface model. Poultry Science. 2025
- Feeding a persistent laying hen from day 0 until 110 weeks of age: Performance impact. Poultry Science. 2026
- Big data and artificial intelligence in animal nutrition: A new era of precision feeding. Tropical Animal Health. 2026
- Lactobacillus plantarum improves gut microbiota, metabolism, and performance in laying hens. Poultry Science. 2026



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7 October
2026