

Nutritive value of commonly used feed ingredients in poultry feeds

Ingredient	ME	Crude	Crude	Sand	Lysine	Methionine	Linoleic
	kcal/kg	Protein	Fibre	Silica	Dig	Digest	acid
Maize	3300	9	2	1	0.22	0.16	1
Jowar	3000	10	4	1	0.16	0.15	1.1
Bajra	2640	12.7	2.2	1			
Rice (broken)	2600	7.9	1.4	2	0.21	0.17	0.6
Wheat	3100	14	2.5	1	0.31	0.18	2
Ragi	2950	12.6	2.8	0.5	0.24	0.2	--
Rice Polish	2700	12.7	5	2.5	0.4	0.18	4.4
Molasses	2000	3	--	--	--	--	--

Indian Standard - POULTRY FEEDS — SPECIFICATIONS - (Fifth Revision - 2021)

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	kcal/kg	Protein	Fibre	Silica	Dig.	Dig.	
Soy Meal	2250	44	6.5	2.5	2.48	0.59	0.4
De oiled Groundnut meal	2400	44	10	2.5	1.07	0.37	0.19
Rapeseed Extractions	1900	36	11.5	2	1.61	0.65	0
Sunflower Extractions	1540	28	24	2	0.86	0.62	0.5
Full fat Soybean	3300	38	5	2	1.9	0.4	7.7
Maize Gluten- 42	3150	42	4	1.5	0.63	0.85	--

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Ingredient	ME	Crude	Crude	Sand	Lysine	Methionine	Linoleic acid
	kcal/kg	Protein	Fibre	Silica	Dig	Digest	
Fishmeal	2180	45	1	5	2.8	0.7	--
Meat & Bonemeal	1848	45	2.1	--	2.12	0.59	0.3
Rice bran – Deoiled	1800	16	14	5	0.48	0.23	--
Wheat Bran	1400	14.5	11	2	2.12	0.19	1.7

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Improved native chicken



Nutrient requirements (as fed basis) of improved native birds and their crosses

	Frizzle or Naked Neck X CARI-Red (HitCARI and UpCARI)				Aseel or Kadaknath			
	0-4	4-12	12-20	Laying	0-4	4-12	12-20	Laying
Age, weeks				g				
CP (%)	20	16	12	16	18	18	14	16
ME (kcal/kg)	2,600	2,600	2,600	2,600	2,700	2,700	2,500	2,600
Lysine (%)	0.92	0.75	0.56	0.85	0.85	0.85	0.65	0.85
Methionine (%)	0.42	0.34	0.26	0.31	0.38	0.38	0.30	0.31
Threonine (%)	0.75	0.63	0.47	0.63	0.70	0.70	0.55	0.63
Calcium (%)	1.0	0.90	0.80	3.20	1.0	0.90	0.80	3.00
Available Phosphorus (%)	0.40	0.35	0.32	0.30	0.40	0.35	0.32	0.30

Nutrient requirements (as fed basis) of Japanese quails

Nutrients	Growing		Breeder/layer (5-30wk)	
	0-3 wk	3-5wk	Meat line	Egg line
ME (kcal/kg)	2,900	2,950	2,950	2,850
Protein (%)	25.0	21.5	20.0	18.6
Lysine (%)	1.45	1.20	1.10	1.00
Methionine (%)	0.55	0.50	0.45	0.40
Methionine + Cysteine (%)	0.90	0.80	0.80	0.70
Arginine (%)	1.80	1.50	1.25	1.15
Threonine (%)	1.12	0.92	0.80	0.70
Linoleic acid (%)	1.00	1.00	1.00	0.90
Calcium (%)	0.85	0.85	3.00	3.00
Non phytate P (%)	0.45	0.35	0.35	0.32
Choline (mg)	2000	1500	1500	1350

ICAR, 2013 Nutrient Requirements of Poultry

Nutrient requirements (as fed basis) of ducks

Nutrients	Starter	Grower	Rearer	Layer
Age, weeks	0-8	8-16	16-20	>20
Protein (%)	20.5	16.5	15	16.5
ME (kcal/kg)	2,800	2,650	2,500	2,650
Linoleic acid (%)	1.0	1.0	0.8	1.0
Lysine (%)	1.0	0.75	0.60	0.75
Methionine (%)	0.45	0.35	0.30	0.3
Methionine + Cysteine (%)	0.85	0.65	0.60	0.75
Calcium (%)	1	1		3
Available Phosphorus (%)	0.42	0.35	0.35	0.35
Choline (mg/kg)	1,000	750	500	750

ICAR, 2013 Nutrient Requirements of Poultry

Nutrient requirements (as fed basis) of turkey

Nutrients	0-6 wk	6-12 wk	12-18 wk	18 wk, pre-laying	Breeder
ME (kcal/kg)	2,800	2,800	2,650	2,600	2,650
CP (%)	24.0	22.0	18.0	15.0	15.0
Arginine (%)	1.5	1.4	0.90	0.65	0.6
Lysine (%)	1.5	1.2	1.05	0.72	0.6
Methionine (%)	0.55	0.45	0.35	0.25	0.2
Threonine (%)	0.95	0.85	0.70	0.55	0.45
Linoleic acid (%)	1.0	1.0	0.80	0.8	1.10
Calcium (%)	1.2	1.0	0.80	0.6	2.25
Phosphorus (%)	0.55	0.5	0.38	0.3	0.35
Niacin (mg/kg)	60.0	60.0	45	40	40.0
Pantothenic (mg/kg)	10.0	9.0	9	9	16
Choline (mg/kg)	1,600	1,400	1,050	875	1,000

ICAR, 2013 Nutrient Requirements of Poultry

Feed formulation

Feed formulation is a mathematical calculation to prepare a balanced ration

Feeding standards

- ▶ ARC and NRC standards
- ▶ ICAR – Indian Council of Agricultural Research
- ▶ BIS – Bureau of Indian Standards
- ▶ Breeder specifications



Important nutrients

Metabolizable energy, protein and amino acids (lysine, methionine, methionine + cysteine, threonine, arginine, phenylalanine), calcium, available P, electrolyte balance (sodium, potassium, chlorine), zinc, manganese, iron, copper, selenium, vitamin A, vitamin D3, vitamin E, riboflavin, biotin and other water soluble vitamins.

Feed formulation

- ▶ Requirement of nutrients
- ▶ Feed composition values:
- ▶ Maximum level of inclusion of feed ingredients
- ▶ Availability and cost of feed ingredients
- ▶ Feed formulation software – Least cost ration
- ▶ Linear programming

Non-linear adjustment (NLA) model accounts for non-linear effects when optimizing formulas

Stochastic Programming has been widely recommended for feed formulation



Feed Processing – Batching and grinding

Batching – As per the feed formula

Semi automatic vs fully automatic

Use – load cell for accurate weighing

**Use ingredients – good quality, check for moisture
– use old and new arrivals**



Grinding

Particle size reduction - Hammer / roller mill vs pulverizer

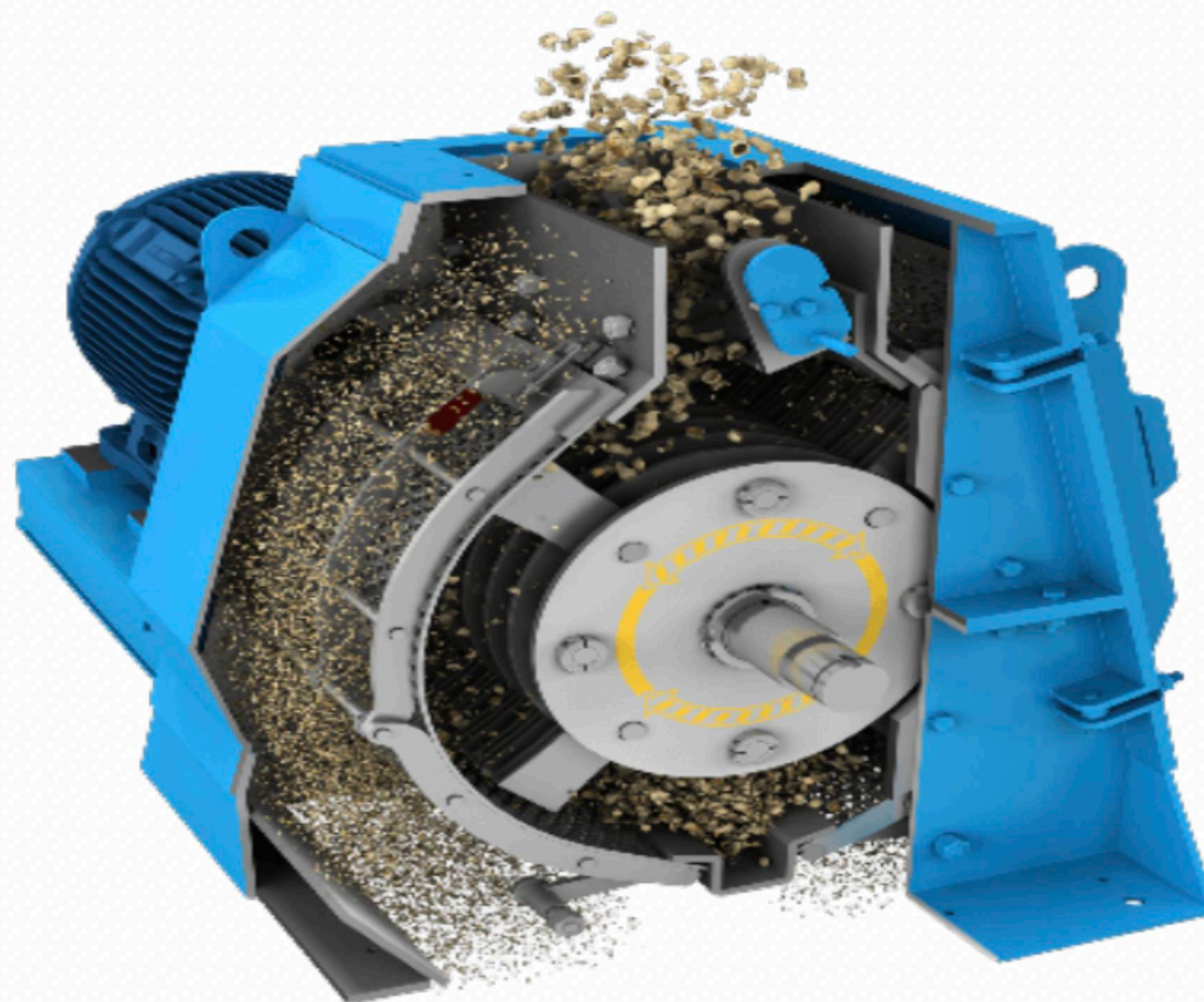
Particle size recommended

- ▶ **Chicks – 300 – 500 micron**
- ▶ **Growers – 500 – 800 microns**
- ▶ **Adults – 800 – 1200 microns**

Feed Processing – Batching and grinding

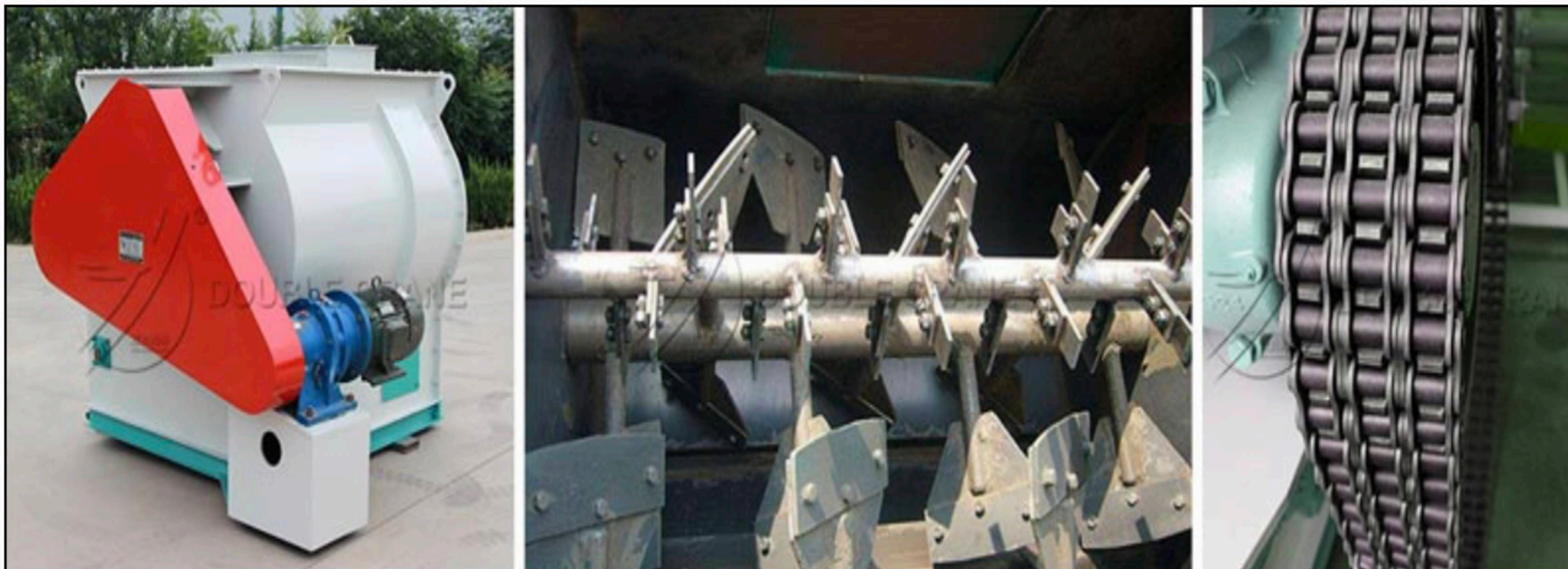
Grinding efficiency

- ▶ Moisture content of raw materials
- ▶ Fibre level, Tip speed – 4000 rpm
beater size, screen mesh size, open area in screen, loading rate.
- ▶ Particle size uniformity is important





Feed Processing – Mixing



**Types of mixers – Cone blender, Vertical, Horizontal
– Ribbon, paddle – Twin shaft**

Mixing time – 2-4 minutes Depends on Shaft speed and CV Value

Batch size – Mixer volume and bulk density

Mixer sequencing – major ingredients - supplements and additives – liquids

Feed Processing – Pelleting

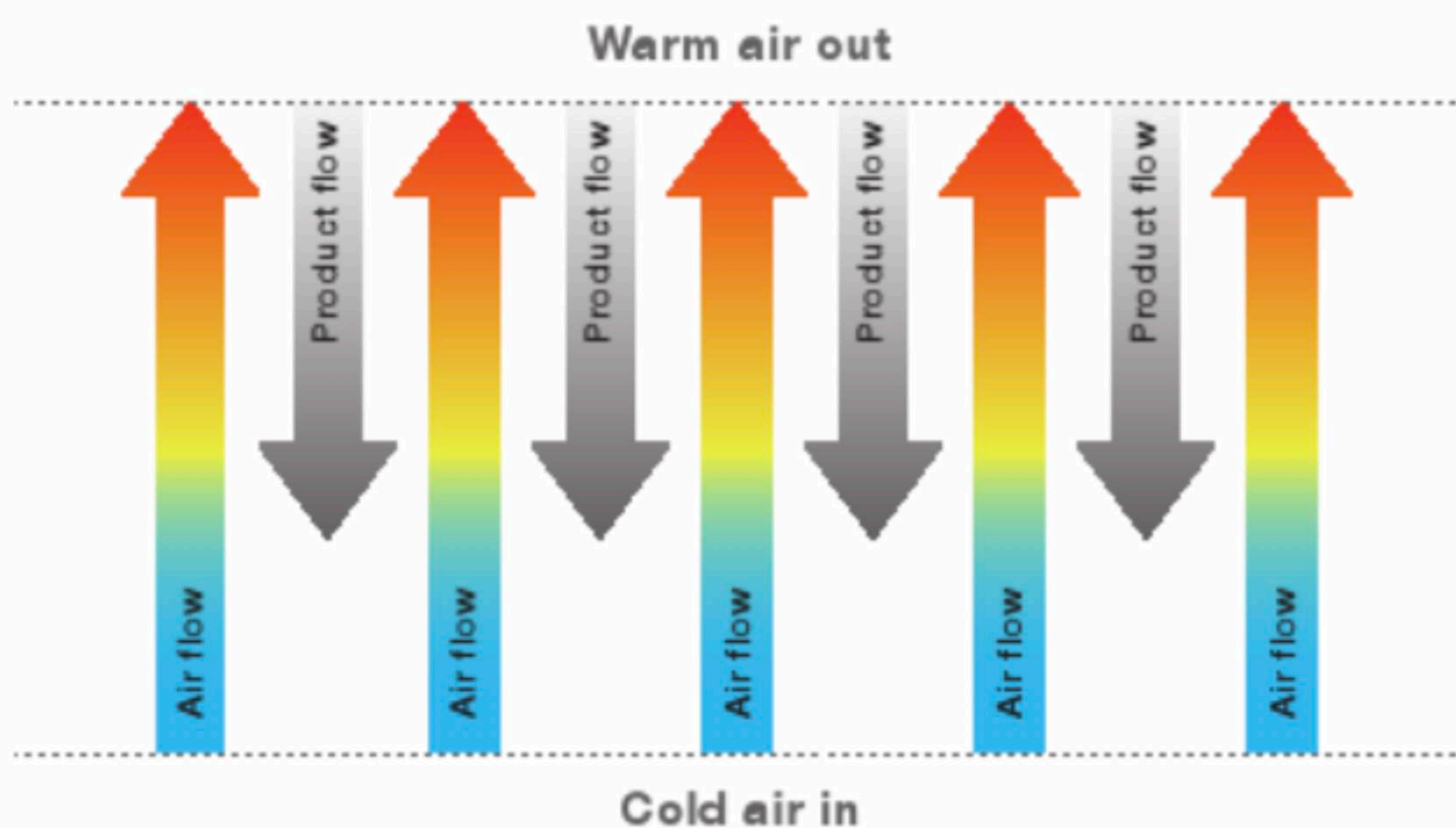
- ▶ Pelleting temperature – Conditioning
– 75 – 85 degree celcius
Duration – 60 – 120 sec.
- ▶ In case of layers – Avoid excess temperature
– Recommended 65 – 75 deg. C
- ▶ Moisture – 80 dry stream + 20 % water droplet
- ▶ Feed moisture – 16 % Steam pressure :
1.0 – 2.5 bars
- ▶ Pellet binders : molasses, rice polish,
starch etc.





Feed Processing – Cooling and packing

- ▶ To reduce the temperature
From 70 deg. C to 35 deg. C or below
- ▶ To reduce the moisture from
16 % to 12 % or below
- ▶ Counter flow air coolers



Feed processing - Crumbles



Mash



Crumble



Pellet

LEAST COST FEED FORMULATION

How to use it

1. In the menu at the top in the Tools you should have solver it will not be installed normally, you have to specifically install it
2. In the LM sheet from row 43 you will have the data, fill in the values for Cost to available phosphorus.
3. The amino acids are on pro rata basis it changes as you change the protein %
4. Fill in the column C and D the maximum and minimum levels
5. Fill in the additives in column K
6. Fill in the Overheads and Contingencies in columns S & Z
7. Fill in the Cells From G2 to H14, except for ME in G3 and H3, in the sheet LM and LM2 in the layer mash the ME is calculated fill in cells from F22 to f26
8. Place the cursor in the cell F15 and go to the tools click the solver and click solve
9. From B2 to B41 it will alter the contents to achieve the formulation
10. Then round up the decimals.



Nutrient specifications and ration formulation for chicken





Thank you