REPUBLIC OF KENYA

KALRO
Kenya Agricultural & Livestock Research Organization

NAVCDP
NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT

MIXING HIGH-QUALITY, AFFORDABLE FEED RATIONS FOR IMPROVED INDIGENOUS CHICKEN

Feed mixing using hands and spades

Introduction

Feed mixing is putting together feed ingredients to make a uniform nutritionally-balanced ration for the livestock type and age-category under consideration. The proportions of ingredients may be determined using the "spreadsheet method". This formulation technique involves continuously adjusting the ratios of the ingredients until one achieves a mix that meets or exceeds the nutrient requirements of the target animal. The unit cost of each formulation is also calculated automatically. Tables 1 and 2 show the proportions of ingredients used to mix 100 kg of affordable feed rations for growing and laying improved Indigenous chicken, respectively. Feed mixing can be done using four different methods depending on resources available. The methods are; use of hands, spades, manual drum feed mixers or motorized feed mixers.

Before Mixing:

- Decide on the type and quantity of ration to mix.
- Acquire the required ingredients, based on proportions in Tables 1 and 2, from reputable sources and at the lowest cost.

- Grind the ingredients according to the recommended particle sizes using appropriate sieves.
- Assemble the feed ingredients at the point of mixing.

To ensure good quality ingredients, the farmer must;

- Not use feed ingredients whose expiry date has passed or is not known.
- Inspect the feed ingredients for any foreign material (for example, metal filings in sunflower seed cake meal), damage by insects, moulds, loss of natural colour and any other abnormalities.
- Smell ingredients to detect any rotten or unusual odour.
- Feel feed ingredients for caking, dampness, bad texture, hardness, warmth and any other abnormalities.
- Collect a sample (at least 100 grams) of each feed ingredient: ground maize, wheat bran, maize germ, sunflower seed cake meal, soya bean meal and fish meal. Place each sample in separate clean khaki bags (refer to Figure 1) and label them appropriately, including the name of the farmer, contact details, sample type and date of sampling. Deliver all the samples for quality analysis to a reputable animal nutrition laboratory as soon as possible.

Major Steps during Mixing

1. Weigh the feed ingredients depending on the ration type and amount to be prepared (Tables 1 & 2 and Figure 2).
2. Pour the 'bulky' quantity ingredients (see Tables 1 and 2) on a clean canvas/polythene sheet. Alternatively, pour the ingredients into a manual or motorized feed mixer.
3. Mix thoroughly using hands, spades or manual/motorized feed mixer to make a uniform mixture of the 'bulky' quantity ingredients.
4. Mix the 'small' quantity ingredients (lysine, methionine, toxin binder, dicalcium phosphate (DCP), layer premix and iodized salt) in an open container (Figure 3).
5. Add and spread the 'small' quantity ingredients mixture evenly to the 'bulky' quantity ingredients mixture and mix thoroughly to make the final ration.
6. Take a sample (at least 100 grams) of the mixed ration (refer to Figure 4), place it in a clean khaki bag and label it appropriately, including the name of the farmer, contact details, sample type,

and date of sampling. Deliver the sample for quality analysis to a reputable animal nutrition laboratory at the soonest possible time. Tables 3 and 4 present the expected chemical composition of the feed rations for growing and laying birds, respectively, compared to standards set by Kenya Bureau of Standards (KEBS)

7. Pack the mixed ration in well labelled storage bags.
8. Record date of feed mixing since the mixed ration should be used within 6 months under ideal storage conditions.

Table 1. Proportions of ingredients used to mix affordable rations for growing improved indigenous chicken

Ingredients*	Feed Rations for Growers birds (8-19 weeks of age)				
	Maize-based	Maize/ Maize germ-based	Sorghum-based	Sorghum/ Maize germ-based	Maize/ Sorghum-based
1. Maize	70.0	50.0	6.0	0.0	35.0
2. White sorghum	0.0	0.0	60.0	50.0	30.0
3. Wheat bran	0.0	1.0	4.0	1.0	5.0
4. Maize germ	0.0	20.0	0.0	20.0	0.0
5. Sunflower seed cake	3.0	2.0	3.0	2.0	3.0
6. Soya bean meal	15.0	15.0	15.0	15.0	15.0
7. Shrimp meal (Ochong'a)	5.0	5.0	5.0	5.0	5.0
8. Limestone	5.0	5.0	5.0	5.0	5.0
9. Dicalcium phosphate	1.0	1.0	1.0	1.0	1.0
10. Iodised salt	0.35	0.35	0.35	0.35	0.35
11. Vitamin/ Mineral premix (for Growers)	0.25	0.25	0.25	0.25	0.25
12. DL-Methionine	0.05	0.05	0.05	0.05	0.05
13. L-Lysine HCL	0.10	0.10	0.10	0.10	0.10
14. Coccidiostat	0.006	0.006	0.006	0.006	0.006
15. Toxin binder	0.244	0.244	0.244	0.244	0.244
Ration Total Quantity (Kg)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

*1-8 "Bulky" quantity; 9-15 "Small" quantity

Table 2. Proportions of ingredients used to mix affordable rations for laying improved indigenous chicken

Ingredients*	Feed Rations for Layers (19-68 weeks)				
	Maize-based	Maize/ Maize germ-based	Sorghum-based	Sorghum/ Maize germ-based	Maize/ Sorghum-based
1. Maize	59.0	39.0	0.0	0.0	29.0
2. White sorghum	0.0	0.0	50.0	39.0	25.0
3. Wheat bran	0.0	5.0	9.0	5.0	5.0
4. Maize germ	0.0	20.0	0.0	20.0	0.0
5. Sunflower seed cake	5.0	5.0	5.0	5.0	5.0
6. Soya bean meal	20.0	15.0	20.0	15.0	20.0
7. Shrimp meal (Ochong'a)	5.0	5.0	5.0	5.0	5.0
8. Limestone	9.0	9.0	9.0	9.0	9.0
9. Dicalcium phosphate	1.0	1.0	1.0	1.0	1.0
10. Iodised salt	0.35	0.35	0.35	0.35	0.35
11. Vitamin/ Mineral premix (for Layers)	0.25	0.25	0.25	0.25	0.25
12. DL-Methionine	0.05	0.05	0.05	0.05	0.05
13. L-Lysine HCL	0.10	0.10	0.10	0.10	0.10
14. Toxin binder	0.25	0.25	0.25	0.25	0.25
Ration Total Quantity (Kg)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

*1-8 "Bulky" quantity; 9-14 "Small" quantity

Table 3. Chemical composition of Rations for Growers compared to standards set by KEBS

Grower Ration	Metabolizable Energy (Kcal/ kg)	Crude Protein (%)	Calcium (%)	Available Phosphorous (%)	Crude Fibre (%)	Lysine (%)	Methionine (%)
Maize-based	3,005.39	15.11	2.21	0.46	4.14	0.91	0.36
Maize/Maize germ-based	2,904.94	16.39	2.21	0.53	4.56	0.98	0.38
Sorghum-based	2,880.72	17.58	2.20	0.45	4.12	0.92	0.32
Sorghum/Maize germ-based	2,854.44	18.19	2.20	0.50	4.28	0.98	0.34
Maize/Sorghum-based	2,895.00	16.57	2.21	0.47	4.37	0.93	0.34
Growers Mash Standard (KEBS 2014)	**2,679.00 (min)**	**13.0-14.0 (min)**	**1.3-3.0 (min)**	**0.45 (min)**	**6.00 (max)**	**0.60 (min)**	**0.28 (min)**

Table 4. Chemical composition of Rations for Layers birds compared to standards set by KEBS

Layer Ration	Metabolizable Energy (Kcal/ kg)	Crude Protein (%)	Calcium (%)	Available Phosphorous (%)	Crude Fibre (%)	Lysine (%)	Methionine (%)
Maize-based	2,804.68	17.24	3.58	0.46	4.63	1.04	0.39
Maize/Maize germ-based	2,670.92	17.42	3.58	0.54	5.43	1.00	0.38
Sorghum-based	2,610.01	19.73	3.58	0.47	5.06	1.07	0.35
Sorghum/Maize germ-based	2,631.53	18.83	3.57	0.52	5.21	1.00	0.36
Maize/Sorghum-based	2,699.34	18.52	3.58	0.47	4.88	1.05	0.37
Layers Mash Standard (KEBS 2014)	**2,600.00 (min)**	**15.0 (min)**	**3.5-4.5 (min)**	**0.40 (min)**	**7.50 (min)**	**0.69 (min)**	**0.30 (min)**

Figure 1. Taking sunflower seed cake meal sample for laboratory analysis

Figure 2. Weighing ingredients

Figure 3. Mixing the ‘small’ quantity ingredients in an open container

Figure 4. Taking a sample of the mixed ration for laboratory analysis

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