Introduction

This document contains the nutritional recommendations for Ross® broilers fed all plant protein-based diets and is intended to be used in conjunction with the Ross Broiler Management Handbook.

The nutrient specifications included in this document aim to support the achievement of optimal biological performance in varying environments and market scenarios globally. Specific adjustments may be required depending on a range of factors, principally:

- Final product – live bird or portioned products – and meat product values.
- The supply and price of feed ingredients.
- Age and live weight at processing.
- Yield and carcass quality.
- Market requirements for skin color, shelf-life, etc.
- Use of sex-separate growing.

Smaller dietary transitional changes between feeding phases were maintained to promote enteric health by avoiding abrupt dietary changes. The most appropriate diets must be designed case-by-case to either minimize costs for live bird production or maximize margins over feed cost (MOFC) for portioned products. Optimizing the MOFC for portioned products, in most instances, can require an increased dietary amino acid density.

The energy values used in these specifications are based on assays for Metabolizable Energy published by the World’s Poultry Science Association.

The digestible amino acid specifications were calculated according to the optimally balanced protein profile in Appendix 1. These values are based on Standardized Ileal Digestibility (SID) assays due to their accuracy in predicting performance outcomes in broiler diets formulated with a wide variety of raw materials. In addition, formulating on a digestible amino acid bases avoids potential amino acid imbalances, improves nitrogen retention and reduces nitrogen excretion into the environment. Although substantial information supports higher digestible arginine to digestible lysine ratios, these ratios have been adjusted to avoid an additional increase in dietary protein when formulating to achieve higher digestible arginine levels.

Total calcium and available phosphorus specifications were determined with corn/wheat-soybean-based diets to optimize both live performance and welfare characteristics. Limestone and monocalcium phosphate were the only supplemental sources of calcium and phosphorus used. As a reference, slow/intermediate soluble limestone (300-350 microns geometric mean diameter [GMD]) has been adopted in Aviagen® trials, providing 55-60% of solubility at 5 minutes according to published methods.

Available phosphorus specifications are based on the classical availability system whereby a reference inorganic phosphorus source is described as 100% available, and plant sources are described as 33% available.

When using limestone sources with different solubilities, alternative raw materials, different phosphates, or enzymes, changes in the calcium and available phosphorus contributions are expected. Therefore, requiring the development of accurate matrices for such nutrients.

For further information regarding these recommendations or more specialized situations and advice on local markets, please contact your Aviagen Nutritionist or any Aviagen representative.
To achieve the listed amino acid levels, adopting the use of either feed-grade amino acids or more complex diets may be necessary.

Formulation should focus on achieving an adequate amino acid profile. These crude protein levels are not a requirement per se but instead are levels that can likely be achieved in corn/wheat and soybean meal-based diets and ensure a functional pool of non-essential amino acids.

NOTES: These feed specifications should be used as a guide only. Adjustments may be necessary for local conditions, legislation and markets. A withdrawal feed should be fed to meet local requirements for medication withdrawal times and can be formulated to the same standards as the final feed listed above.

Table 1: Nutrient Specifications for As-Hatched Broilers - Target Live Weight 1.70-3.50 kg (3.75-7.70 lb).

<table>
<thead>
<tr>
<th>Age Fed</th>
<th>Starter</th>
<th>Grower 1</th>
<th>Grower 2</th>
<th>Finisher 1</th>
<th>Finisher 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>0-10</td>
<td>11-20</td>
<td>21-30</td>
<td>31-40</td>
<td>41-market</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy per kg</th>
<th>kcal</th>
<th>MJ</th>
<th>kcal</th>
<th>MJ</th>
<th>kcal</th>
<th>MJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy</td>
<td>2975</td>
<td>12.4</td>
<td>3050</td>
<td>12.8</td>
<td>3075</td>
<td>12.9</td>
</tr>
<tr>
<td>crude protein</td>
<td>1349</td>
<td>0.96</td>
<td>1383</td>
<td>0.89</td>
<td>1395</td>
<td>0.88</td>
</tr>
</tbody>
</table>

**DIGESTIBLE AMINO ACIDS**

- **Lysine** % 1.26, 1.14, 1.06, 1.02, 0.98
- **Methionine + Cyst(e)ine** % 0.96, 0.89, 0.84, 0.82, 0.78
- **Methionine** % 0.53, 0.49, 0.47, 0.45, 0.43
- **Threonine** % 0.84, 0.76, 0.71, 0.68, 0.66
- **Valine** % 0.96, 0.88, 0.83, 0.80, 0.76
- **Isoeucine** % 0.84, 0.78, 0.73, 0.70, 0.68
- **Arginine** % 1.31, 1.20, 1.12, 1.09, 1.06
- **Tryptophan** % 0.20, 0.18, 0.17, 0.16, 0.16
- **Leucine** % 1.39, 1.25, 1.17, 1.12, 1.08

**Crude Protein** % 22.0, 20.5, 19.0, 18.0, 17.5

**MINERALS**

- **Total Calcium** % 0.95, 0.75, 0.70, 0.65, 0.60
- **Available Phosphorus** % 0.50, 0.42, 0.39, 0.36, 0.34
- **Magnesium** % 0.05-0.30, 0.05-0.30, 0.05-0.30, 0.05-0.30, 0.05-0.30
- **Sodium** % 0.18-0.23, 0.18-0.23, 0.18-0.23, 0.18-0.23, 0.18-0.23
- **Chloride** % 0.18-0.23, 0.18-0.23, 0.18-0.23, 0.18-0.23, 0.18-0.23
- **Potassium** % 0.60-0.90, 0.60-0.90, 0.60-0.90, 0.60-0.90, 0.60-0.90

**ADDED TRACE MINERALS PER KG**

- **Copper** mg 16, 16, 16, 16, 16
- **Iodine** mg 1.25, 1.25, 1.25, 1.25, 1.25
- **Iron** mg 20, 20, 20, 20, 20
- **Manganese** mg 120, 120, 120, 120, 120
- **Selenium** mg 0.30, 0.30, 0.30, 0.30, 0.30
- **Zinc** mg 120, 120, 120, 120, 120

**ADDED VITAMINS PER KG**

- **Vitamin A** IU 13000, 11000, 10000, 10000, 10000
- **Vitamin D₃** IU 5000, 4500, 4000, 4000, 4000
- **Vitamin E** IU 80, 65, 55, 55, 55
- **Vitamin K (Menadione)** mg 4.0, 3.6, 3.2, 3.2, 3.2
- **Thiamin (B₁)** mg 5, 4, 3, 3, 3
- **Riboflavin (B₂)** mg 9, 8, 7, 7, 7
- **Niacin** mg 70, 65, 50, 50, 50
- **Pantothenic Acid** mg 25, 20, 15, 15, 15
- **Pyridoxine (B₆)** mg 5, 4, 3, 3, 3
- **Biotin** IU 0.35, 0.28, 0.22, 0.22, 0.22
- **Folic Acid** mg 2.5, 2.0, 1.8, 1.8, 1.8
- **Vitamin B₁₂** mg 0.02, 0.018, 0.016, 0.016, 0.016

**MINIMUM SPECIFICATION**

- **Choline per kg** mg 1700, 1600, 1500, 1450, 1450
- **Linoleic Acid** % 1.25, 1.20, 1.00, 1.00, 1.00

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1. To achieve the listed amino acid levels, adopting the use of either feed-grade amino acids or more complex diets may be necessary.
2. Formulation should focus on achieving an adequate amino acid profile. These crude protein levels are not a requirement per se but instead are levels that can likely be achieved in corn/wheat and soybean meal-based diets and ensure a functional pool of non-essential amino acids.

**NOTES:** These feed specifications should be used as a guide only. Adjustments may be necessary for local conditions, legislation and markets. A withdrawal feed should be fed to meet local requirements for medication withdrawal times and can be formulated to the same standards as the final feed listed above.
### Appendix 1 - Ratios for an Optimally Balanced Protein Profile.

<table>
<thead>
<tr>
<th>Age Fed - days</th>
<th>Lysine</th>
<th>Methionine + Cyst(e)ine</th>
<th>Methionine</th>
<th>Threonine</th>
<th>Valine</th>
<th>Isoleucine</th>
<th>Arginine</th>
<th>Tryptophan</th>
<th>Leucine</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>11-20</td>
<td></td>
<td>100</td>
<td>76</td>
<td>67</td>
<td>76</td>
<td>67</td>
<td>104</td>
<td>16</td>
<td>110</td>
</tr>
<tr>
<td>21-30</td>
<td></td>
<td>100</td>
<td>78</td>
<td>67</td>
<td>77</td>
<td>68</td>
<td>105</td>
<td>16</td>
<td>110</td>
</tr>
<tr>
<td>31-40</td>
<td></td>
<td>100</td>
<td>79</td>
<td>67</td>
<td>78</td>
<td>69</td>
<td>106</td>
<td>16</td>
<td>110</td>
</tr>
<tr>
<td>41-market</td>
<td></td>
<td>100</td>
<td>80</td>
<td>67</td>
<td>78</td>
<td>69</td>
<td>107</td>
<td>16</td>
<td>110</td>
</tr>
</tbody>
</table>

NOTE: The information in the table is derived from Aviagen internal trials and published literature.