# Broiler Simulation to Demonstrate Impact and Cost of Ingredient Variation

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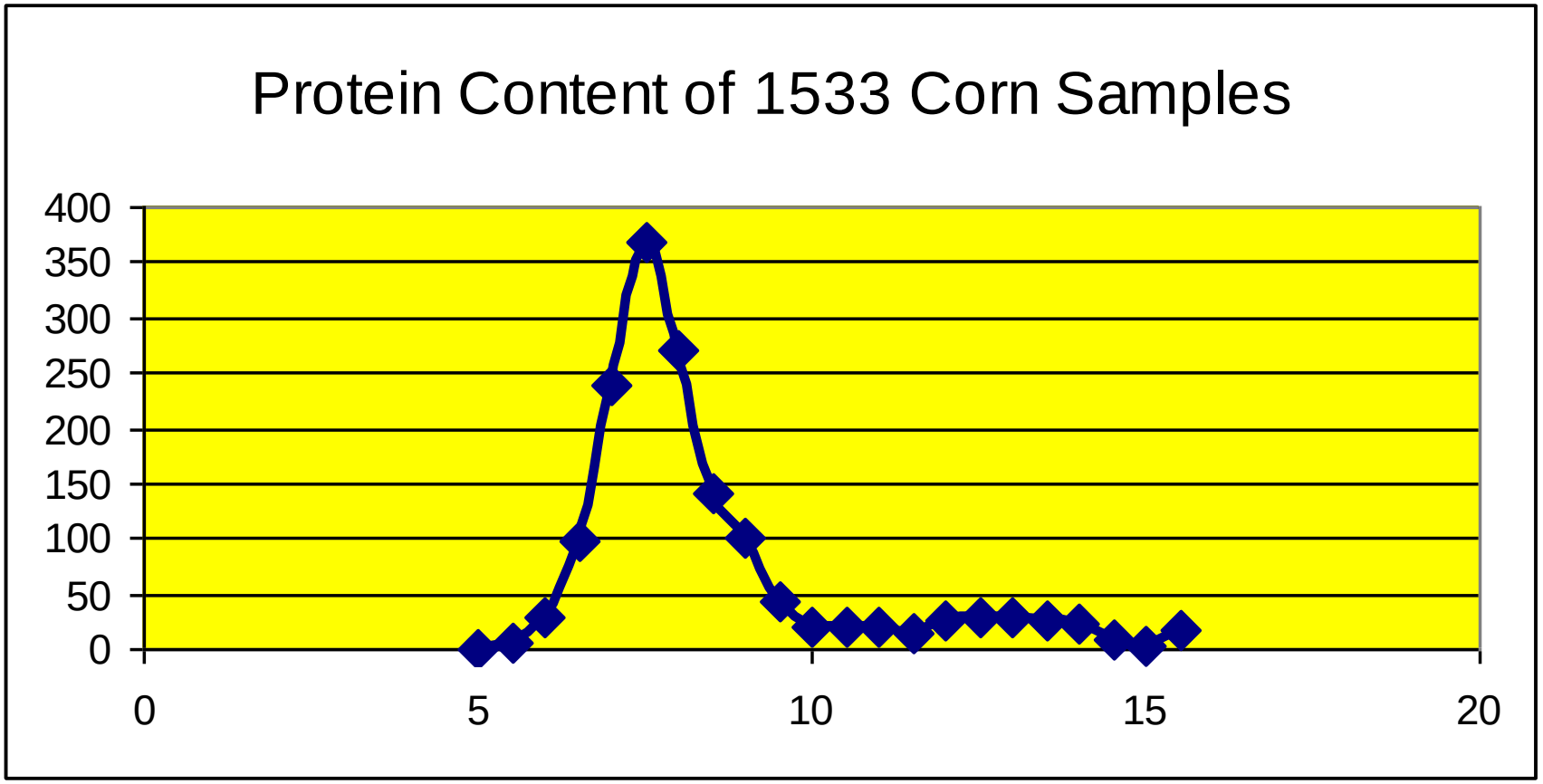
# Nutrition Impacted by Variation of Ingredients

- Nutrition is key part of most ingredients' impact on animal growth.
- Variation in an ingredient is normal, but…
- Variation in protein (and the amino acids) impacts growth rate, feed conversion and cost.
- Managing Variation is important to consistent production and cost control.

# Variation is Less if Processing is Involved

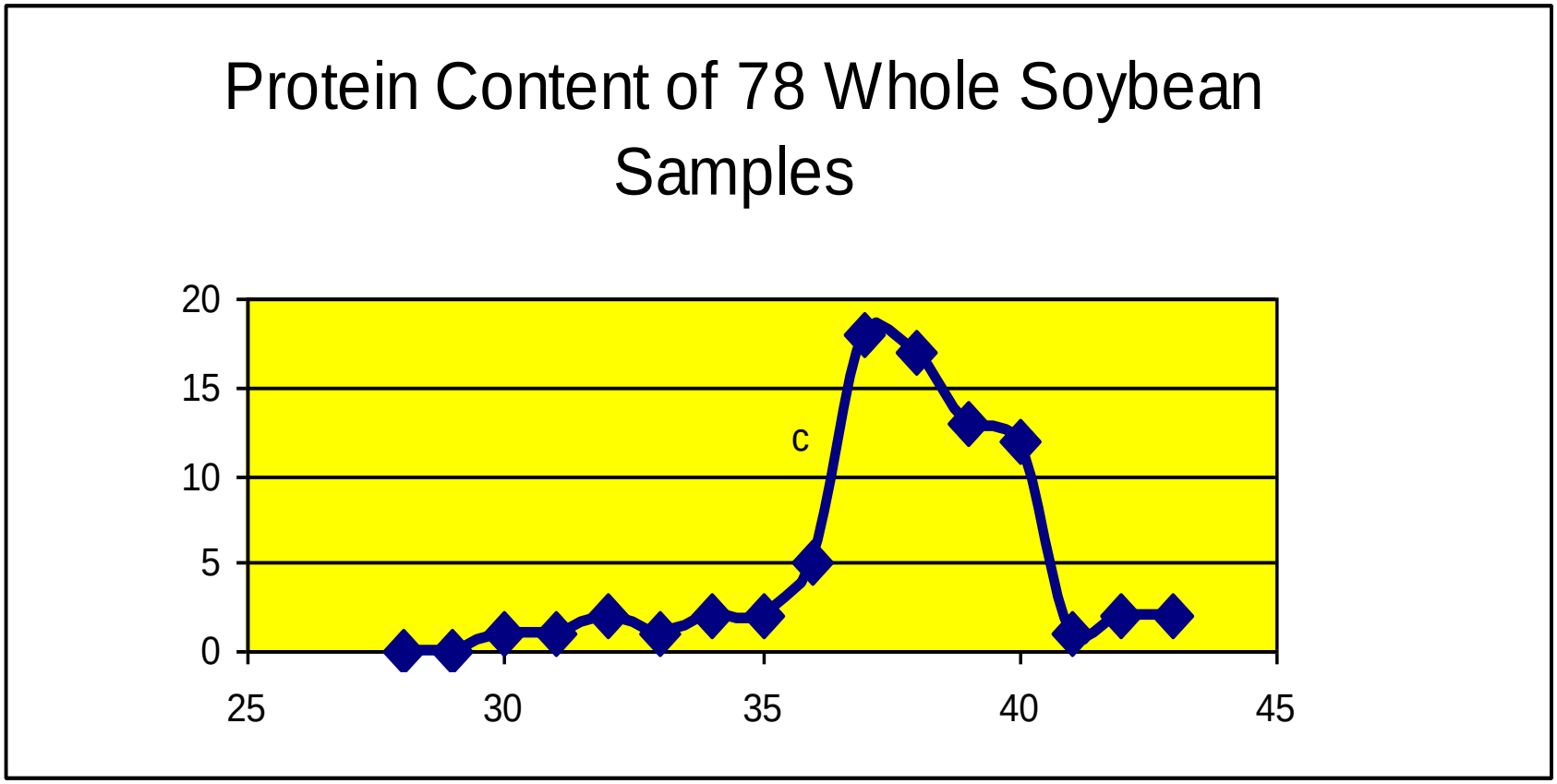
- Field Grown Materials Are More Variable Than Processed Materials.
  - Raw Materials such as corn and whole soybeans are dependent on weather for variation.
  - Processed Materials such as soybean meal have several controlled steps that reduce variability
  - Manufactured materials like methionine, lysine or vitamins are totally controlled and very uniform.

# Protein Content of Corn is Highly Variable



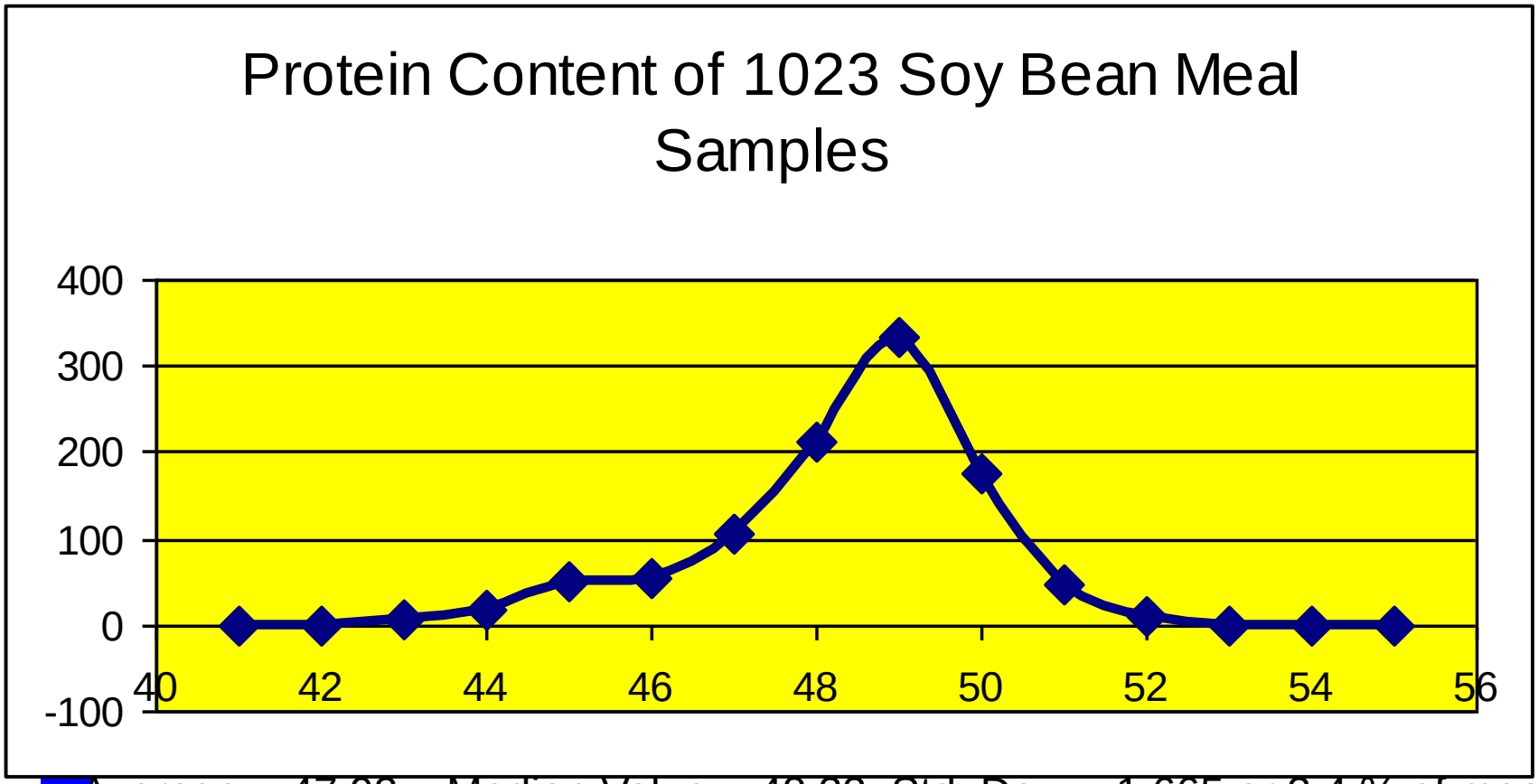

Average = 8.66  Median Value = 8.08  Std. Dev. = 1.88 or 21.7% of mean

# Protein Content of Whole Soya is Less Variable than of Corn




Average = 37.42 Median Value = 37.41 Std. Dev. = 2.38 or 6.5% of mean

# Protein Content of Soybean Meal is Half as Variable as Beans




Average = 47.92 Median Value = 48.33 Std. Dev. = 1.665 or 3.4 % of mean

# Blending has a Natural Effect of Reducing Variation

- Nutritionists already employ several strategies for minimizing impact of Variation:
  - Mixing feed reduces variation
  - Blending a combination of 58% Corn with 32% Soyabean meal gives a cv of 6%, slightly less than the soya alone even though the CV of corn was 20%
  - Mixing always reduces the CV of a mixture, if more than one source of a nutrient is used.

# Blending Feeds as Needed Gives Some of the Benefits of Mixing

- Nutritionists already employ several strategies for minimizing impact of Variation:
  - Making feeds for a flock at different times reduces variation. It is unlikely that the same ingredients are used when feed is made several weeks apart. So, if an ingredient was low in protein at one point in time, it is unlikely to be as low another.
  - Feed Intake controls the impact of different feeds (starter, grower, withdrawl feeds).

# Cost of Variation – Long Term
# Across Time, Averages Are Found

- Across Time, Variation of an Ingredient will have NO impact on Cost. The product will be better than expected almost as much as it is poorer than expected (averages to expected).
- Two factors are important, however. Short Term Costs and Market Age. Short Term Costs may vary Markedly, Causing Concern.
- Across Time, Marketing Age will vary, if one monitors Live Weight carefully, or Live Weight reaching Market will vary.
- Having the Right Estimate of Average Value is Important.

Table 1. Impact of Variation of Protein and Energy on the Live Weight, Feed Conversion and Cost per kg of Live Weight of Mixed Sex Broilers on a 3 Diet Feeding Program

| Variation of Nutrients | Live Weight kg | Feed Conversion | Cost, $/kg |
|---|---|---|---|
| No Variation | 2.092 ± 0 | 1.884 ± 0 | 0.3685 |
| 3 % CV Theoretical Minimum | 2.084 ± 0.04 | 1.891 ± 0.022 | 0.3698 |
| 6 % CV Typical | 2.064 ± 0.055 | 1.911 ± 0.052 | 0.3735 |
| 12 % CV Poor | 2.030 ± 0.095 | 1.946 ± 0.096 | 0.3797 |
| 24 % CV Severe | 1.983 ± 0.146 | 1.999 ± 0.166 | 0.3886 |

# Controlling Variation
# Feed Analyses

- Better Estimates of Ingredient Content:
  - Measure Protein and ratio amino acids to the Protein value.
  - Measure Proximate analyses (Protein, Moisture, Fat, Fiber, Ash) use NRC equations for better estimates of amino acids and European Table of Energy Values for Poultry Feedstuffs equations for energy.
  - You cannot control something that you do not measure.

# Controlling Variation
# Other Strategies

- Two Bins – Mixing Incoming Lots of the same Ingredient
  - If you can afford a second bin for grain or soybean meal, put each shipment in alternate bins and take half of the weight for a feed mix from each bin. You will reduce variation by 30%, so if soybean meal has a 3% standard deviation, using 2 bins will reduce that to 2.1%. Corn would go from 20% to 14%.

# Controlling Variation
# Other Strategies

- Feeding higher protein shows less effect of variation.
- Below is the observed effects on the feed conversion of 2.0 kg mixed sex flocks of broilers when protein and amino acids were increased 10 % (from 20 to 22%, for example).

| Relative Protein Content of the Diets | 2915 Kcal/kg | 3100 Kcal/kg | 3285 Kcal/kg | 3470 Kcal/kg |
|---|---|---|---|---|
| 85% - 95% of Normal | -0.1255 | -0.0959 | -0.1348 | -0.1098 |
| 100% - 110% | -0.0295 | -0.0555 | -0.0411 | -0.0540 |
| 115% - 125% | -0.0158 | -0.0026 | +0.0017 | -0.0298 |

# Controlling Variation
# Other Strategies

- Feeding Higher Energy Shows Less Effect Of Variation.
  - Below is the observed effects on the feed conversion of 2.0 kg mixed sex flocks of broilers when energy was 100 kcal/kg with no change in protein.

| Relative Protein Content of the Diets | 100 Kcal to 2915 Kcal/kg | 100 Kcal to 3100 Kcal/kg | 100 Kcal to 3285 Kcal/kg |
|---|---|---|---|
| 85% | -0.0906 | -0.0359 | -0.0204 |
| 100% | -0.0666 | -0.0675 | -0.0037 |
| 115% | -0.0876 | -0.0558 | -0.0142 |
| 130% | -0.0727 | -0.0566 | -0.0397 |

# Formulation Impacts of Different Ingredients

- When formulating with competitive ingredients like Soybean Meal from different suppliers, evaluating the value of different specifications is usually done with Least Cost Programming.
- With more sophisticated programs that find the least cost way to feed broilers, such as BroilerOpt, better estimates can be made.

# Formulation Impacts of Different Ingredients

- For the purpose, we will use 3 different sources of Soybean Meal.

- A US Soybean Meal- Dehulled
- A Generic Soybean Meal
- A Lower Protein Soybean Meal

- Matrix Values Next

# Formulation Impacts of Different Ingredients

| | ME Poultry | Crude Protein | Crude fat | Linol. Acid | Crude fiber | Ash | Calcium | Phos. total | Phos., avail |
|---|---|---|---|---|---|---|---|---|---|
| SBM, US dehulled | 2521.8 | 47 | 1.2 | 0.5 | 3.2 | 5 | 0.264 | 0.6062 | 0.2347 |
| SBM generic 46% | 2422.6 | 46 | 0.8 | 0.5 | 4 | 6 | 0.264 | 0.6062 | 0.2347 |
| SBM Protein 45% | 2345.5 | 45 | 0.8 | 0.4 | 5 | 6 | 0.2637 | 0.6055 | 0.2344 |

# Formulation Impacts of Different Ingredients

| | Lys | Lys, dig pou | Trypt | Trp, dig pou | Meth +Cys | M+C, dig pou | Meth | Met, dig pou | Threonine | Thr, dig pou |
|---|---|---|---|---|---|---|---|---|---|---|
| SBM, US dehulled | 2.971 | 2.733 | 0.665 | 0.598 | 1.329 | 1.2 | 0.665 | 0.598 | 1.827 | 1.6444 |
| SBM generic 46% | 2.811 | 2.136 | 0.609 | 0.518 | 1.288 | 1 | 0.639 | 0.524 | 1.759 | 1.4427 |
| SBM, Protein 45% | 2.75 | 2.475 | 0.596 | 0.537 | 1.26 | 1.1 | 0.625 | 0.55 | 1.721 | 1.5491 |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