



## **Prof Jeff Firman**

Animal Science Research Center,  
University of Missouri

**Use of rendered products  
in poultry feed**



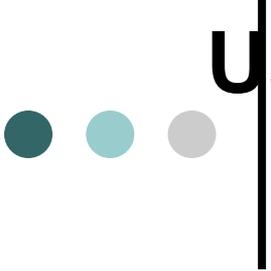
Organiser



Technical  
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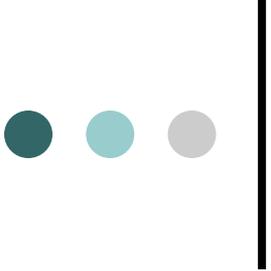


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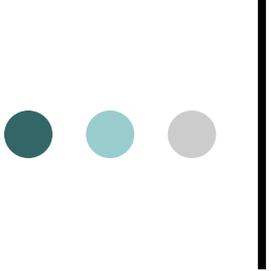
# Use of Rendered Products in Poultry Feed

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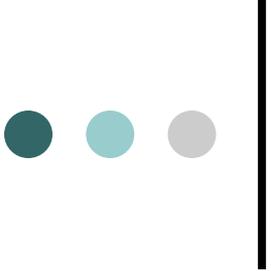
# High Quality Protein and Energy Sources

- World is deficient in protein
- Needs for animal products continue to increase both with population and with affluence
- While there have been issues in the past, use in the US and elsewhere is heavy
- Given the paucity of protein sources, rendered product use makes sense
- One of the early practitioners of recycled product use



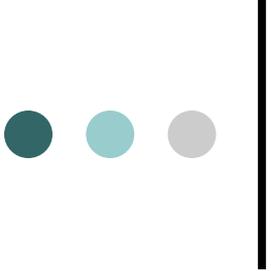
# Introduction: Rendered proteins and fats

- Long history worldwide of use of animal proteins and rendered fats in the poultry industry.
- Products currently being utilized include meat meals from ruminant, swine and poultry, blood meals, fats, feather meal.
- Variety of use, broilers, turkeys, pigs, less use layers.
- Provide nutrients needed at competitive prices
- Animal protein sources may improve performance parameters over corn-soya diets
- While each product has different nutrient contents and potential values, most are excellent sources of high quality protein, highly available phosphorus and other minerals.



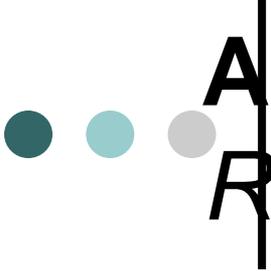
# Goals

- Provide an overview of the products
- Basics of production
- Methods and Limitations on their use
- Economics of their use



# Meal Production

- Product is collected at small and large scale plants
- Ground, cooked (partial drying), fat removed, further drying, grinding
- Heat is sufficient to inactivate micro-organisms
- Product is the packaged or shipped bulk
- HACCP based procedures are followed to avoid any recontamination of product



# Available products

## *Ruminant/porcine meat meals*

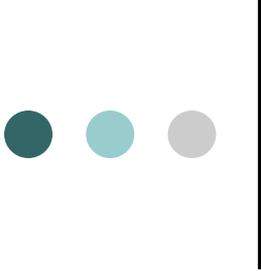
- Products from non-edible portion of cattle/pig processing
- Products may vary based on input materials, proportion of bone
- Utilized in the US poultry industry as a protein/AA, calcium and phosphorus source
- Inclusion levels typically limited by price
- 10% of high quality product would be fine
- Can be used in combination with other by-products
- Typically 50-54% CP, 10% fat, 5% avail P



# Available products

## *Poultry By-product meal:*

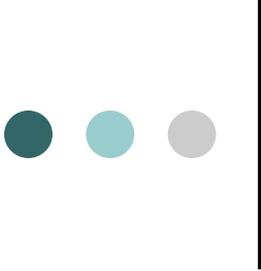
- By-product of the poultry processing industry
- Consist of the offal and other inedible parts of the chicken
- Differentiation of the products is protein/ash content.
- High ash content less desirable, lower price
- Pet food grade significantly more expensive, now used in aqua feeds
- Inclusion of the product is primarily limited by ash content, but may be something around 10% again.
- 55-64% CP, 10-14% fat, 3-5% avail P



# Available products

## *Blood meal:*

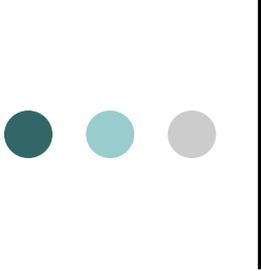
- Blood has foreign material removed followed by a drying process from the blood collected in slaughter plants
- The more sophisticated the drying process, in general the better the product produced, spray drying is generally considered superior
- Blood meal is generally not used in high concentration due to its poor amino acid balance
- May be used as an attractant in some aqua feeds
- Constraints would be at 1-2% of the total ration in poultry, perhaps more in aqua, used as a by-pass protein
- 80-88%CP, 1% fat, 0.3% P



# Available products

## *Poultry Feather meal:*

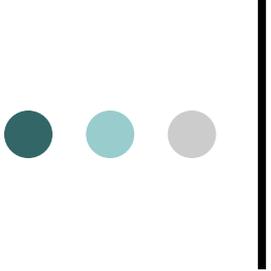
- Feather meal is the ground and hydrolyzed feather from chicken and turkey processing
- Considered to be low in digestibility and with a poor amino acid balance and is thus not heavily used in the poultry industry
- It is generally economically priced, but will normally be used at 1-3% of the ration
- May be utilized in ruminant rations as a by-pass protein, 3% addition improves milk yield in higher producing dairy cattle
- 80% CP, 7% fat, 0.5% P



# Available products

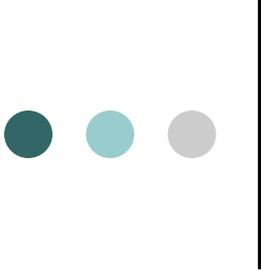
## *Blended meals:*

- Several commercial blends are available as well as the ability to have products custom blended to customer specifications
- Some products were designed specifically as a replacement for fishmeal for instance
- May increase costs, useful if storage space is lacking or need to simulate fish meal
- Blends were more heavily utilized in the past, before computer formulation, digestible amino acids
- Still have a place in international markets



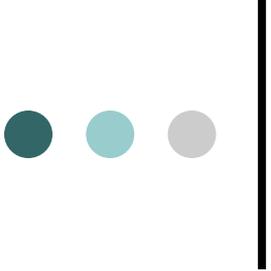
# Use of animal proteins in feed

- 1. Gather info on your current feeds
- 2. Gather info and pricing on potential products
- 3. Run formulas with products and available prices to determine the feed value in your rations
- 4. Look at use of several products



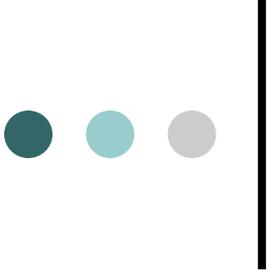
## Comparison of diets with added MBM at different prices/levels

Level of MBM	Relative Price of MBM	Price of Broiler starter/ ton in USD
0%	NA	322.72
5%	100% of soya	319.39
10%	100%	316.20
5%	110%	321.39
9.8	110%	320.12
5%	90%	317.39
10%	90%	312.23



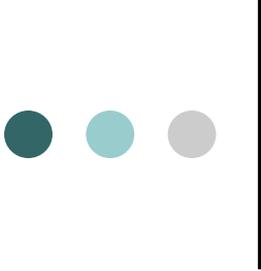
# Additions of MBM and PBM

MBM Level	PBM Level	Relative price of Prod.	Price of Broiler starter / ton in USD
0%	0%	NA	322.72
5%	5%	100%	313.77
3.8%	10%	100%	308.91
5%	5%	110%	317.77
3.8%	10%	110%	314.45
5%	5%	90%	302.90
3.8%	10%	90%	294.65



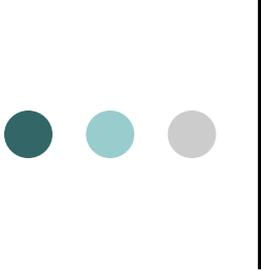
# Rendered fat use

- Feeding of fat in poultry and pig rations has a long history in the US and the world.
- Fats are generally included at 1-8% of ration
- Benefits
- Concerns



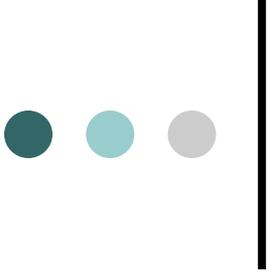
# Benefits of Fat Addition

- **-Concentrated source of energy and the main method of increasing the energy content of diets**
- **-May increase growth rates**
- **-May increase feed efficiency**
- **-Source of linoleic acid**
- **-Decreases dustiness of feeds and reduces dust losses**
- **-Lubricant for equipment in feedmills**
- **-Increases palatability of feeds**
- **-Increased rate of gain can decrease age at market and increase throughput of housing systems**



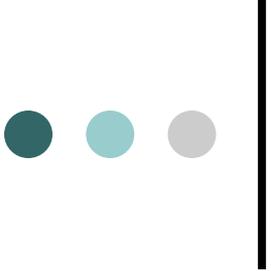
# Benefits of Fat Addition (cont)

- **-Lower heat increment is useful during heat stress to keep caloric intake up**
- **-May slow gut transit of other feeds, resulting in increased digestibility**
- **-May show an ‘extracaloric’ effect**
- **-May be more cost effective than other energy sources**
- **-Concentrated feeds can decrease transportation costs for feed delivery**
- **-Use of higher levels of fat may negate the effects of pelleting**



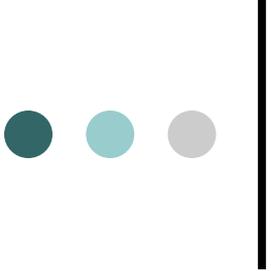
# Concerns of Fat Utilization

- -Measurement of Metabolizable Energy (ME) content can be somewhat difficult
- -Potential for oxidative rancidity
- -Equipment needs relative to fat additions must be adequate
- -Poor digestibility of fats by the young animal in some cases
- Shipping can be problematic



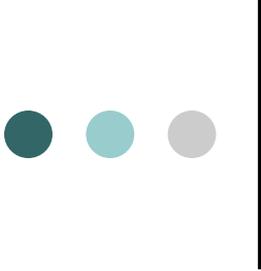
# Types of fat Available for Use in Rations

- **Tallow: saturated source, used for soap manufacture traditionally**
- **Poultry fat: less saturated, probably source of choice for poultry, but frequently less available**
- **Fish oil: less saturated, other purported benefits, very expensive**
- **Vegetable oils: soy oil, etc, generally good source, expensive**
- **Yellow grease: generally cost effective if available, generally comparable to soyoil**
- **Soapstocks: from manufacture of soap, generally less energy available, considered poor overall source**



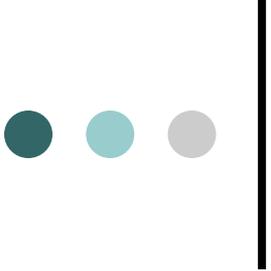
# Minimal Usage of Fat

- 1% minimum recommended
- Meet linoleic acid requirement
- Hold down dust
- Improved palatability
- Usage beyond this is primarily cost based



## Response of broilers to different energy levels

- Greatest benefit seen at low energy as maintenance costs do not change
- Allows for increased energy going primarily to growth
- At higher energy levels growth rate will plateau and less benefit
- Looks like changing genetics have resulted in decreased energy needs



# Understanding energy use

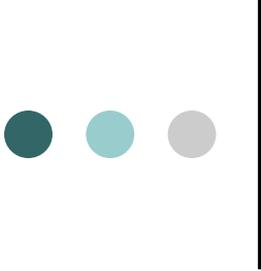


Maintenance energy

Energy for production

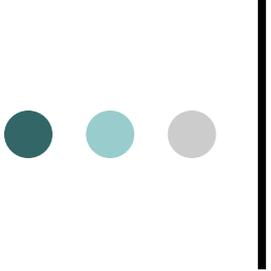
+/-

Changes in energy



# Response of broiler breeders to added fat

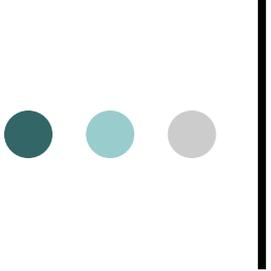
- |                            | <b>Added Fat %</b> |            |            |            |
|----------------------------|--------------------|------------|------------|------------|
| <b>Production variable</b> | <b>0</b>           | <b>2</b>   | <b>4*</b>  | <b>6</b>   |
| <b>Eggs/hen</b>            | <b>131</b>         | <b>156</b> | <b>162</b> | <b>159</b> |
| <b>Feed/dozen (kg)</b>     | <b>4.1</b>         | <b>3.5</b> | <b>3.3</b> | <b>3.4</b> |
| <b>Chicks/hen</b>          | <b>105</b>         | <b>121</b> | <b>132</b> | <b>125</b> |
- **\*Authors recommended 4% level as close to optimum.**
  - **Body weight was increased with each increment of fat.**



# Calorie Cost to Determine Energy Levels

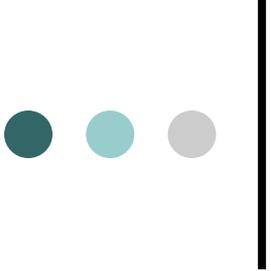
Diet Energy (kcal/kg)	Cost/ton (US\$)	Calorie cost(\$/mcal)	Fat added(%)
2900	246.24	84.90	0
3000	252.14	84.07	1****
3100	262.82	84.78	3.3*****
3200	273.46	85.45	5.5
3300	282.10	85.48	7.7
3400	294.76	86.69	10

\*\*\*\*Given the prices used in this scenario, one would choose between the 3000-3100 kcal/kg ration as the most cost effective. In many cases, more fat will help performance so some would feed more than the 1% level seen in this scenario.



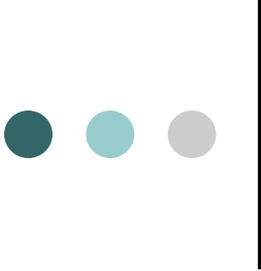
# Concerns of Fat Addition

- ME measurement of fats can be somewhat difficult.
- Relatively easy to get a good comparison value (soy oil versus yellow grease), but difficult to get a good absolute value.
- Simplest method of handling this is to put same value as comparison fat source
- If yellow grease gives same performance use same value as soy oil



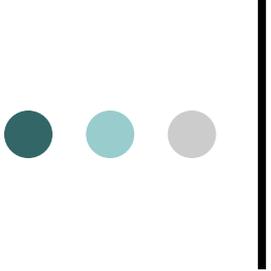
# Concerns of Fat Addition

- Handling of fat to control rancidity is also a concern.
- Rancidity can be controlled by use of antioxidants and is generally not a problem
- The supplier should take care of the antioxidant at the point of manufacturing



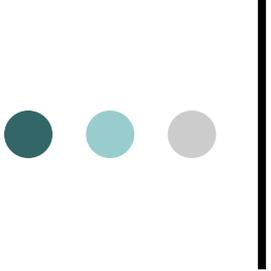
# Concerns of Fat Addition

- Equipment is needed for fat usage
- Fat additions can be made by the simple addition of a funnel to a mixer or as complicated as post-pelleting application.
- Storage facilities will be needed if not currently using fat
- Generally suppliers can be helpful with equipment needs for fat storage and addition.



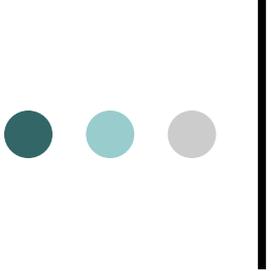
# Concerns of Fat Addition

- Young bird does not digest saturated fats well (most of the fats used in broiler feeding are relatively unsaturated).
- Actual energy value of the fats normally fed to the young broiler (10-14 days) are somewhat lower than might be expected, but the same benefits of fat addition are generally seen.



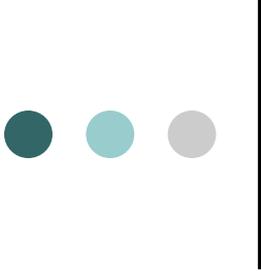
# Source Effects

- While there is concern that certain sources perform differently, there is little evidence on major sources (soapstocks excluded)
- Yellow grease performs similar to other sources



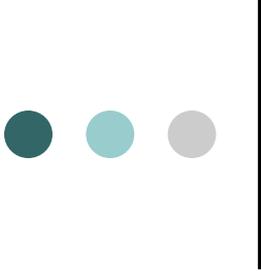
# Yellow grease

- Yellow grease is the reprocessed cooking grease from restaurants
- Vegetable oil based product
- Performance is similar to vegetable oil products
- Generally cheapest acceptable source of oil



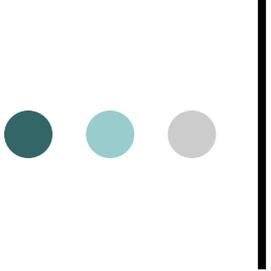
**Means for Broiler Gain for the 3, 5, and 7 Week  
Growth Period**

<b>Fat Source</b>	<b>0-3 Week (kg/bird/phase)</b>	<b>0-5 Week (kg/bird/phase)</b>	<b>0-7 Week (kg/bird/phase)</b>
Soybean Oil	0.77	1.92	2.85
Yellow Grease	0.76	1.96	2.95
Poultry Fat	0.76	1.93	2.92
Tallow	0.75	1.92	2.99
HAPVA	0.74	1.89	2.96
Lard	0.75	1.88	2.97
Palm Oil	0.75	1.95	2.94



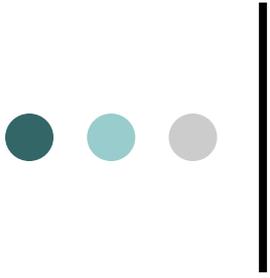
**Means for the Adjusted Feed:Gain Ratios per Bird for the  
3, 5 and 7 Week Growth Period**

<b>Fat Source</b>	<b>0-3 Week (kg:kg)</b>	<b>0-5 Week (kg:kg)</b>	<b>0-7 Week (kg:kg)</b>
Soybean Oil	1.38	1.60	1.87
Yellow Grease	1.38	1.56	1.85
Poultry Fat	1.38	1.58	1.85
Tallow	1.40	1.61	1.83
HAPVA	1.42	1.63	1.86
Lard	1.40	1.52	1.77
Palm Oil	1.42	1.56	1.88



# Summary

- Overall fat additions to broiler rations can be a positive addition to the feeding programs worldwide
- Always check for cost effectiveness using a method such as calorie cost comparison, and generally go with the slightly higher cost to account for non-feed benefits such as decreased transport costs and reduced fixed costs.
- Look for least cost per pound of gain as the simplest measure of efficiency for an operation.



Questions?