# Feeding for Live Performance and Breast Meat Yield of Toms

Sally Noll
University of Minnesota
St. Paul, MN

# *Introduction - Turkey Perfomance*

- Market Body Weight
- Rate of Gain
- Feed Conversion
- Mortality
- Condemnation

# *Introduction - Turkey Performance Redefined*

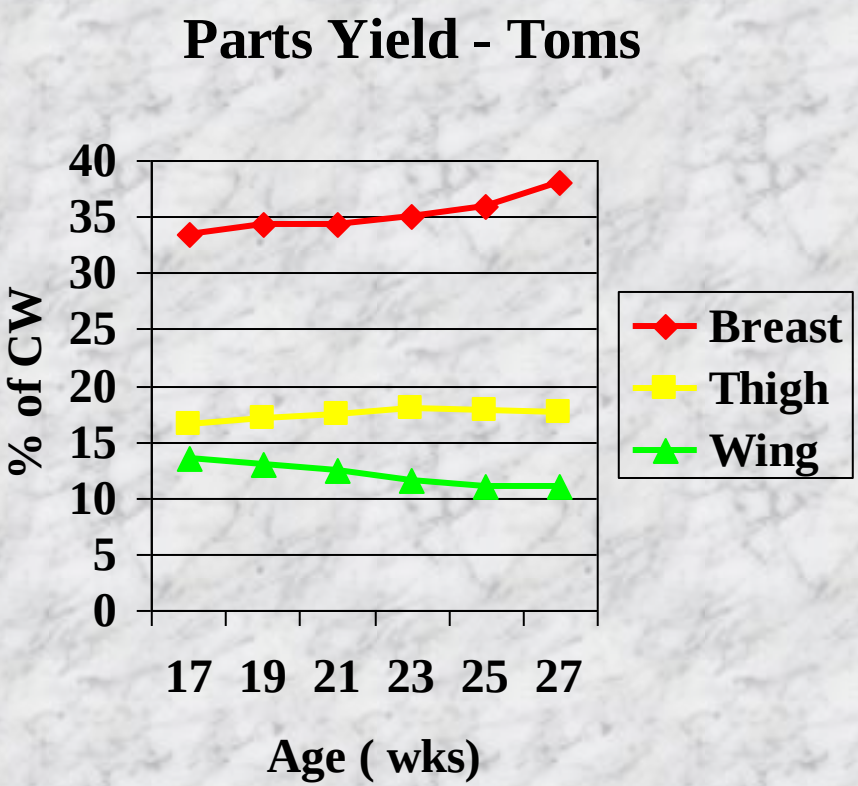
- Marketing - Further Processed Products
- Yield of Breast Meat
- Quality and Value of Breast Meat

# Introduction - Growth and Meat Yield

- Growth curves for body components vary with age
- Relationship of body weight with meat yield

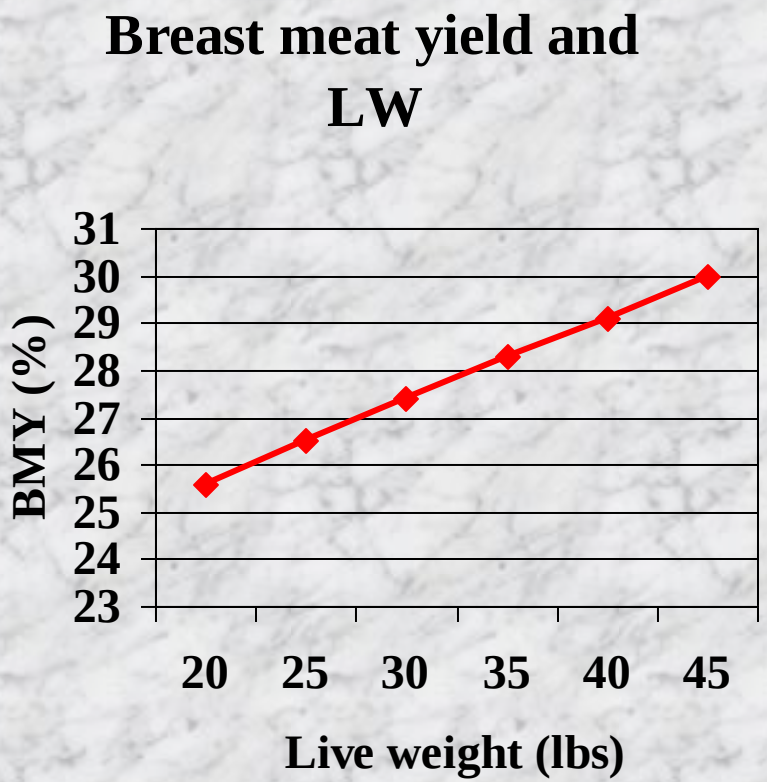
# Introduction - Growth and Meat Yield

- Growth curves for body components vary with age
  - (Moran, et al., 1977)



# Introduction - Growth and Meat Yield

- Relationship of body weight with meat yield (Douglas, 1997)



# *Introduction - Breast Meat Yield*

- Improve yield by better weight per age
  - Protein and amino acid (re. energy)
  - Amino acid balance-alternative ingredients
  - Feed processing
- Improve yield at same weight
  - Feed Additives

# *Introduction-Protein and amino acids*

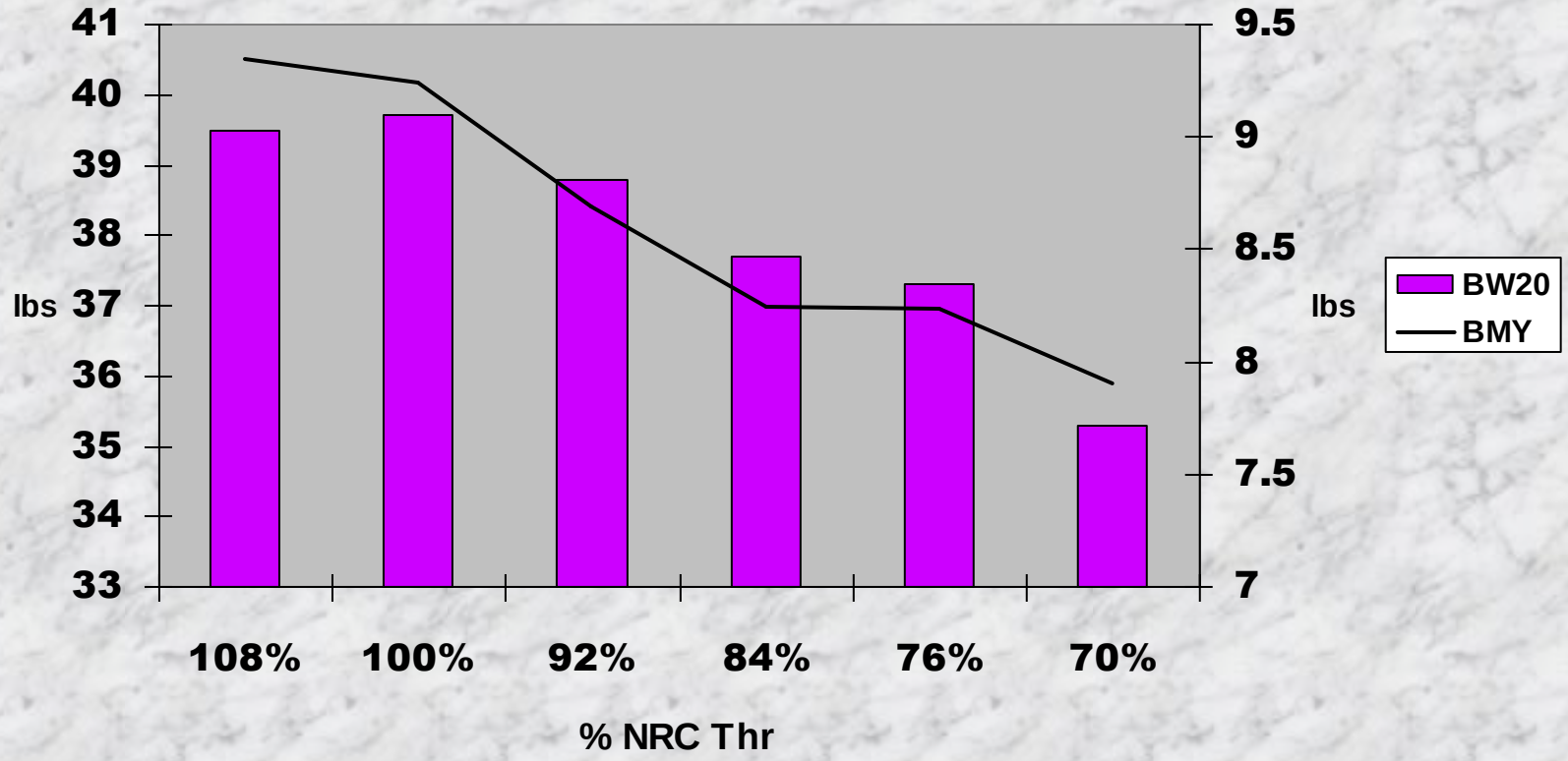
- Protein concentration and amino acid adequacy
- Comparisons to NRC recommendations for turkeys - Nutrient Requirements for Poultry (1994)
- Improvements in breast meat yield with increasing diet concentration of protein
- AA Requirement for BMY > F/G >/= BW

# Diet Protein (NRC) and Tom Performance*

| % NRC CP | Exp 1 BW20 (lbs) | Exp 1 BMY (%) | Exp 2 BW18 (lbs) | Exp 2 BMY (%) |
|---|---|---|---|---|
| 100 | 32.8[b] | 28.8[b] | 26.7[b] | 26.0[b] |
| 110 | 33.7[ab] | 28.6[b] | 30.4[a] | 28.2[a] |
| 120 | 34.2[a] | 30.7[a] | 31.1[a] | 29.1[a] |

***From Waldroup et al., 1997 and 1998**

# Tom Response to Diet Protein (Thr)*




*University of Minnesota, Stangeland et al., 1999

# Economic Analyses – Live Weight Basis*

| Feed Trt | 108% Thr | 100% Thr | 92% Thr |
|---|---|---|---|
| Live wt (lbs) | 39.46 | 39.68 | 38.78 |
| F/G (8-20 wk) | 2.88 | 2.84 | 2.88 |
| F/G (0-20 wk) | 2.53 | 2.50 | 2.51 |
| Feed $/lb LW | .160 | .157 | .156 |
| Feed $/tom | 6.33 | 6.22 | 6.03 |
| Return $/tom | 7.48 | 7.67 | 7.54 |

***Ingredient cost plus $12/ton overhead; No LW or F/G adjustment for mortality or condemnation; Revenue $.35/lb LW; Return over feed only**

# Economic Analyses –Breast Meat Yield Basis*

| Feed Trt | 108% Thr | 100% Thr | 92% Thr |
|---|---|---|---|
| Meat (lb)/tom | 9.35 | 9.24 | 8.69 |
| Feed $/lb BM | .677 | .673 | .694 |
| Return $/tom | 4.89 | 4.86 | 4.37 |

*Revenue $1.2/lb BM; Return over feed cost only

# *Introduction-Protein and amino acids*

- Improvements with increasing diet concentration of critical amino acids
  - Lysine - Lehmann et al. 1996
    - 16-20 wks .75 vs .96%
  - Threonine- Lehmann et al. 1997
    - 16-20 wks .58 vs .64
  - Threonine- UM 1999
    - 8-20 wks 96% vs 106% NRC Thr

# Lysine Requirement and Tom Performance (Lehmann et al., 1996)

| % Lys | BW20 (lbs) | BMY (%) |
|---|---|---|
| .61 | 39.2[c] | 33.5[b] |
| .75 | 40.1[b] | 34.0[ab] |
| .96 | 40.6[a] | 34.6[a] |

# Threonine Requirement and Tom Performance (Lehmann et al., 1997)

| % Thr | BW20 (lbs) | BMY (%) |
|---|---|---|
| .49 | 39.8[b] | 32.0 |
| .52 | 39.9[b] | 32.4 |
| .58 | 40.1[a] | 32.2 |
| .64 | 40.15[a] | 32.8 |

# *Protein and Amino Acids Continued*

- Improvements with increasing diet concentration of critical amino acids
  - Methionine (TSAA) ?
    - UM studies - variable response to TSAA

# Diet TSAA (NRC) and Tom Performance (Waibel et al., 1995)

| % NRC CP/TSAA | % NRC Met Add | BW18 (lbs) | BMY (%) |
|---|---|---|---|
| 100 | | 28.7[b] | 22.5 |
| 100 | 10 | 29.8[a] | 22.5 |
| 100 | | 27.0 | 21.0[b] |
| 100 | 10 | 27.4 | 22.3[a] |

# Responses from other amino acids (Waibel et al., 2000)

| | BW (lbs) | BMY(%) |
|---|---|---|
| Exp 1 6-20wks | | |
| 78% NRC CP+Thr | 35.5[b] | 27.3[b] |
| +Arg, Iso, Val, Trp | 36.9[a] | 28.0[a] |
| Exp 2 6-21 wks | | |
| 78% NRC CP+Thr | 32.9[b] | 25.5[b] |
| + Trp | 33.4[b] | 26.1[b] |
| +Arg, Iso, Val, Trp | 37.7[a] | 27.9[a] |

# *Protein and Breast Meat Yield-Concerns*

- Protein and diet cost
- Environmental impact-nutrient output
- Examination of reduced protein diets with supplemental amino acids
  - Limiting amino acids
  - Quantities and relationships

# *Protein Reduction and Breast Meat Yield*

- Previous research by Waibel (1995) and others - 90% NRC plus lys and met
  - comparable weights and meat yield
- Next level of reduction?
  - 80-85% reduced body weights and BMY (Waibel et al., 2000 & Kidd et al., 1997)

# Amino Acid Balance Alternative Ingredients

- Concerns with use of DDGS
  - Nutrient variability among sources
  - Amino acid digestibility
  - Protein quality - amino acid balance
  - Limiting amino acids (Parsons et al., 1983)
    - Lys, Tryp, Arg (perhaps equally limiting with tryp)

# Protein Quality and Alternative Protein Ingredients

- Corn - soybean meal based diets
- Alternatives - canola, distillers grains
- Potential shortages of iso, try, arg
- Supplements of lys, met, thr

**University of Minnesota, Noll et al., 2001**

# ***Specific Experimental Objectives***

- Determine if significant inclusion of canola and DDGS affects turkey meat yield
- Determine potential for limiting amino acids other than lysine and methionine
- Evaluate diet response in warm and cool rearing conditions
- Determine amino acid digestibility of DDGS and other alternative ingredients

# ***Methods***

- Treatments
  - 1. Control - corn, SBM, MBM
  - 2. As 1 plus DDGS
  - 3. As 1 plus canola
  - 4. As 1 plus DDGS and canola
  - 5. As 4 plus tryp to Trt 1
  - 6. As 4 plus tryp, iso to Trt 1
  - 7. As 4 plus tryp, iso, arg to Trt 1

# *Example Diets for 5-8 wk Old Turkey Toms*

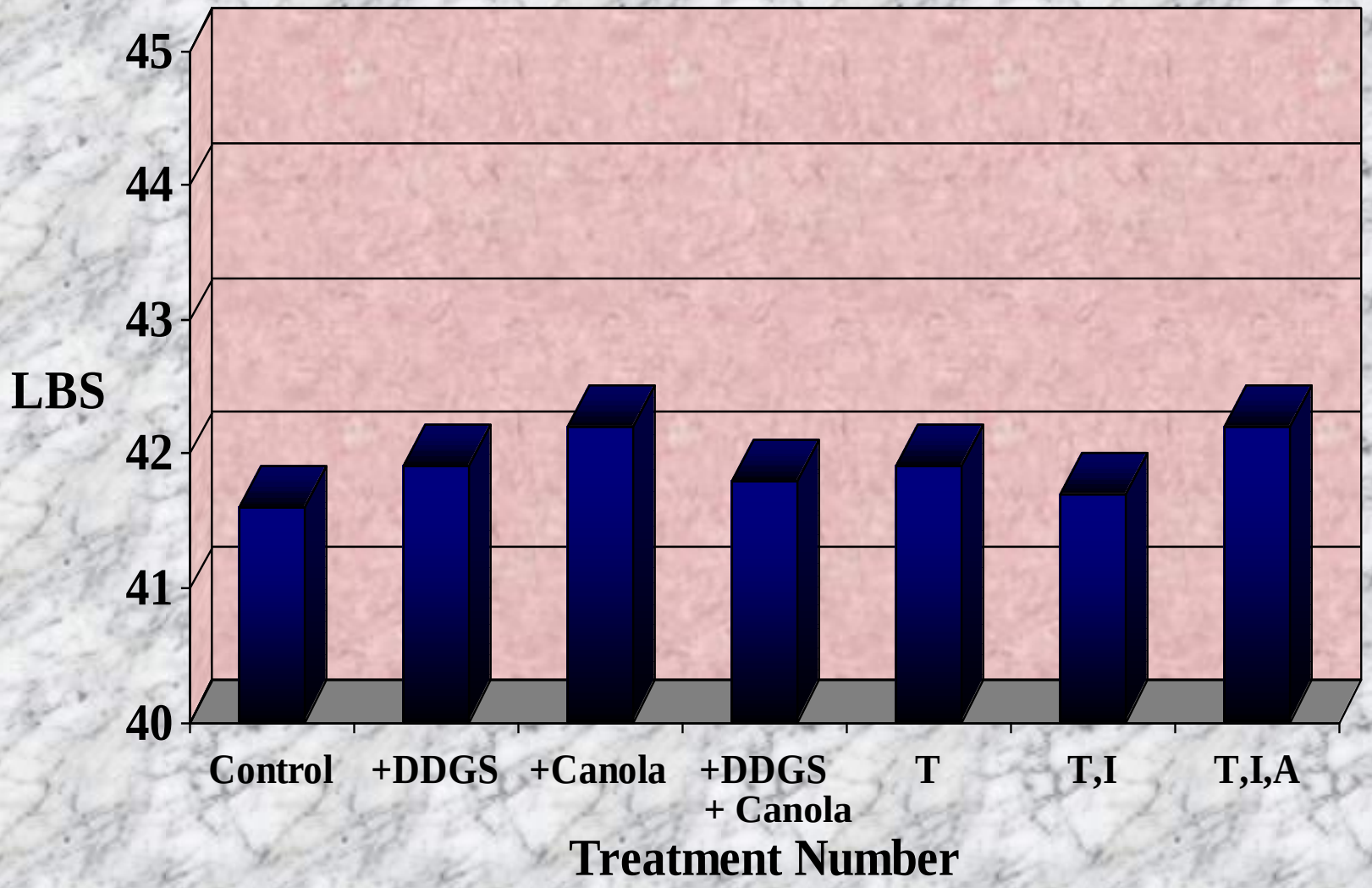
| Ingr. % | Trt 1 | Trt 2 | Trt 3 | Trt 4 |
|---|---|---|---|---|
| Corn | 60.0 | 54.1 | 54.8 | 49.0 |
| SBM | 26.8 | 20.5 | 18.7 | 12. |
| MBM | 8.0 | 8.0 | 8.0 | 8.0 |
| Canola | --- | --- | 12.0 | 12.0 |
| DDGS | --- | 12.0 | --- | 12.0 |
| Supp. Fat | 2.1 | 2.1 | 3.6 | 3.6 |
| Other | +++ | +++ | +++ | +++ |

# *Example diets for 5-8 wk old turkey toms*

| Nutrient,% | Trt 1 | Trt 2 | Trt 3 | Trt 4 |
|---|---|---|---|---|
| Tryp | 0.23 | 0.21 | 0.23 | 0.21 |
| Iso | 0.79 | 0.76 | 0.76 | 0.73 |
| Arg | 1.34 | 1.24 | 1.31 | 1.22 |
| Energy, (kcal/kg) | 3070 | 3070 | 3070 | 3070 |
| Prot. (%) | 22.7 | 22.5 | 22.9 | 22.7 |

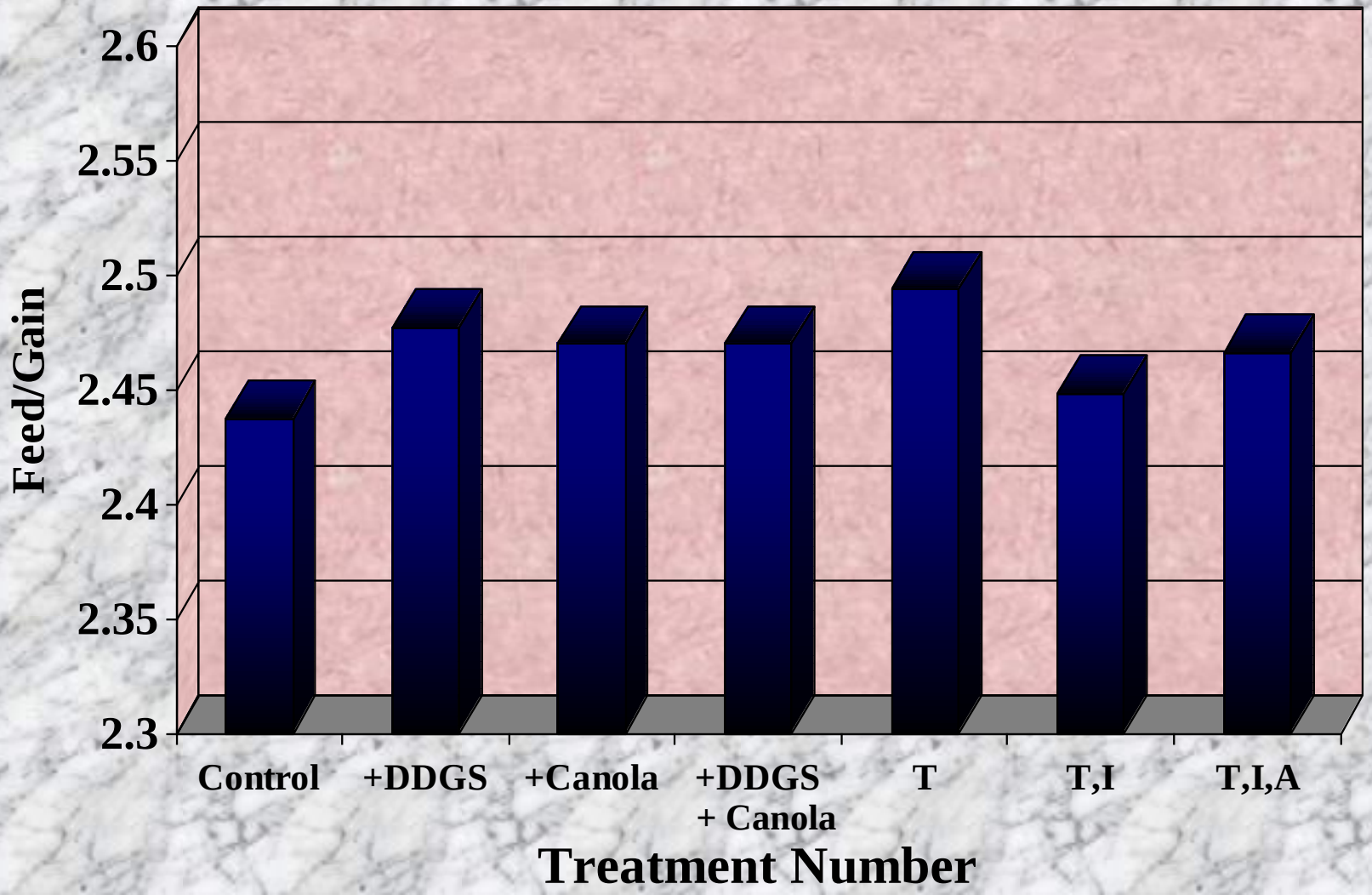
*Lys (1.29%), M+C (.82%), Thr (.79%) and Val (.90%) same in all diets

# Market Tom Body Weight at 19 wks



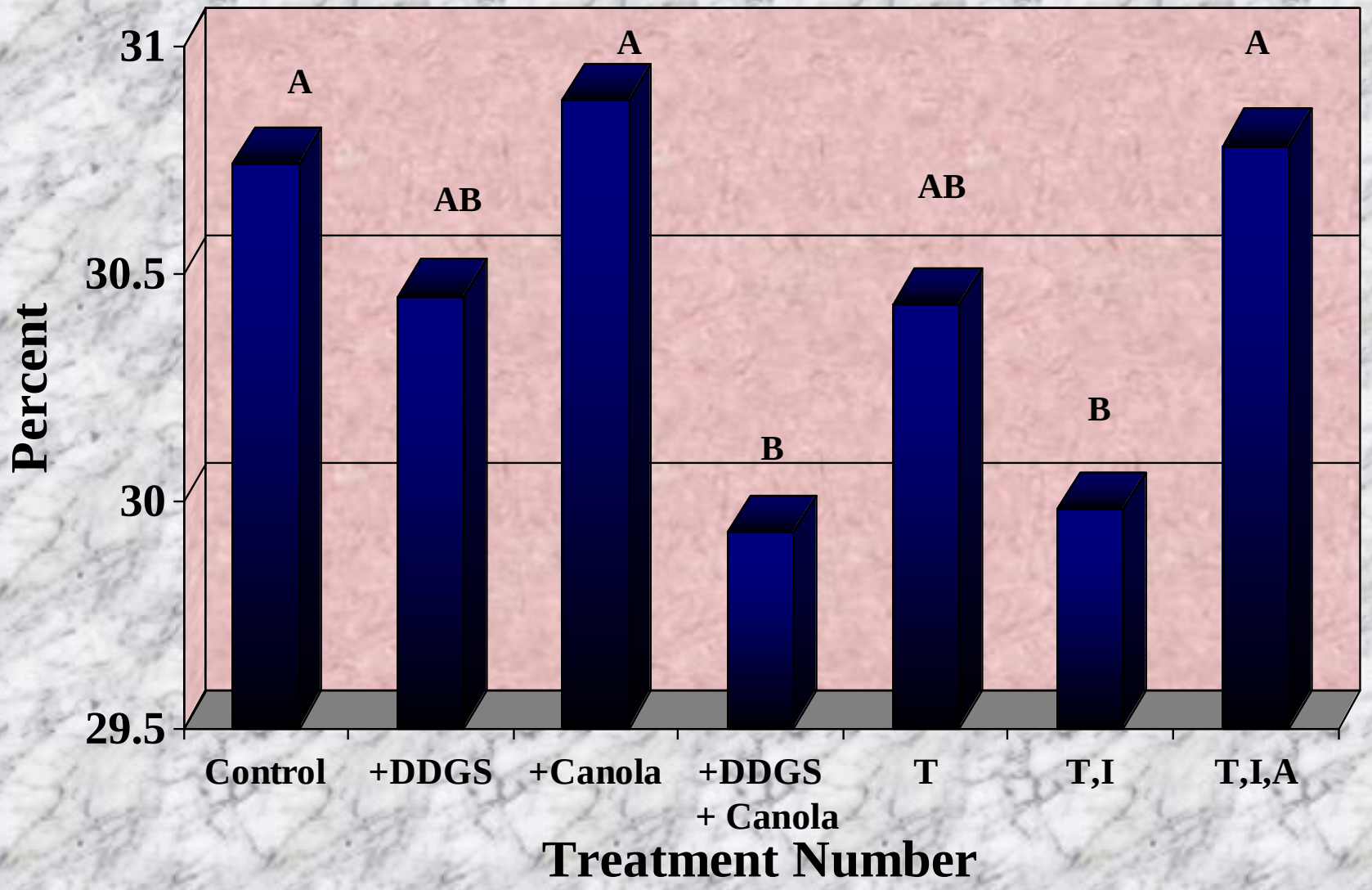

TG-002

# Feed Efficiency 5-19 wks




TG-002

# % Breast Meat Yield - Heavy Toms




TG-002

# Enhancing Breast Meat Yield - Use of Betaine, UM Studies

- Study 1 (Winter)
- No betaine vs betaine
- 20 Wk Body Weight
  43.7 vs 44.0 lbs
- Breast Meat Yield (%)
  - 32.7 vs 33.6**
- Breast Meat (lbs/bird)
  - 11.2 vs 11.6**

- Study 2 (Summer)
- No betaine vs betaine
- 20 wk Body Weight
  - 40.1 vs 40.3 lbs
- Breast Meat Yield (%)
  - 30.0 vs 30.8**
- Breast Meat (lbs/bird)
  - 9.5 vs 9.9**

**University of Minnesota, Kalbfleisch et al 2000**

# *Feed Processing and Diet Energy*

- Feed form
  - Pellets vs mash - improved gains; F/G
- Ratio of diet energy and protein
  - Narrow vs wide - improved meat yield

# *Response of turkeys to diet energy:protein and feed form**

- Dietary energy - 100, 104, 108% NRC ME with same amino acids
- Mash vs expanded/crumbles
- 5-20 wk growing period

***University of Minnesota, Stangeland et al., 1999**

# *Main comparisons*

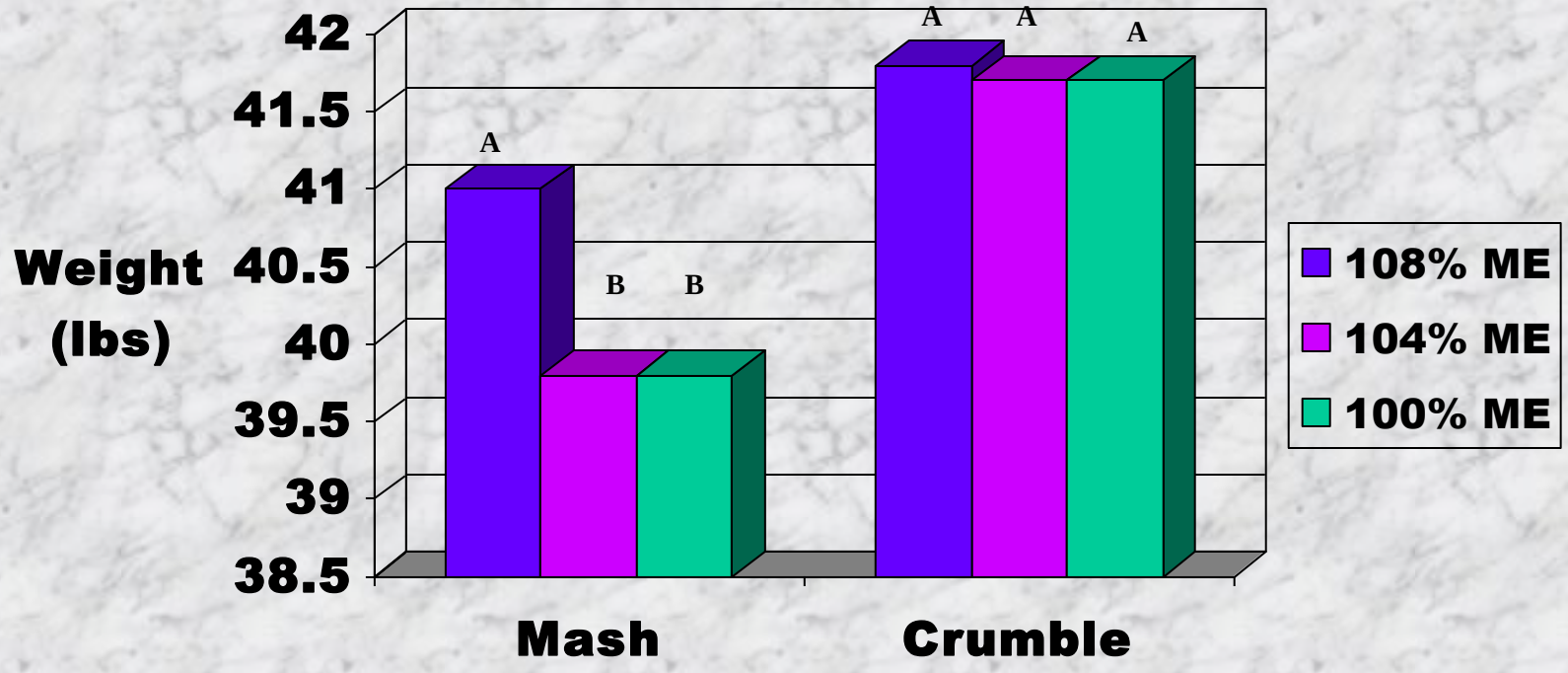
- Dietary energy - 100, 104, 108% NRC ME with same amino acids
- Mash vs expanded/crumbles

# *Selected Diets for 11-14 wks of Age*

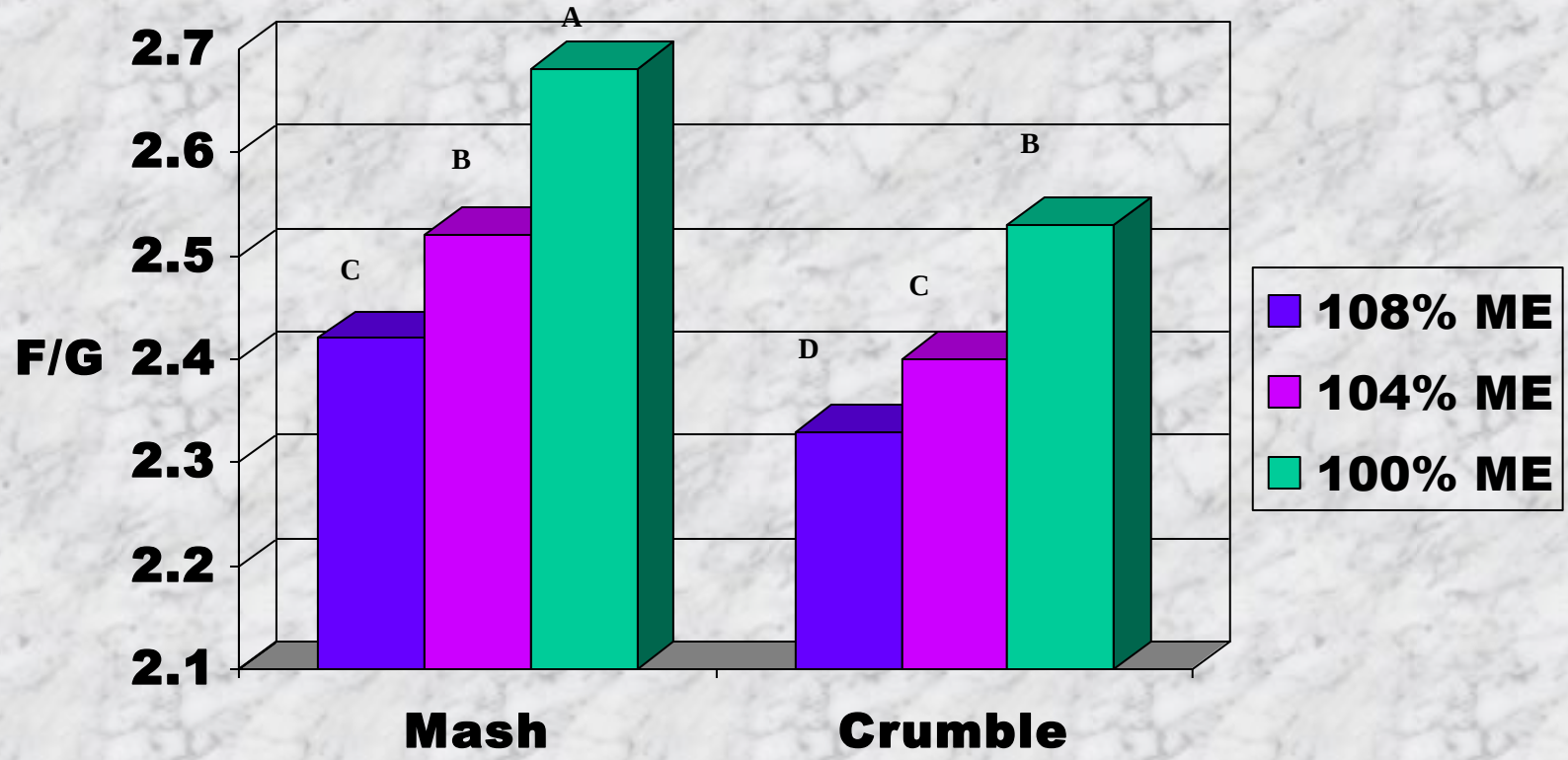
| Ingredient (%) | Metabolizable energy as % of NRC 108% | 104% | 100% |
|---|---|---|---|
| Corn, mash grind | 60.13 | 63.32 | 66.40 |
| Soybean meal, 47% | 19.71 | 19.25 | 18.82 |
| Canola meal | 5.00 | 5.00 | 5.00 |
| Meat/poultry ML, 56% | 5.00 | 5.00 | 5.00 |
| DI-Methionine | 0.13 | 0.12 | 0.12 |
| L-Lysine HCL | 0.28 | 0.29 | 0.29 |
| Vit/minerals | ++ | ++ | ++ |
| Animal fat | 7.03 | 4.29 | 1.64 |
| **Nutrient Analysis** | | | |
| Protein (%) | 19.60 (94)[1] | 19.65 (94) | 19.70 (95) |
| ME (kcal/lb | 1506 (108) | 1451 (104) | 1395 (100) |
| Met+Cys (%) | 0.79 (108) | 0.79 (108) | 0.79 (108) |
| Lys (%) | 1.21 (108) | 1.21 (108) | 1.21 (108) |
| Try (%) | 0.22 (122) | 0.22 (122) | 0.22 (121) |
| Val (%) | 0.89 (105) | 0.90 (105) | 0.90 (105) |
| Thr (%) | 0.75 (100) | 0.75 (100) | 0.75 (100) |

[1] Nutrient level as percent NRC

# Feed and Dietary Energy Effects on Tom Body Weight



# Feed and Dietary Energy Effect on Tom Feed/Gain (5-20 wks)



# *Feed Processing and Dietary Energy Amino Acid Ratio and Carcass Characteristics*

| Treatment description | Carcass weight (lb) | Breast meat yield (lb) | Breast meat yield (%) |
|---|---|---|---|
| Mash – 108% NRC ME | 32.45 | 10.21 | 31.45 |
| Mash – 104% NRC ME | 31.24 | 9.96 | 31.85 |
| Mash – 100% NRC ME | 31.28 | 9.96 | 31.81 |
| Mash Average | 31.65[B] | 10.05[B] | 31.70[B] |
| Crum – 108% NRC ME | 33.62 | 10.78 | 32.01 |
| Crum – 104% NRC ME | 33.08 | 10.58 | 32.00 |
| Crum – 100% NRC ME | 32.78 | 10.83 | 33.00 |
| Crumble Average | 33.16[A] | 10.74[A] | 32.34[A] |

# Economic Analyses - Live Weight Basis

| | Mash 108%ME | Mash 100%ME | Pltd 108%ME | Pltd 100%ME |
|---|---|---|---|---|
| LW,lb | 41.0 | 39.8 | 41.8 | 41.6 |
| F/G (0-20wk) | 2.51 | 2.77 | 2.47 | 2.67 |
| Feed $/lb LW | .149 | .153 | .154 | .156 |
| Feed $/tom | 6.10 | 6.10 | 6.42 | 6.49 |
| Return $/tom | 8.27 | 7.92 | 8.21 | 8.09 |

# Economic Analyses - Breast Meat Yield Basis

| | Mash 108%ME | Mash 100%ME | Pltd 108%ME | Pltd 100%ME |
|---|---|---|---|---|
| Meat, lb | 10.2 | 10.0 | 10.8 | 10.8 |
| Feed $/lb | .598 | .612 | .596 | .601 |
| Meat Return $/tom | 6.14 | 5.90 | 6.51 | 6.49 |

# Presentation Summary

- Breast meat yield optimized by higher protein levels; also greater amino acid requirements(>100% NRC (1994))
- Breast meat yield and growth response to feed form and diet energy:protein allows producers to choose best strategy based on costs

# Presentation Summary

- BMY sensitive to protein/amino acid quality
- Betaine improved breast meat yield

# Acknowledgments


- MTGA Nutrition Committee: Virgil Stangeland, W. Carlson, G. Engelke, J. Halvorson, H. Klein-Hessling, R. Nelson, R. Schwartz, G. Speers
- UM staff and students - Jeanine Brannon, Fred Hrbek, Sheila Groth, Jayne Kalbfleisch
- Sponsors - MTGA, FinnFeeds, NTBF, Aventis, ADM, Degussa, Heartland, Novus, FMC, Pfizer, Central Bi-Products, Minnesota AURI, MN Ethanol Distillers Cooperative