ADVANCED FEED PROCESSING TECHNOLOGY

INNOVATIONS IN TECHNOLOGY, EQUIPMENT AND OPERATIONS

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The biggest issue that animal agriculture will face in the future?

FOOD SAFETY

When consumers loose confidence in their government AND in their food supply, to whom do they turn??

When consumers loose confidence in their government AND in their food supply, to whom do they turn??

As in Europe, the "Food Chains" will assume *regulatory* responsibility

Do we really want the Krogers, Safeway or McDonalds telling us how to make feed and what we can or cannot put in that feed?

“We live in an age where

CONSUMER POWER

frequently outweighs

SCIENTIFIC PERSUASION”.

Feedstuffs 72:3, 1999

Food Safety
Safe Feed=Safe Food

- Farm to Fork, Dirt to Dinner, Soil to Supper
- *Everyone* in the feed industry makes food
- Major changes in food safety mandates
- These **will** affect the feed industry
- cGMP's, HACCP, ISO 900*x*, TQM
- If you don't pay attention, your competition will!

HACCP and CGMPs

- Hazard Analysis & Critical Control Points
- A 7-step program to control hazards: microbiological, chemical & physical
- Steps: hazard analysis, CCPs, ranges, monitor, corrective actions, records, verification
- cGMPs are control points, may be critical

Microbial Control in Feed Mills

The U.S. Center for Disease Control has tried for years to draw a line from the feed mill to the dinner plate!! So far, with little success.

THERMAL PROCESSING FOR MICROBIAL CONTROL

Temp °C	Number Samples	Entrobacteria Log_{10} CFU/gm
<60	18	3.3
60-65	17	3.4
65-70	33	3.0
70-75	44	2.5
75-80	34	1.7
>80	24	1.1

THERMAL PROCESSING FOR MICROBIAL CONTROL

Location	Incidence* (%)
Cereal Grain	3
Protein Meals	4
Animal Protein	67
Batch Mixer	69
Pellet Conditioner	32
Pellet Die	4
Cooler	7
Finished Feed	13
Truck	13
Farm	19

*** Percentage of samples contaminated with Salmonella**

FACTORS BRINGING ABOUT CHANGE

Public Safety, Laws and Regulations

* Food Safety-Microbiological
* Feed Additives/Growth Promotants
* Pesticide and Chemical residues

MILL DESIGN AND CONSTRUCTION

What will the mill of the future look like?

MILL DESIGN AND CONSTRUCTION

- Highly computerized
- Few employees
- Automation of nearly all processes
- “Lights out” operations

INGREDIENTS

Current Global Population of 6.5 Billion
"90 Million People Added Annually"

"Conventional technology alone will not allow food, feed, and fiber production to be increased sufficiently to meet the needs of the 10 billion global population of the 21st century"

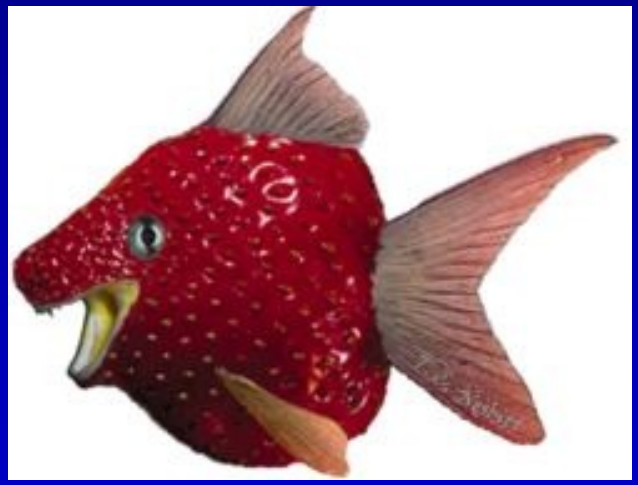
Biotechnology is the only Significant Means to Increase Food, Feed, and Fiber Production

- Currently 5 billion tons of food is produced annually.
- 25% (1.25 billion tons) is lost to pests
- Loss of cultivable land (0.44 ha/capita in 1961; only 0.26 ha in 1997).

What is the Solution?

How are we going to feed
10 billion people??

Transgenic Crops



INGREDIENTS

Genetically Modified Ingredients (GMO's)
Must be Identity Preserved

May Have 4 to 6 GMO's Plus Commodity Grains in a Single Feed Mill

Bin Space, Grinding, Inventory, and QA?

RECEIVING AND STORAGE

- High-Speed Unloading
- Larger units of Microingredients
- Ingredient Segregation
- Inbound Analysis and QC

Receiving Ingredients

- **Tote Bags**
- **Liquid Tote Tanks**

The industry does not want to deal with bags, bag dumping and disposal, pallets or barrels!

Tote Bags

- Use for micro or low use ingredients.
- Can be used to directly refill micro batching system bins.
- Reduces labor and disposal of paper bags.

High Speed Infrared Instrument

- Inbound Quality Control
- Segregation of Ingredients

GRINDING OPERATIONS

* Hammer Design and Metallurgy
* Air Assist System Design
* Noise Control
* Automation and Routing
* Quick-Change Screens
* Quick-Change Hammer Gangs

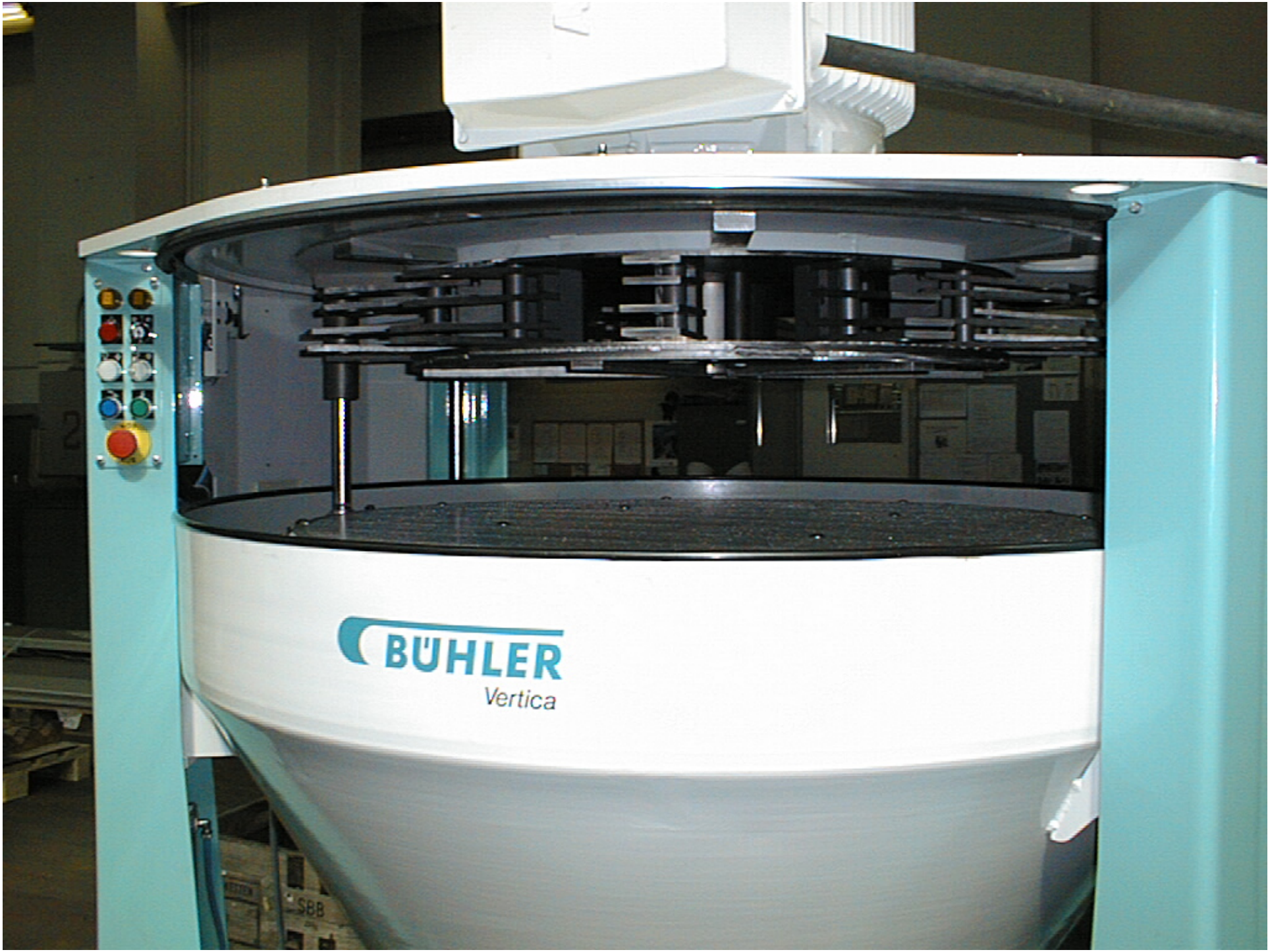
THE FUTURE!

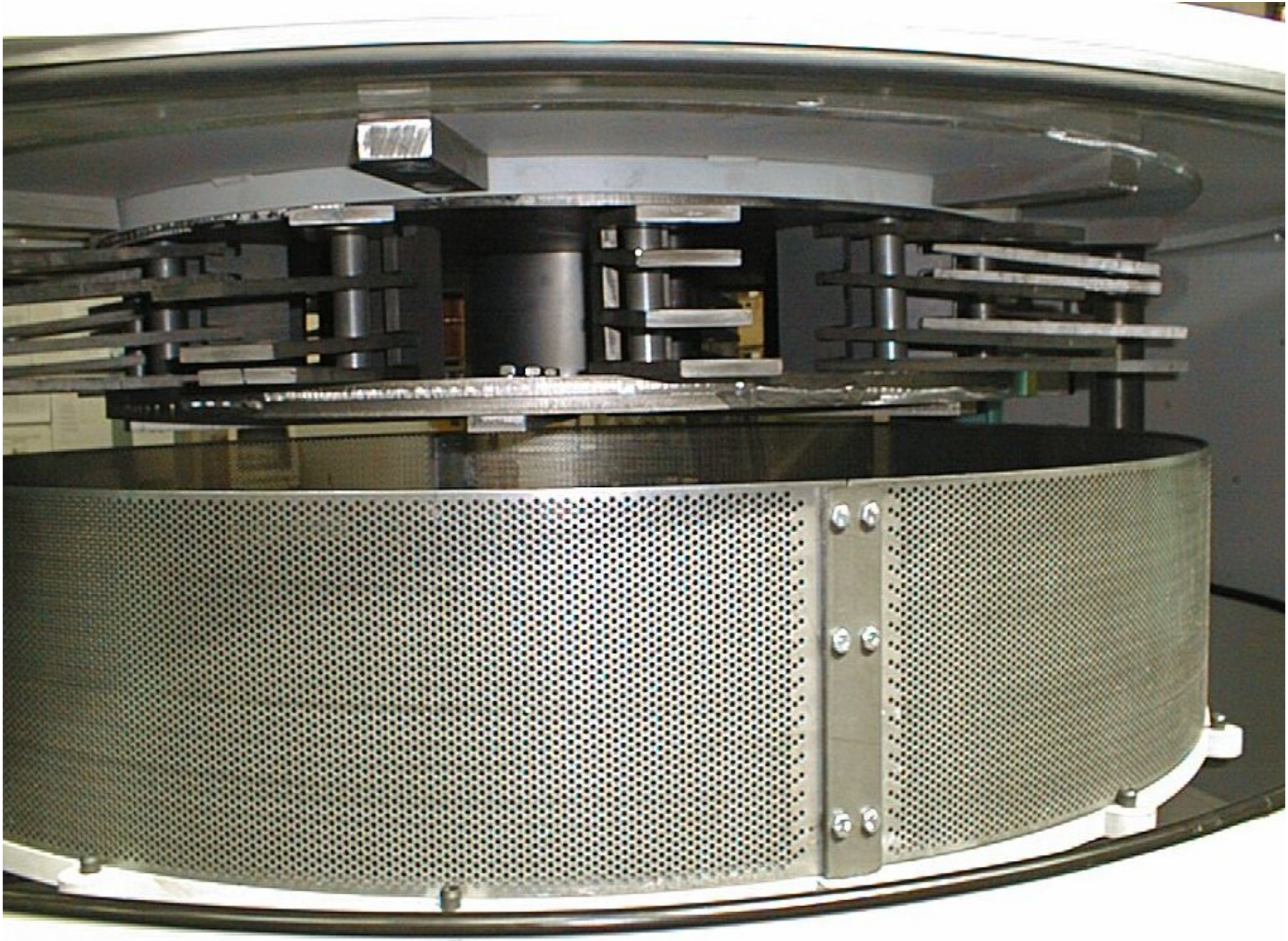
GRINDING OPERATIONS

* Vertical Shaft Hammermills??

  -European Designs now available
  -Air-Assist not recommended

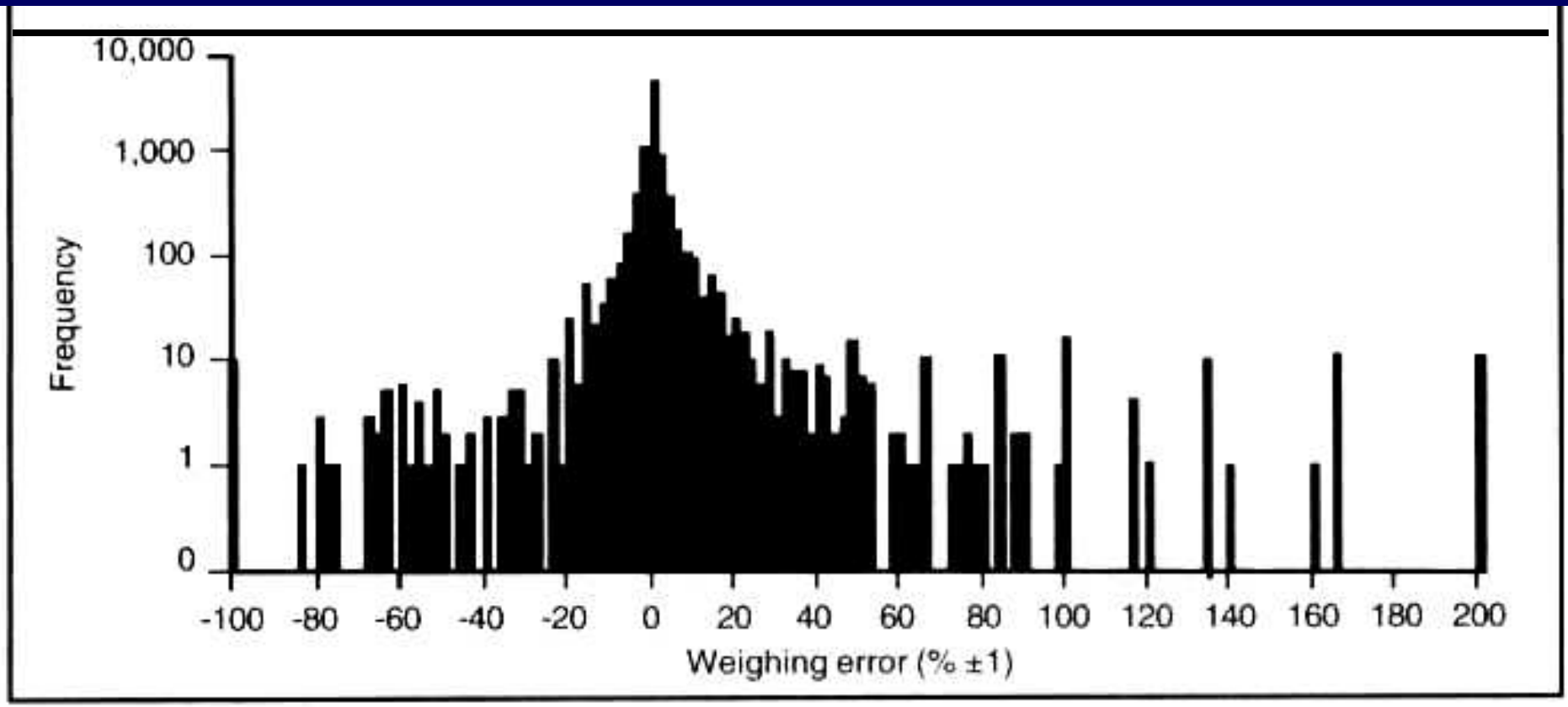
VERTICAL SHAFT HAMMERMILL


BÜHLER
Vertica



Proportioning Systems

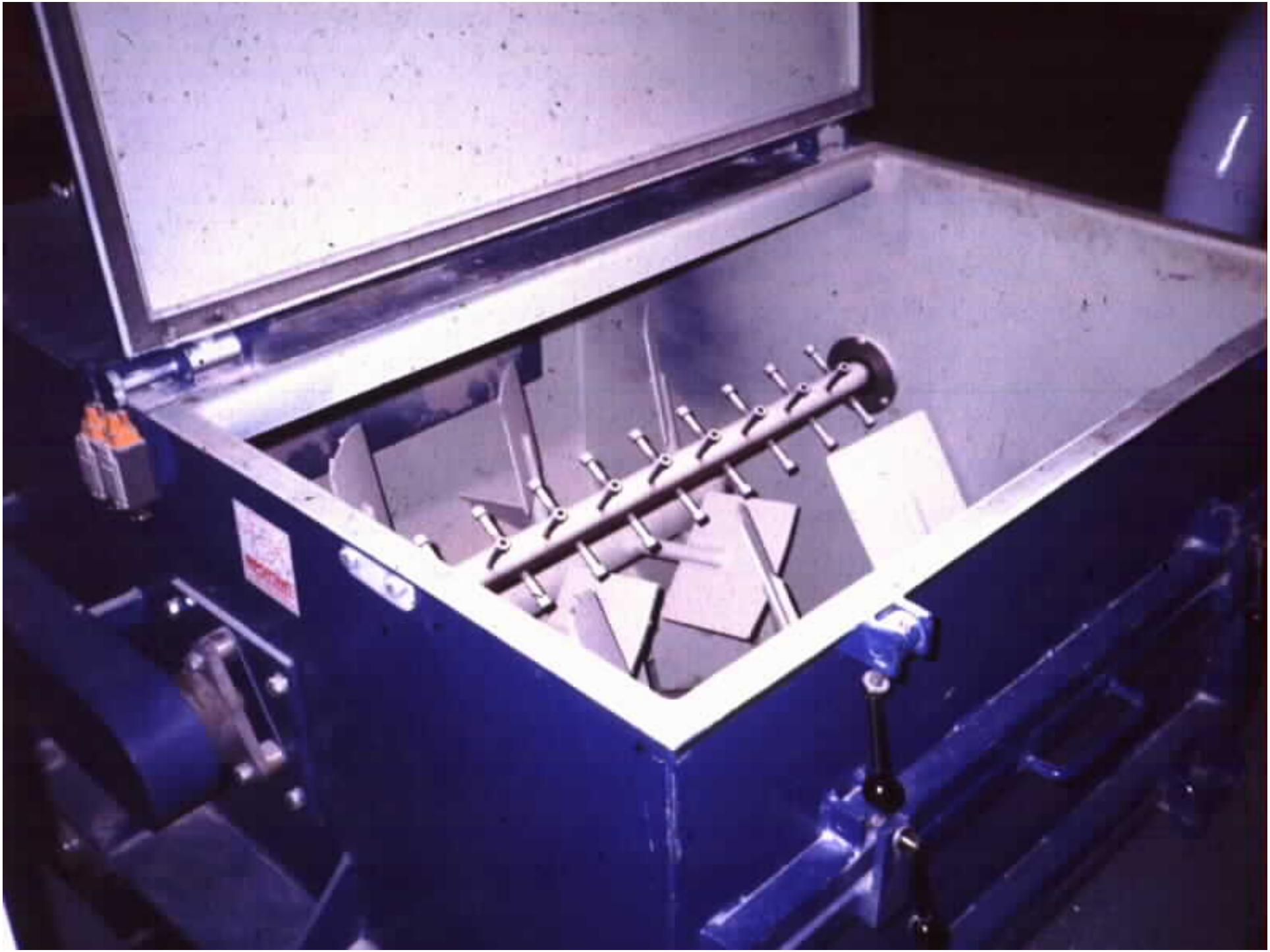
* On-line Reformulation
* Weighing Accuracy
  Loss-in-Weight Systems
* Short Cycle Batching
  1.0-1.5 Min. Cycles



1. Distribution of weighing errors. Errors exceeding 200% are listed as in the 200 category (the largest weighing error noted was 440%)

Mixing and Mixing Equipment

* Trend is Toward Large (12-16 Ton) Mixers.
  - Concern with Uniformity!
* Smaller, Short-Cycle Mixers
  - -1.0 to 1.5 Min.Mixing Cycles
  - -High Flexibility



H&S
TR Mixer

Pelleting?

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Pelleting Will Not Go Away!!!

PELLETING-CONDITIONING

Conditioning Time Control

-Variable Shaft Speed
-Pick Angle Control
-Steam Block Panels
-Conditioner Angle

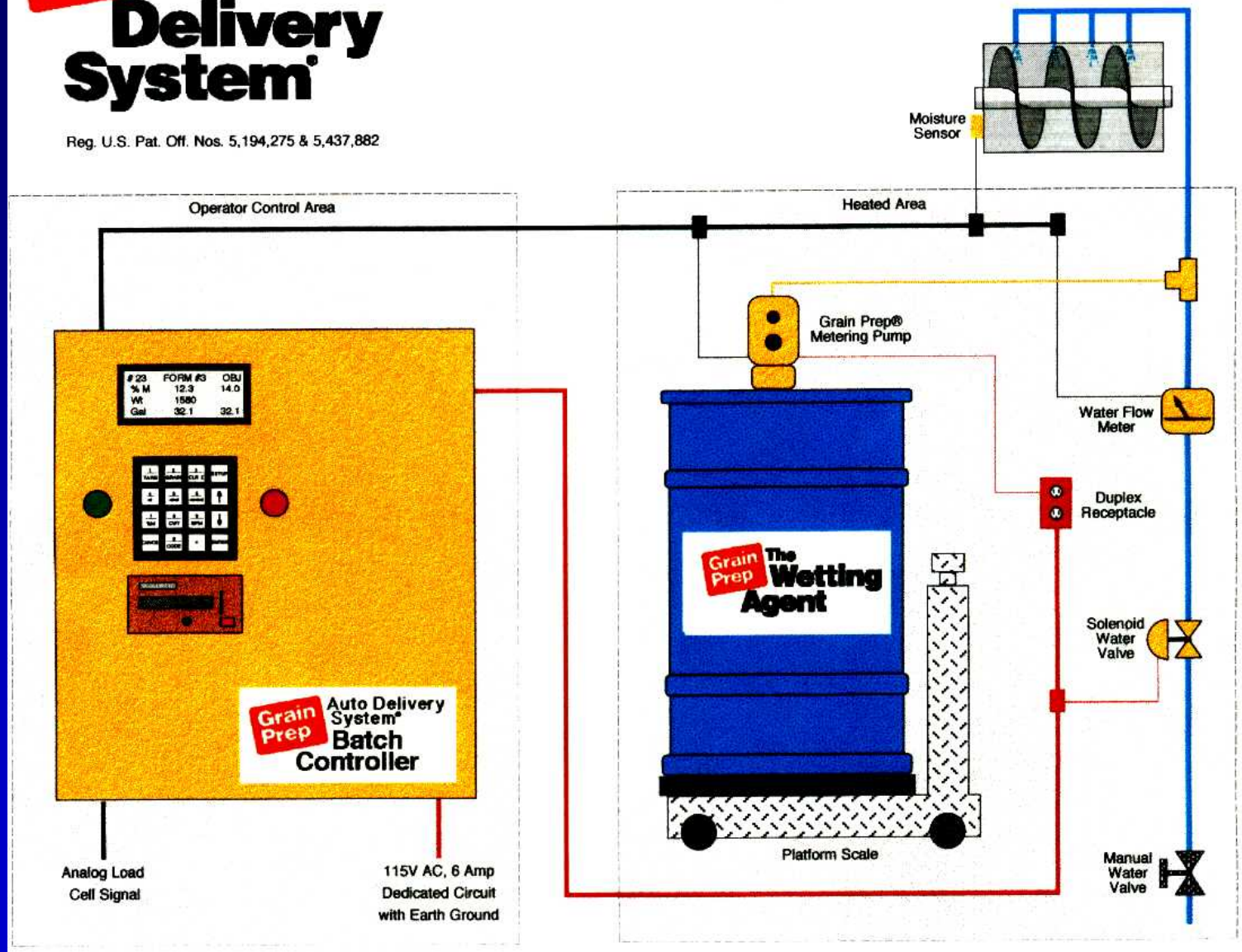
On-Line Moisture Control

The Effect of Precise Moisture Control on Pelleting Operations

Grain Prep Auto Delivery System®

Batch Version

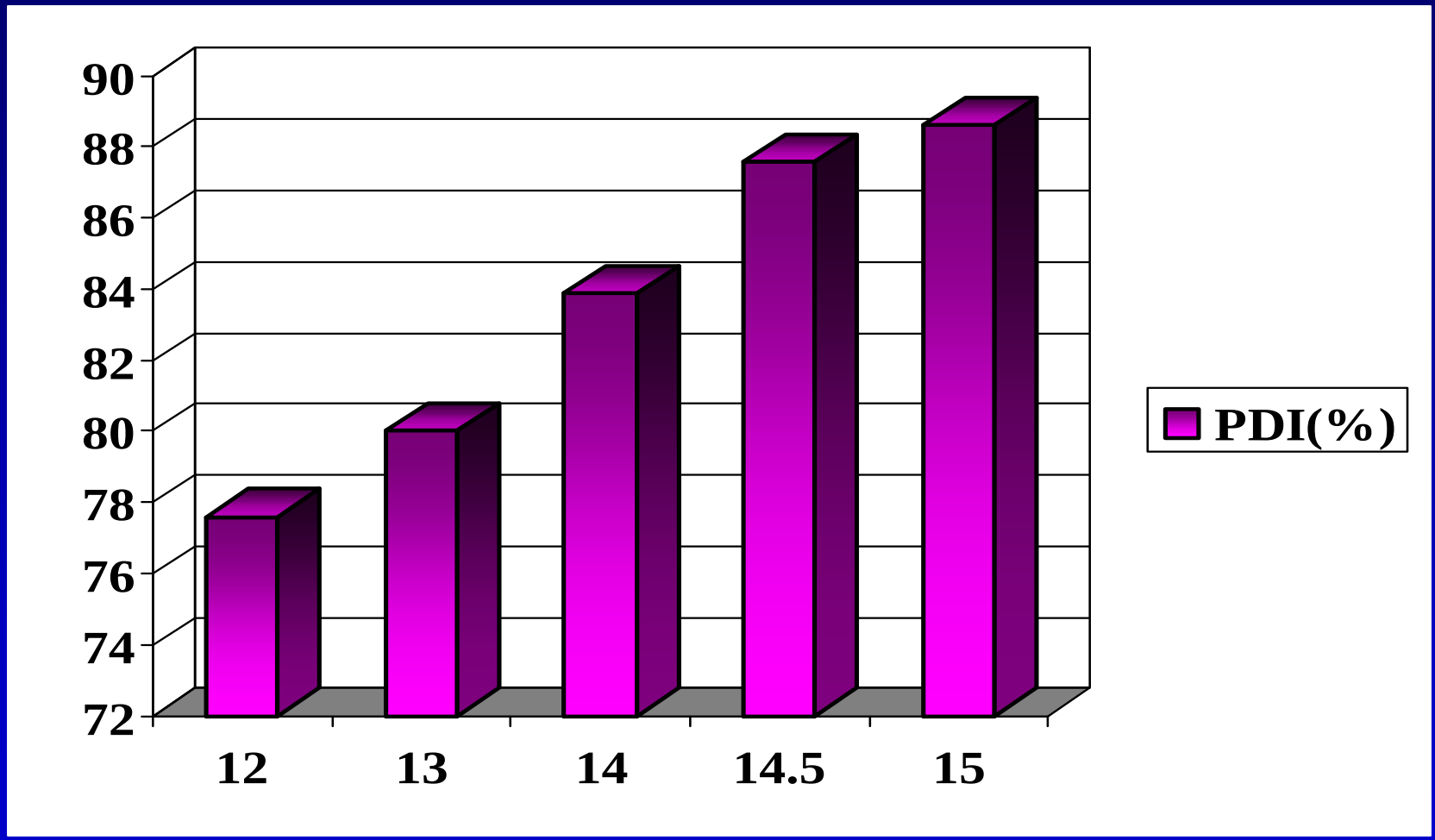
Reg. U.S. Pat. Off. Nos. 5,194,275 & 5,437,882



Moisture and Conditioning Results

Incoming (%)	Target (%)	Actual (%)	Conditioned (%)
11.4	12.0	12.2	15.1
11.0	13.0	13.0	15.9
10.9	14.0	14.0	16.8
10.7	14.5	14.7	17.0
11.1	15.0	15.1	18.5

Effect of Added Moisture on Pellet Quality



THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Formulating for Pellet Quality !!

Is It Possible??

The effects of feeding cracked corn and pelleted concentrate protein pellets on broiler performance and feed manufacturing costs

Objective

Evaluate the effects of a diet consisting of cracked corn and concentrate pellets on broiler growth performance

Procedures (Exp 1 &2)

- **2,080 day-old chicks allotted to 52 pens**
- **40 birds/pen; 0.76 ft^2/bird (pen exp unit)**
- **Feed and water consumed** *ad libitum*
- **Pen and feeders weighed on d 0, 18, 32, and 41 for evaluation of ADG, ADFI, and F:G.**
- **On d 41 random selection of 2 birds/pen for carcass evaluation of dress body weight (WOG), gizzard weight, and small intestine strength**

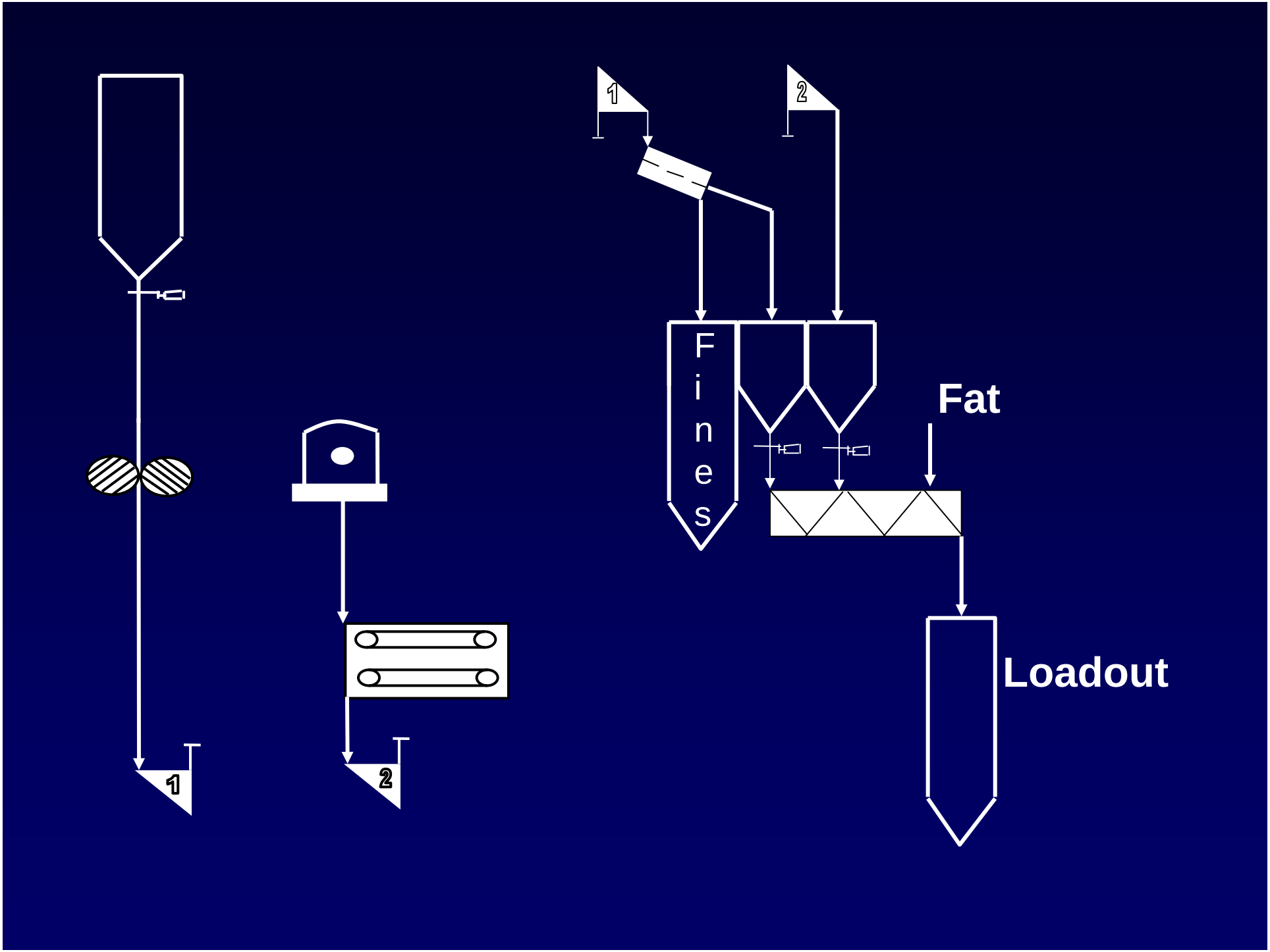
Procedures (Exp 2)

- Cracked corn was added in place of the ground corn fraction on a wt:wt basis at levels of none, 25%, and 50%.
- Treatments included:

1) Control
2) 0% d 0 to 18; 25% d 19 to 41
3) 0% d 0 to 18; 50% d 19 to 41
4) 25% d 0 to 41
5) 50% d 0 to 41

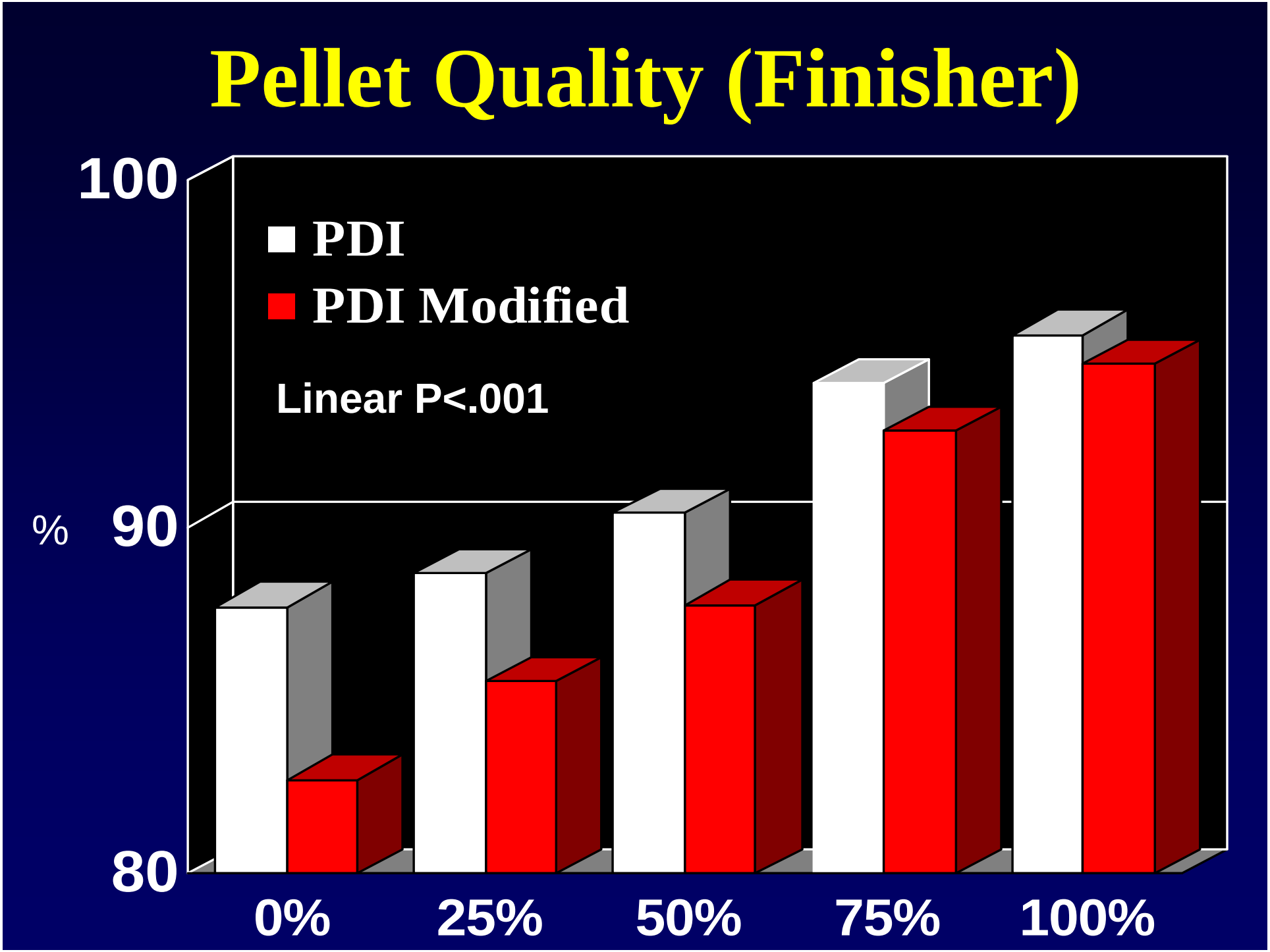
Experimental Diets

Item	Starter	Grower	Finisher
Ground Corn	60.54	64.61	68.05
Soybean Meal	31.55	27.85	24.80
Meat Meal	3.50	2.50	----
Fat	1.35	1.95	3.60
Limestone	0.95	1.05	1.15
Monocal 21%	1.20	1.15	1.55
Salt	0.34	0.35	0.39
L-Lysine HCl	0.03	----	----
DL-Methionine	0.25	0.19	0.15
Vitamin/Mineral PMX	0.25	0.25	0.25
Coccidiostat	0.05	0.05	0.05
Calculated Analysis, %			
Crude Protein	22.20	20.12	17.50
Methionine	0.60	0.52	0.45
Calcium	0.95	0.90	0.84
Total Phos	0.73	0.67	0.65

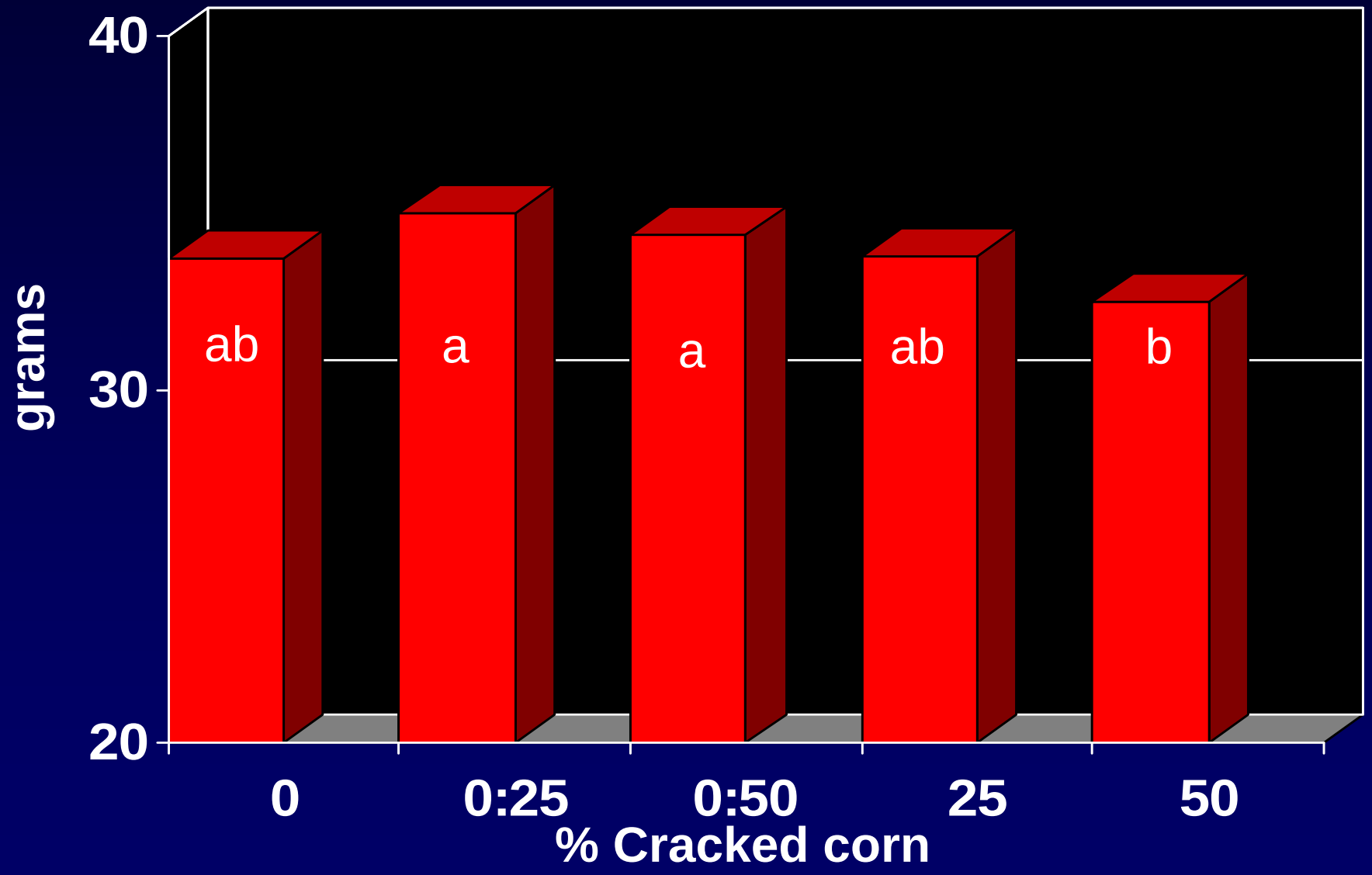

1
2
Fines
Fat
Loadout
1
2

Results

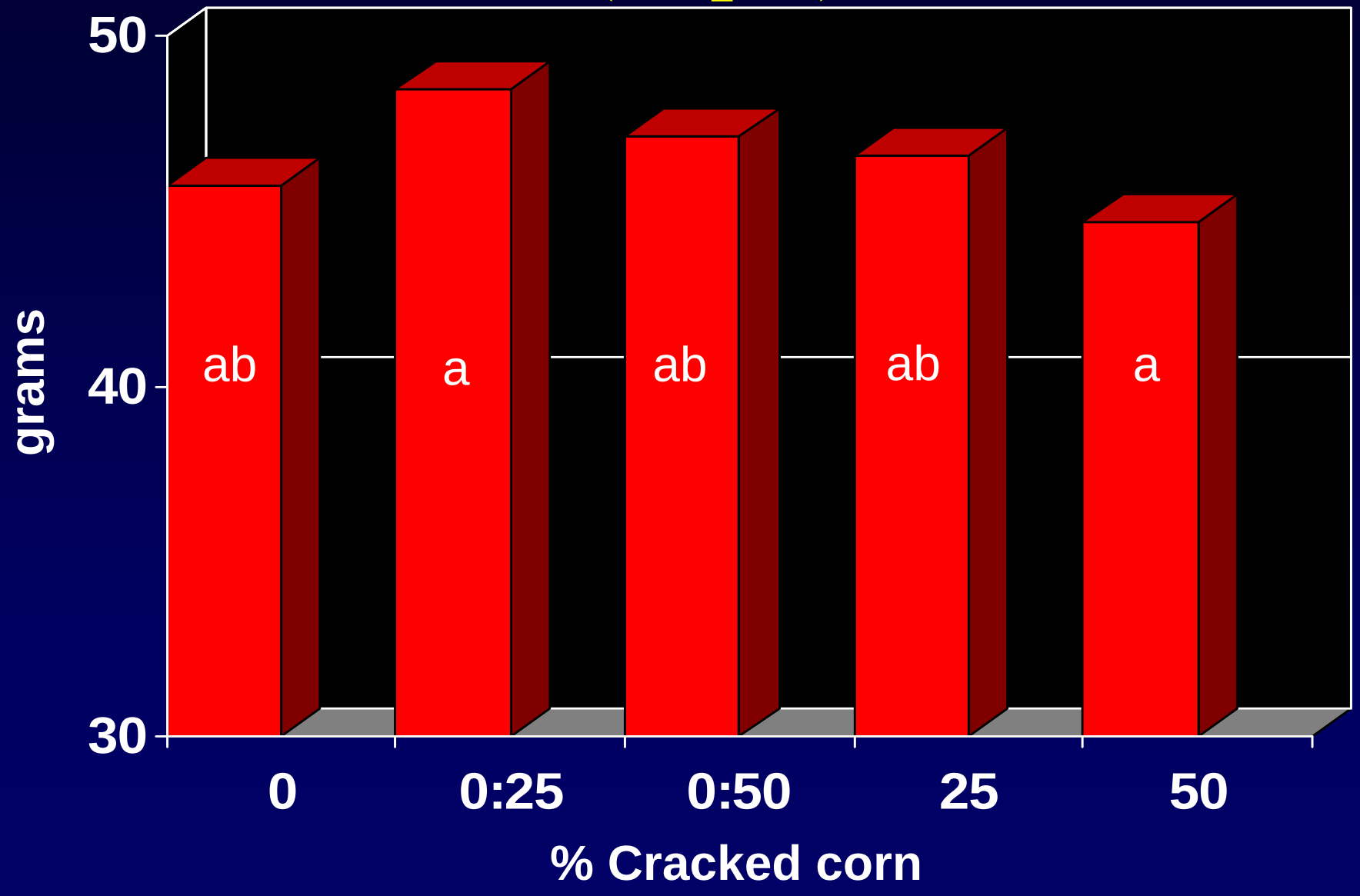
Pellet Quality (Finisher)



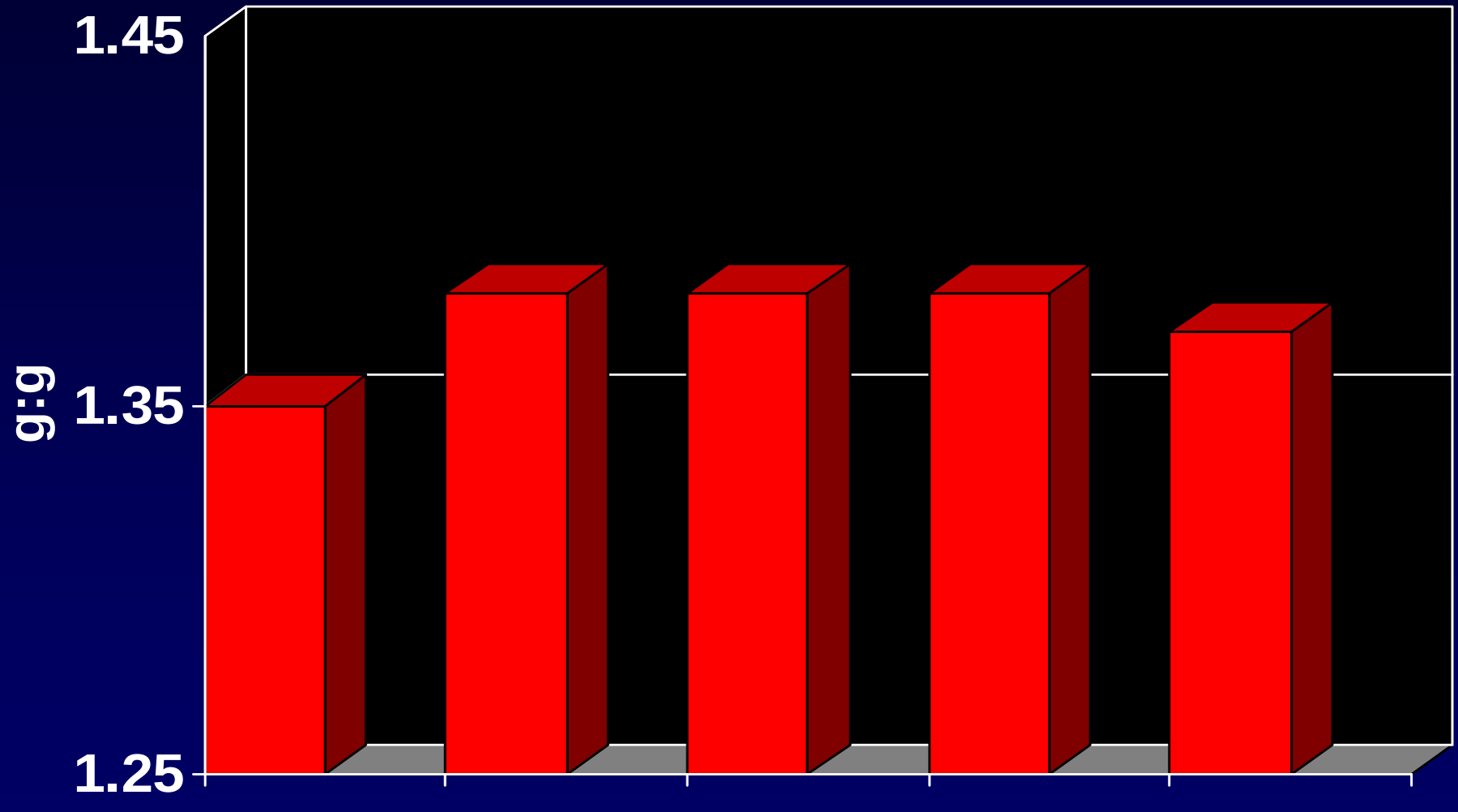
Cracked Corn and ADG (d 0 to 18) (Exp 2)



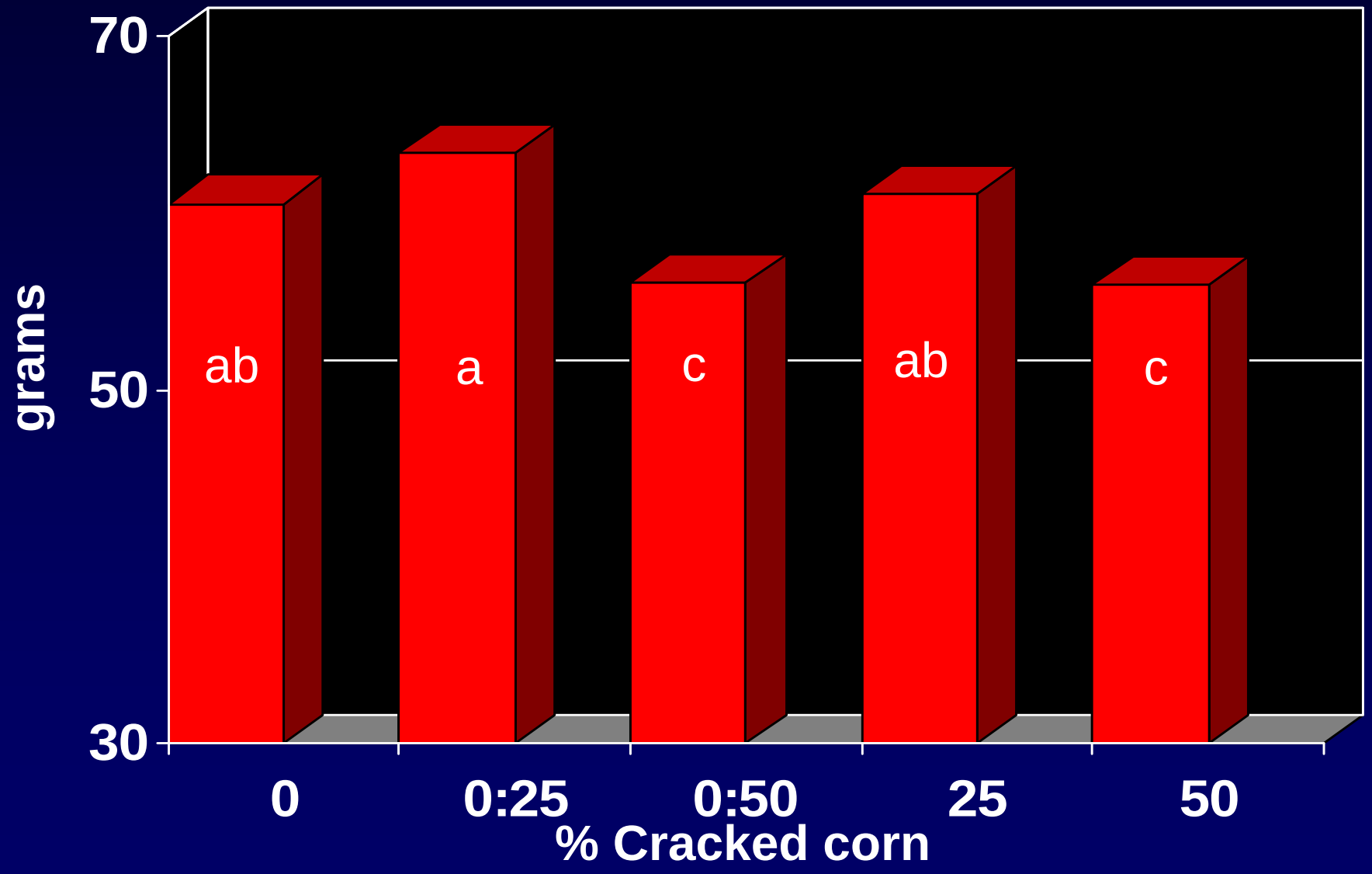
Cracked Corn and ADFI (d 0 to 18) (Exp 2)



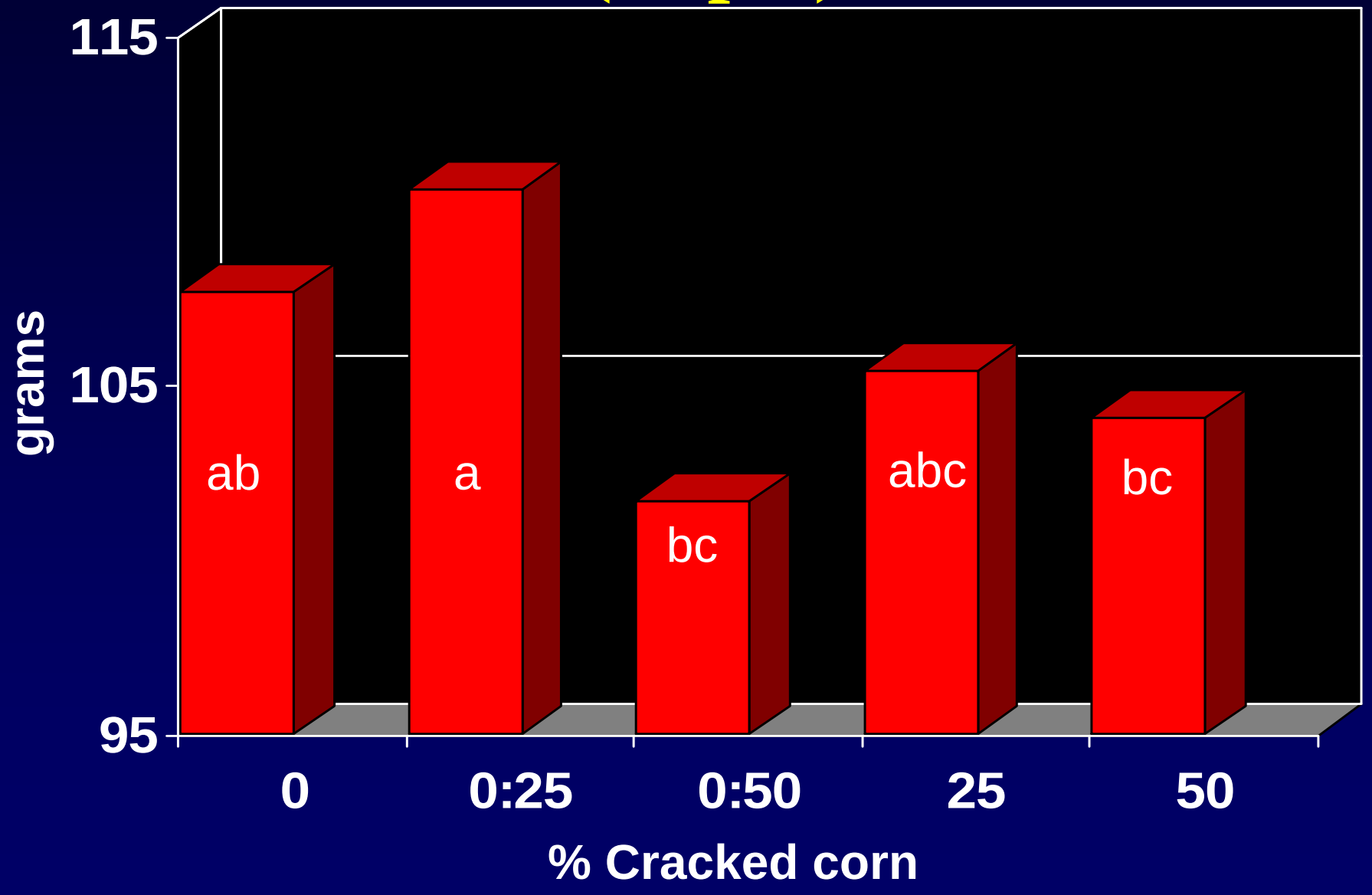
Cracked Corn and F:G (d 0 to 18) (Exp 2)



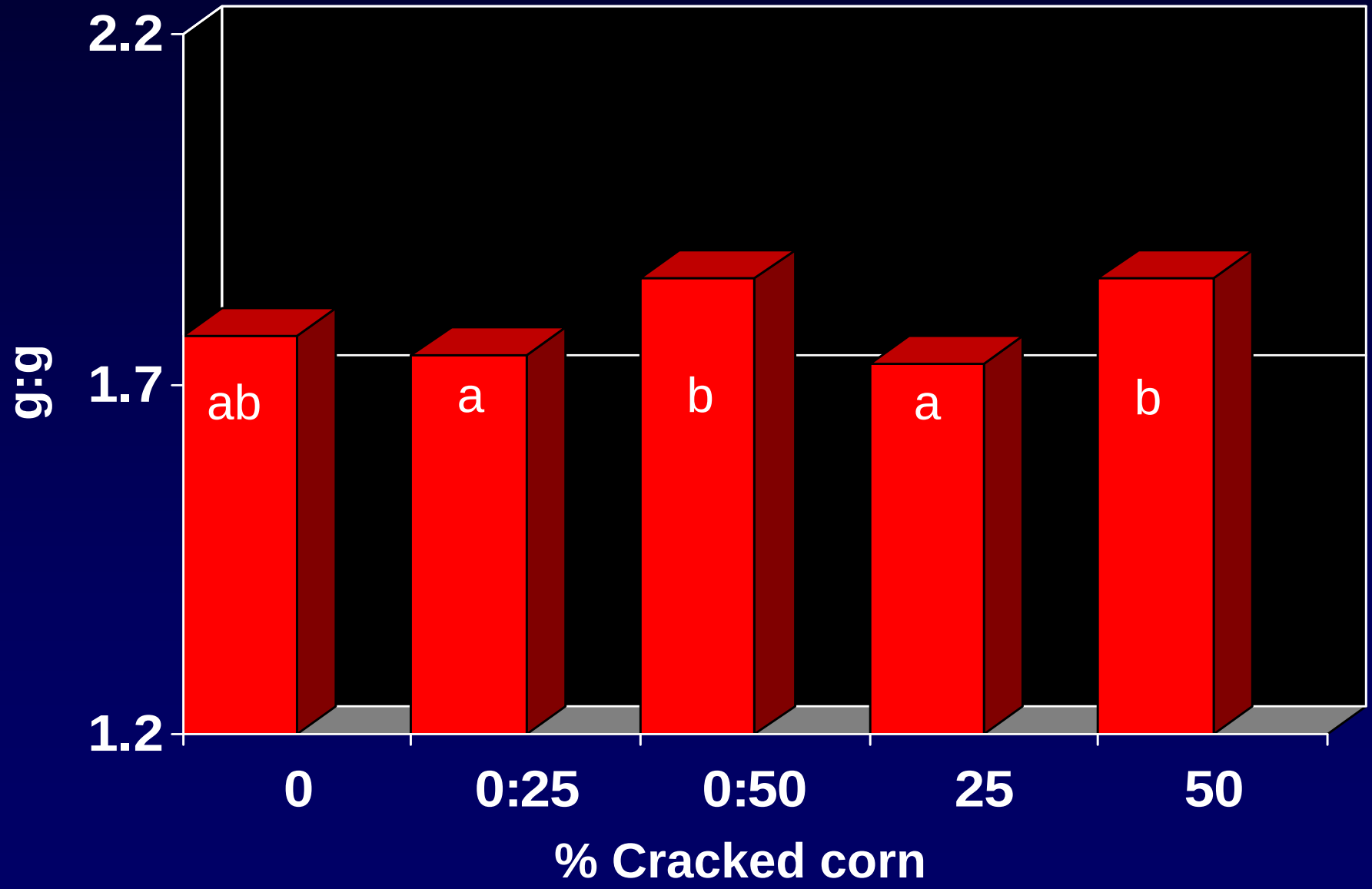
Cracked Corn and ADG (d 0 to 41) (Exp 2)



Cracked Corn and ADFI (d 0 to 41) (Exp 2)



Cracked Corn and F:G (d 0 to 41) (Exp 2)



Example

- **Production: 70% corn (average);**
- **2- 10hr shifts; 6 d/wk; 80% efficiency**

4400 ton/wk → 733 ton/d → 45.8 ton/hr

3630 tons Pellets **770 tons Corn**

Currently:

4400 ton/wk / 45.8 t/hr = 96 hrs

Proposed:

3630 ton/wk / 45.8 t/hr = 80 hrs

Example (cont.)

- 96 hr – 80 hr = 16 hours
- 16 hours/wk x $300/hour = $4,800/week
- $200,000 (equipment/installation)
- 42 week pay-off period

THE FUTURE!

COOLERS AND COOLER DESIGN

Counter Flow Coolers
Are Here To Stay!

THE FUTURE!

COOLERS AND COOLER DESIGN

Future Designs Will Include Drying Capability

Post Pellet Additive Application

***Low Inclusion Liquids**

Enzymes are just the first of several low inclusion liquids that will likely be used by the feed industry in the near future.

Post Pellet Additive Application

***Low Inclusion Liquids**

-Enzymes

-Drugs

-Vitamins

-Biologicals

Load Out System Design

*** Finished Feed Blending**

Can Create an Infinite number of Feeds to Match Stage of Growth

SUMMARY
(ADVICE!!)

Stay Informed!!!

* Consider the Economics
* Consider the Alternatives
*Make Logical, Rational Decisions
*Watch Related Developments