

# Establishing a NIR Center of Excellence: A Solution for Successful Management of Multiple Instruments and Programs

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# Agenda

- Overview of Land O'Lakes
- Our NIR History
- Establishing the NIR Center of Excellence
- Challenges & Solutions
  - Dairy
  - Feed



**LAND O' LAKES, INC.**

FEEDING HUMAN PROGRESS

Land O'Lakes has an exceptional reputation with a 95-year history

More than a “butter business”

Powerful, respected brands

Industry-leading operations



Answer Plot<sup>®</sup>

Mazuri<sup>®</sup>



LAND O'LAKES<sup>®</sup>  
ANIMAL MILK PRODUCTS CO.

CROPLAN<sup>®</sup>

KOZYSHACK<sup>®</sup>

By WINFIELD UNITED

Answer Tech<sup>™</sup>



# Feed: A leader in animal nutrition



B2C: Lifestyle, Livestock & Exotic

B2B: Milk Replacer & Premix

1,200-acre farm dedicated to research

Dairy Foods: #1 butter brand in the U.S.



Retail: Butter, cheese, pudding

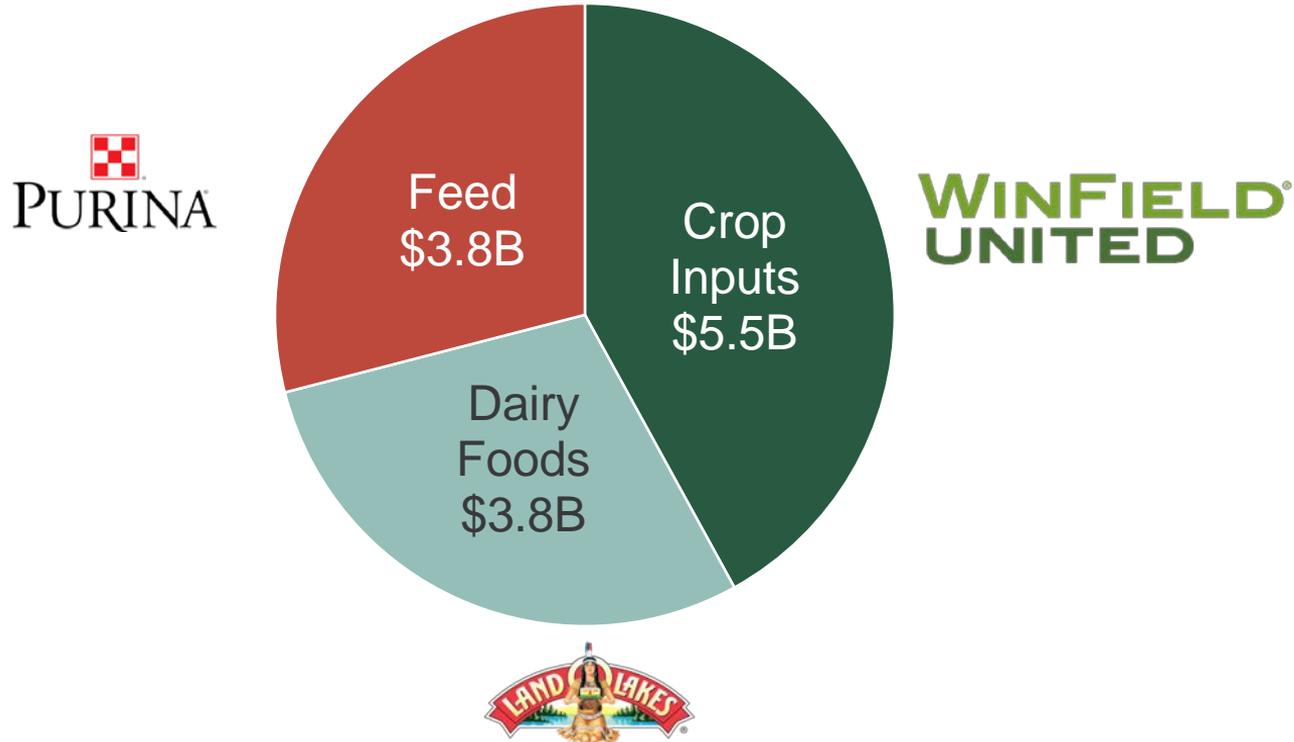
Foodservice: K12 and commercial

Global Dairy Ingredients: B2B

An icon in our nation's kitchens

Our 2016 revenue as a company was \$13 billion

Net sales by business unit



# Our NIR History

# 1990s to early 2000's

## Dairy

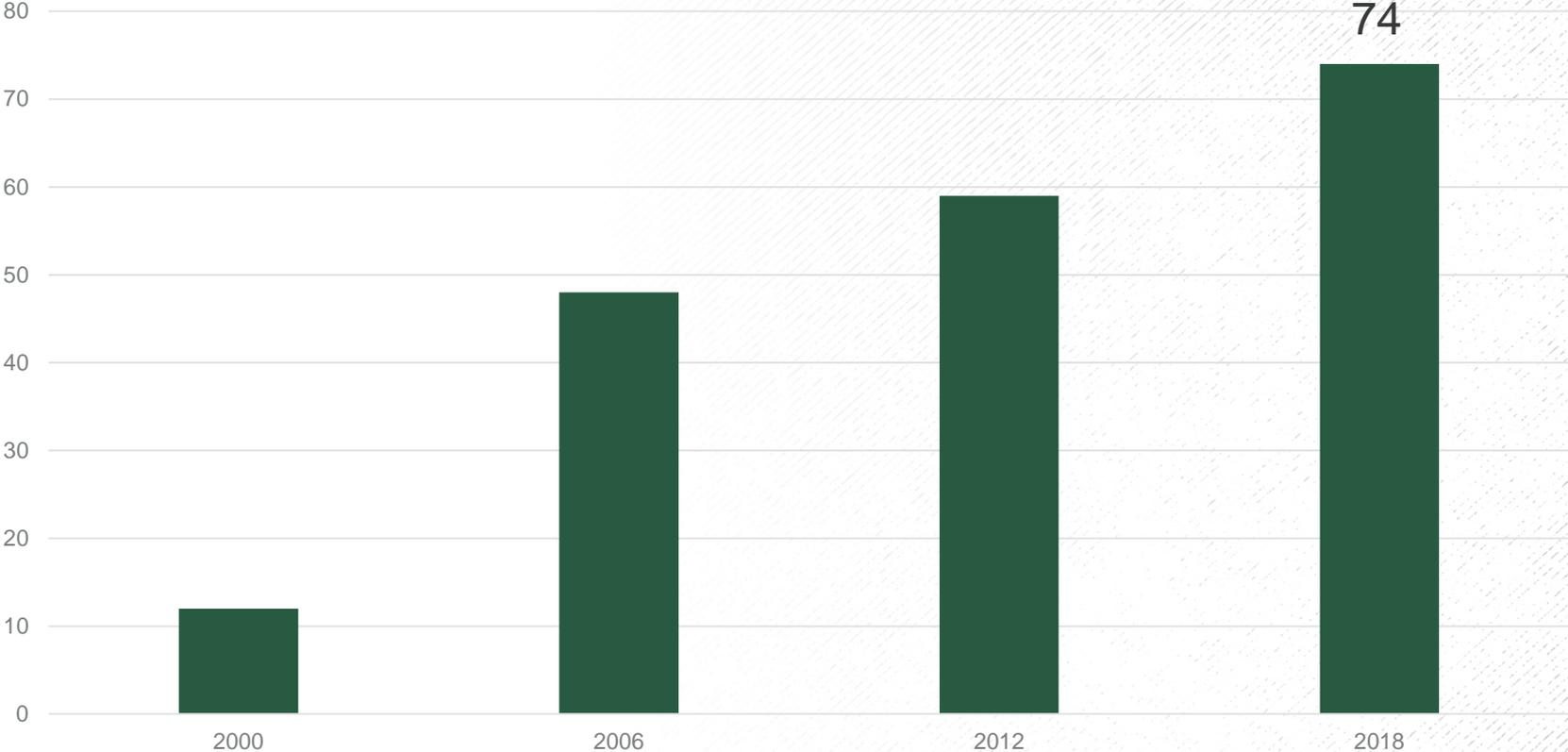
- NIR used minimally
- Moisture, Fat, Protein - Finished Goods
- Plants purchased whatever equipment they wanted and managed themselves
- Infrequent verification (if at all)

## Feed

- Purchase of Purina (2001) expanded the use of NIR



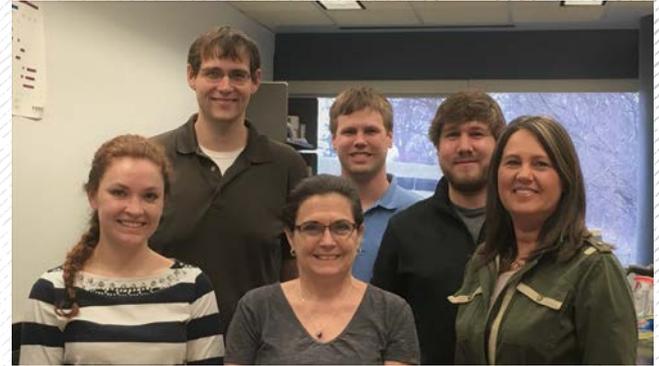
# NIR Instruments 2000-2018



# Establishment of NIR Center of Excellence

# Establishment of NIR Center of Excellence (NIR COE) - 2009

- Brought Feed and Dairy NIR groups together at our corporate headquarters in Arden Hills, MN
- Expanded knowledge and capabilities
- Eliminated need for NIR experts at each location
- Resource for all of Land O' Lakes
- Cross-functional resources
- Started using the internal lab for feed wet chemistry
- Continuous improvement of current programs and practices
- 6 fulltime employees (2018)



# Support all NIR activities at feed and dairy plants

- Calibration model development & updates (99% of all models internally developed)
- Troubleshooting & Technical issues
- Management of multiple programs
- Training and Education
- Running of samples for non-NIR plants
- International – Kenya, China, Philippines
- Co-manufacturers, Outside labs



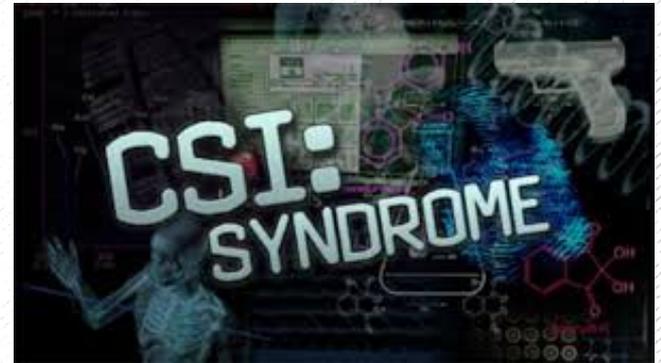
2,000,000+

Number of results generated by our NIR  
Instruments Annually

# Challenges & Solutions

# Reality of NIR: Educating Users, Operations, and Management

- Realistic expectations
- Results are predicted values
- Validation and ongoing verification



# Land O'Lakes Dairy Programs

LAND O'LAKES, INC.





## 25 benchtop instruments and 5 inline instruments at 11 locations

- Dairy Powders, Cheese, Butter, Spreads, Cheese Powders, Thick Liquids, Whey
- Moisture, Fat, Protein, and Salt
- ~60 Calibration models
- ~80 Channels
- In-process control and Finished Goods testing
- Traditional verification using wet chemistry

# Business Impact

- Reduced Labor costs or increased time for other quality tasks
- Increased volume of testing
- Minimal error, reduces need for retests due to lab mistakes
- Environmentally friendly – reusable cups, no reagents or waste
  
- Finished Goods
  - Fast, efficient release of product
  
- In-process control
  - Immediate composition feedback allows for process adjustments
  - Improved quality with less defects
  - Optimized composition



1,000,000

Number of Samples Run on One of our  
NIR Instruments (so far)

# Some Challenges

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Proper verification

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Real time samples used for verification

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Seasonality

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Process Changes

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Tracking verification data

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Chasing the bias

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Sufficient samples to perform a bias change

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Pressure from operations to make bias adjustments

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Blaming the instrument

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Large number of instruments, locations, channels, ingredients, calibration models

# Dairy Solution #1

## Formal Verification Program

- Specific requirements for all
- Frequent, routine verification throughout the year
- Verification samples added to calibration models
- Monthly review by NIR COE
  - Bias adjustments only made by NIR COE
  - Statistically valid (20+ data points)
- Verification metrics
- Mandatory remote access
- Shared file locations
- Confidence in results

A person wearing a dark t-shirt and jeans is holding a red bucket with the Purina logo. The background shows a barn or farm setting with wooden walls and various equipment. The text "Purina Feed Programs" is overlaid in white on the right side of the image.

# Purina Feed Programs

**LAND O'LAKES, INC.**

## 44 Instruments, Multiple Purposes

- 3 Corporate (Arden Hills, MN)
- 32 Feed plants - incoming ingredients
- 3 Animal Milk Replacer Plants – ingredients and finished goods
- 1 Finished product
- 1 Raw material identification
- 1 Kenya, 2 Philippines, 1 China
- Multiple Programs



PURINA<sup>®</sup>



# Formulation Program

- 58 different feed ingredients w/ multiple constituents
  - Moisture, Fat, Protein, Fiber, ADF, NDF, Ash, Minerals, Fatty Acids, Sugars, etc.
  - Calibration models for each
- 32 Plants with a NIR onsite run a sample from every unload
- 20 Plants without NIR send in every unload to the NIR COE





# Business Impact

- Best cost formulation of product
- Ingredient claims and acceptability
- Quality Assurance
- Eliminates need for laboratory and lab technician at each location

# Feed Challenges

- Limited Budget, traditional verification not practical
- Large number of ingredients
- Multiple Suppliers
- Multiple Instruments/locations
- Different Ingredient Mixes at each location
- Ingredient Variability
  - Suppliers
  - Regionality
  - Seasonality
  - Sample Homogeneity



# Feed Solutions

- Modified verification
  - Selected sample sets get wet chemistry in duplicate and sets are passed to all the instruments that run that ingredient
  - The most critical ingredients get more attention. Routinely send in samples and compare to our master instrument
  - All plants are required to send in samples that exceed M-distance limits or outside of our calibration ranges
- Monthly ingredient request
- Use of spreadsheets for tracking instrument info, calibrations, contacts, ingredients, etc.
- Automated transfer of data



# General Challenges & Solutions – Feed and Dairy

## Difficult Matrices/Sample Homogeneity

- Duplicate wet chemistry
- Large cups, specialty cups

## Wet chemistry accuracy & variability

- Internal wet chemistry
- Duplicates
- Lab assessments
- Proficiency programs

## Communication

- SharePoint sites, Webinars
- Group email and phone line

# Critical NIR COE Solution: Remote Access Software

- Allows us to more readily manage calibrations and bias settings across all of our plants
- Can use from our own desktop rather than a shared designated computer
- Multiple people can be using the system at the same time
- Easily make changes, pull spectra or run reports
- We can quickly check on plant compliance of our programs or just view their data
- Assists in troubleshooting
- Having different levels of access allows us to give the tool to individuals
- Allows personnel to easily use the data for their needs (QA, Finance, Technical Service, Production, etc.)



# Critical Solution for NIR COE: Vendor Partnerships



- Leveraging Vendor Partnerships
  - Customer and Technical Service
  - Work with us on our projects including custom setups for instrument with special IT needs
  - Ask for our input on software needs and improvements
  - Desire to share knowledge and calibration models
  - Competitive pricing
  - Willingness to let us trial new instrumentation
  - Direct access to resources

Thank you!

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