NORTHERN CROPS INSTITUTE

NPA ANNUAL MEETING

Looking to the Future: Innovation in Manufacturing and Food Safety

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WELCOME TO THE NEW PELTIER COMPLEX!

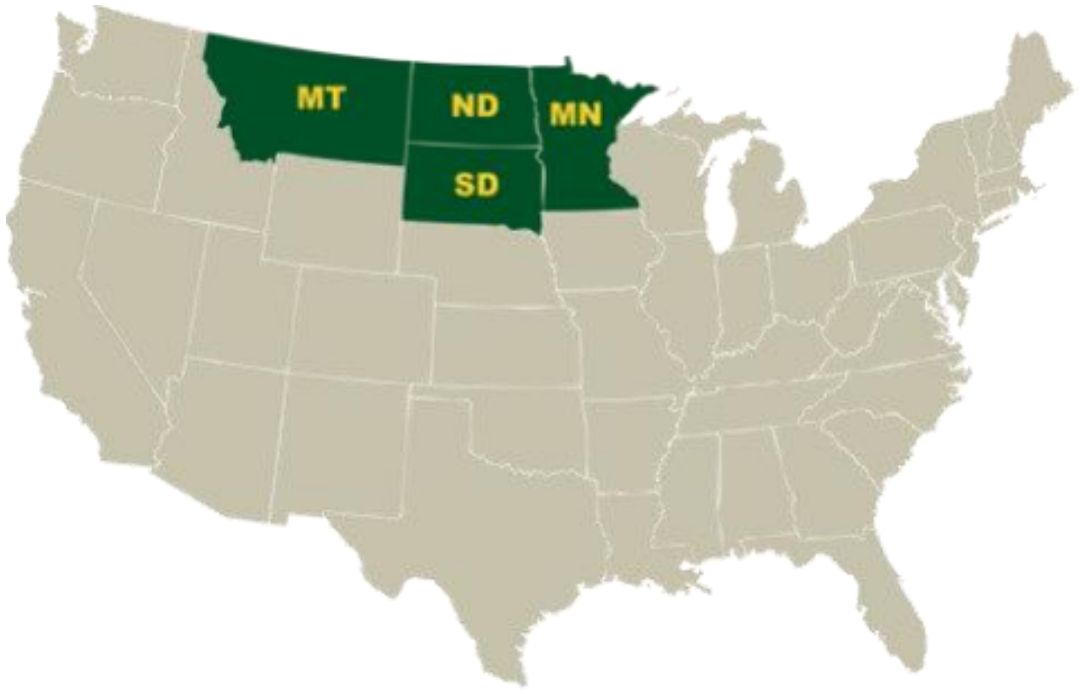
NORTHERN CROPS INSTITUTE

NCI'S MISSION:

NCI's mission is to support agriculture through educational programs and technical services that expand markets for northern grown crops.

WHO WE ARE:

Four state collaboration based at North Dakota State University in Fargo, ND.



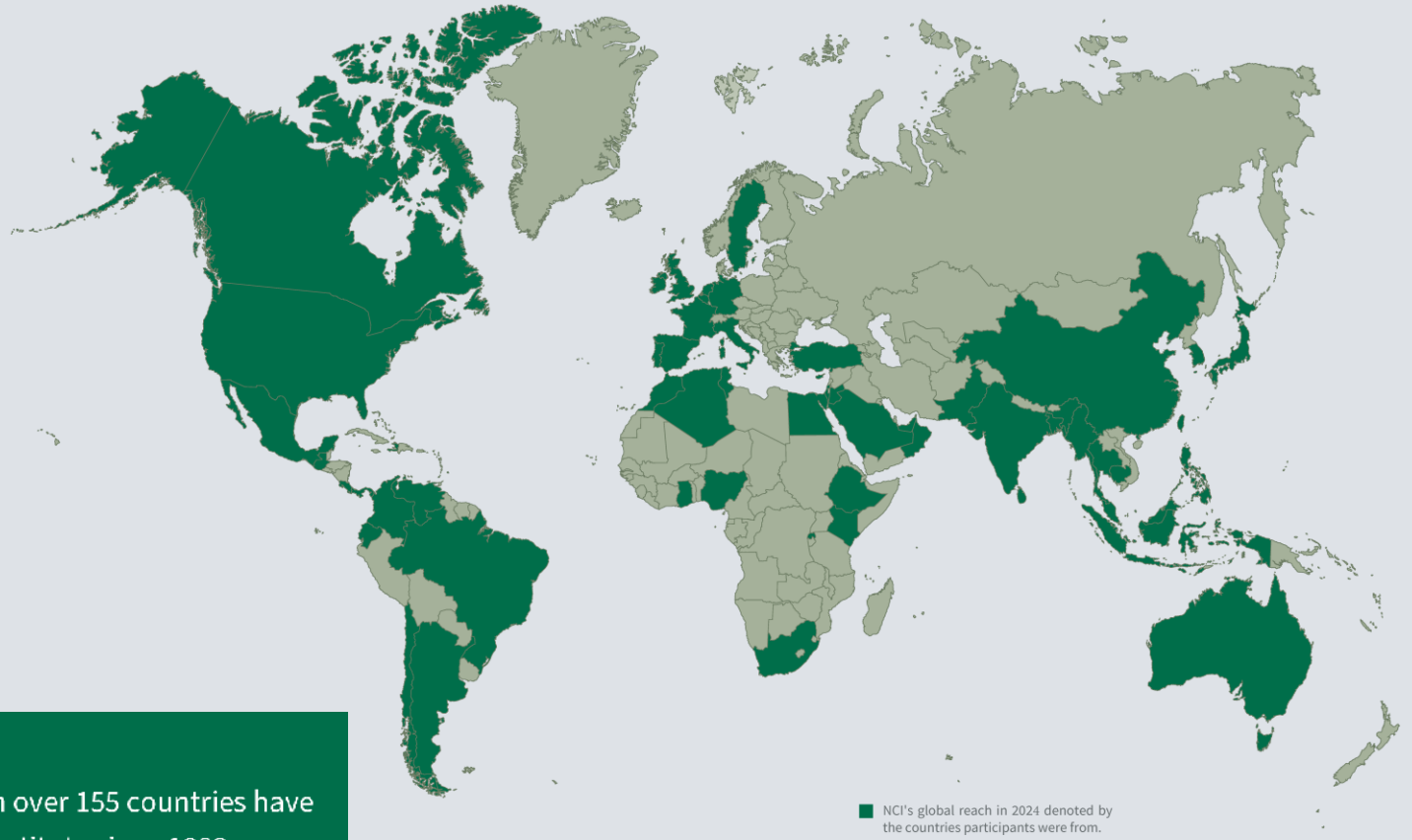
GOVERNANCE:

- ND State Century Code 1981
- Governed by Northern Crops Council
- At NDSU, collaborate with regional land-grants and commodity groups

CONNECTING IN THE GLOBAL MARKETPLACE

2,399 **PARTICIPANTS**
attended or watched the recording of an educational course, webinar, or event hosted by the NCI in 2024.

71 **COUNTRIES**
were represented by virtual or in-person participants in these NCI happenings.



NCI's global reach in 2024 denoted by the countries participants were from.

DID YOU KNOW? Participants from over 155 countries have attended courses at the Northern Crops Institute since 1983.

WHAT NCI PROVIDES

EDUCATIONAL COURSES

Our courses cover a variety of topics that allow participants to learn in a variety of settings

PROCESSING & PRODUCT DEVELOPMENT

We can assist in the processing or testing of an ingredient or new product

TESTING SERVICES

With our analytical labs, we can test and evaluate a wide range of products

CONSULTING

Our highly qualified technical team is able to consult with clients, even on-site

EDUCATIONAL PROGRAMS

EDUCATION

In-Person and On-Demand Courses

Topics covering procurement & risk management, food and feed processing and quality evaluation

Custom and Private Courses

- Large and small class sizes
- Allows for discussion of proprietary information
- Online, in Fargo, or around the world

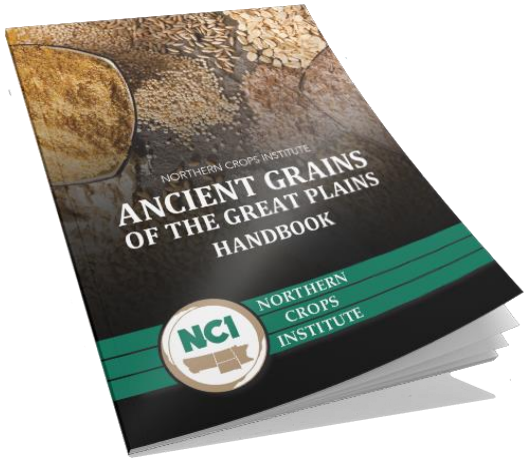
OTHER EDUCATION

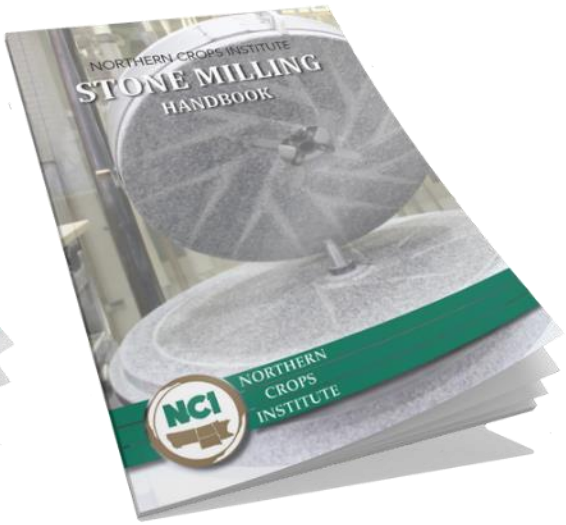
NCI Webinars

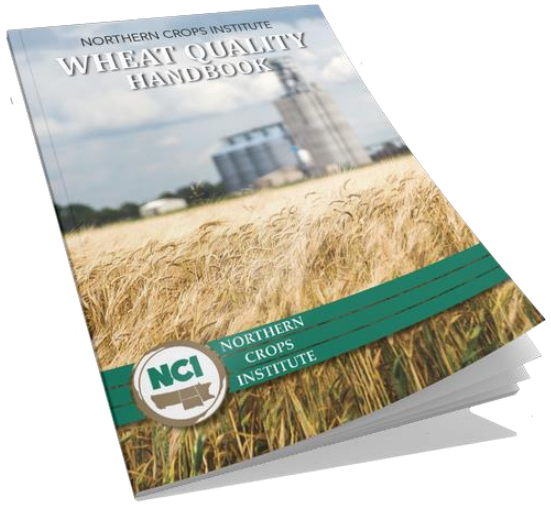
- Market Update
- Cereal Innovators
- Pulse Potential
- Future of Feeding

NCI Handbooks

- Wheat Quality
- Ancient Grains of the Great Plains
- Stone Milling
- Your Kitchen to Consumer







2025 NCI EDUCATIONAL PROGRAMS

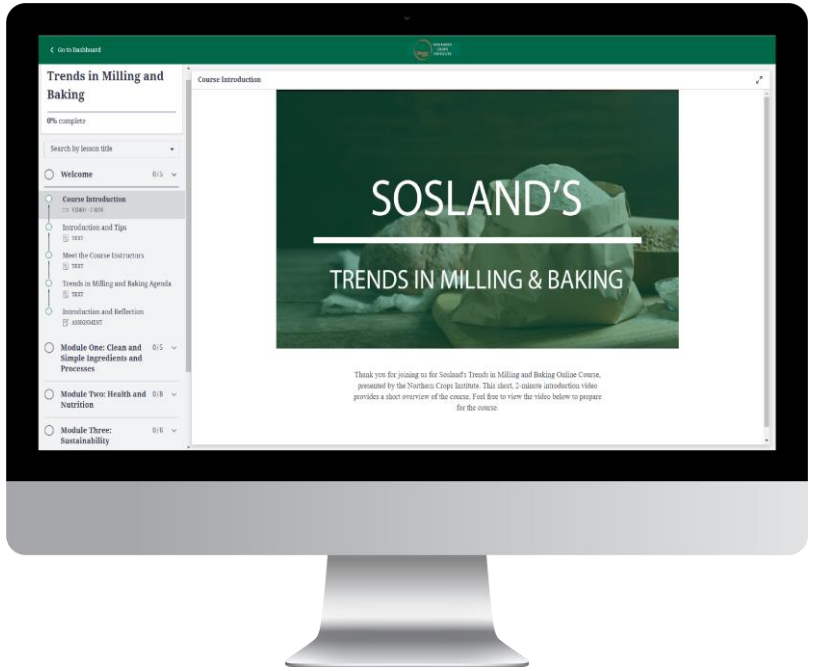
In-Person Short Courses:

- **Pasta Production and Technology (Concurrent with Fresh, Refrigerated, and Frozen Pasta) | April 22 - 24, 2025**
- **Fresh, Refrigerated, and Frozen Pasta (Concurrent with Pasta Production and Technology) | April 22 - 24, 2025**
- U.S. Soy and the Value of Essential Amino Acids (In-Person) | May 5 - 9, 2025
- Soybean and Soybean Meal Procurement and Risk Management (In-Person) | May 12 - 20, 2025
- Food Soy Procurement (In-Person) | June 16 - 20, 2025
- INTSOY: Introduction to Soybean (In-Person) | August 25 - 29, 2025
- Grain Procurement Management for Importers (In-Person) | September 8 - 17, 2025
- **Pasta Production From Multiple Wheat Classes | October 7 – 10, 2025**
- Gluten-Free & High Protein Pasta Production | October 7 – 10, 2025
- Food, Feed & Fuel: Understanding the U.S. Corn Supply | November 3 - 7, 2025
- Stone Milling: A Hands-On Experience | November 10 - 13, 2025

2025 NCI EDUCATIONAL PROGRAMS

On Demand Courses

- Introduction to U.S. Commodities, Procurement, and Risk Management
- Sosland's Trends in Milling and Baking
- High Oleic Soyfoods
- Sourdough Baking
- Feed Milling 101
- Stone Milling Basics
- Ethanol Procurement for Traders
- Quality Feed Pellet Production
- Producing Quality Feed Through Effective Communication
- Future of Feeding Soybean Meal and Other Non-Grain Ingredients

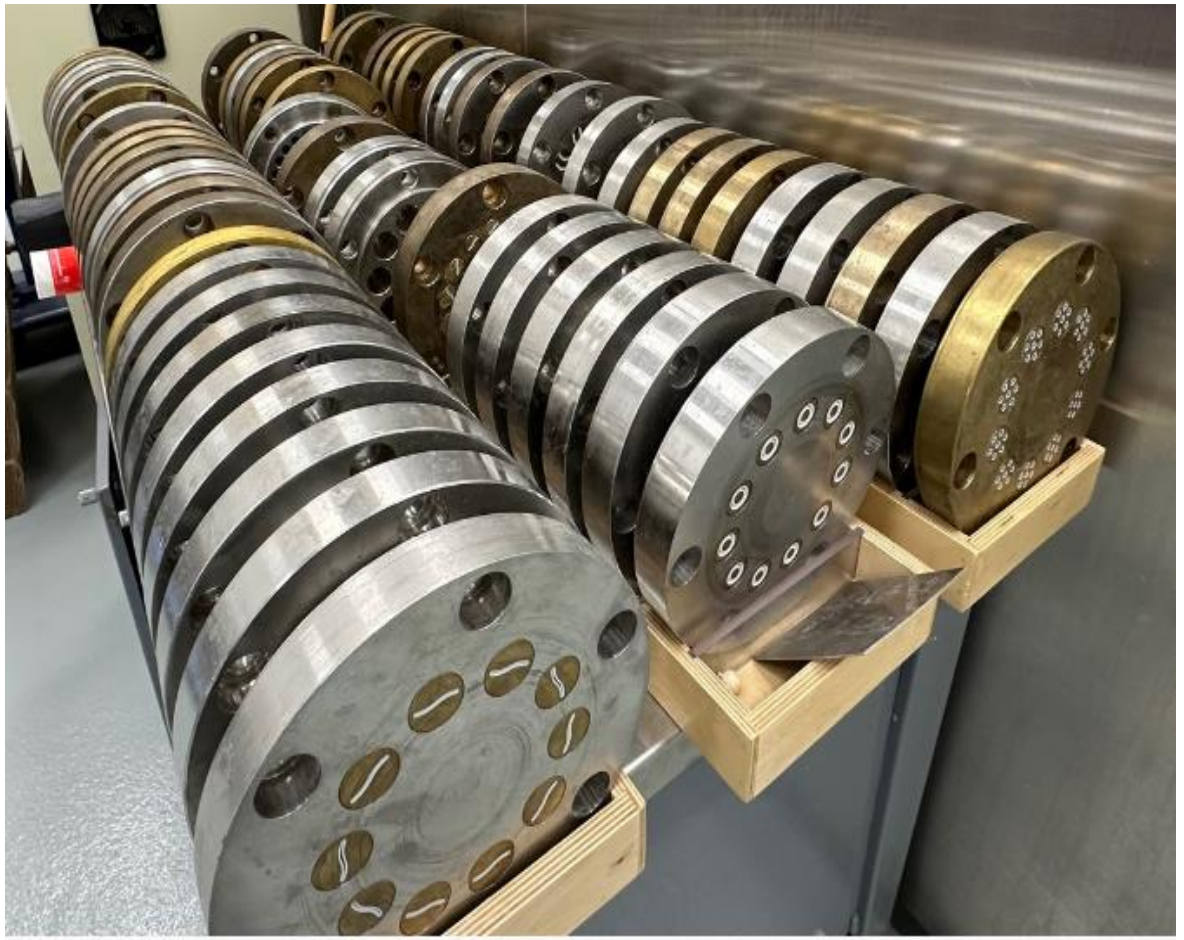


TECHNICAL SERVICES

TECHNICAL SERVICES

NCI FOOD-GRADE DEVELOPMENT LABS

Pasta Processing Laboratory



NCI Pasta Dies

TECHNICAL SERVICES

Pasta Processing Laboratory

- Food safe space: Demaco Pasta Extruder —100 kg/hr
- Traditional pasta, ravioli and gluten-free pasta
- Product development, process testing, and training
- Computerized data collection system, controls, and monitors
- Scalable solution for pasta innovation
- Pasta Production Equipment
- Array of pasta dies available (over 50 pasta dies available with capability to test custom dies)
- Batch Dryer — ~100 kg
- Microprocessor controls: conventional and high temperature drying profiles of long and short cut pasta
- Ravioli Machine — utilized for filled pasta production
- Blast freezer — 12 cubic foot frozen storage for IQF products

TECHNICAL SERVICES

NCI FOOD-GRADE DEVELOPMENT LABS

Extrusion Laboratory

Baking Laboratory

TECHNICAL SERVICES

NCI FOOD-GRADE DEVELOPMENT LABS

Sensory science Laboratory

Soy Foods Laboratory

TECHNICAL SERVICES

NCI PROCESSING LABS

Oilseed Processing Laboratory

Stone Milling Room

TECHNICAL SERVICES

NCI PROCESSING LABS

BUHLER MLU-202 Mill

Flaking, Dehulling Systems

LOOKING TO THE FUTURE: INNOVATION IN MANUFACTURING AND FOOD SAFETY

National Pasta Association's Mission:

We encourage the **consumption** of pasta by being the center of **knowledge** and promoting sound public policy to the **consumer**, the **industry** and the **regulatory bodies** because a **sustainable pasta industry is vital to healthy diets**.

USDA Approach to Sustainability:

Sustainable agriculture integrates plant and animal production

Satisfies human food and fiber needs long-term

Enhances environmental quality and supports the agricultural resource base.

Efficient use of nonrenewable and on-farm resources, integrating biological cycles

Ensures economic viability of farm operations

Improves quality of life for farmers and society.

SUSTAINABLE PASTA WITH HEALTHY DIET APPROACH

- Optimizing ingredient sourcing
- Improving processing methods; High-Tech Efficiency vs. Artisanal Revival
- Sustainable and Eco-friendly Packaging
- Maintaining product quality and safety

INNOVATIONS IN NUTRITIONAL AND FUNCTIONAL ENHANCEMENT

- High Amylose
- High Fiber
- High Protein
- Gluten Free
- Low Carbohydrate
- Low Sodium
- Micronutrient Enriched Pasta
- Functional Ingredient (hydrocolloids, egg white replacer)

NUTRITIONAL ENHANCEMENT

High amylose wheat flour:

HealthSense® *is made from a unique, non-GMO* ***variety of wheat*** *that contains much more* ***prebiotic fiber (****three times the amylose content of common wheat) than traditional wheat.*

- Resistant Starch wheat varieties contain up to **94** percent amylose
- **25-30** percent amylose in traditional wheat
- Starch matrix that is less accessible to digestive enzymes functions as dietary fiber.
- They enter the large intestine, where they are fermented by resident bacteria, contributing to various health benefits.

NUTRITIONAL ENHANCEMENT

High fiber wheat flour:

Trusource™ wheat *is a high-fiber* ***durum wheat*** *designed to be used in high-volume foods like pasta and baked goods.*

High-fiber wheat supports **gut health** by acting as a prebiotic, nourishing beneficial gut bacteria, promoting regular bowel movements, and potentially reducing the risk of certain gut-related conditions.

3 Farm Daughters

GoodWheat Pasta

CORTEVA™ agriscience

NUTRITIONAL ENHANCEMENT

High Protein; Plant-based, Egg white replacer

Banza *pasta from* ***Banza****, Inc.:* ***Chickpea***

- *25 gr protein per serving (3-4 times more protein)*
- ***Gluten-free*** *and Low Glycemic Index*

Barilla Protein+® *pasta from* ***Barilla:*** *wheat and protein from* ***lentils, chickpeas, and peas****,*

- *17g of protein per 3.5oz serving.*

Banza

NUTRITIONAL ENHANCEMENT

High Protein; Plant-based, Egg white replacer

Explore Cuisine : lentils, mung bean, chickpeas, black beans, edamame

- *High protein,* ***High fiber*** *and* ***Gluten free***
- *20-25g per 3.5 oz serving*

Ancient Harvest: lentil, quinoa

- *High protein****, Gluten free***

NUTRITIONAL ENHANCEMENT

Innovative Pasta Substitutes (non-grain pasta)

- ***Palmini,*** *heart of palm, gluten free, high fiber, low carb, low calorie*

- ***Cappello's****, almond flour, fresh pasta, gluten free, dairy free, soy free, 11gr protein per serving*

CAPPELLO'S

PALMINI

SUSTAINABLE AND ECO-FRIENDLY PACKAGING

- Paper Packaging
- Biodegradable Plastics (PLA):

  Polylactic acid (PLA)
- Cellulose Films: windowed boxes
- Plant-based Inks and Dyes

ROVEMA
Passion for packaging
SUSTAINABLE PACKAGING SOLUTIONS

Rovema: Kraft paper 50 g/m² with laminated PLA film as sealing medium, total 100ym

NCI PULSE PRODUCT DEVELOPMENT

100% chickpea

100% yellow pea

Dry Whole GF yellow peas penne

Cooked GF Whole yellow peas

CHALLENGES IN MAKING NON-SEMOLINA PASTA

Lack of gluten in gluten-free, plant-based protein, high-fiber pasta

Texture and Structure; Protein Integration and Binding

Dough Handling and Consistency: Brittle, sticky, or too dense, complicating the kneading and shaping process

Breakage and Crumbling: Breaking or crumbling during production or cooking

Water Absorption: Difficulty in controlling water absorption during cooking

Extrusion and Shaping: Difficulty in extrusion and shaping due to dough fragility

Appearance and Consistency: Alter the pasta's color, and overall appearance acceptability

Shelf Life and Preservation: Alternative ingredients may have different moisture content requiring specialized packaging to maintain freshness

SOLUTIONS TO ADDRESS EMERGING CHALLENGES

Formulation Modification:

- **Binding agents**: gums (xanthan gum), starches (tapioca), pre-gelatinized starch (high heat and high presser extrusion, pelleted and milled)
- **Enzyme treatment**: amylases or proteases can break down starches or proteins, enhancing the dough's handling properties or texture
- **Ingredient blending**: rice, corn, or pulse-based flours or adding fortifying ingredients can help achieve better texture and consistency

SOLUTIONS TO ADDRESS EMERGING CHALLENGES

Processing Modifications:

- **Pre-mixing an Conditioning the Flour:** Enhance water absorption and heat transfer prior to the mixer
- **Extrusion parameters**: Adjusting extrusion speed, temperature, and pressure can significantly affect the texture and structure of non-semolina pasta. These parameters can help form the desired pasta shape and texture.
- **Gelatinization (above 85 ◦C)**: Gelatinizing starches can improve dough consistency and texture by ensuring that starches are more easily digestible and contribute to a smoother texture.
- **Low temperature drying (52 ◦C vs 83 ◦C):** Using low-temperature drying can preserve the nutritional content, flavor, color and texture of the pasta.

DIVERGING INNOVATIONS IN PASTA PRODUCTION: HIGH-TECH EFFICIENCY VS. ARTISANAL REVIVAL

Aspect	Industrial Pasta Production	Artisanal Pasta Making
Machinery & Technology	Utilizes high-capacity, automated machinery with AI, sensors, and digital monitoring for efficiency.	Uses small-scale equipment or manual methods like bronze dies and hand shaping.
Ingredient Selection	Often uses standardized semolina or enriched flour for consistency and cost-effectiveness.	Typically uses high-quality, often organic, durum wheat or alternative flours for unique flavors and textures.
Drying Process	Rapid, high-temperature drying (above 80°C) for fast production and longer shelf life.	Slow, low-temperature drying (below 50°C) over longer hours to preserve flavor and structure.
Texture & Cooking Quality	More uniform texture due to high-pressure extrusion and quick drying.	More porous texture (especially with bronze dies), allowing better sauce absorption and a more delicate bite.
Market & Pricing	Mass-market, widely available, and lower-cost due to economies of scale.	Premium pricing due to artisanal techniques and high-quality ingredients.

Rustichella d'Abruzzo

MAINTAINING PRODUCT QUALITY AND SAFETY

PART 117—CURRENT GOOD MANUFACTURING PRACTICE, HAZARD ANALYSIS, AND RISK-BASED PREVENTIVE CONTROLS FOR HUMAN FOOD

FDA U.S. FOOD & DRUG ADMINISTRATION

- **Grain & Flour Safety Controls**: Wheat Tempering with Antibacterial Agents, Fumigation & Pest Control, Steam or Heat Treatment**,** Mycotoxin Testing, Foreign Material Removal, Entoleter system

- **Other Raw Material Sourcing & Supplier Verification**: Suppliers follow GMP, provide COA, Ingredient traceability, Allergen Management (Segregation of Allergenic Ingredients, Labeling & Documentation)

Entoleter system; Matador (BUHLER)
The Matador exterminates more than 99.5% of insect eggs in flour and semolina after the milling process, providing a very high level of food safety.

MAINTAINING PRODUCT QUALITY AND SAFETY

- **Water & Moisture Control in the Plant**: Water Purification, Moisture Level Control
- **Quality and Safety Testing on Final Product**: Metal Detection, Microbial Testing, Pesticide Residue, Heavy Metal Analysis
- **Packaging & Storage Controls**: MAP Packaging, Controlled Storage Conditions, First-In, First-Out (FIFO) Inventory Management

Cleaning and Sanitation:

- **Routine Cleaning and Sanitization of Equipment**: Dry/Wet Cleaning (food grade detergent, vacuuming, brushing), Sanitizing Food Contact Surfaces
- **Hygiene Monitoring and Verification:** swabbing and microbiological testing (e.g., ATP testing, total plate counts)
- **Documentation:** Good Manufacturing Practices (GMP) and FDA regulations

MAINTAINING PRODUCT QUALITY AND SAFETY

Food Safety Aspect	Fresh Pasta	Dry Pasta
Microbial Control	Higher microbial risks due to moisture (30%) and perishable ingredients (e.g., eggs), Control: *Salmonella*, *E. coli*, and *Listeria*.	Lower microbial risk, moisture 12%.
Refrigeration Requirements	**Refrigeration (0-4°C)** storage.	**Ambient temperature** storage.
Drying Process	Low or no drying.	High-temperature or low-temperature drying processes, shelf-stable product.
Packaging and shelf life	**Oxygen reduction** or **vacuum sealing,** Modified Atmosphere Packaging (MAP). Shelf stability **days to a few weeks.**	**Moisture-proof** and protect from environmental contaminants, shelf life (**12–36 months**).
Hygiene Control	Requires strict **hygienic practices** due to the higher risk of contamination, particularly in dough handling, equipment, and surface contact.	Requires basic hygiene practices, but fewer risks of contamination due to dry nature of the product.
Regulatory Requirements	Requires compliance with more stringent food safety regulations, especially concerning eggs and refrigerated products.	Must comply with less stringent requirements related to drying and shelf-stable products.
Final Product Testing	Frequent **microbial testing** for pathogens; sensory tests for spoilage.	Less frequent microbial testing; **texture, firmness**, and **cooking quality** are the focus.

The National Pasta Association (NPA) study to validate the effectiveness of different pasta cooking instructions (boiling, microwave heating, baking) to provide a kill step for possible Salmonella enterica contamination in dried pasta.

(Covance/NFL project reference: 8343777/MW1300)

- Under FSMA, companies are required to conduct a hazard analysis to identify the "hazards requiring a preventive control" (**HPRCs**) for foods.

- **Salmonella** is identified as an HRPC for dry pasta and validated that boiling dry pasta provides greater than a 5-log reduction of Salmonella.

COVANCE
SOLUTIONS MADE REAL®

Table 2. Minimum time and temperatures per cooking method tested which achieved a greater than 6-log reduction of *S. enterica*, determined in the pasta cooking instruction validation study (Covance/NFL project reference: 8343777/MW1300).

Product	Initial a_w[1]	Final a_w[1]	Cooking Method	Minimum Cooking Parameters
Elbow pasta	0.5424	>0.99	Microwave	2:30 minutes in a 1,100 W microwave (average output: 720 ± 25 W)
Flat noodle pasta	0.6531	>0.99	Stovetop	6 minutes (effective cooking time after adding pasta to boiling water)
No-boil lasagna noodle pasta	0.5622	>0.98	Baking	50 minutes in a covered dish at 204°C/400°F

[1] a_w: water activity.

NORTHERN CROPS INSTITUTE

THANK YOU

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