

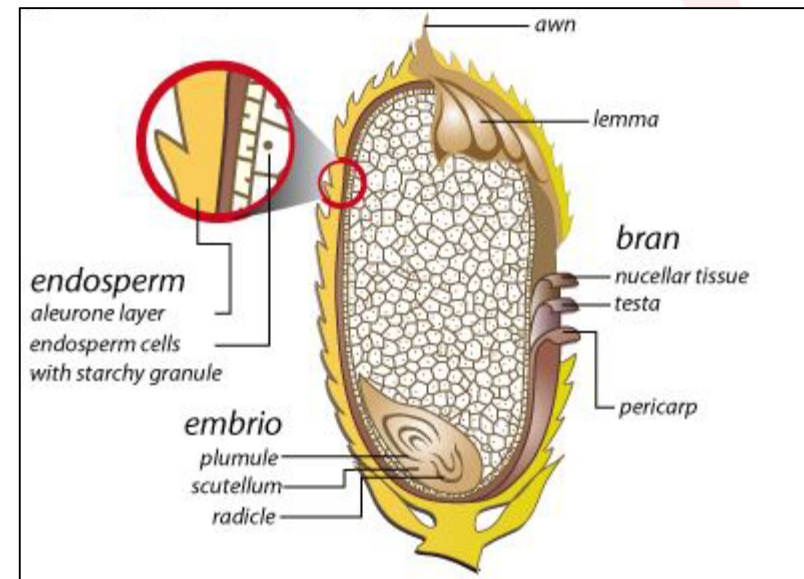


# RiceBran Technologies

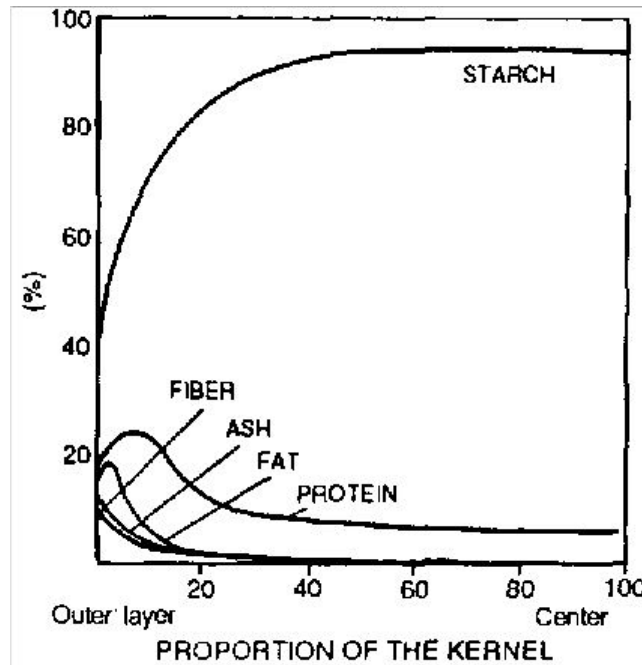
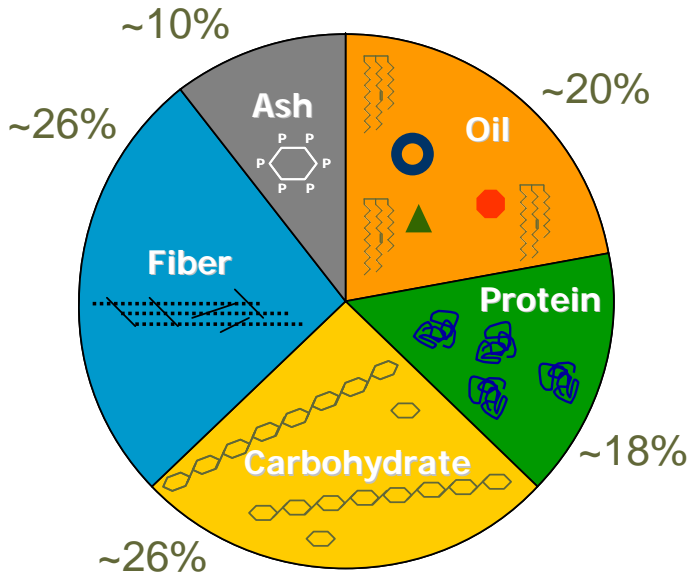
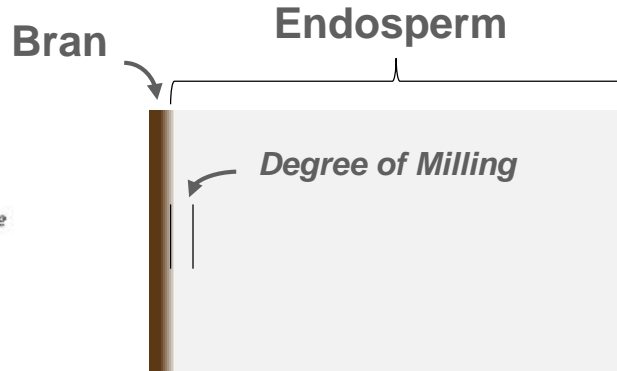
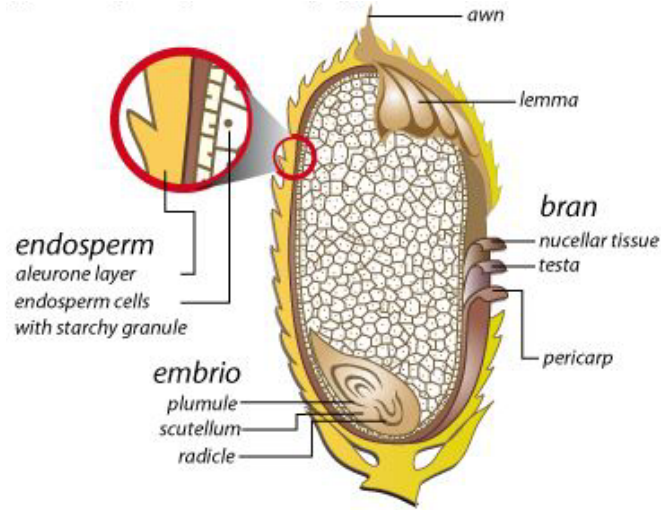
## RiSolubles®

# About RiceBran Technologies

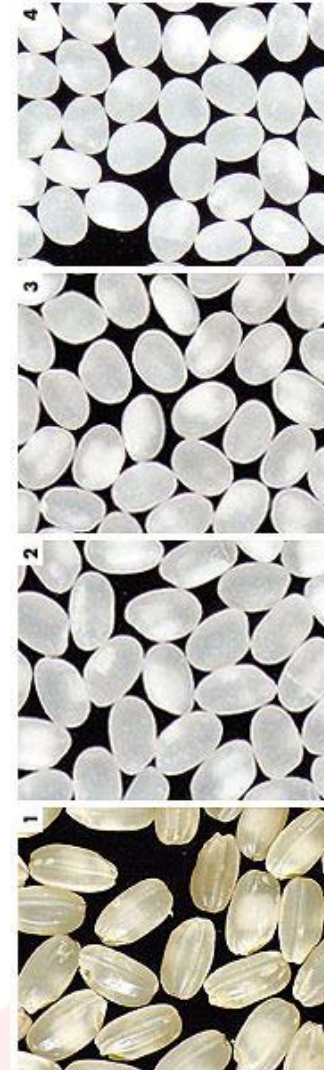
- ❑ In the business of stabilizing and marketing rice bran and derivatives for 25+ years
- ❑ Corporate Office: Scottsdale, AZ
- ❑ US Segment Operations: CA, LA, MT & TX
- ❑ Brazil Segment Operations: Pelotas (RS)
- ❑ Primary Markets: Vegetable Oil, Contract Manufacturing, Food/Functional Ingredients and Animal Feed
- ❑ Products Distributed Globally
- ❑ Intellectual Property: Extrusion technology for stabilizing raw rice bran; process and use patents for rice bran derivatives



# The Bulk of the Nutrition is in the Germ and Bran Layers



Degree of Milling



# Rice Bran Provides Balanced Nutrition

<http://nutritiondata.self.com/>

## Rice, white, medium-grain, raw, unenriched

Serving size: 100 grams

- Add to Tracking
- Add to Compare
- Create Recipe
- Add to My Foods

### FOOD SUMMARY

#### Nutrition Facts

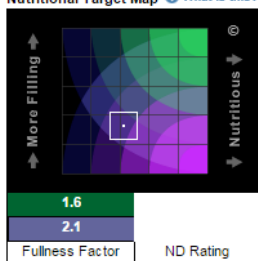
Serving Size 100 grams

Amount Per Serving	% Daily Value*
Calories 360	Calories from Fat 5
% Daily Value*	
Total Fat 1g	1%
Saturated Fat 0g	1%
Trans Fat	
Cholesterol 0mg	0%
Sodium 1mg	0%
Total Carbohydrate 79g	26%
Dietary Fiber	0%
Sugars	
Protein 7g	
Vitamin A 0% • Vitamin C 0%	
Calcium 1% • Iron 4%	

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

[NutritionData.com](http://NutritionData.com)

#### Nutritional Target Map



#### Caloric Ratio Pyramid



**NutritionData's Opinion**

Weight loss: ★★★★★

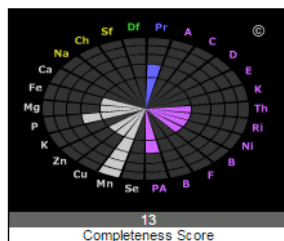
Optimum health: ★★★★★

Weight gain: ★★★★★

**The good:** This food is very low in Saturated Fat, Cholesterol and Sodium. It is also a good source of Manganese.

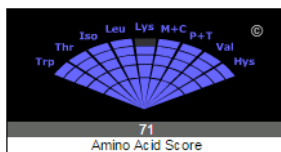
[Download Printable Label Image](#)

### NUTRIENT BALANCE



[What is this?](#)

### PROTEIN QUALITY



[What is this?](#)

Adding other foods with complementary amino acid profiles to this food may yield a more complete protein source and improve the quality of some types of restrictive diets.

[Find foods with complementary profile](#)

## Rice bran, crude

Serving size: 100 grams

- Add to Tracking
- Add to Compare
- Create Recipe
- Add to My Foods

### FOOD SUMMARY

#### Nutrition Facts

Serving Size 100 grams

Amount Per Serving	% Daily Value*
Calories 316	Calories from Fat 176
% Daily Value*	
Total Fat 21g	32%
Saturated Fat 4g	21%
Trans Fat	
Cholesterol 0mg	0%
Sodium 5mg	0%
Total Carbohydrate 50g	17%
Dietary Fiber 21g	84%
Sugars 1g	
Protein 13g	
Vitamin A 0% • Vitamin C 0%	
Calcium 6% • Iron 103%	

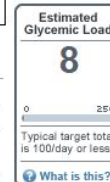
\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

[NutritionData.com](http://NutritionData.com)

#### Nutritional Target Map



#### Caloric Ratio Pyramid



**NutritionData's Opinion**

Weight loss: ★★★★★

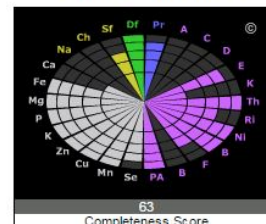
Optimum health: ★★★★★

Weight gain: ★★★★★

**The good:** This food is very low in Cholesterol and Sodium. It is also a good source of Potassium, Zinc and Copper, and a very good source of Dietary Fiber, Thiamin, Niacin, Vitamin B6, Pantothenic Acid, Iron, Magnesium, Phosphorus and Manganese.

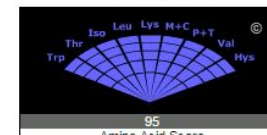
[Download Printable Label Image](#)

### NUTRIENT BALANCE



[What is this?](#)

### PROTEIN QUALITY

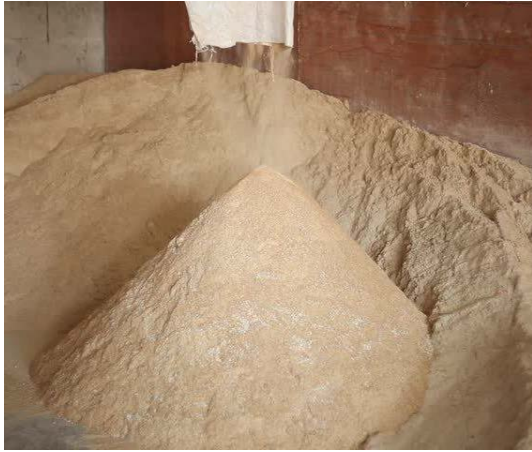


[What is this?](#)

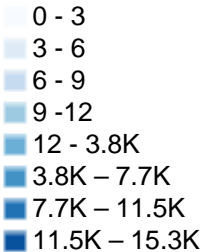
Adding other foods with complementary amino acid profiles to this food may yield a more complete protein source and improve the quality of some types of restrictive diets.

[Find foods with complementary profile](#)

# Rice Bran is a Highly Underutilized Food Resource



1000 MT/YR



- ❑ Global production of rice bran is estimated at ~52 MMT per year
- ❑ Raw rice bran is prone to rapid oxidation due to a lipase enzyme that destroys its nutritional and economic value
- ❑ Major Uses
  - ~90% animal feed
  - ~9% for rice bran oil production (produces ~1.5 MMT crude RBO/yr)
  - <1% human food consumption and cosmetics

# Unlocking the Nutritional Value of Rice Bran Through Proprietary Stabilization

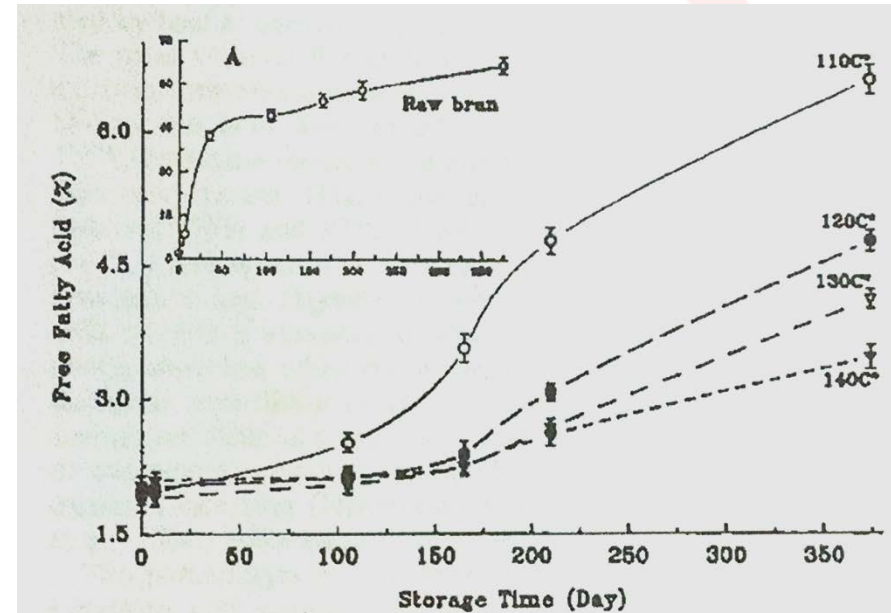
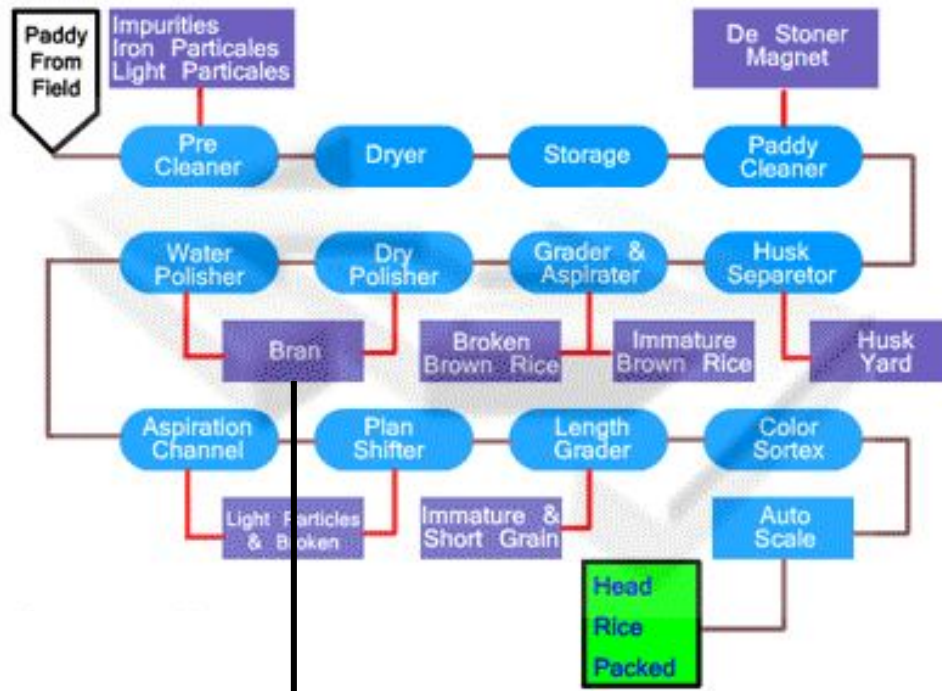


Fig. 1—Total free fatty acid in raw rice bran (A) and stabilized rice bran (B) stored at ambient temperature for 1 yr.

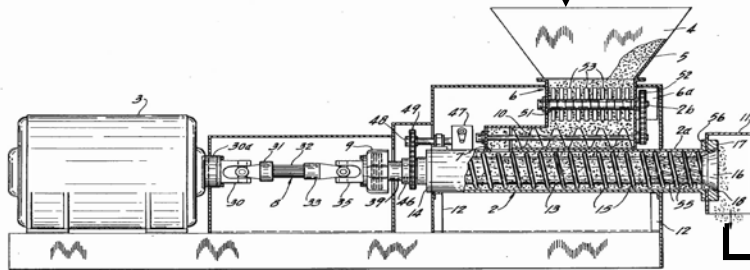
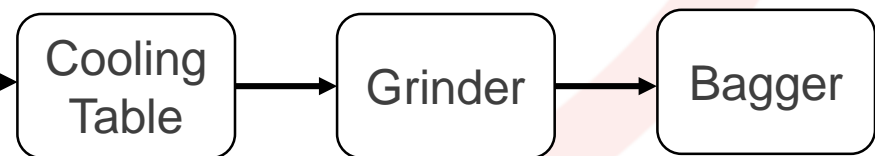


Fig. 1





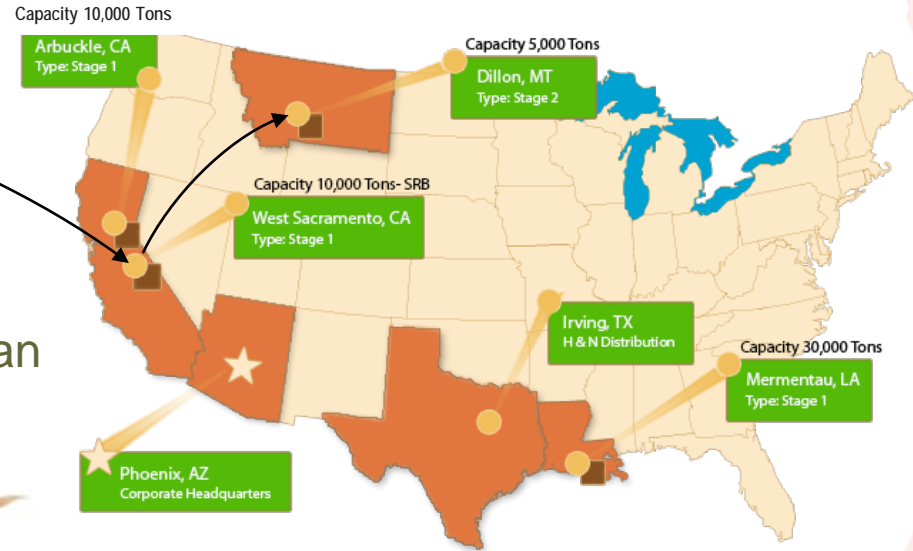
Chiang Rai  
Thailand



Organic Rice Bran  
400 Tons



Organic Rice Bran  
Derivatives



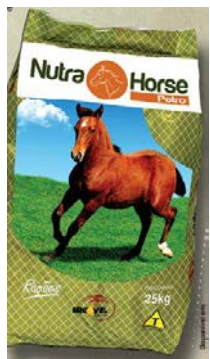


# Rice Bran Oil and Defatted Rice Bran

Irgovel (Pelotas, Brazil)



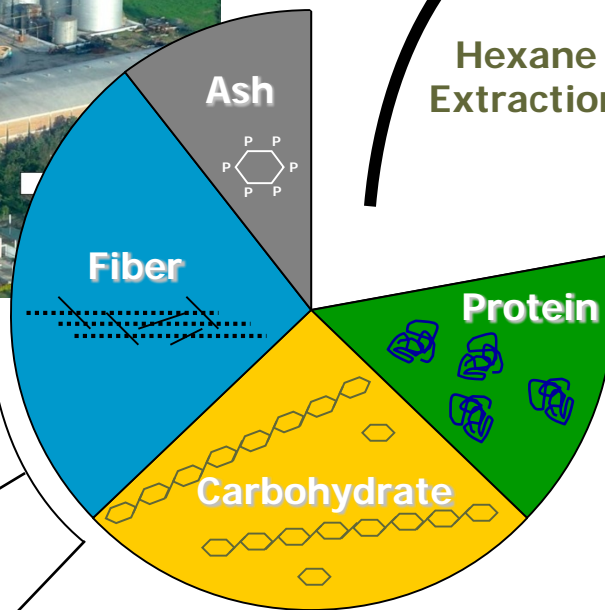
Capacity: 9,000 MT/month



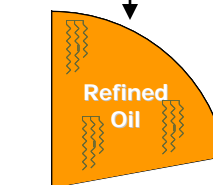
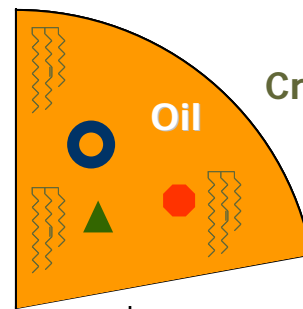
Animal Nutrition

Human Food Ingredient

Further Processing (i.e. Protein)



Hexane Extraction



# BALANCED NUTRITION

**NATURAL**

environmentally friendly

**vegan**

**non-gmo**

**NUT FREE**

*no major allergens*

no trans fats

**SOY FREE**

**sustainable**

locally produced



no added sugar

**gluten-free**

**WHOLE GRAIN**

MINIMAL PROCESSING

zero cholesterol

dairy free

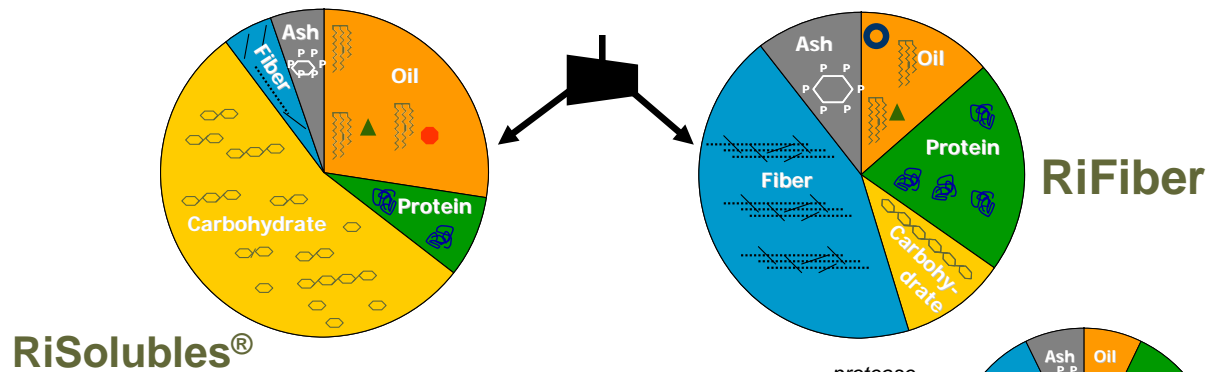
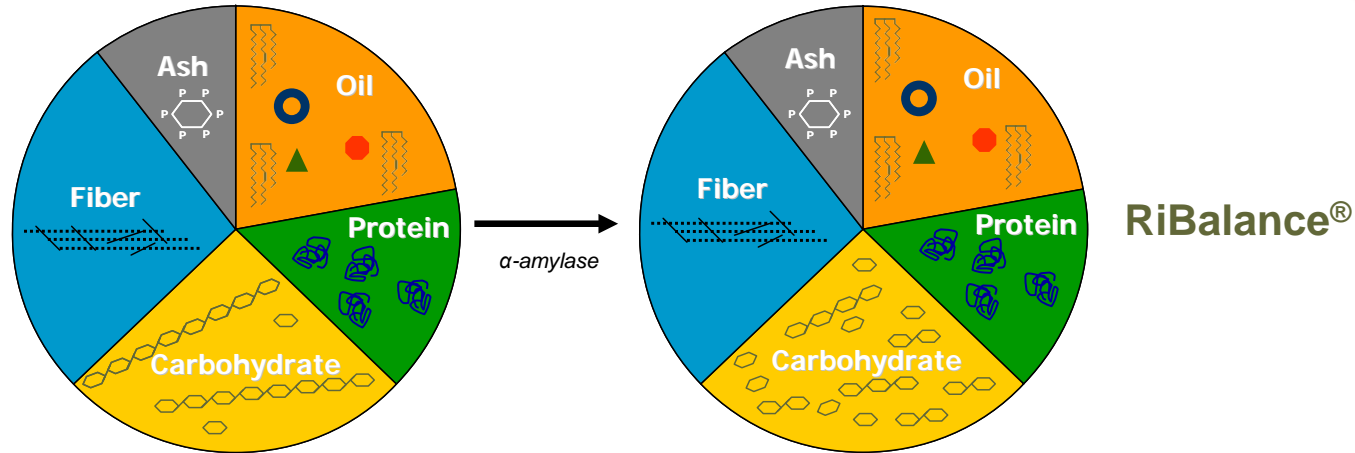
no preservatives

organic

**low sodium**

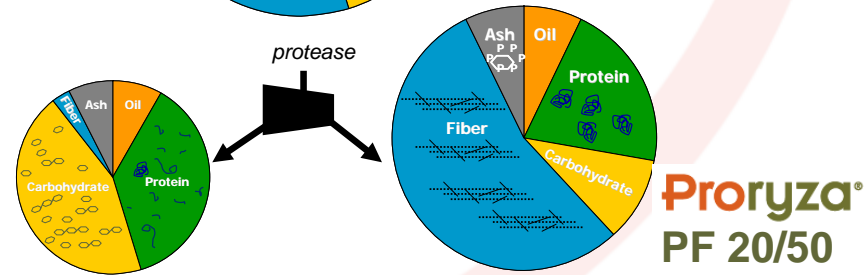
egg free

# Functional Ingredients



**RiSolubles®**

**Proryza®  
P-35**

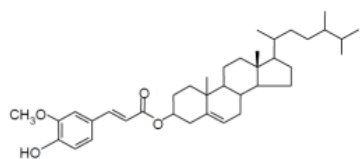


# Some Key Bioactives in Rice Bran

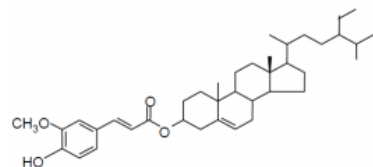
- ❑  **$\gamma$ -Oryzanols** – Family of ferulic acid esters of phytosterols and triterpene alcohols
- ❑ **Phytosterols** – i.e  $\beta$ -sitosterol
- ❑ **Tricin** (methylated flavone)
- ❑ **Tocopherols/Tocotrienols** (Vitamin E)
- ❑ **Ceramides** – family of waxy lipid molecules

# Rice Bran is Uniquely Enriched in Gamma-Oryzanols

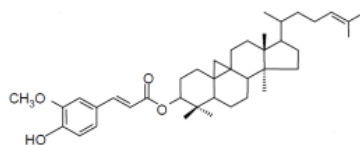
**Gamma-Oryzanols:** Group of ferulic acid esters of phytosterols and triperpene alcohols. Present mainly in the germ and bran layers at levels ranging from 0.2% to 2.5% (w/w).



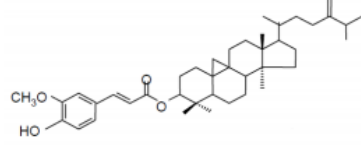
Campesteryl ferulate



$\beta$ -Sitosteryl ferulate



Cycloartenyl ferulate



24-Methylenecycloartenyl ferulate

## ❑ Cholesterol Regulation

- Conversion of cholesterol to bile acids
- Bile acid excretion
- Inhibits absorption of cholesterol

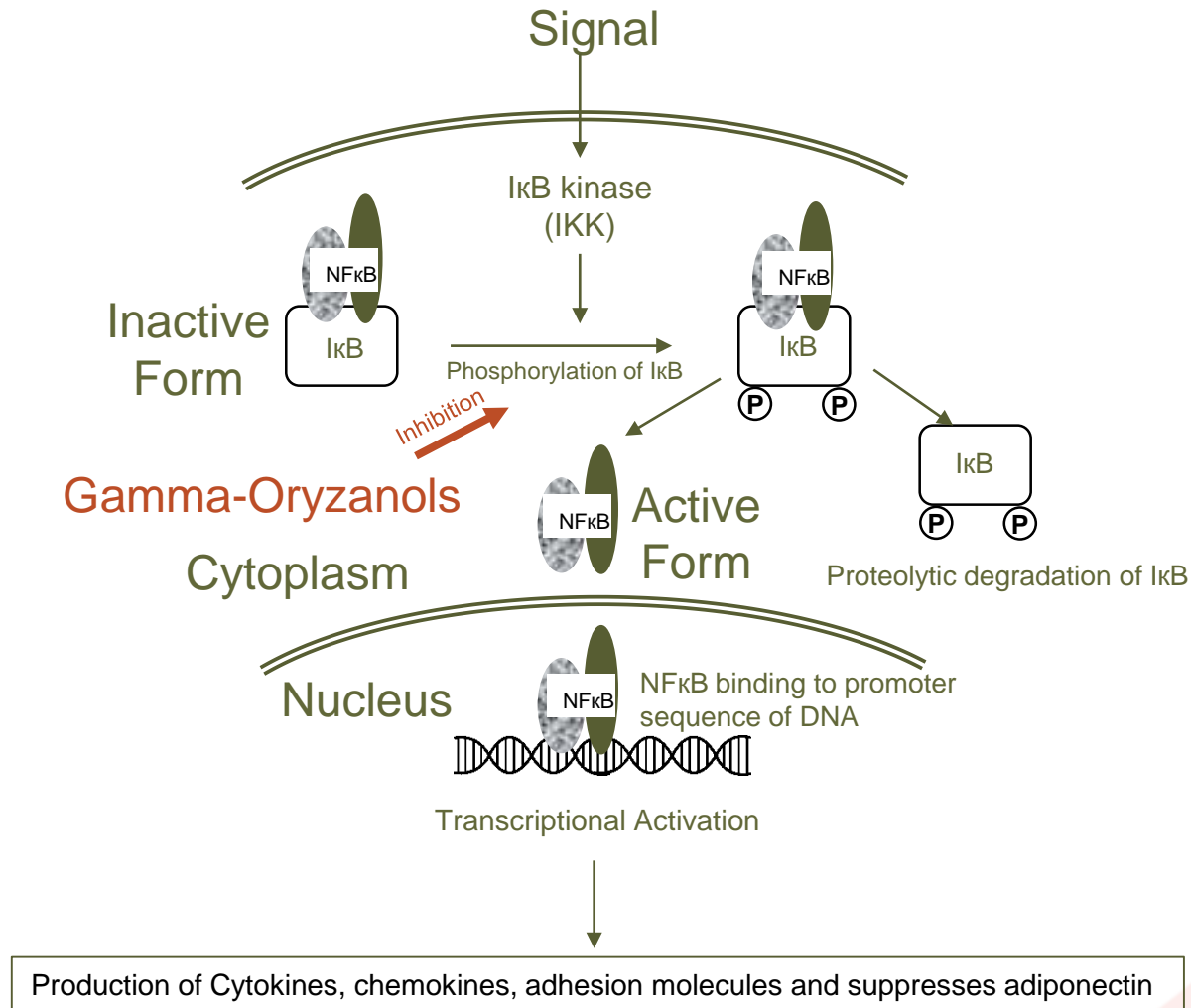
## ❑ Allergy Control

- $\gamma$ -Oryzanols binds IgE antibodies
- Suppresses IgE binding to mast cells
- Inhibits mast cell degranulation

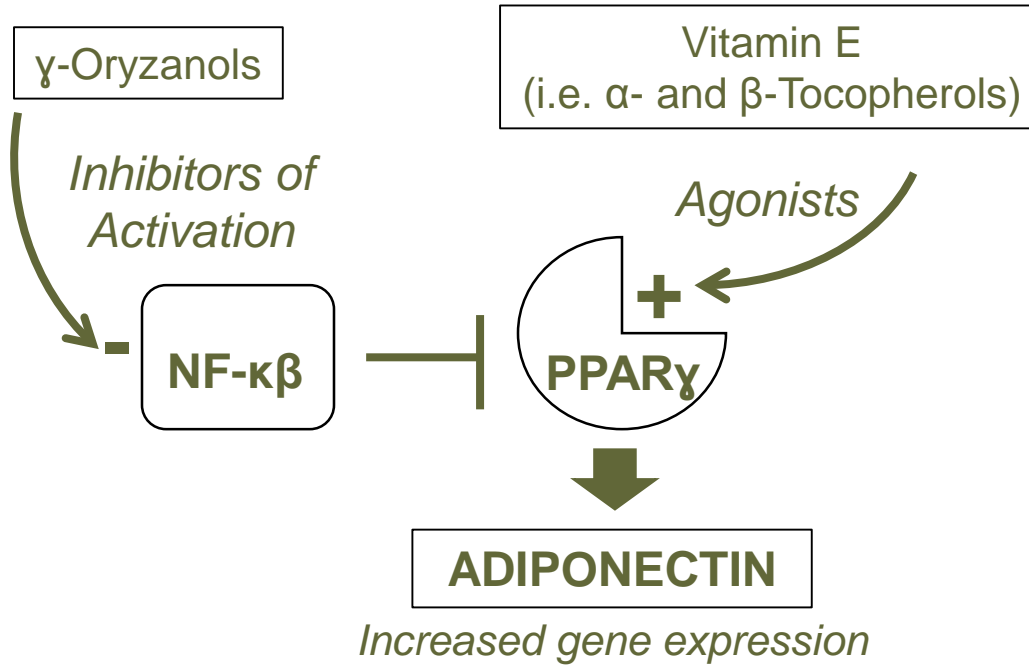
## ❑ Glucose Regulation/Inflammation

- Suppresses activation of NF $\kappa$ B

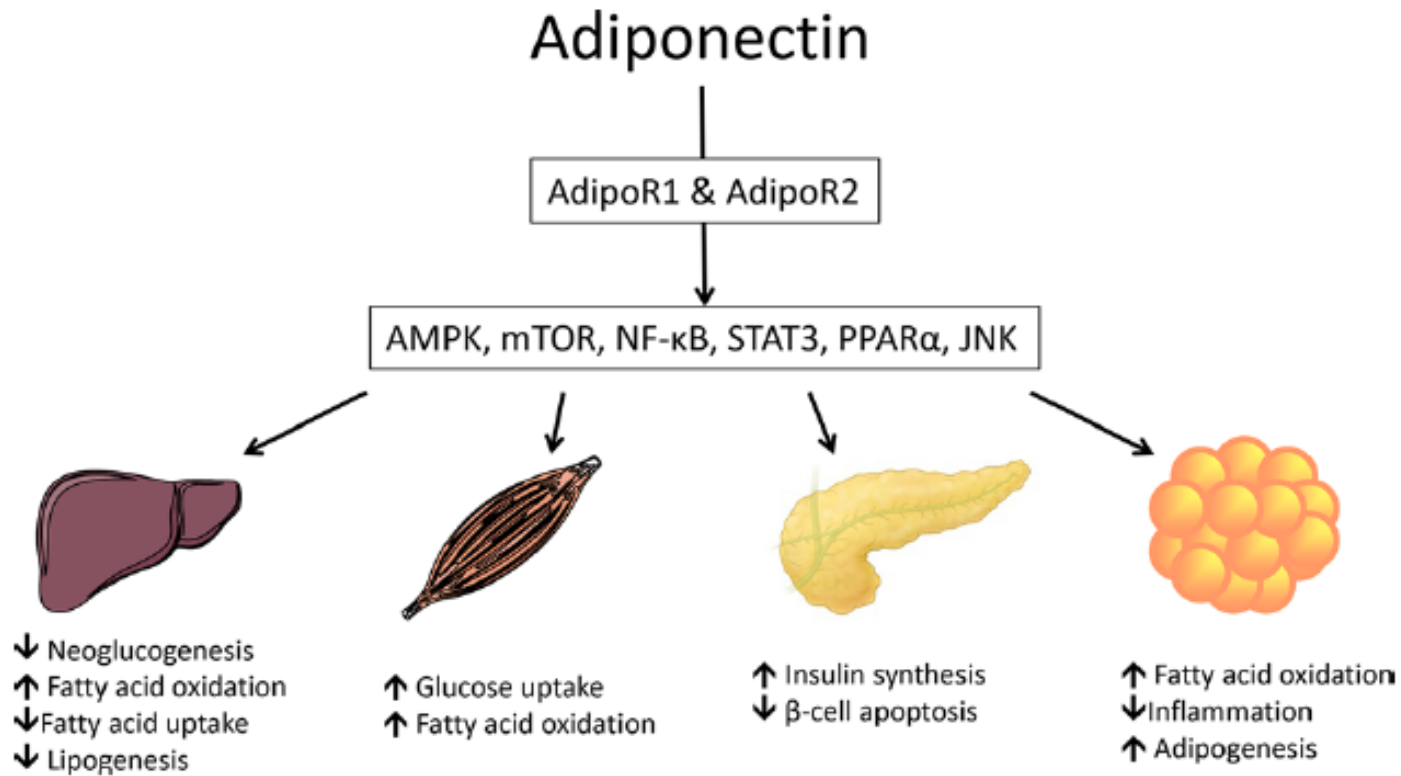
# Gamma-Oryzanols – Mode of Action



# Vitamin E Induces Adiponectin



# Adiponectin Mechanisms of Action



*Mol. Nutr. Food Res.* 2016, 60, 175-184



# Rice Bran Consumption Increases Adiponectin

- ❑ Randomized, placebo controlled trial with Type II diabetic subjects (N=28) had 40% higher adiponectin after consuming rice bran (20g/day) for 12 weeks (*Cheng 2010*)
- ❑ Preclinical study on mice with hypoadiponectinemia showed increased adiponectin levels when administered gamma-oryzanol (Nagasaka 2011)
- ❑ Obese rats fed 5% rice bran extract containing gamma-oryzanol for 20 weeks recovered adiponectin levels (Justo, 2013)

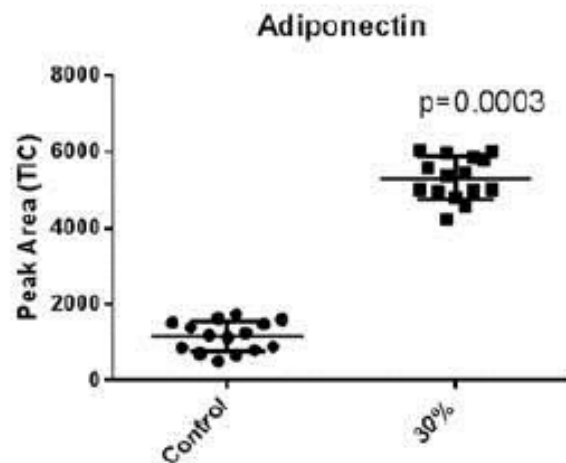
# Rice Bran Consumption Increases Adiponectin

**Title:** Search for novel circulating cancer chemopreventive biomarkers of dietary rice bran intervention in  $Apc^{Min}$  mice model of colorectal carcinogenesis, using proteomic and metabolic profiling strategies

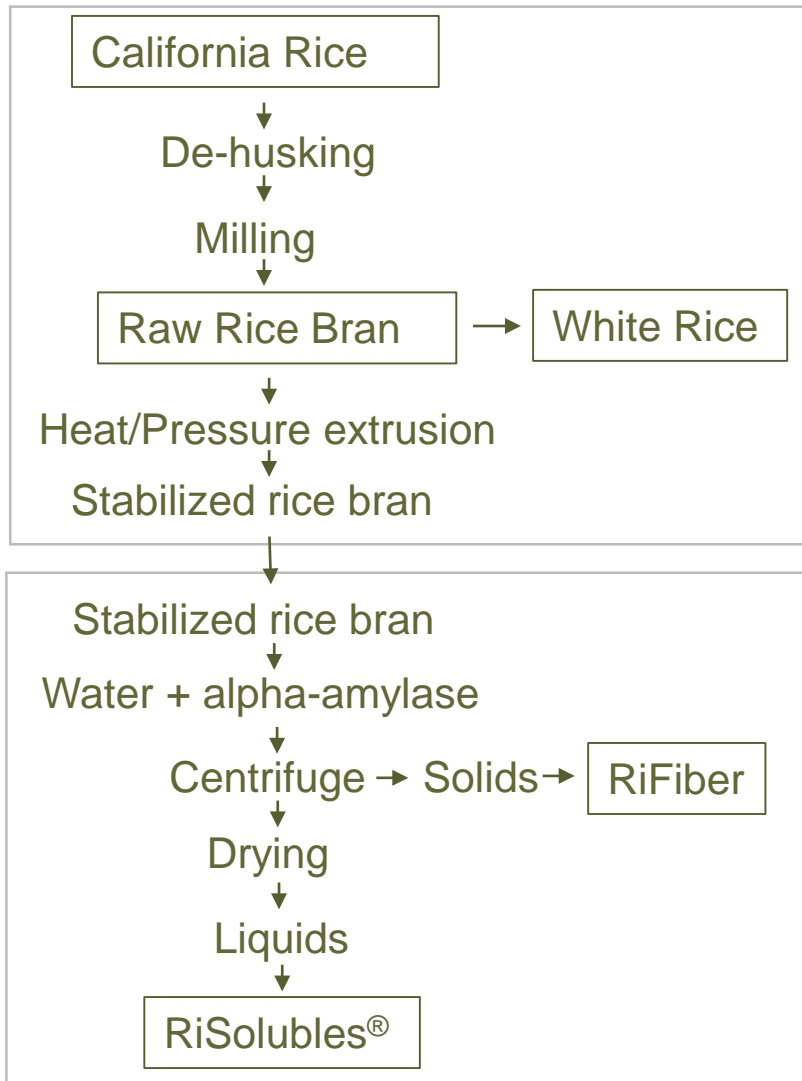
*University of Leicester, Loughborough University & Glenfield Hospital*

*Molecular Nutrition & Food Research 59:1827-1836, 2015*

Mice diet supplemented with a rice bran derivative (RiFiber) supplied by RiceBran Technologies



# Process Flow



## Nutritional Profile

Protein	7-12%
Fat	25-32%
Carbohydrates	50-60%
Ash	3-7%
Gamma-Oryzanols	250 mg/100g
Tocopherols	8 mg/100g
Tocotrienols	10 mg/100g
Phytosterols	400 mg/100g

**Production capacity:** >500 MT/yr  
(Dillon, MT)

**Process & Use Patents:** USPTO  
6,126,943; 6,303,586; 6,350,473;  
6,350,473; 6,558,714; 6,733,799

# RiSolubles® – Possible Claims

Claim	Substantiated Statements & Evidence Tables
<i>Reduces hyperglycemia</i>	<ul style="list-style-type: none"> <li>• Two human clinical studies have shown that RI-Solubles® can reduce serum glucose levels in both diabetic and healthy subjects</li> <li>• One human study, eight preclinical studies and one in vitro/in vivo study have shown that gamma-oryzanol and rice bran in general can reduce glucose levels</li> </ul>
<i>Improves insulin levels and insulin sensitivity</i>	<ul style="list-style-type: none"> <li>• Two human clinical studies have shown that RI-Solubles® can improve insulin levels and insulin sensitivity in diabetic and healthy subjects</li> <li>• Six preclinical studies, one in vitro/in vivo study and one review have shown that gamma-oryzanol and rice bran in general can improve insulin levels insulin sensitivity</li> </ul>
<i>Increases adiponectin levels</i>	<ul style="list-style-type: none"> <li>• Four human clinical studies, one in vitro/in vivo study, and two reviews have revealed that plasma adiponectin is positively correlated with insulin sensitivity and lower risk of impaired glucose metabolism</li> <li>• Two human studies, three preclinical studies and two in vitro studies have shown that gamma-oryzanol and rice bran in general can increase adiponectin levels through NF-kappaB inhibition</li> </ul>

**Study:** Effects of stabilized rice bran, its soluble and fiber fractions on blood glucose levels and serum lipid parameters in humans with diabetes Types I and II

**Publication:** *Journal of Nutritional Biochemistry* 13:175-187 (2002)

**Treatment:** 20 g/day RiSolubles® for 8 weeks

## Results:

- ❑ Significant reduction in fasting serum glucose Type I and Type II diabetes subjects
- ❑ Significant increase in insulin levels by 4% in both Types I & II diabetes subjects

**Study:** Glycemic and Insulinemic Response and Glycemic Index Determination of RiSolubles

**Publication:** Final Report by Glycemic Index Laboratories, 2007

**Subjects:** Healthy subjects (N=10)

**Treatment:** 45 g RiSolubles®

## Results:

- Significantly lower postprandial glucose at 15, 30, 45 and 60 min post consumption
- Glycemic Index = 54.9

**Evidence-Based Functionality:** Glucose and lipid metabolism

**Clean Label:** Minimally processed, free of all major allergens, non-GMO, natural

**Country of Origin:** 100% Made in the USA

**IP Protection:** Process and use patents 100% owned by RBT

**Production:** >500 MT per year and can easily be expanded

**Applications:** Ideal for health and wellness beverages and foods

**Taste/Flavor:** Very nice flavor profile