What is NUTRIO™?

Product Line for Biologically Active Products

Crop inputs that benefit crops by providing more than traditional plant nutrition, such as:

- Improving soil health.
- Providing relief from abiotic stresses.
- Elevating crop response to nutrient applications.
- Enhancing natural soil nutrient availability.
- Aid in providing a more hospitable environment for plant growth.

NUTRIO products may contain biological components and/or biologically active chemistry.

Biologically Derived Products

Biologically derived products may be classified into a variety of categories including, but not limited to, seaweed extracts, amino acids, fermentation broths and microbial inoculants.

Microbial Inoculants

Microbial inoculants are classified into two categories: fungal inoculants and bacterial inoculants. Wilbur-Ellis Company’s NUTRIO UNLOCK® biochemistry technology is a bacterial inoculant, also known as a Plant Growth Promoting Rhizobacteria (PGPR).
What Do Microbes Do?

Microbes have many functions within soil-plant systems. Some of these functions include:

- Increasing nutrient availability
- Mineralizing organic matter in the soil
- Increasing root mass and root hair proliferation
- Increasing the ability of plants to tolerate stress

**Nutrient Availability**

Microbes improve nutrient availability in multiple ways. Bacteria play a key role in organic matter mineralization, which releases plant-available nutrients in the soil. Bacteria also promote the production of enzymes, such as proteases and phosphatases, which increase nutrient availability.

The production of organic acids (malic, lactic, citric, etc.) in the rhizosphere is also promoted by bacteria. These acids lower the pH of the rhizosphere, which increases the availability of phosphorus and most of the essential micronutrients.

**Root Mass and Root Architecture**

There are multiple microbes that are known to stimulate lateral root development and root hair proliferation. This increased root mass results in greater opportunity for nutrient uptake by the root system of the plant. Root hairs are the most effective root tissue for uptake of water and nutrients.

Increased root volume can also provide better anchoring of plants and improved stress tolerance of plants.

**Stress Tolerance**

Stressed plants release compounds that signal microbes to colonize roots. The microbes then cause a plant response that allows the plant to better tolerate the stress. Examples include production of antioxidants within the plant, closure of leaf stomates, and production of key stress compounds.

**Soil Structure**

Microbes assist in the production of polysaccharides, which help bind soil particles into aggregates and better structured soils.

Increased aggregation tends to improve soil health with more efficient drainage, water holding capacity and water infiltration.
**Beneficial Bacteria Strain** | **Functions**  
--- | ---  
*Rhodopseudomonas palustris* | - Produces favorable enzymes for nitrogen fixation  
- Improves organic matter mineralization  
- Strong enzyme producer – amylase and protease  

*Bacillus brevis* | - Enhances phosphorus availability  
- Boosts plant biomass  
- Strong extracellular enzyme producer – wide spectrum  

*Bacillus licheniformis* | - Increases plant root establishment and development  
- Aids in organic mineralization  

*Streptomyces griseus* | - Enhances nutrient uptake  

*Bacillus megaterium* | - Enhances nutrient release  
- Improves nitrogen fixation  
- Boosts phosphate solubilization  

*Rhodococcus rhodochrous* | - Enhances nitrogen fixation  
- Converts nitrogen into a usable plant form  
- Improves organic matter mineralization  
- Superior enzyme secretor – amylase, protease, lipase  

*Lactobacillus plantarum* | - Enhances nitrogen fixation  
- Nutritionally adaptive  
- Utilizes alternate forms of organic carbohydrates  
- Increases phosphorus utilization  

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**NUTRIO UNLOCK**  

NUTRIO UNLOCK is the foundation of microbial technology found in NUTRIO BIOSOAK™, NUTRIO POWERSHIFT™ and NUTRIO HIGH GEAR.  

After years of research and data collection, Wilbur-Ellis developed NUTRIO, a line of biologically active products that are intended to improve soil and plant nutrition and lead to better quality and greater yielding crops. The use of microbials in this new product line allows Wilbur-Ellis to bring an eco-friendly approach to the soil health challenge.

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**Biological Soil Amendment**  

CONTAINS NON-PLANT FOOD INGREDIENTS:  
Contains 60 million colony forming units (CFU) per gallon of the following:  

- *Rhodopseudomonas palustris* ............... $2.26 \times 10^3$ CFU/ml  
- *Bacillus brevis* ........................................ $2.26 \times 10^3$ CFU/ml  
- *Bacillus licheniformis* ............................. $2.26 \times 10^3$ CFU/ml  
- *Streptomyces griseus* .............................. $2.26 \times 10^3$ CFU/ml  
- *Bacillus megaterium* ............................... $2.26 \times 10^3$ CFU/ml  
- *Rhodococcus rhodochrous* ...................... $2.26 \times 10^3$ CFU/ml  
- *Lactobacillus plantarum* ....................... $2.26 \times 10^3$ CFU/ml
**NUTRIO UNLOCK** is cultured from pure strains of specifically selected beneficial bacteria. These specific strains have been isolated from the rhizospheres of highly productive soils. “Studies have shown that rhizobacteria are better adapted to root colonization than bacteria isolated from nonrhizosphere soil”1.

Each strain in UNLOCK and the blend of strains have been thoroughly evaluated to understand the specific mechanisms involved in promoting improved soil and plant nutrition. Research has shown that the application of blends of multiple strains results in better responses than individual strains applied alone.

Multiple species of bacteria (both beneficial and detrimental) have the ability to colonize plant roots. Inoculating the rhizosphere with UNLOCK allows for “niche exclusion” of the root surface with good bacteria. Niche exclusion is when the beneficial bacteria from UNLOCK occupy the space and resources in the rhizosphere before harmful species of bacteria have the opportunity to colonize the root surface.

1 Source: The Rhizosphere Biochemistry, Table 3.1

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**DIRECTIONS FOR USE**

**Recommended for all vegetable crops, small fruit, berries, citrus, bananas, tobacco, alfalfa, and all row (field) crops including, but not limited to cotton, sorghum, corn, wheat, sugarcane and soybeans.**

**NUTRIO UNLOCK** can be blended with liquid fertilizers and soil amendments to be applied in ground application equipment and through fertigation equipment.

**STARTER OR SIDE-DRESS:** Apply 1-2 pints per acre.

**BROADCAST:** Apply 2-4 quarts per acre in enough solution to provide thorough coverage.

**MANURE APPLICATIONS:** 2-4 quarts per acre (2-4 quarts per 3,000-3,500 gallons of liquid manure).
### Wisconsin Corn Trial

2015 season | BZU = 5 gpa | Research conducted by Agri-Tech Consulting

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<thead>
<tr>
<th>Treatment</th>
<th>Corn Grain Yield (bu/ac)</th>
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<tbody>
<tr>
<td>Control</td>
<td>238</td>
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<tr>
<td>BZU alone</td>
<td>241</td>
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<tr>
<td>UNLOCK</td>
<td>251</td>
</tr>
<tr>
<td>UNLOCK16 + PURIC™16</td>
<td>255</td>
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Yield gain in corn from TILL-IT® BLUE-ZONE® ULTRA, TILL-IT BLUE-ZONE ULTRA plus NUTRIO UNLOCK and TILL-IT BLUE-ZONE ULTRA plus a half rate (16 oz) of both NUTRIO UNLOCK and PURIC™ MAX.

### Wisconsin Soybean Trial

2015 season | BZU = 5 gpa | Research conducted by Agri-Tech Consulting

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Soybean Yield (bu/ac)</th>
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</thead>
<tbody>
<tr>
<td>Control</td>
<td>69.6</td>
</tr>
<tr>
<td>BZU alone</td>
<td>70.6</td>
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<tr>
<td>UNLOCK</td>
<td>73.9</td>
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<tr>
<td>UNLOCK16 + PURIC™16</td>
<td>74.5</td>
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</table>

Yield gain in soybeans from TILL-IT BLUE-ZONE ULTRA, TILL-IT BLUE-ZONE ULTRA plus NUTRIO UNLOCK and TILL-IT BLUE-ZONE ULTRA plus half rate (16 oz) of NUTRIO UNLOCK and PURIC MAX.
NUTRIO BIOSOAK™

NUTRIO BIOSOAK

- Combination of beneficial soil bacteria with a soil wetting agent and humic acid
- Prepares soil for improved infiltration of rain and leaching of salts
- Same proven microbial package as NUTRIO UNLOCK and highly concentrated PURIC humic acid

Guaranteed Analysis

Soluble Potash (K₂O) .................................................................1.00%
DERIVED FROM: Potassium Hydroxide and Potassium Thiosulfate.

ALSO CONTAINS NON-PLANT FOOD INGREDIENTS:

1.20% Humic Acid derived from Leonardite
1.50% Triblock Copolymer
0.50% Glucoethers

CONTAINS NON-PLANT FOOD INGREDIENTS:
Contains 3 million colony forming units (CFU) per gallon of the following:

- Rhodopseudomonas palustris ........................................ 790 CFU/ml
- Bacillus brevis .............................................................. 790 CFU/ml
- Bacillus licheniformis .................................................... 790 CFU/ml
- Streptomyces griseus .................................................... 790 CFU/ml
- Bacillus megaterium ...................................................... 790 CFU/ml
- Rhodococcus rhodochrous ............................................. 790 CFU/ml
- Lactobacillus plantarum ............................................... 790 CFU/ml
NUTRIO HIGH GEAR

- Same proven microbial package as NUTRIO UNLOCK and highly concentrated PURIC humic acid
- Formulated for dry fertilizer impregnation

Guaranteed Analysis

Total Nitrogen (N) ............................................ 3.00%
  0.75% Ammoniacal Nitrogen
  0.75% Nitrate Nitrogen
  1.50% Urea Nitrogen

DERIVED FROM: Ammonium Nitrate and Urea.

ALSO CONTAINS NON-PLANT FOOD INGREDIENTS:

0.70% Humic Acid derived from Leonardite

CONTAINS NON-PLANT FOOD INGREDIENTS:
Contains 23 million colony forming units (CFU) per gallon of the following:

- *Rhodopseudomonas palustris* ........................................... $8.70 \times 10^2$ CFU/ml
- *Bacillus brevis* ................................................... $8.70 \times 10^2$ CFU/ml
- *Bacillus licheniformis* .................................................... $8.70 \times 10^2$ CFU/ml
- *Streptomyces griseus* .................................................. $8.70 \times 10^2$ CFU/ml
- *Bacillus megaterium* ................................................... $8.70 \times 10^2$ CFU/ml
- *Rhodococcus rhodochrous* ........................................ $8.70 \times 10^2$ CFU/ml
- *Lactobacillus plantarum* ............................................. $8.70 \times 10^2$ CFU/ml

DIRECTIONS FOR USE

Recommended for all vegetable crops, small fruit, berries, citrus, bananas, tobacco, alfalfa, and all row (field) crops including, but not limited to cotton, sorghum, corn, wheat, sugarcane and soybeans.

DRY FERTILIZER IMPREGNATION: 1-4 quarts per ton

STARTER: 1-2 quarts per acre

SIDE-DRESS: 1-2 quarts per acre

BROADCAST: 2-8 quarts per acre in enough solution to provide thorough coverage

MANURE APPLICATIONS: 2-8 quarts per acre (2-8 quarts per 3,000-3,500 gallons of liquid manure)
NUTRIO POWERSHIFT™

NUTRIO POWERSHIFT
- Low salt, high orthophosphate fertilizer with the microbial package from NUTRIO UNLOCK
- Designed for starter/pop-up fertilizer applications
- Maximizes phosphorus availability
- Contains chelated micronutrient package
- Stimulates seedling root growth, emergence and overall plant health

Guaranteed Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (N)</td>
<td>6.00%</td>
</tr>
<tr>
<td>Ammoniacal Nitrogen (5.60%)</td>
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</tr>
<tr>
<td>Water Soluble Nitrogen (0.40%)</td>
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</tr>
<tr>
<td>Available Phosphate (P₂O₅)</td>
<td>22.00%</td>
</tr>
<tr>
<td>Soluble Potash (K₂O)</td>
<td>6.00%</td>
</tr>
<tr>
<td>Boron (B)</td>
<td>0.02%</td>
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<tr>
<td>Chelated Copper</td>
<td>0.05%</td>
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<tr>
<td>Manganese (Mn)</td>
<td>0.06%</td>
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<tr>
<td>Chelated Manganese</td>
<td></td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>0.46%</td>
</tr>
<tr>
<td>Chelated Zinc</td>
<td></td>
</tr>
</tbody>
</table>

DERIVED FROM: Ammonium Phosphate, Potassium Phosphate, Boric Acid, Copper EDTA and IDS, Manganese EDTA and IDS, and Zinc EDTA and IDS.

CONTAINS NON-PLANT FOOD INGREDIENTS:
Contains 3 million colony forming units (CFU) per gallon of the following:

- Rhodopseudomonas palustris: 1.13 x 10² CFU/ml
- Bacillus brevis: 1.13 x 10³ CFU/ml
- Bacillus licheniformis: 1.13 x 10² CFU/ml
- Streptomyces griseus: 1.13 x 10² CFU/ml
- Bacillus megaterium: 1.13 x 10³ CFU/ml
- Rhodococcus rhodochrous: 1.13 x 10² CFU/ml
- Lactobacillus plantarum: 1.13 x 10³ CFU/ml

DIRECTIONS FOR USE

Moisture conditions and planting strategies are important considerations when using NUTRIO POWERSHIFT.

POP-UP APPLICATIONS: Apply 1-5 gallons per planted acre on seed as established by local agricultural practices. NUTRIO POWERSHIFT may be diluted with water for ease of calibration if needed. When applied in the seed furrow on very dry soils, a post plant irrigation within 24 hours is recommended. Use CAUTION when applying directly to the seed in very saline soils as there may be a risk of seedling injury.

STARTER APPLICATIONS: Apply 1-8 gallons per acre as a band directly below the seed or 5-20 gallons below and to the side of the seed line. NUTRIO POWERSHIFT may also be applied as a surface spray band over the top or to the side of the seed prior to planting. Bluegrass, canola, rape, mustard, soybeans, and other small seed crops should have NUTRIO POWERSHIFT placed no closer than 2 inches from the seed.

FOLIAR APPLICATIONS: NUTRIO POWERSHIFT may also be used as foliar spray at 2-4 quarts for row and field crops and 2-8 quarts for tree crops. Apply in a minimum of 5 gallons of water for every 2 quarts of NUTRIO POWERSHIFT.

NUTRIO POWERSHIFT can be applied through center pivot or drip irrigation systems, but check your water source prior to application for calcium or other impurities. Always jar test with water source for precipitation prior to actual field use.