



THE WILBUR-ELLIS HUMIC AND FULVIC ACID GUIDE



Create Pure Growing Power with PURIC[®]



SOME PRODUCTS NOT FOR SALE IN CALIFORNIA



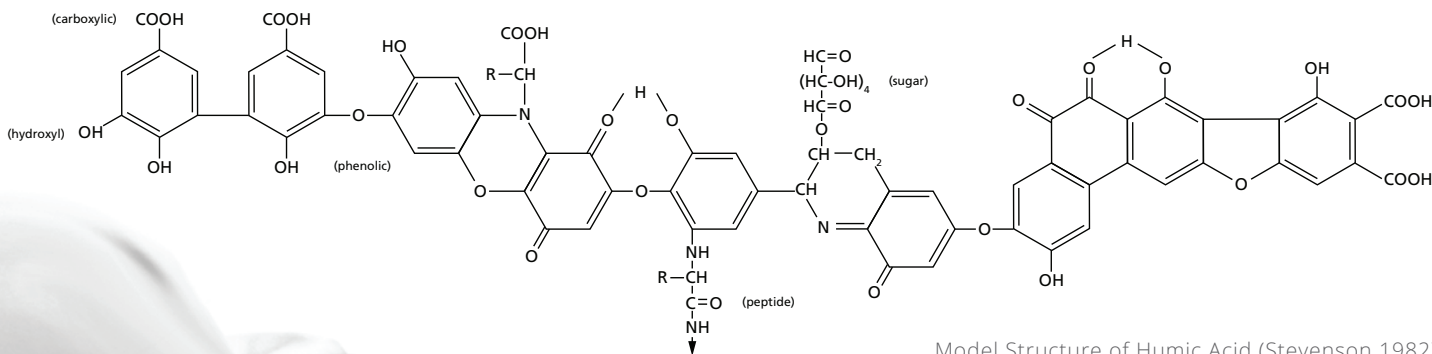
The PURIC® Product Line - Complete Humic Solutions for Every Fertilizer Blend

The PURIC® product line is an advanced line of liquid and water-soluble granular humic acid products produced with state-of-the-art formulation technology. PURIC products are characterized by having high humic acid content, ultra purity and fine particle size. PURIC products may be applied with starter or pop-up fertilizers, foliar fertilizer, soil applied or fertigation applied with liquid fertilizers or as stand alone treatments. PURIC products make nutrients better - and now, there are options for every application of plant nutrition - even acids, calcium fertilizers, and dry blends.

What are Humic Acids and Where do They Come From?

Humic acids help turn fertilizers into PURE GROWING POWER by keeping nutrients available and ready for uptake by harnessing the power of ancient organic matter. Once extracted, humic and fulvic acids become powerful tools to enhance fertilizer efficiency.

Humic acids are an important component of soil humus - meaning they contribute to soil's native fertility, structure and plant growth. Complex and diverse organic compounds, humic acids contain an abundance of "functional groups" (carboxylic, hydroxyl, phenolic, peptide, sugar) that work together to create important chemical and biological functions common to humic acids.



Model Structure of Humic Acid (Stevenson 1982)

"There is also conclusive evidence that quite small amounts of certain organic substances (highly dispersed humic acids) have a definite, positive effect on the growth and development of the plant. It is also well established that humic substances increase the germination capacity of seed..."

*A Review of Humus and Humic Acids,
Clemson University*

"The plant characteristic that the addition of humic substances has consistently enhanced more than any other is root length, especially on sandy soils."

"Humic matter has been shown to increase the uptake of nitrogen by plants, and to increase soil nitrogen utilization efficiency. It can also enhance the uptake of potassium, calcium, magnesium and phosphorus."

University of Florida, Gainesville (2005)

"Enhanced plant growth following additions of humic materials has sometimes been related to increased micronutrient availability, especially iron and zinc."

"Researchers at the University of Idaho showed positive yield and quality of potatoes to humic acid added to banded P in a calcareous soil."

IPNI Better Crops/Vol. 89 (2005, No. 3)

Do Humic Acids Work?

Yes! Existing literature is rich with citations of beneficial response to humic acids, and Wilbur-Ellis has been using humic acid technologies with our customers and through replicated research trials for many years. The most prominent benefits cited in scientific literature, and probably the most realistic and consistent responses to applied humic acid, include:

- **Increased nutrient uptake (phosphorus and micronutrients)**
- **Increased root mass**

Other potential benefits may include:

- **Increased soil buffering capacity**
- **Improved water holding capacity**
- **Increased Cation Exchange Capacity (CEC)**
- **Improved soil structure**
- **Increased soil microbial activity**
- **Increased shoot growth (foliar application)**
- **Increased crop yield and/or quality**

The opportunity to achieve the above cited benefits will depend on soil conditions, application rate, placement and method of application (i.e., banding vs. broadcast).





How are Humic Acids Made?

After millions of years, organic matter decays and condenses into raw leonardite ore. This ore is mined and insoluble.

Creating a soluble carbon molecule requires extraction, breaking bonds of carbon rings to open up functional groups that hold onto nutrients and increase nutrient availability. Wilbur-Ellis PURIC products use pure potassium extractants.

What is the Secret to PURIC?

Most humic acids stop there, but PURIC humic acids are refined further, creating consistent particle size for maximum activity in the soil and compatibility through irrigation with or without fertilizers. That is the secret to creating PURE GROWING POWER.

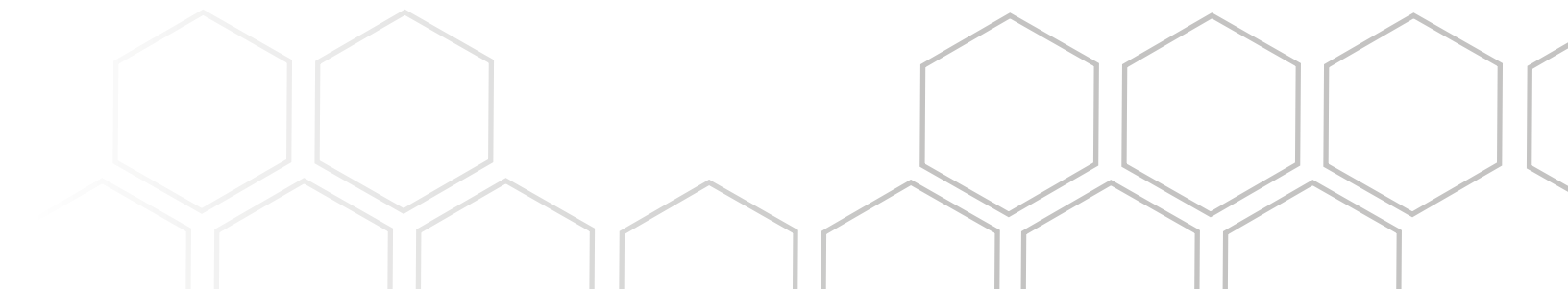
Insoluble Leonardite Ore + Potassium Extraction = Soluble, active humic acids



+



=



Fulvic Acid and Humic Acid

What is the difference?

Humic acids are very large, carbon-based compounds that are dark brown to black in color. Commonly found as a liquid or granular product, humic acids aid in keeping nutrients available by tapping into your soil's nutrient holding power. All humic acids contain a fraction of fulvic acids from 0.1-1.5% by weight.

- Humic acids are much larger molecules
- Contain fulvic acid, too
- Impact soil structure, porosity, salinity, and buffering
- Black, opaque color

Both have unique nutrient solubilizing abilities and increase activity in the rhizosphere.

Humic and fulvic acids increase phosphorus availability and uptake by decreasing nutrient tie-up.

Humic and fulvic acids make fertilizer better, increasing efficiency and yield potential of specialty and row-crops.

Fulvic acids are smaller, highly charged carbon based molecules and are usually dark amber to yellow clear liquids designed to keep nutrients available, especially phosphorus. Fulvic acids are extracted from humic acids.

- Fulvic acids are concentrated from humic acids
- High purity, concentration and negative charge
- Clear, dark amber color



The Test Tells the Difference

How Humic Acids are Tested - State by State







Wilbur-Ellis uses the CDFA method as our standard for all PURIC products.

Colormetric Method: A *qualitative* measurement of the coloration that is accurate and quick, but easily fooled by non-humic/fulvic substances. Recognized by most states - (WA, MT, ND, SD, NE, KS, OK, ID, TX, MO, IA, MN, MI, OH, IN, and eastern US)

CDFA Method: A pH adjustment that is accurate and *quantitative* for the humic portion of the liquid. Recognized by AZ, CA, OR, and WI only, this test is usually 50% lower than the colormetric method on percent humic acid.



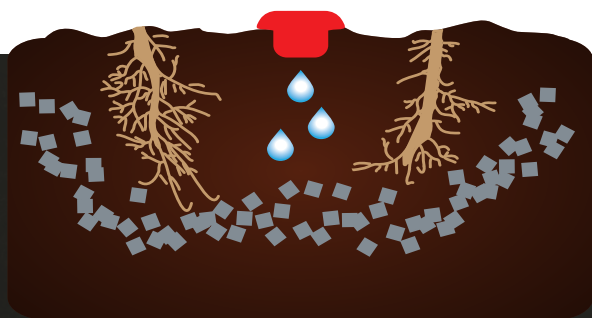
Put PURIC to the Test

| Product | Product Advantages | Humic acid content by CDFA Method | Humic acid content by Colorimetric Method |
|--|---|-----------------------------------|---|
|  PURIC® | Pure, extracted humic acid enhances soil structure and nutrient availability. Helps mitigate salt stress, porosity, and builds the rhizosphere at higher rates. OMRI Listed. | 12% | 24% |
|  PURIC® PRIME | Most concentrated humic acid on the market enhances soil structure and nutrient availability. Superior mixing over other humic acids, can be splash blended. | 12% | 24% |
|  PURIC® FC | Pure fulvic concentrate increases nutrient availability and uptake, especially phosphorus and micronutrients. Built into NUTRIO® TRIOLOGICAL®. | 0% | 0% |
|  PURIC® WSG | Granulated, soluble, extracted humic acid increases nutrient availability, uptake and soil health. Make dry fertilizer better and mitigate salt stress, increase porosity, and add more potassium. OMRI listed. 2 lbs = 1 gal of PURIC. | 67% | 95% |
|  TILL-IT® 6% HUMIC ACID | Pure, extracted humic acid enhances soil structure and nutrient availability. Increases rhizosphere productivity and nutrient exchange at higher rates. OMRI listed. | 6% | 12% |
|  PURIC® SALUTE® | Unmatched compatibility in all liquid fertilizers, including calcium and acid-based liquids. Enhances nutrient availability and root architecture. | 8% | 8% |

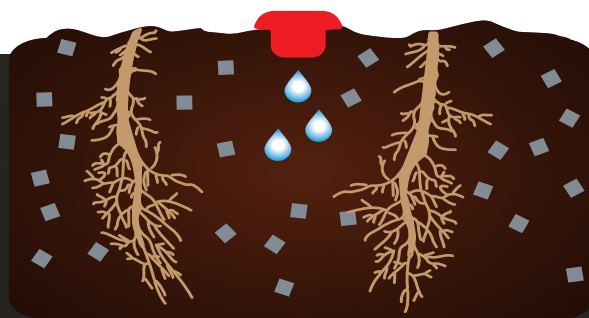


The Most Concentrated Humic Acid on the Market Listed by OMRI

Pure growing power that increases nutrient uptake, builds the rhizosphere, and solves problems like salinity in the root zone and irrigation water.



Sodium can accumulate in the root zone – reducing absorption and root growth, ultimately stunting your plant's growth.



When PURIC is applied, the product can help displace concentrated sodium, creating a healthier root zone and higher water availability for the plant.

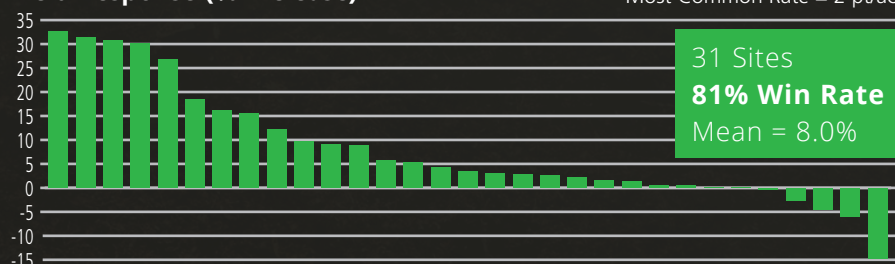
- Improves nutrient uptake and availability
- Improves soil's water-holding capacity
- Chemigation & irrigation friendly

PURIC is a versatile humic acid solution that can aid in soil structure when too much sodium is present in your soil. Though plant species and varieties have differing levels of salt tolerance, accumulation of soil salts will ultimately lead to problems—like reduced growth rates, reduced root growth, stunting and telltale brown patches. Highly concentrated humic acids, like PURIC allow your crops to grow to their full potential.

In-Furrow Trial of PURIC

Yield Response (% Increase)

Most Common Rate = 2 pt/ac



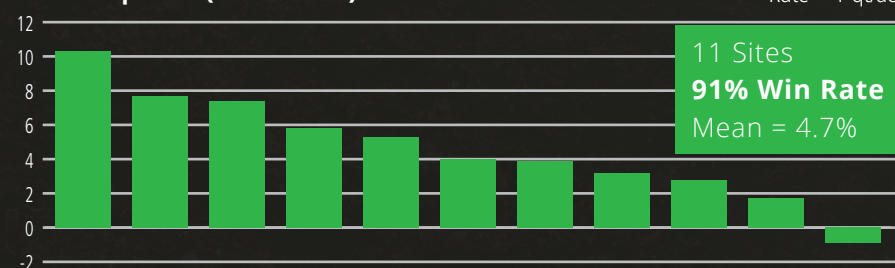
31 Sites
81% Win Rate
Mean = 8.0%

All Crops: Corn, Cotton, Soybean and Wheat
Applied with in-furrow starter fertilizer
Replicated, third party research

Foliar Trial of PURIC

Yield Response (% Increase)

Rate = 1 qt/ac



11 Sites
91% Win Rate
Mean = 4.7%

All Crops: Canola, Corn, Cotton, Soybean and Wheat
applied as a foliar with herbicide early herbicide spray
Replicated, third party research



Your Friend in the Blend

PURIC PRIME is built into TILL-IT® products like TILL-IT BACKBONE® and TILL-IT FLUID CARBON® because it is concentrated and mixes easily with bulk NPK liquid fertilizers. Prime your liquid fertilizer with PURIC and increase uptake and availability to the crop.

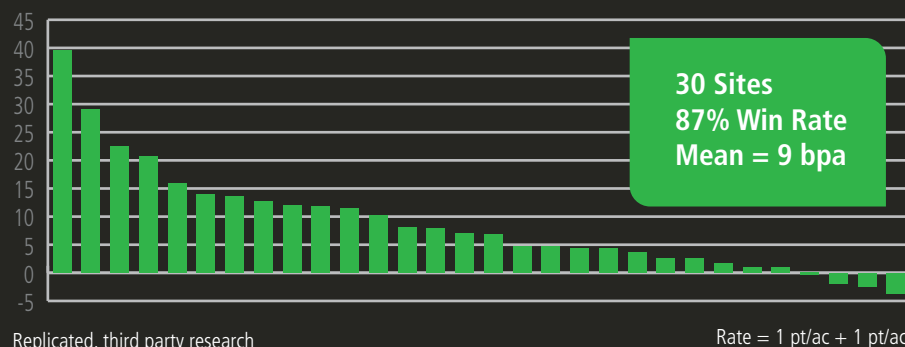
- **Splash blending with UAN or in-furrow starters**
- **Improves soil's water-holding capacity**
- **Compatible with NUTRIO® UNLOCK® and NDURE® DCD for complete agronomic solutions such as TILL-IT® FLUID CARBON® and TILL-IT® BACKBONE®**

Contains special additives that enhance mixing ease and can be mixed with agitation or as a simple splash blend. The optimized pH of PURIC PRIME adds more compatibility and the unique formulation maintains a low viscosity for a product with excellent handling characteristics. The same ultra fine suspended solids content of PURIC enhances the storability of PURIC PRIME. PURIC PRIME is simply the most user friendly humic acid product for blending with liquid fertilizers.

Synergize Your Starter

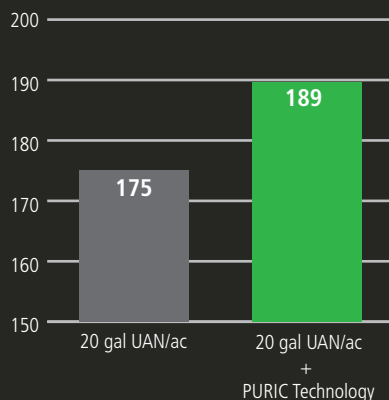
Corn Yield Response(bu/ac)

NUTRIO UNLOCK + PURIC PRIME In-furrow



Prime Your Nitrogen

Corn Yield (bu/ac) at Harvest



Trial #: PDF187004TX48
Corn in Wharton, TX | 2018
UAN applied in-season as a side-dress
Replicated, third party research

PURIC PRIME + UAN 32-0-0 gives growers more growing power. This power couple helps soil stay healthy and increase yields. PURIC PRIME releases and holds nutrients in the soil, promotes plant vigor and improves yields. The refined, clean formulation of PURIC PRIME not only unleashes your crop's potential, but reduces common application issues with sediments associated with less enhanced humic acid products.



+ WATER

PURIC WSG has solubility you can see, activating in the soil or water in minutes.





Pure, Extracted Humic Acid Granule

PURIC WSG is organically listed and improves all dry fertilizer blends at low rates of 1-10 pounds per acre.



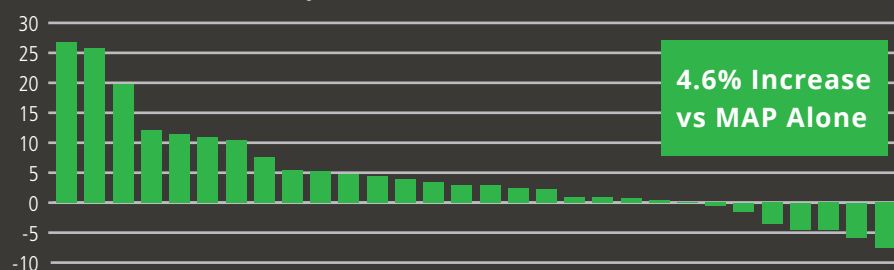
- PURIC humic acid compacted into a patented granule with 10% K_2O and 67% pure, extracted humic acid from leonardite.
- For all broadcast, banded, or seeding applications with urea, MAP, muriate of potash, gypsum, AMS, or TILL-IT ELEMATIC® ZINC.
- Enhance early growth and nutrient availability. Add NUTRIO HIGH GEAR® II to the same blend to bring your soil to life.

PURIC WSG makes dry fertilizer blends and soil work better, together. Improved soil structure, aggregation, and nutrient availability keep your rhizosphere active. PURIC WSG is extracted from pure leonardite ore and compacted into a soluble granule.

PURIC WSG Replicated Research

% Yield Difference Compared To Fertilizer Alone

Rate = 3-6 lb/A

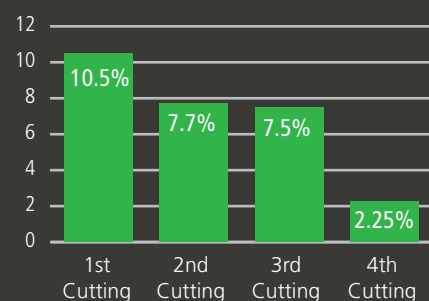


MAP was broadcast preplant alone, or with PURIC WSG
Crops: Corn, Potato, Spring Wheat, Spinach, Alfalfa, Soybean
Replicated, third party research

Replicated Research - Alfalfa

% Yield Increase Above Grower Standard

Rate = 3-6 lb/A

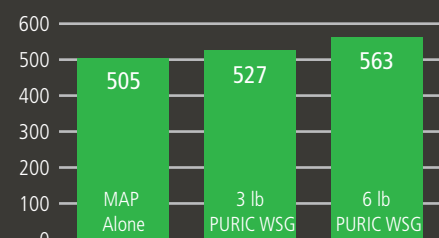


MAP was broadcast applied before the first cutting alone, or with PURIC WSG
Crop: Alfalfa
Replicated, third party research
Overall increases based on 4 total cuttings

Replicated Research - Potatoes

CWT/Acre

Rate = 3-6 lb/A



100 lb MAP was broadcast applied preplant, or with PURIC WSG
Crop: Russet Burbank Potato
Replicated, third party research



Scan to learn about the benefits of using PURIC® WSG during crop production.



+ CAN-17

PURIC SALUTE
has unmatched
compatibility you
can see with CAN-17.





8% Extracted Humic Acid With Unbelievable Compatibility

PURIC SALUTE® mixes with CAN-17, CN-9®, INTELLIPHOS®, even N-pHURIC® so every liquid blend can have PURE GROWING POWER.

PURIC SALUTE has unrivaled compatibility in liquid fertilizer blends.

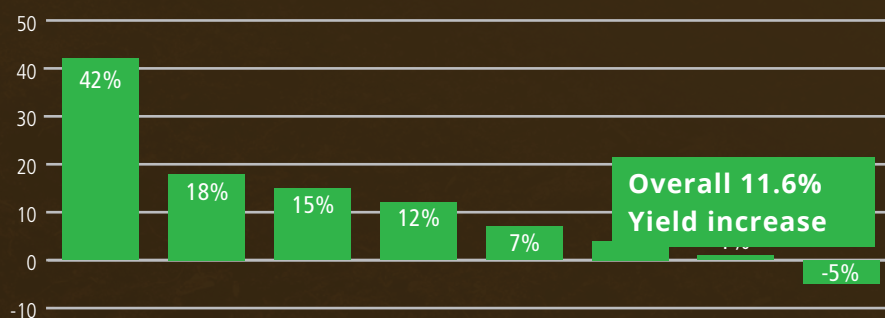
- **Compatible with Acid Fertilizers, Calcium Fertilizers, all NPK and Micronutrient liquids**
- **Optimizes nutrient uptake and retention, soil structure, crop yield and quality**
- **Advanced extraction and purification with PURIC technology.**

PURIC SALUTE is compatible with all fertilizers including:

UAN, CAN-17, CN-9, CATs®, ATS, KTS®, 10-34-0, 11-37-0, orthophosphates and polyphosphates, all INTELLIPHOS products, phosphoric acid, Potassium Carbonate (Pot-carb).

Trials of PURIC SALUTE

% Yield Difference Compared To Fertilizer Alone



Crops: Nonpareil Almonds, Pinot Noir Wine Grapes, Processing Tomatoes, Bell Peppers

UTC = 2 applications of CAN-17 based on N-recommendations through drip

Treatments = 2 applications of CAN-17 based on N-recommendations and 1 gal of PURIC SALUTE

Replicated, third party research

DENSITY (WT): 9.5 LB/GAL



Pure, Concentrated Fulvic Acid For Starter and Foliar Fertilizers

PURIC FC is clear, yellow liquid that increases nutrient availability, specifically phosphorus, while keeping the sight gauges visible.

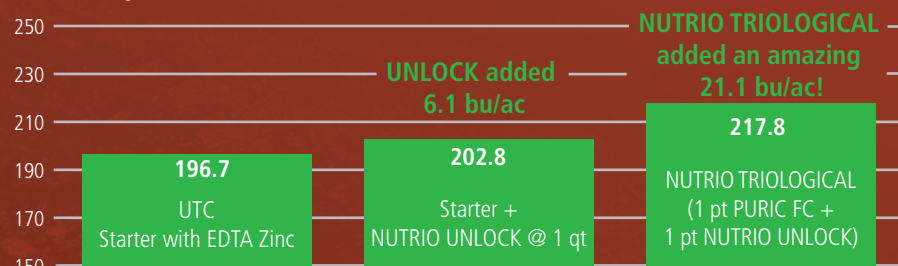
PURIC FC is built into NUTRIO TRIOLOGICAL and compatible with all low-salt and ammonium polyphosphate fertilizers.

- High fulvic content and low use rate of 1-2 pints per acre
- For in-furrow, 2x2, banded and foliar applications
- See your sight gauge - PURIC FC won't turn your fertilizer black
- Enhance early season root growth and emergence, especially with NUTRIO UNLOCK®

PURIC FC is a pure fulvic concentrate of unique organic acids. PURIC FC is isolated from pure leonardite ore rich in organic matter. Through a double extraction process, PURIC FC is concentrated into a clear, bioactive fulvic acid liquid to increase nutrient use efficiency.

Trial of NUTRIO UNLOCK & NUTRIO TRIOLOGICAL In-Furrow on Corn

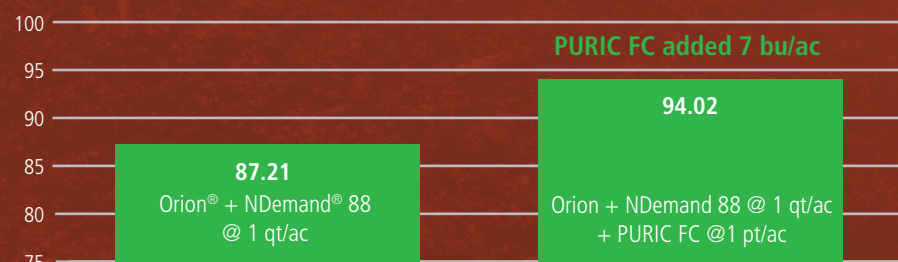
Yield Response (bu/ac)



Starter = 5 gallons of TILL-IT® BLUE-ZONE® ULTRA with 1 qt of zinc
Third party replicated research completed in Indiana

Trial of PURIC FC on Winter Wheat as a Foliar

Yield Response (bu/ac)









Applied May 4

Third party replicated research completed in Wisconsin







PURIC Blending Chart

Red = Incompatible
 Green = Compatible
 Yellow = Compatible, agitation recommended

| | UAN 28 & 32% | Ammonium Thiosulfate (ATS) | Potassium Thiosulfate (KTS) | CAN17 and CN-9 | GOLD-ZONE ULTRA and Low-Salt Starters | Polyphosphates | INTELLIPHOS and Phosphoric Acid blends | High pH Solutions | Low pH Solutions | UREA and Dry Fertilizer Blends | Recommended for Foliar Applications |
|--|--------------|----------------------------|-----------------------------|----------------|---------------------------------------|----------------|--|-------------------|------------------|--------------------------------|-------------------------------------|
|  PURIC® | Green | Red | Yellow | Red | Yellow | Yellow | Red | Green | Red | Red | Green |
|  PURIC® PRIME | Green | Green | Green | Red | Green | Green | Red | Green | Red | Red | Green |
|  PURIC® FC | Green | Green | Green | Green | Green | Green | Green | Green | Green | Red | Green |
|  PURIC® WSG | Red | Red | Red | Red | Red | Red | Red | Red | Red | Green | Red |
|  TILL-IT® 6% HUMIC ACID | Green | Yellow | Yellow | Red | Yellow | Green | Red | Green | Red | Red | Green |
|  PURIC® SALUTE® | Green | Green | Green | Green | Green | Green | Green | Green | Green | Red | Green |



PURIC Product Line Summary

| Product | Advantages | Application Rates | % Humic Acid by CDFA standards* | % Humic Acid by Colormetric Test** | Organic | States Registered | Best Pack Size & Item Code | |
|---|---|--|---------------------------------|------------------------------------|------------|---|-------------------------------------|----------------------------|
|  PURIC® | Pure, extracted humic acid enhances soil structure and nutrient availability. Helps mitigate salt stress, porosity, and builds the rhizosphere at higher rates. OMRI Listed. | 0.5-2 gal Multiple applications are helpful | 12 | 24 | OMRI | All states as a 12% humic acid | BULK GA 270 GA SH 2-2.5 GA JU | 224604 224873 224871 |
|  PURIC® PRIME | Most concentrated humic acid on the market enhances soil structure and nutrient availability. Superior mixing against other humic acids, can be splash blended. | 1-4 qt | 12 | 24 | No | All states as a 12% humic acid | BULK GA 270 GA SH 2-2.5 GA JU | 232463 232560 232569 |
|  PURIC® FC | Pure fulvic concentrate increases nutrient availability and uptake, especially phosphorus and micronutrients. Built into NUTRIO TRIOLOGICAL. | 1-2 pt | 0 | 0 | OMRI | All states as a 3% fulvic acid excluding CA/OR/SD | 2-2.5 GA JU 275 GA SH | 259719 259720 |
|  PURIC® WSG | Granulated, soluble, extracted humic acid increases nutrient availability, uptake and soil health. Make dry fertilizer better and mitigate salt stress, increase porosity, and add more potassium. OMRI listed. Two pounds = One gallon of PURIC. | At Establishment: 2-5 lb Broadcast in the spring or fall: 2-10 lb For beds: 5-20 lb | 67 | 95 | OMRI, CDFA | All states as a 67% humic acid | 55 LB BAG 2200 LB BULK LB | 264430 264196 264433 |
|  TILL-IT® 6% HUMIC ACID | Pure, extracted humic acid enhances soil structure and nutrient availability. Increases rhizosphere productivity and nutrient exchange at higher rates. OMRI listed. | 0.5-5 gal/ac Multiple applications are helpful | 6 | 12 | OMRI, CDFA | All states as a 6% humic acid | BULK GA 270 GA SH 2x2.5 GA JU | 187675 187677 280357 |
|  PURIC® SALUTE™ | Unmatched compatibility in all liquid fertilizers, including calcium and acid-based liquids. Enhances nutrient availability and root architecture. | 1-8 qt Multiple applications are helpful | 8 | 8 | No | All states as an 8% humic acid | BULK GA 270 GA SH 2-2.5 GA JU | 258144 258145 258146 |

*This test is recognized in CA/OR/AZ/WI

**This test is recognized in all other states.

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