PERFORMANCE NUTRITION™

Performance Nutrition is a division of LidoChem, Inc.

PENNAMIN

chelating Micronutrients

microbial Activators

organic Nitrogen

LidoChem
Partners in Growth

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General Information

- **PENNAMIN** products can be used on agricultural crops, turf and ornamentals of all types, as well as greenhouse and nursery production.
- Use 50 gallons of water per acre of field crops, fruits, vegetables, row crops, ornamentals, flowers, and turf.
- Use 100 - 125 gallons of water per quart of **PENNAMIN Driver-L** or **PENNAMIN Driver-LC** on trees, and tree & vine crops.
- Frequent applications at lower rates are generally more effective than fewer applications at higher rates.
- **PENNAMIN** products are recommended for use on all types of soils. Dilute before use to ensure uniform coverage. The product can be incorporated into liquid fertilizers or applied separately*. Soil applications may be made by sprinkler or band application.

- Do NOT use **PENNAMIN** products with selective herbicides.
- **PENNAMIN** products accelerate and enhance the foliar of any component in the same tank mix. It is suggested that you reduce your normal rate of application of tank mix components until you learn how **PENNAMIN** products impact the efficacy of your specific fertility, disease control, insect control and herbicide products.
- Please read complete product label before using any **PENNAMIN** products.
- Rates given are maintenance rates. A tissue test should be taken on a regular basis. If tests show deficient or excessive levels of any mineral consult with your local ***Performance Nutrition*** Dealer for corrective rates.

**** Be sure to perform a jar test before tank mixing PENNAMIN products.***

Introducing the PENNAMIN *Advantage*

PENNAMIN products, which include **organic fertilizers, complexed micronutrients and nutritional products for microbial populations**, contain a unique blend of **water-soluble amino acids** derived from hydrolyzed feathers.

Explore the **PENNAMIN** advantages and you'll understand the value of adding **PENNAMIN** products to your fertility programs.

- **PENNAMIN** products are water soluble (or easily suspendable) so they are **easy to blend and apply**.
- 80% of **PENNAMIN** amino acids are ***free*** **amino acids** so that they are **quickly available to the plant**.
- **PENNAMIN** amino acids have a ***6:1 C:N ratio*** which allows for the **quick and sustained release of organic nitrogen** (see Chart 1 below).
- **PENNAMIN** amino acids have a **very low average molecular weight – *130 Daltons* – which makes them ideal and effective for foliar applications**.
- **PENNAMIN** products contain a high level of *Proline* known to **enhance water stress and drought tolerance**.
- **PENNAMIN** products contain a high level of *Histidine* which, along with *Proline*, help **regulate stomatal activity for enhanced foliar uptake.**
- **PENNAMIN** amino acids are effective ***chelating agents*** which can chelate micronutrients tied up in the soil **making them available for plant uptake.**
- **PENNAMIN products nourish beneficial soil microorganisms which are critical for a healthy and productive ecosystem.**

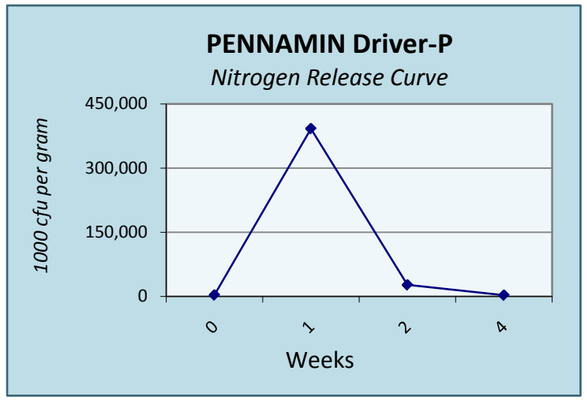


Chart 1 (left): Chart 1 illustrates the increase in the population of microorganisms which corresponds to the production and availability of organic nitrogen.

Microbial populations build almost immediately, peak at about 1 week and sustains higher populations for up to 2 weeks.

It represents nature's own sustained-release nitrogen fertilizer.

PENNAMIN Product List

SPRAYABLE

Microbial Activators & Foliar Uptake Enhancers

PENNAMIN DRIVER – P	**12-0-0**	*Water-Soluble Powder*
PENNAMIN DRIVER – L	**3-0-0**	*Liquid*
PENNAMIN DRIVER – LC	**3-0-0**	*Liquid with Chitosan sticker*

SPRAYABLE

Chelated Micronutrient Powders

PENNAMIN CA	**7-0-0+14% Ca**
PENNAMIN HIGH K	**6-0-15+9% Ca**
PENNAMIN CU	**11-0-0+8% Cu**
PENNAMIN FE	**9-0-0+6% Fe**
PENNAMIN MG	**12-0-0+12% Mg**
PENNAMIN MN	**10-0-0+7% Mn**
PENNAMIN ZN	**11-0-0+9% Zn**

SPRAYABLE

Chelated Micronutrient Mixes

PENNAMIN CA+MG	**8-0-0+8% Ca + 8% Mg**
PENNAMIN FE + MN	**9-0-0+4% Fe + 3% Mn**
PENNAMIN PERFECT	**5% Ca, 2% Mg, 0.025% B, 0.25% Cu, 0.125% Zn, 0.008% Fe& 0.06% Mn**

Typical Chemical Analysis

PENNAMIN Driver-P

Dry Matter	**96%**
Free Amino Acids	**80%**
Crude Ashes	**6%**
Sodium Chloride	**<4%**
Organic Nitrogen	**12%**

Physical Data

Water Solubility at 20°C	**200 grams/litre**
pH in 1% solution	**5.5 +/- 0.3**

PENNAMIN DRIVER-P has the appearance of a beige dry powder and is **100% water-soluble.**

PENNAMIN DRIVER-P

Amino Acid Profile

Alanine	**4.23%**
Arginine	**5.32%**
Aspartic Acid	**6.28%**
Cystine	**1.27%**
Glutamic Acid	**9.26%**
Glycine	**7.29%**
Histidine	**0.96%**
Isoleucine	**2.51%**
Leucine	**6.18%**
Lysine	**1.40%**
Methionine	**0.45%**
Phenylalamine	**4.39%**
Proline	**9.66%**
Serine	**11.11%**
Threonine	**4.08%**
Tyrosine	**1.09%**
Valine	**4.96%**
Total	**80.44%**

Amino Acid Technology at Work for You!

Amino Acid Characteristics

80% of the amino acids in **PENNAMIN** products are ***free amino acids.*** This means nitrogen becomes plant available very quickly and the benefits of each amino acid are expressed sooner.

PENNAMIN's amino acids are in ***L*-Form**. Only *L*-Form amino acids are suitable for plant uptake and utility.

PENNAMIN's mix of 17 amino acids maintains the inherent characteristics of the individual amino acids.

Chelation

PENNAMIN amino acids have the ability to chelate metals and **improve micronutrient absorption by plants and turf.**

PENNAMIN sequesters heavy metals and can help **protect crops grown in soils high in heavy metals.**

High Salinity Tolerance

PENNAMIN impacts enzyme activity !

Proline can protect enzymes against denaturation by salinity, heat or dilution.

Organic Nitrogen Source

PENNAMIN amino acids are the **precursors of other nitrogen-containing compounds**; as examples, **nucleic acids and chlorophyll**.

PENNAMIN amino acids **promote microbial life** in the soil and on the leaf surface and are "easy-to-use" nitrogen sources for micronutrients.

PENNAMIN Driver-P has a **6:1 *carbon to nitrogen* (C:N) *ratio*.** This means nitrogen becomes plant available shortly after application and is slowly released for two (2) weeks.

PENNAMIN amino acids have a ***very low average molecular weight: 130 Daltons***.

Studies have confirmed that **PENNAMIN** improves the foliar absorption of critical micronutrients through the leaf's stomates.

chelation

foliar NUTRITION

stress & drought tolerance

Drought Tolerance

PENNAMIN products have a **high level of Proline**, an amino acid known to **contribute to water and drought stress tolerance**.

PENNAMIN products **improve plant and turf water stress and drought tolerance.**

*Note : Research has shown that proline applications **can delay wilting** when a plant is exposed to osmotic stress.*

By managing membrane permeability and ionic uptake, the amino acids in **PENNAMIN** products **help mitigate drought and salt stress affects.**

Regulating the Stomates

Amino acids like proline and others have been shown to have an inhibiting action on stomatal opening.

Histidine and other amino acids found in PENNAMIN promote the opening of the stomates.

Trial results suggest amino acids are part of the balancing mechanism of the stomates, and are essential for water retention and the exchange of gases.

PENNAMIN Application Recommendations

Pennamin	Analysis	Rate per 100 Gallons of Solution	Timing
Driver-P	12-0-0	4 - 16 ounces per 100 gallons of fertilizer solution	Include PENNAMIN Driver products in every tank of fertilizer solution for improved foliar uptake and soil vitality.
Driver-L	**3-0-0**	1 - 4 quarts per 100 gallons of fertilizer solution.	
Driver-LC	**3-0-0**	1 - 4 quarts per 100 gallons of fertilizer solution.	

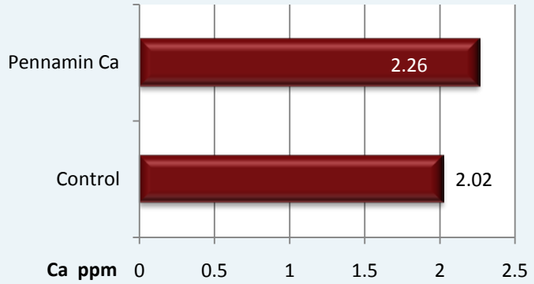
Pennamin	Analysis	Rate Per acre	Rate Per 1000	Timing
High K	**6-0-15 + 9% Ca**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Perfect	**5% Ca, 2% Mg, 0.025% B & Cu, 0.125% Zn, 0.008% Fe and 0.06% Mn**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Ca+Mg	**8-0-0 + 8% Ca + 8% Mg**	2 – 4 pounds	0.75 – 1.5 ounces	Apply every 14-28 days as needed
Fe+Mn	**9-0-0 + 4% Fe + 3% Mn**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Ca	**7-0-0 + 14% Ca**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Cu	**11-0-0 + 8% Cu**	0.5 – 1 pound	0.2 – 0.4 ounces	Apply every 14-28 days as needed
Fe	**9-0-0 + 6% Fe**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Mg	**12-0-0 + 12% Mg**	0.5 – 1.5 pounds	0.2 – 0.4 ounces	Apply every 14-28 days as needed
Mn	**10-0-0+7% Mn**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed
Zn	**11-0-0+9% Zn**	1 – 3 pounds	0.4 – 1.2 ounces	Apply every 14-28 days as needed

Case Study, Tomato:

Foliar uptake of Pennamin chelated micronutrient applications by tomato plants.
These results below show the uptake of Pennamin foliar micronutrients after one application.
Samples were taken 24 hours after application.

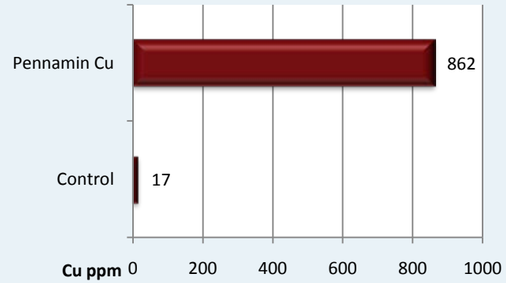
Pennamin Ca
Foliar Uptake of Calcium

12% Increase over the Control



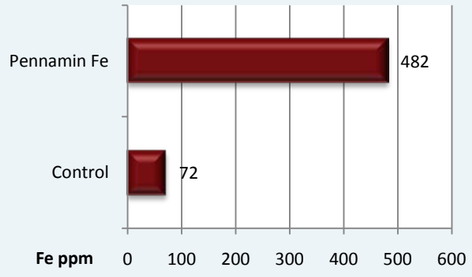
Pennamin Cu
Foliar Uptake of Copper

4,970% Increase over the Control



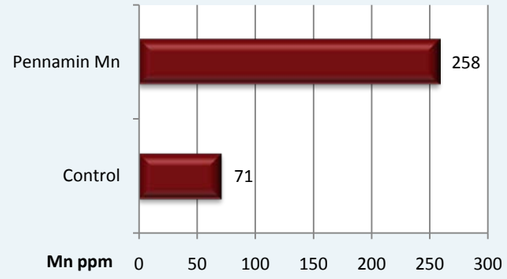
Pennamin Fe
Foliar Uptake of Iron

469% Increase over the Control



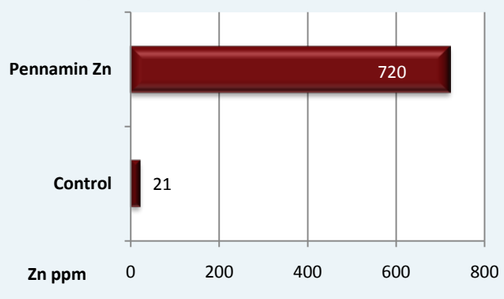
Pennamin Mn
Foliar Uptake of Manganese

270% Increase over the Control



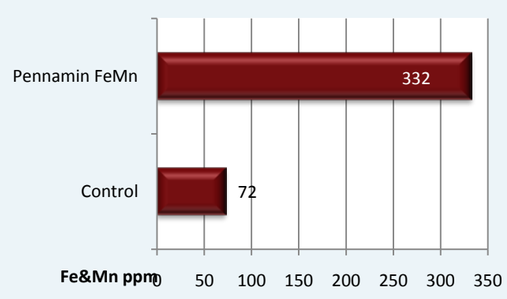
Pennamin Zn
Foliar Uptake of Zinc

3,329% Increase over the Control



Pennamin Fe&Mn
Foliar Uptake of Iron & Manganese

361% Increase over the Control

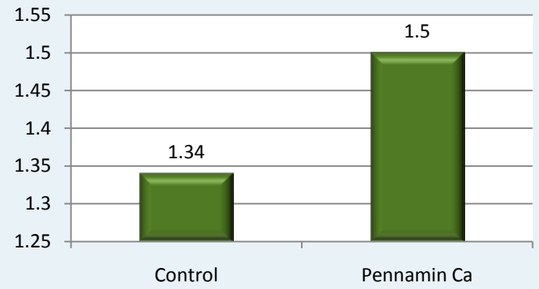


Case Study, Impatiens:

Foliar uptake of Pennamin chelated micronutrient applications by impatiens.
These results below show the uptake of Pennamin foliar micronutrients after one application.
Samples were taken 24 hours after application.

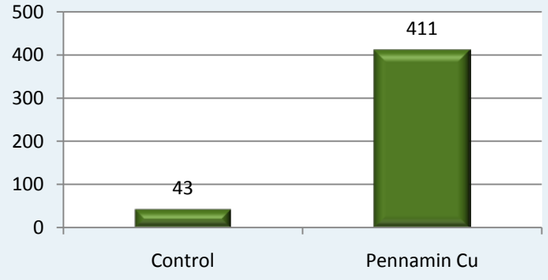
Pennamin Ca
Foliar Uptake of Calcium

12% Increase over the Control



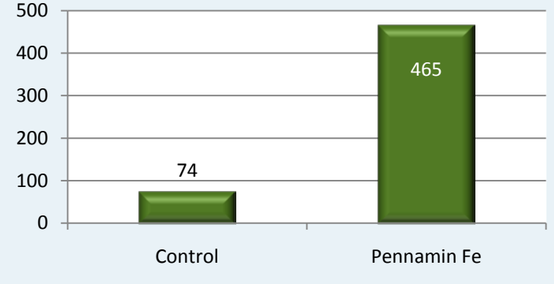
Pennamin Cu
Foliar Uptake of Copper

856% Increase over the Control



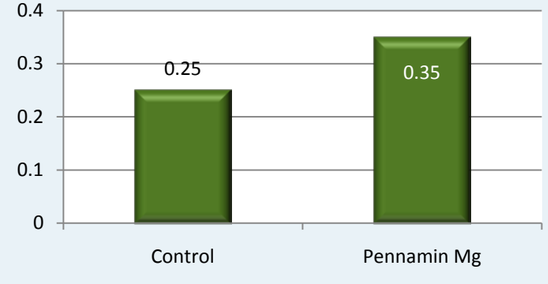
Pennamin Fe
Foliar Uptake of Iron

528% Increase over the Control



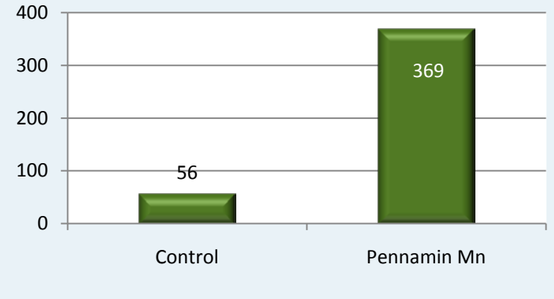
Pennamin Mg
Foliar Uptake of Magnesium

40% Increase over the Control



Pennamin Mn
Foliar Uptake of Manganese

559% Increase over the Control



Pennamin Zn
Foliar Uptake of Zinc

1,169% Increase over the Control