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Amino Acids as biostimulants

What are they and how can they be utilised in turf?

John Smart MPBR

- What is a biostimulant?

Materials that, in minute quantities, promote plant growth are biostimulants. Many biostimulants are on the market. With proper use, some may enhance turf stress tolerance and quality. Others do not. The question that arises is, which ones do and which ones don't?

Xunzhong Zhang and Richard Schmidt

Drs. Xunzhong Zhang and Richard Schmidt are professors of turfgrass ecology at Virginia Polytechnic Institute and State University (Blacksburg, Va.).

- One particular area of interest are amino acids

WHY?

The very first compounds on the planet were amino acids.

Amino acids are building blocks for proteins and enzymes.

- Biostimulants are **preventive** measures

Turfgrass typically grow well without biostimulants when the environment is favourable. In these situations, the beneficial effects of biostimulants may not be easy to identify solely based on leaf colour or other visual indices. When the plants become stressed, however, biostimulant-treated turfgrasses perform better because they have developed a better defence system, apparently due to higher levels of **antioxidants**.

- In a study, we found that photosynthetic activity of bentgrass growing under summer stress did not improve with a high rate of nitrogen fertilizer alone. However, when we added a biostimulant, it rose significantly. We associated this with high **antioxidant** activity that resulted from the biostimulant application.

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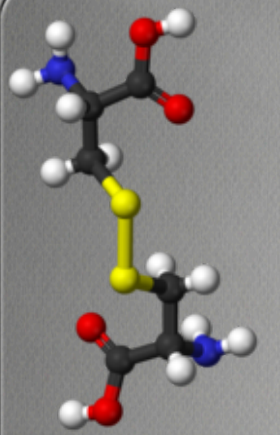

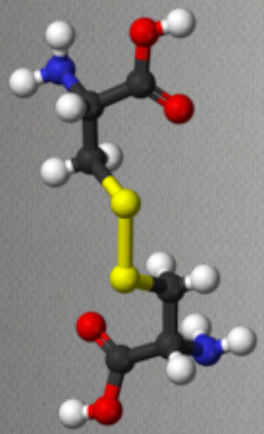

- Anti-stress effect
- Bio-stimulation
- Nutrition balancing
- Micronutrient uptake improvement
- Pesticides activation in tank-mix

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ProtaPlex

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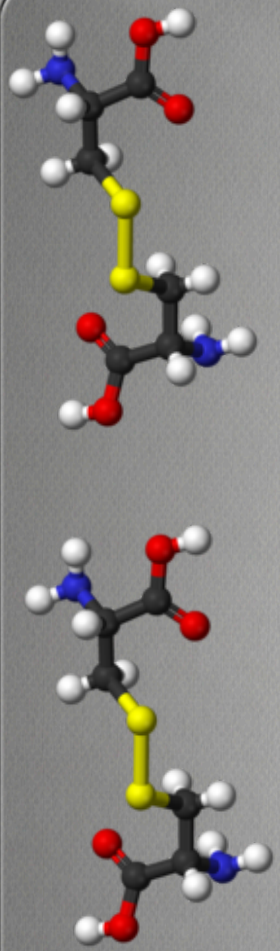

contents	
	%
Alanine	0.85
Arginine	1.06
Aspartic Acid	1.26
Cystine	0.25
Glutamic Acid	1.85
Glycine	1.46
Isoleucine	0.50
Histidine	0.19
Leucine	1.24
Lysine	0.28
Methionine	0.09
Phenylalanine	0.88
Proline	1.93
Threonine	0.82
Serine	2.22
Tyrosine	0.22
Valine	0.99
TOTAL Amino Acids	**16.09**

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Crop	Application Rate l/ha	Water Volume liters per ha	Timing
Apples, Pears	0.5	500 – 1000 liters	1st Application 1 week after petal fall. Apply every 10-14 days. Make 3-5 applications
Stone Fruits	0.5	500 – 1000 liters	1st Application 1 week after petal fall. Apply every 10-14 days. Make 3-5 applications.
Citrus	0.5	500-1000 liters	When fruit has set. Repeat 14 days later.
Grapes	0.5	500 – 1000 liters	After fruit has set, repeating every 10-14 days
Olives	0.75	500 -1000 liters	Immediately before flowering. Repeated 14days after flowering has finished
Vegetable Brassicae	0.75	200-400 liters	7 days after transplanting followed by repeat applications as the crop start to mature
Cucurbits	0.5	200 -400 liters	7 days after transplanting followed by immediately after flowering at 7 -10 day intervals
Onions	0.75	200-400 liters	Make the 1st application at the start of bulb swelling. Repeat 14 -21 days later
Potatoes	0.75	200 – 400 liters	1st application at early tuber initiation will increase tuber number. Subsequent applications during bulking will affect tuber size
Pepper	0.5	200 – 400 liters	When fruit is set on 1st truss. Repeat at 10-14 day intervals
Tomatoes	0.5	200 - 400 liters	1st application should be made when flowering commences on 2nd truss. Repeat at 10-14 day intervals

Anti- stress effect is the most important of all Amino Acid actions

- Physiological stress
- Transplanting stress
- Water stress
- Cold and frost stress
- Nematodes activity
- Virus activity

Anti-stress effects

- Effect on water balances
- On the cell walls
- On the formation of chlorophyll
- Pest and Disease resistance

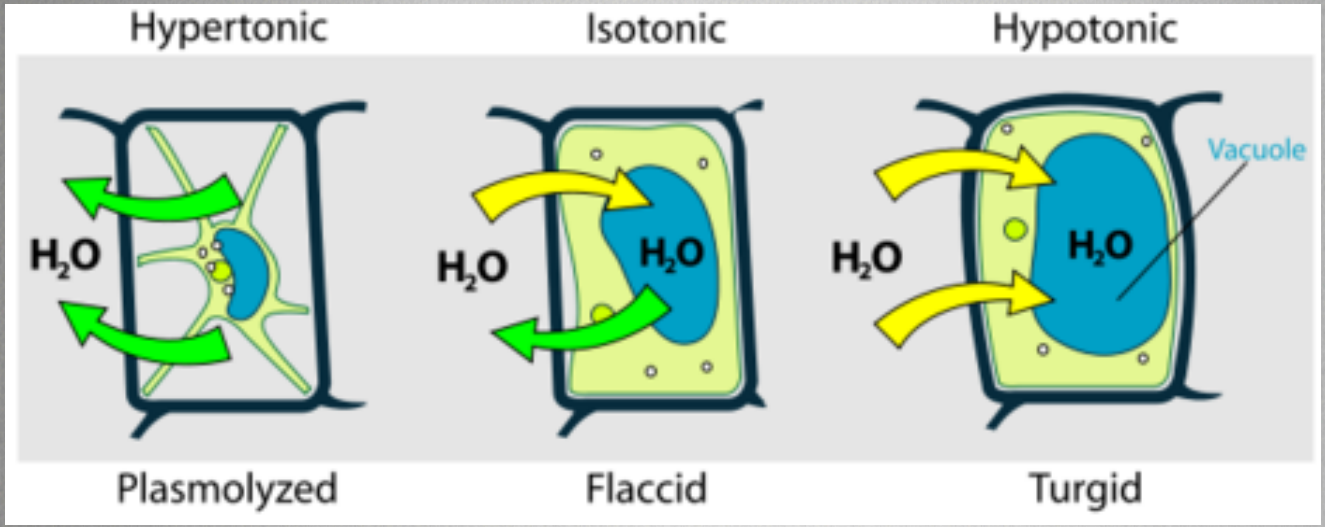
Amino Acids in Water stress

- Proline and others Amino Acids are present at much higher rate than usual in plant under drought conditions.
- Externally applied proline can delayed wilting when a plant is exposed to osmotic stress.

Biostimulant Properties

- Readily absorbed and transported
- Effects fundamental enzyme systems
- Reduces waste of energy by the plant

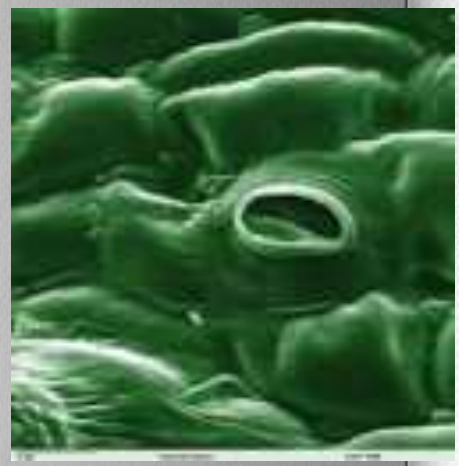
Effect on membrane permeability and osmotic regulation



By modulating membrane permeability and ions uptake, amino acids help in mitigating drought or salt stress effects

Regulation on stomatal closure

Amino acids like proline and others have been shown to have an inhibiting action on stomatal opening while histidine, and others where promoting it.



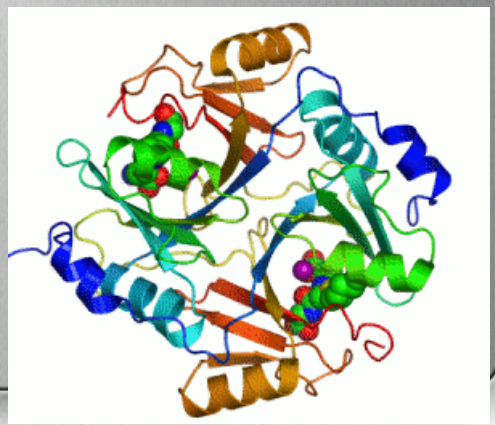
It suggests amino acids are part of the balancing mechanism of stomata, in order to council water keeping and gas exchanges

Effects on Fundamental Enzyme Systems

- glutamate-dehydrogenase → Inorganic N incorporation
- nitrite-reductase → Nitrate → ammonium reduction
- acid fosfatase → Carriage / metabolism sugar
- fosforilase → hydrolysis and synthesis of starch
- leucine-amino peptidase → hydrolysis proteins
- malate-dehydrogenase → Ionic balance under stress

Effect on enzyme activity

By catching an enzyme, it had been shown that proline can protect enzyme against denaturation by salinity, heat or dilution.

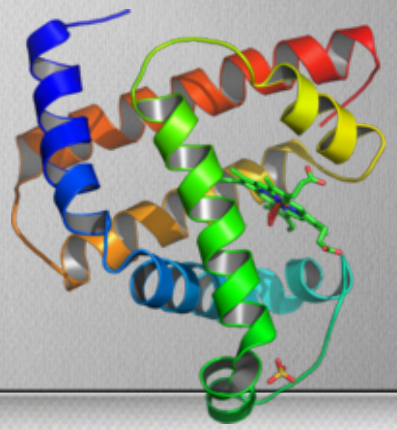


Nutrition balancing

- Helps the incorporation of nitrogen into proteins
- Less need for nitrogen fertilizer
- Less risk of nitrates accumulation in plants and soil

Micronutrient uptake improvement

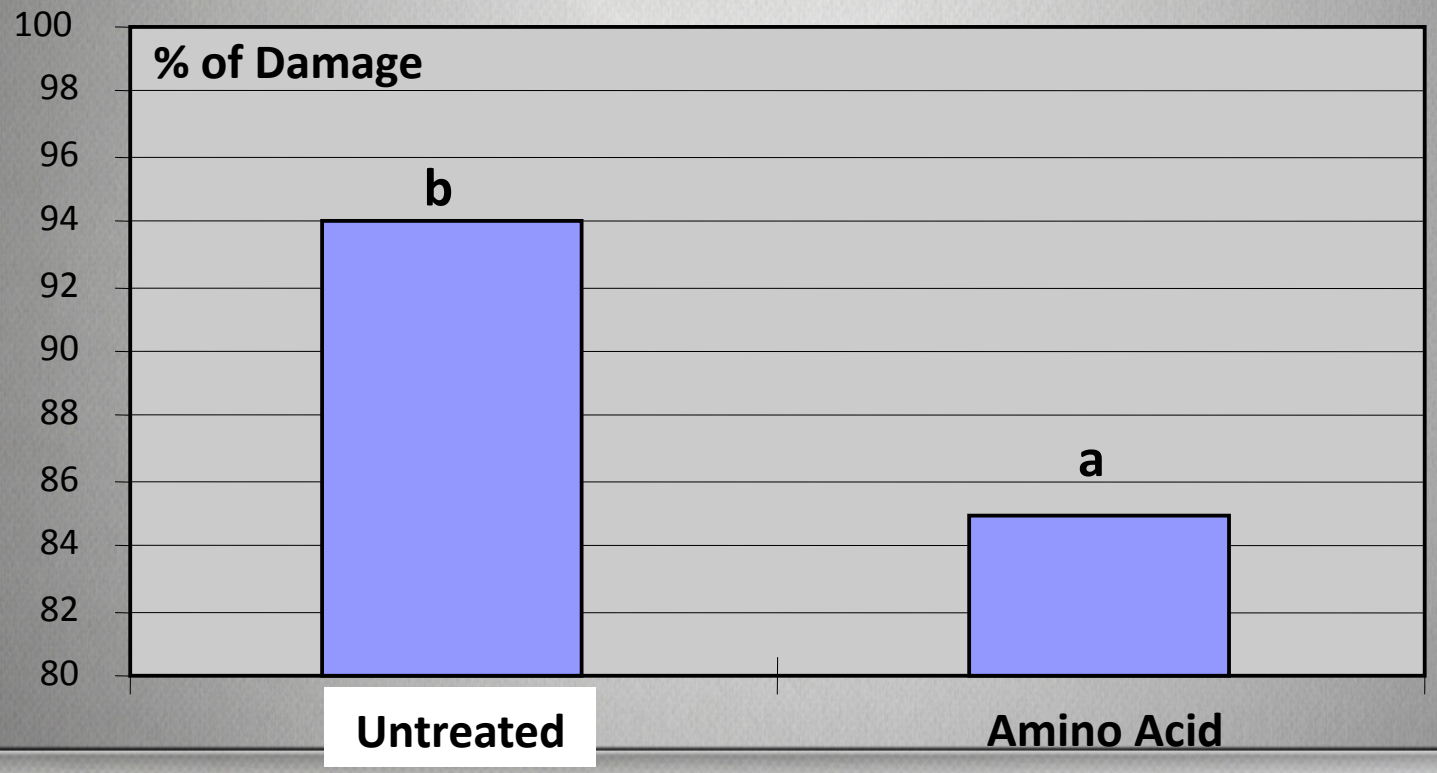
- Short chain peptides have shuttle activity for microelements and helps assimilation and transport in plant tissues



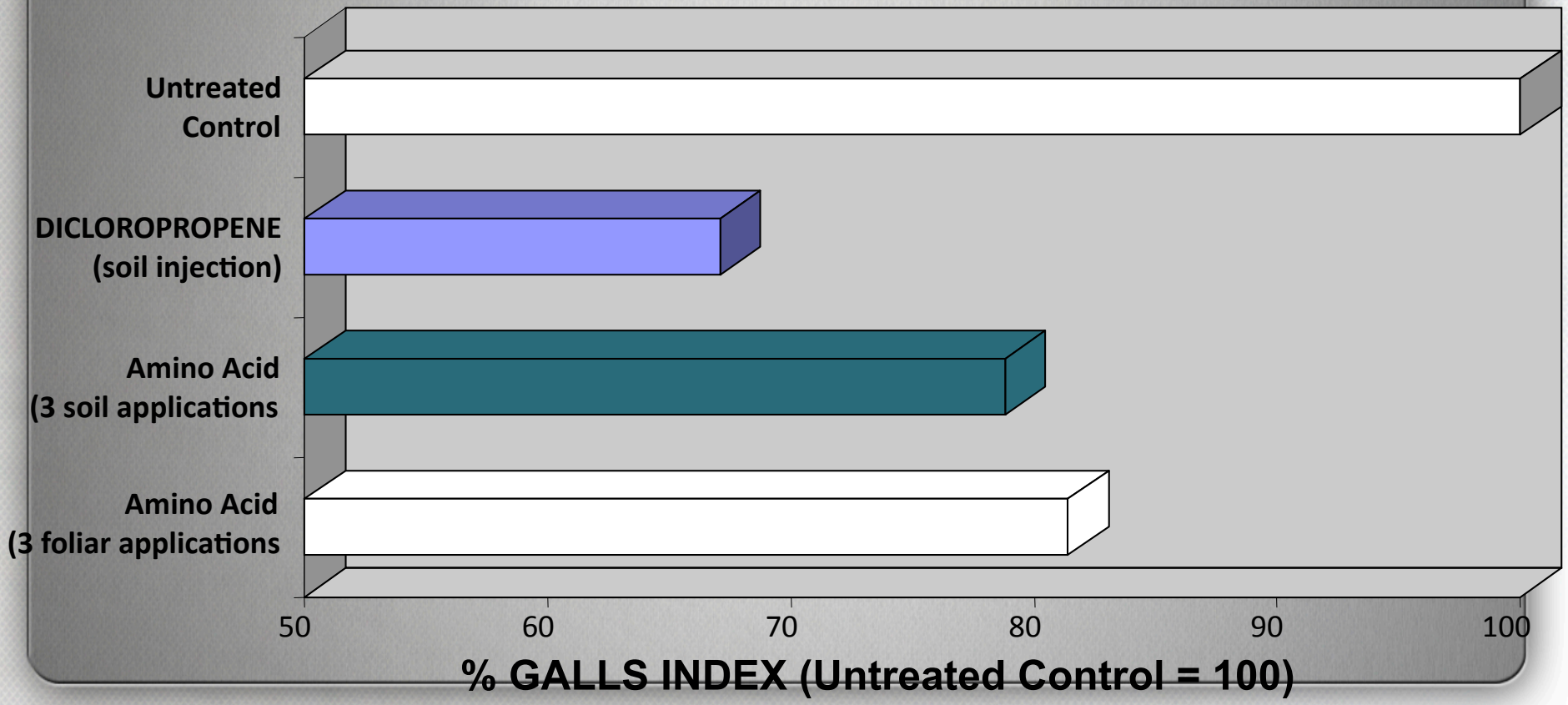
Pesticides activation in tank-mix

- Improves wettable and adhesive properties;
- Short chain peptides have shuttle activity also for pesticides

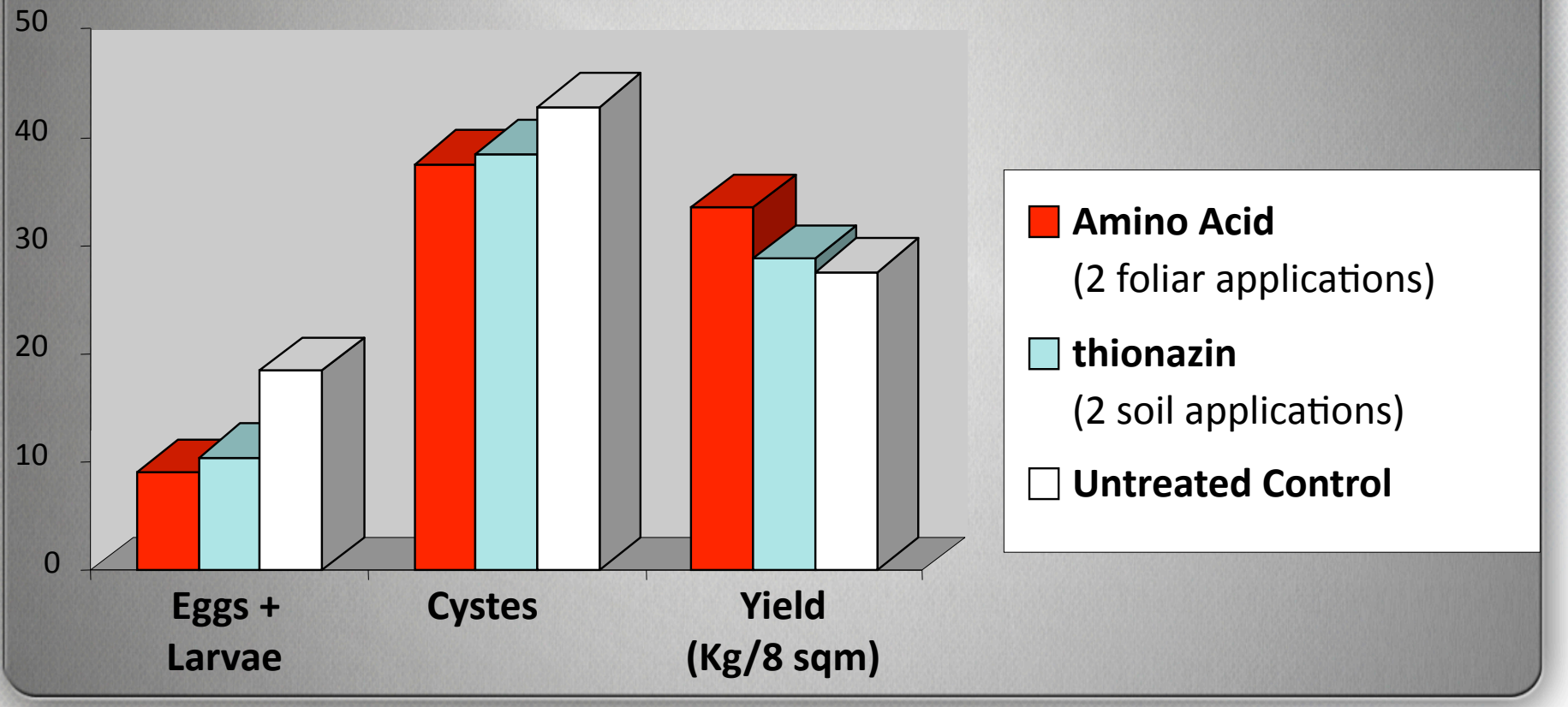
Winter Frost damage (Germany) *(Duncan test, P= 0.05)*



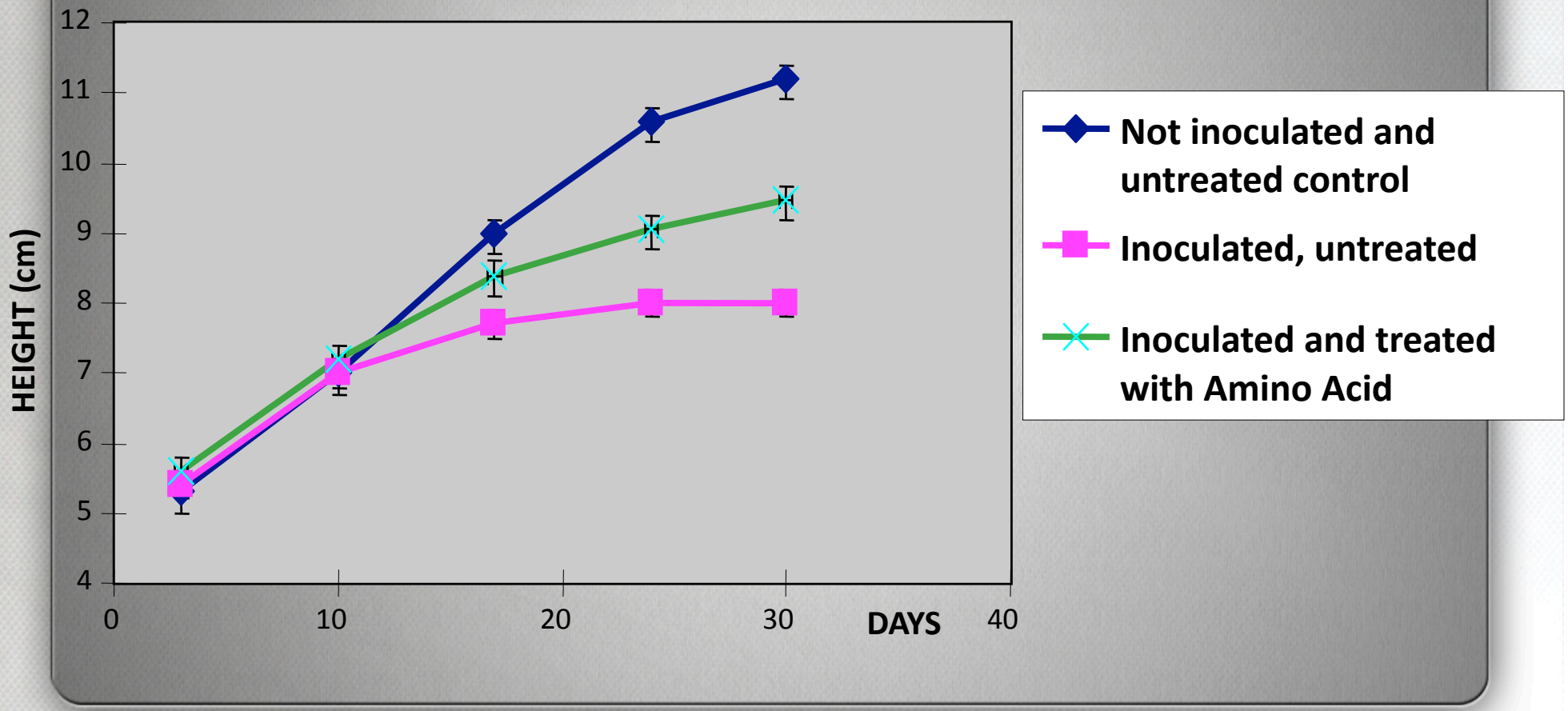
Nematode - Meloidogyne spp.
Amino Acid(10 l/ha)
vs 1,3-dicloropropene 97%(400 Kg/ha)



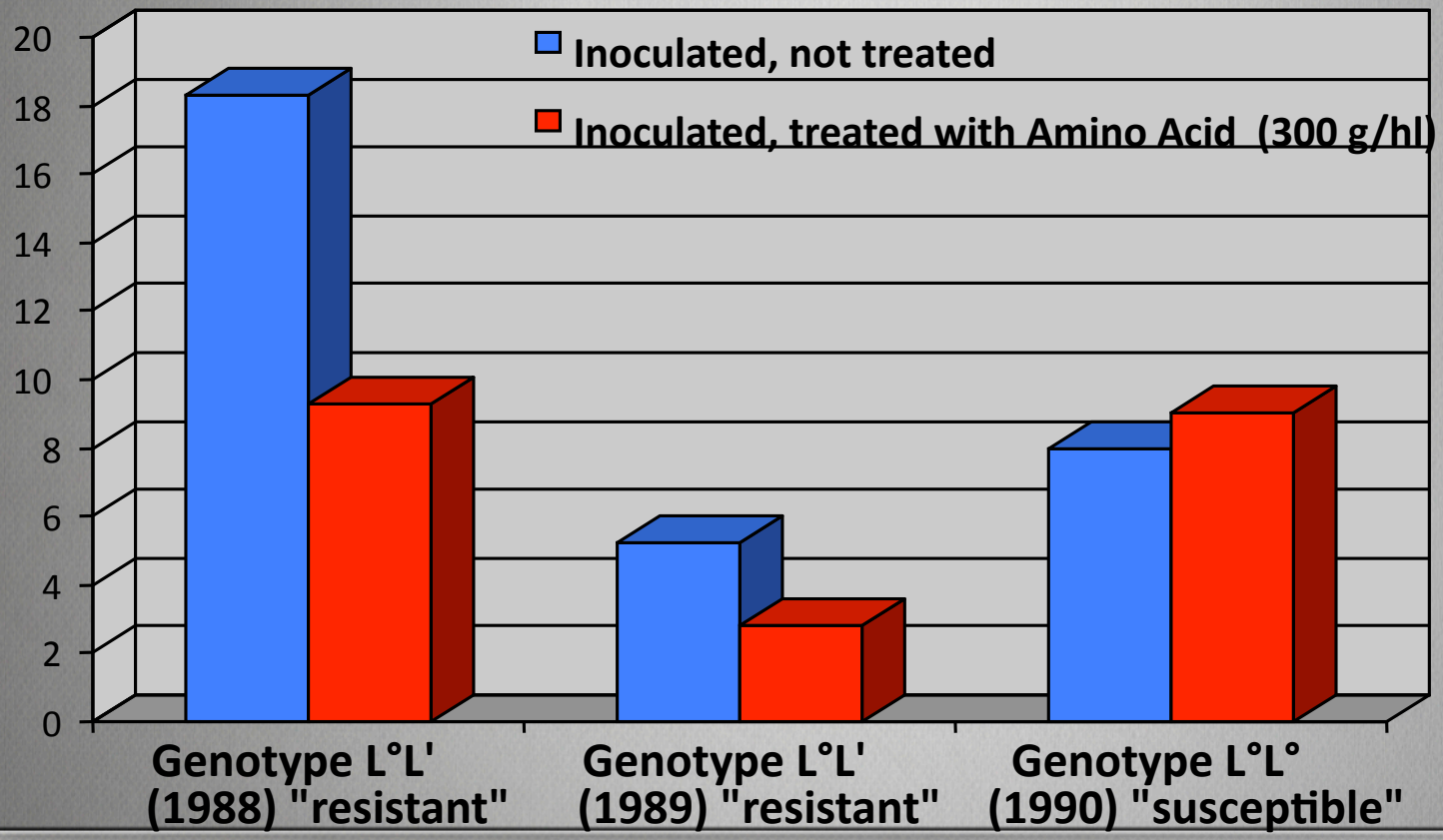
Nematode - Globodera rostochiensis
Amino Acid 5 l/ha vs thionazin 5 kg/ha



Virus - plant growth (infected by PepMV)
(Duncan test, P<0,05)



Virus - PepMV Multiplication in leaves of Capsicum annuum measured by biological assay = N° of lesions/leaf (1988, 1990) and by physical assay = mg/g fresh wt (1989)



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