ZBORNIK PREDAVANJ

Strokovno predavanje za sadjarje 2017

Zbrala in uredila: Gordana Veber

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DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

claris-p

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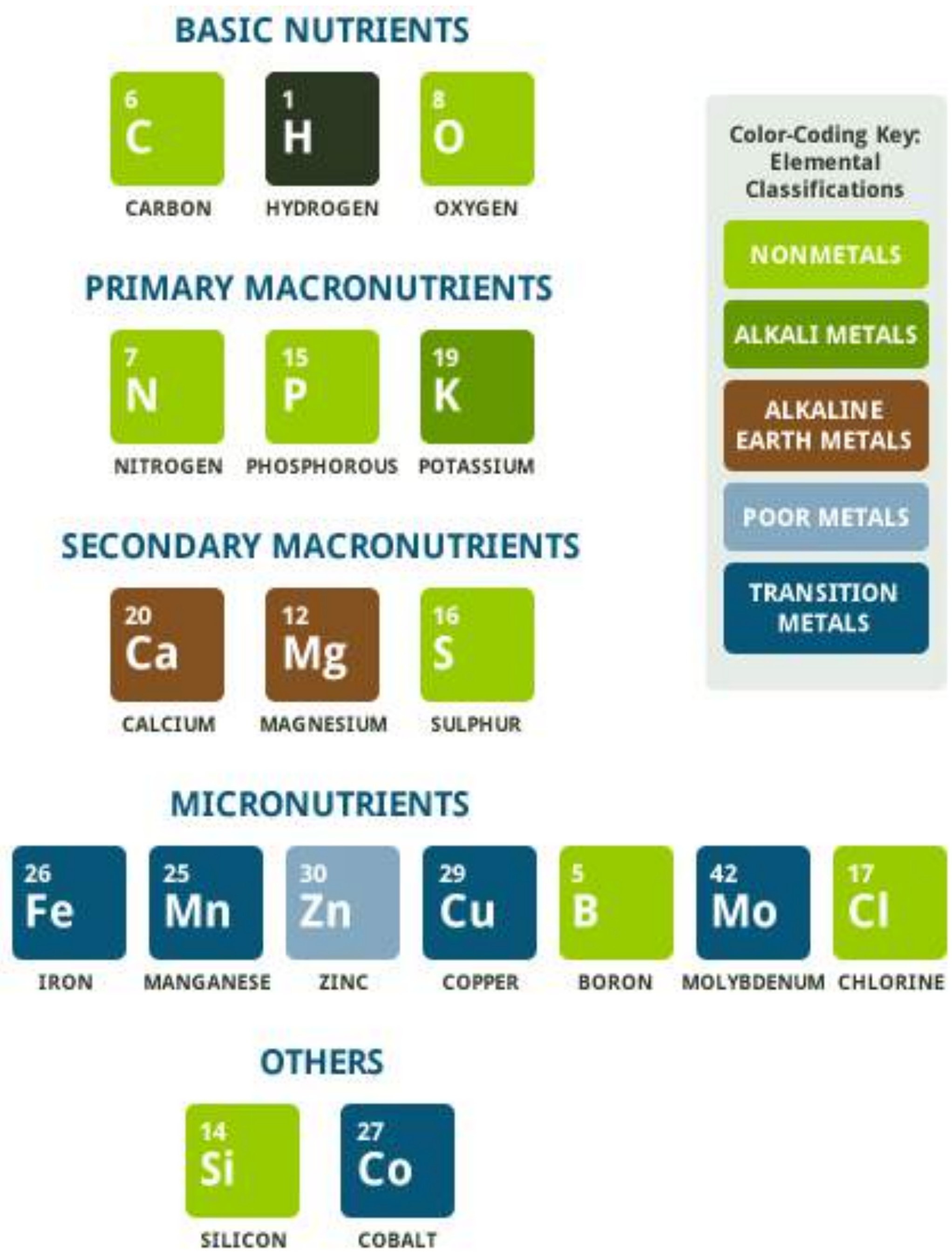
beverage service

Analize tal, listov, plodov



Stanje preskrbljenosti plodov jabolk slovenskih pridelovalcev z nekaterimi makro in mikroelementi, v % za posamezne razrede preskrbljenosti

Element (hranilo)	**Vsebnosti v %**				
	Zelo nizka	**nizka**	**Rahlo pomanjkanje**	**normalna**	**visoka**
Ca (kalcij)	**27,9 %**	**14,7 %**	**22,0 %**	**33,8 %**	**1,6 %**
B (bor)	**25,0 %**	**57,4 %**	**13,2 %**	**4,4 %**	**-**
P (fosfor)	**39, 8 %**	**20,6 %**	**20,6 %**	**13,2 %**	**5,8 %**
Zn (cink)	**-**	**26,5 %**	**30,9 %**	**42,6 %**	**-**
K (kalij)	**2,9 %**	**36,8 %**	**35,3 %**	**19,1 %**	**5,9 %**
Mg (magnezij)	**-**	**-**	**-**	**80,9 %**	**19,1 %**
N (dušik)	**-**	**7,4 %**	**51,5 %**	**22,1 %**	**19,0 %**

dobra obarvanost

CALCIOGREEN


KONTROLA
PHOSTRADE-Ca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PRIMJENA BIOSTIMULATORA U MODERNOJ PROIZVODNJI VOĆA

Dr.sc. David Gluhić

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BIOSTIMULATORI

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Tržište biostimulatora u EU/Svijetu

Prema prognozi iz 2016. godine koju objavljuje "Business Wire" tržište biostimulatora ima **godišnji rast od 10,1%** i do 2025. godine dosegnuti će vrijednost od 5,5 milijardi USD.

Na EU tržištu godišnja prodaja biostimulatora vrijedi oko 600 mil. USD/godišnje

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Zašto raste tržište biostimulatora ?

VISOKI PRINOS = PROIZVODNJA SA PROFITOM

VISOKA KVALITETA = PROIZVODNJA SA PROFITOM

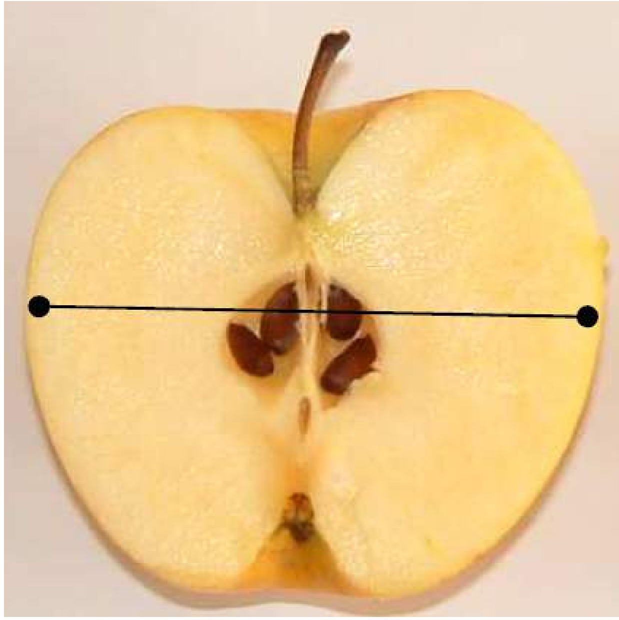
Zašto raste tržište biostimulatora ?

VISOKI PRINOS = PROIZVODNJA SA PROFITOM

VISOKA KVALITETA = PROIZVODNJA SA PROFITOM

Tab.1. Klase plodova jabuke obzirom na minimalan prečnik

	Extra klasa	Klasa I	Klasa II
Krupnoplode sorte (3)	65 mm	60 mm	60 mm
Ostale sorte	60 mm	55 mm	50 mm



Može li biostimulator napraviti razliku u promjeru ploda jabuke za 5-10 mm?

65 mm vs. 60 mm ?????

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Zašto raste tržište biostimulatora ?

VISOKI PRINOS = PROIZVODNJA SA PROFITOM

VISOKA KVALITETA = PROIZVODNJA SA PROFITOM

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Može li biostimulator napraviti razliku u prečniku ploda jabuke za 5-10 mm?

DA

65 mm vs. 60 mm ?????

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Zašto raste tržište biostimulatora ?

VISOKI PRINOS = PROIZVODNJA SA PROFITOM

- **40 t/ha**
- **50 t/ha**
- **60 t/ha**
- **70 t/ha**
- **80 t/ha**
- **90 t/ha**
- **??????**

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Zašto raste tržište biostimulatora ?

VISOKI PRINOS = PROIZVODNJA SA PROFITOM

K

(kalij)

Optimalno:
100 mg/100 grama ploda

40 t/ha ploda → 40 kg K/godišnje
80 t/ha ploda → 80 kg K/godišnje

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Zašto raste tržište biostimulatora ?

<u>VISOKI PRINOS</u> = PROIZVODNJA SA PROFITOM

Ca

(kalcij)

Optimalno:
5 mg/100 grama ploda

40 t/ha ploda → 2 kg Ca/godišnje
80 t/ha ploda → 4 kg Ca/godišnje

Ali; svega 5% od ukupne dodane količine kalcija (Ca) završi u plodovima !!!!
Za 80 t ploda treba 80 kg čistog Ca/ha.

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Definicija biostimulatora

Biostimulatori su spojevi (substance) koji se primjenjuju u uzgoju poljoprivrednih kultura sa ciljem:

- **<u>POTICANJE</u>** svih fizioloških procesa u biljci (rast, cvatnja, oplodnja)
- Bolje **<u>USVAJANJE</u>** hraniva (povećanje učinkovitosti gnojidbe)
- Povećanje otpornosti na **<u>STRESNE</u>** uvjete
- Povećanje **<u>KVALITETE</u>** plodova/uroda

BIOSTIMULATORI NISU GNOJIVA

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OBLICI STRESA ZA BILJKE?

Agro-Klimatski stres:

• **<u>Nedostatak vode</u>**

• Nedostatak svijetla

• Visoka količina soli/pH

• **<u>Visoka/niska temperatura</u>**

• Teški metali

• **<u>Visoka koncentracija hraniva</u>**

• Zagađivači (polutanti različitog porijekla)

Vegetacijski stres:

• Sadnja

• Rezidba

• Cvatnja

• **<u>Rast plodova</u>**

• Dozrijevanje plodova

Ostali izvori stresa:

• Oštećenje biljaka (tuča)

• **<u>Fitotoksičnost nakon primjene pesticida</u>**

• Oštećenja uzorkovana gljivicama (bolesti), nematodama, insektima i sl.

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BIOSTIMULATORI (*Plant biostimulants*)

Glavna pitanja:

1. Što su biostimulatori?
2. Zašto biostimulatori u proizvodnji jabuke?
3. Podjela biostimulatora?
4. Tržište biostimulatora (EU/Svijet)?
5. Praktična iskustva u primjeni biostimulatora?

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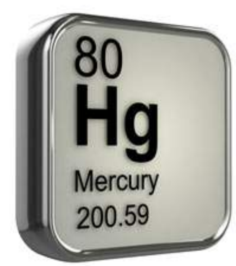
Zakonska regulativa za biostimulatore

Na globalnoj razini ne postoje ujednačeni zakonski kriteriji za proizvodnju i upotrebu biostimulatora.

Za EU tržište glavnu ulogu igra EBIC (European Biostimulants Industry Council)

EBIC
European Biostimulants Industry Council

U većini zemalja EU zakonska regulativa biostimulatore označava kao “organska gnojiva” te je prije stavljanja na tržište OBAVEZNA analiza biostimulatora na količinu TEŠKIH METALA.



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Zakonska regulativa za biostimulatore

	Content [ppm]	
	Delfan	Delfan Plus
Cadmium Cd	<0,05	<0,05
Crome Cr	<0,06	<0,06
Nickel Ni	0,66	1,55
Lead Pb	<0,14	<0,14
Copper Cu	1,54	1,23
Zinc Zn	0,5	<0,14
Mercury Hg	<0,25	<0,25

Doza primjene DELFAN PLUS:
1 lit/ha → 0,05 grama Cd/ha
<u>10 lit/ha → 0,5 grama Cd/ha/godišnje</u>

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Znanstveni rad/istraživanja na temu biostimulatora

EBIC (European Biostimulants Industry Council)

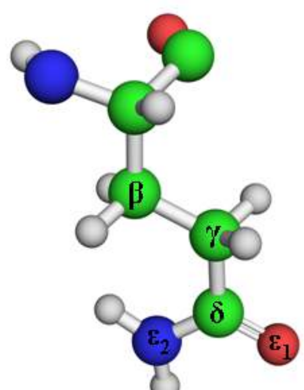
European Biostimulants Industry Council

Podjela biostimulatora

Biostimulatori se mogu (prema svojim **kemijskim i biološkim** karakteristikama) podijeliti:

Glavna grupa biostimulatora danas u poljoprivrednoj proizvodnji. **ZAŠTO?**

- **AMINOKISELINE**
- **Ekstrakti algi (morske alge, mikroalge)**
- **Mikrobiološki preparati (metaboliti bakterija, gljiva)**
- **“Trace” elementi (silicij (Si), titan (Ti), jod (I))**
- **Vitamini (B i D grupe)**
- **Huminske i fulvo kiseline**



Glutamine
(Gln, Q)

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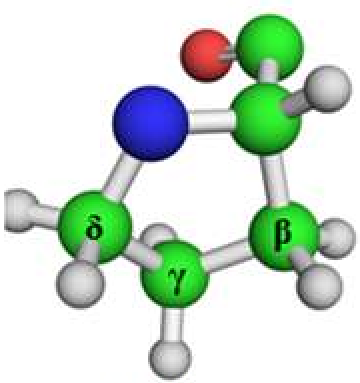
AMINOKISELINE

SVAKI FIZIOLOŠKI PROCES U BILJCI za svoj tijek (odvijanje, završetak) ZAHTJEVA PRISUSTVO određene AMINOKISELINE !!!

Postoji veliki broj aminokiselina (determinirano je 20 fiziološki važnih) i **svaka aminokiselina ima specifičnu fiziološku ulogu**:



Proline
(Pro, P)

- PROLIN →ABIOTSKI STRES (suša, visoka temperatura)
- ARGININ →razvoj korijena, sinteza hormona rasta (auxina)
- ALANIN →sinteza klorofila
- PROLIN →CVATNJA I OPLODNJA
- GLUTAMINSKA KIS. →sinteza klorofila

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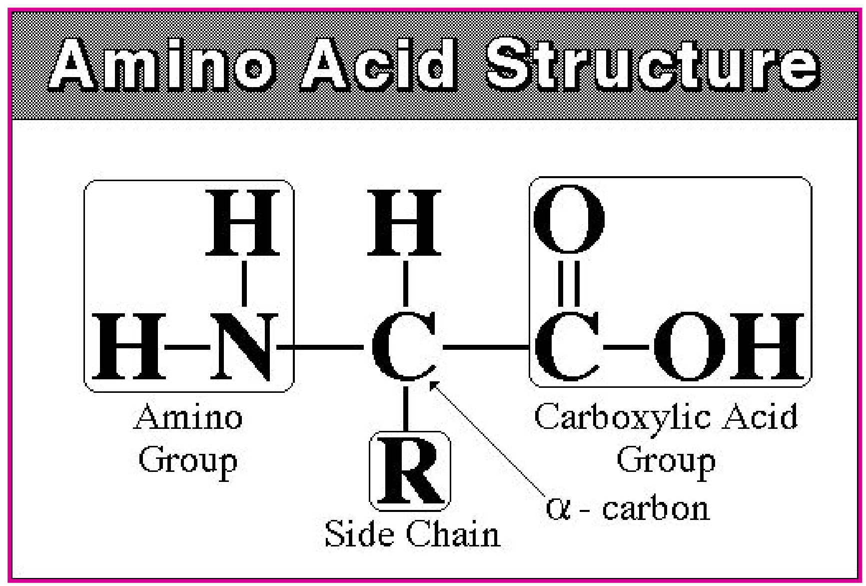
ŠTO SU AMINOKISELINE?

Spojevi koji imaju specifičnu molekularnu strukturu koja se sastoji od:

- **AMINO GRUPE (visoki pH)**
- **KARBOKSILNE GRUPE (nizak pH)**
- **Centralno smještenog atoma ugljika (C)**

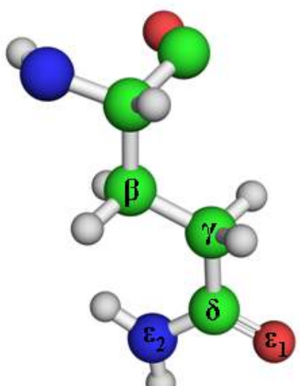


PODJELA AMINOKISELINA?

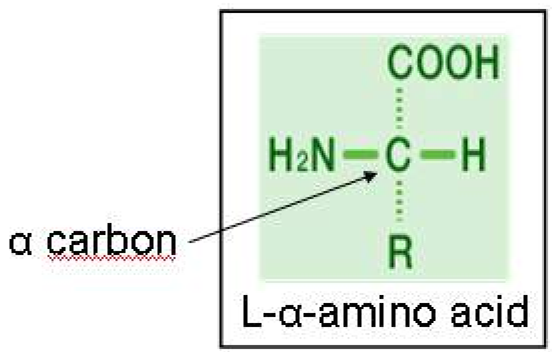
Ovisno o položaju amino grupe, mogu biti D- i L-aminokiseline

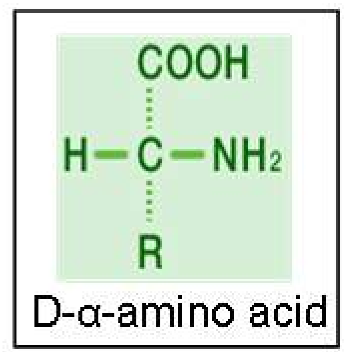
SAMO SU:

L-alfa-aminokiseline fiziološki aktivne kiseline.



Glutamine
(Gln, Q)





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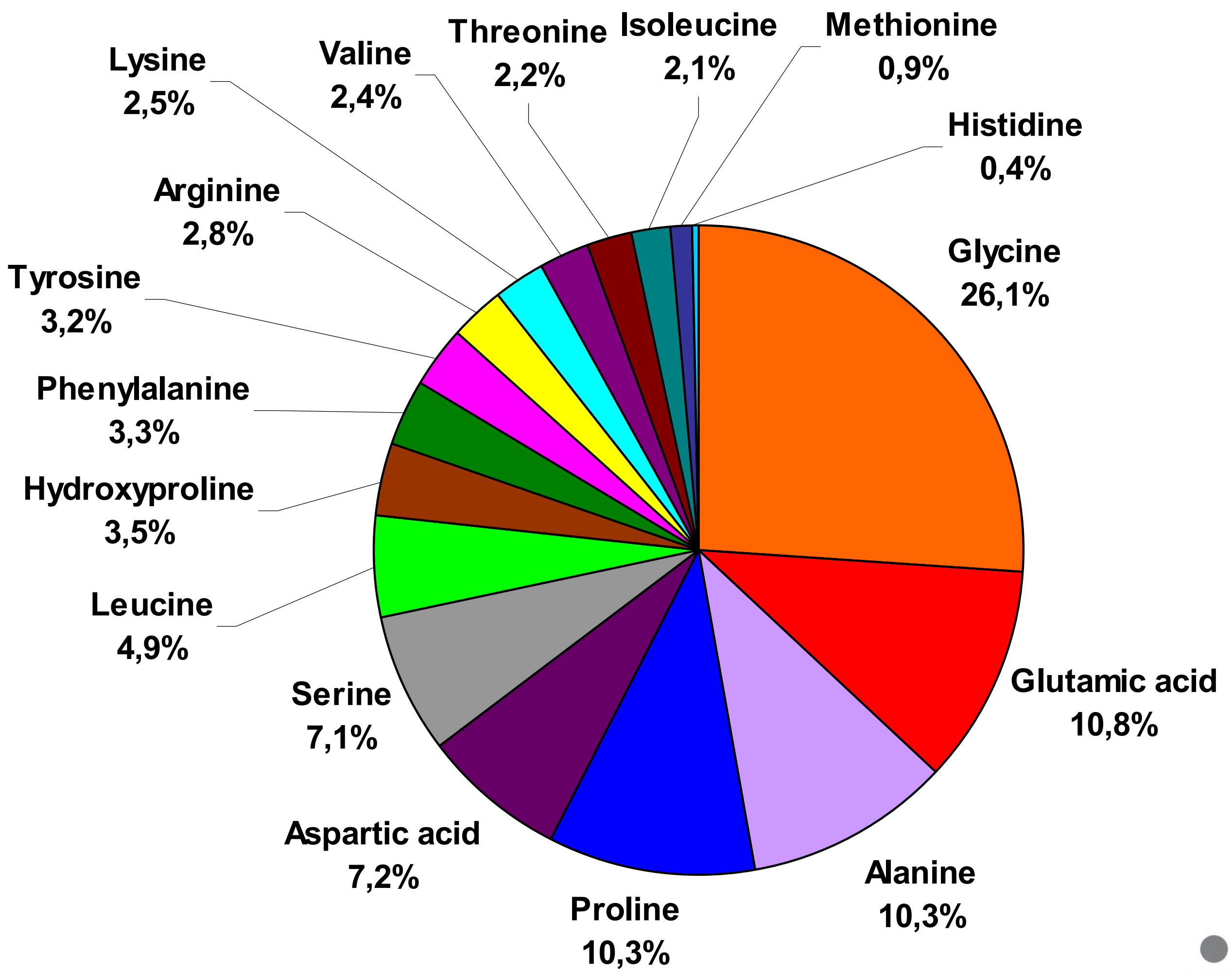
SASTAV BIOSTIMULATORA (AMINOGRAM)?



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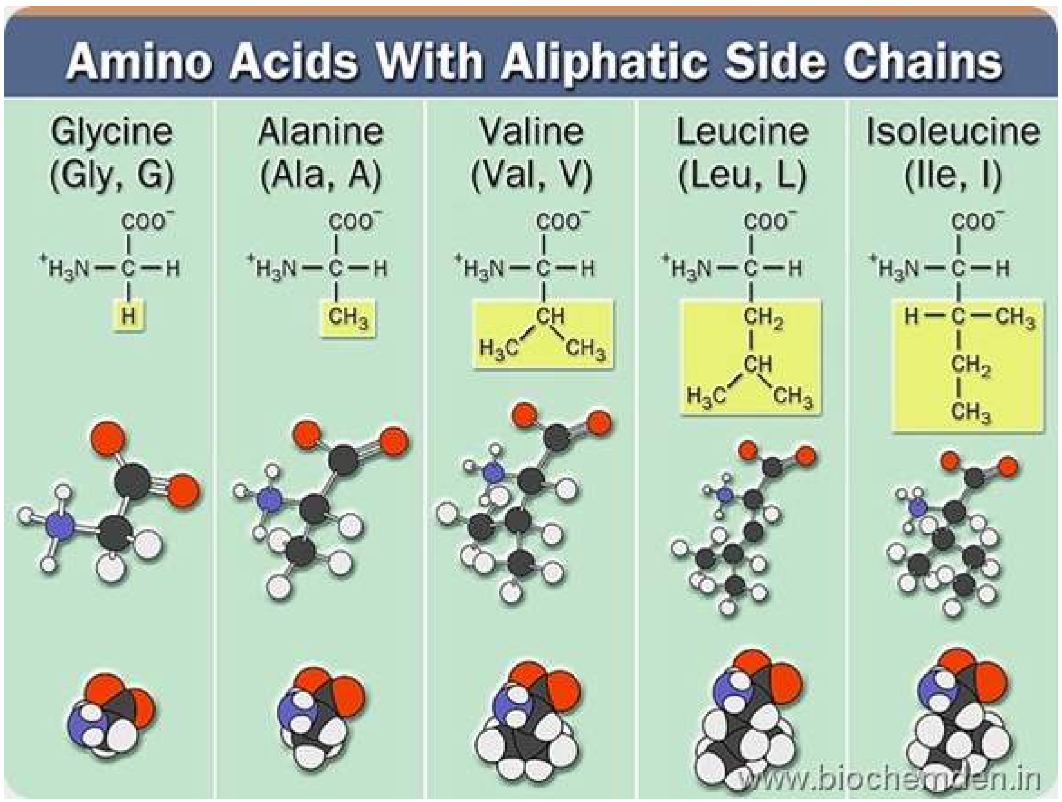
NAČINI EKSTRAKCIJE AMINOKISELINA ZA PROIZVODNJU BIOSTIMULATORA?

Enzymatic hydrolysis	Acid hydrolysis
Enzymes	Acid extractant
specific peptide bonds are broken	Unspecific braking of peptide bonds
Digestion incomplete	More complete digestion
Lower content of free amino acids	Higher content of free amino acids
Higher peptide content	Smaller peptide size and less peptide content
More difficult uptake and efficiency	Good uptake and efficiency

PORIJEKLO AMINOKISELINA?



1. Aminokiseline dobivene ekstrakcijom iz materijala **<u>životinjskog</u>** porijekla
2. Aminokiseline dobivene ekstrakcijom iz materijala **<u>biljnog</u>** porijekla
3. **<u>Sintetske</u>** aminokiseline
4. Aminokiseline **<u>mikrobiološkog</u>** porijekla

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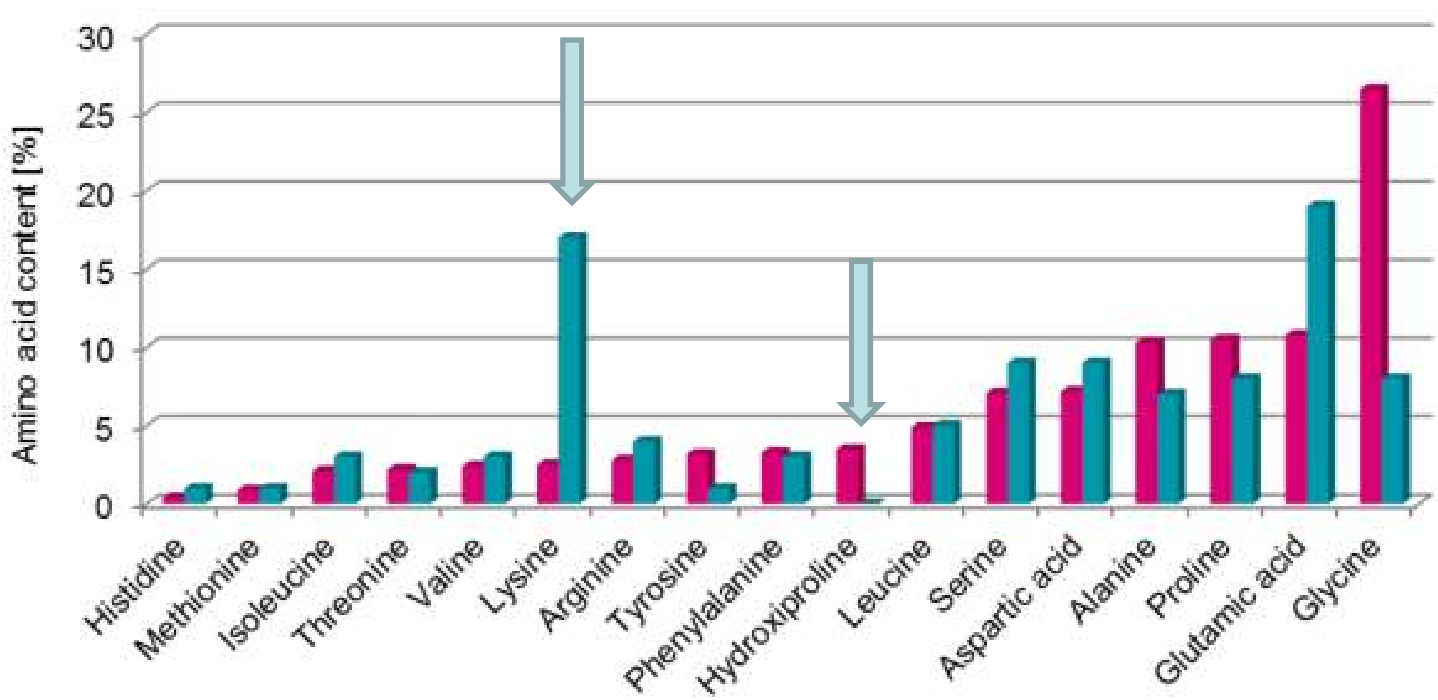
Aminokiseline životinjskog vs. biljnog porijekla?

AK biljnog porijekla

AK životinjskog porijekla

Osnovna razlika je u sastavu aminokiselina:

lizin (biljne) vs. hydroxprolin i glicin (životinjske)



HIDROKSIPROLIN →ABIOTSKI STRES (suša, visoka temperatura)

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SINTETSKE AMINOKISELINE

<u>Proizvode se kemijskom reakcijom</u> određenih kemijskih spojeva.

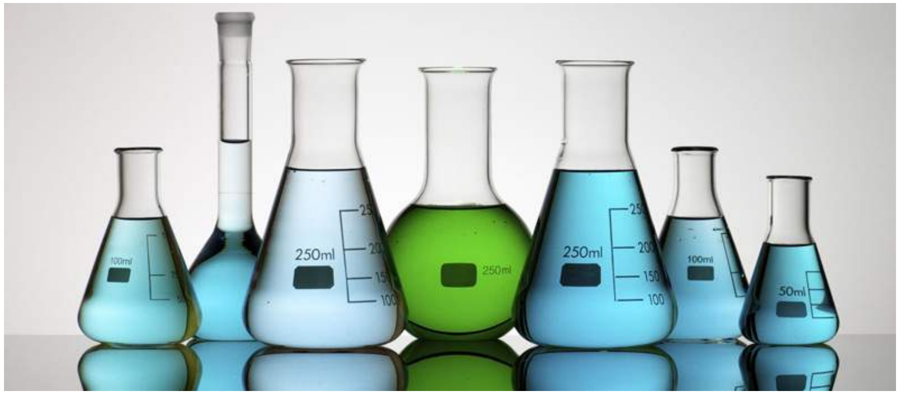
Samo neke od aminokiselina mogu se dobiti sintetskim putem.

- *Glicin, Alanin, Metionin, Fenilalanin, Serin, Triptofan, Tirosin*

Bistre otopine karakterističnog (neugodnog) mirisa.

Skupa proizvodnja (služe za mješanje sa ostalim organskim biostimulatorima; **<u>za "popravak" aminograma</u>**)

Isključivo L-alfa-aminokiseline – 100% fiziološki aktivne aminokiseline.



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AMINOKISELINE MIKROBIOLOŠKOG PORIJEKLA

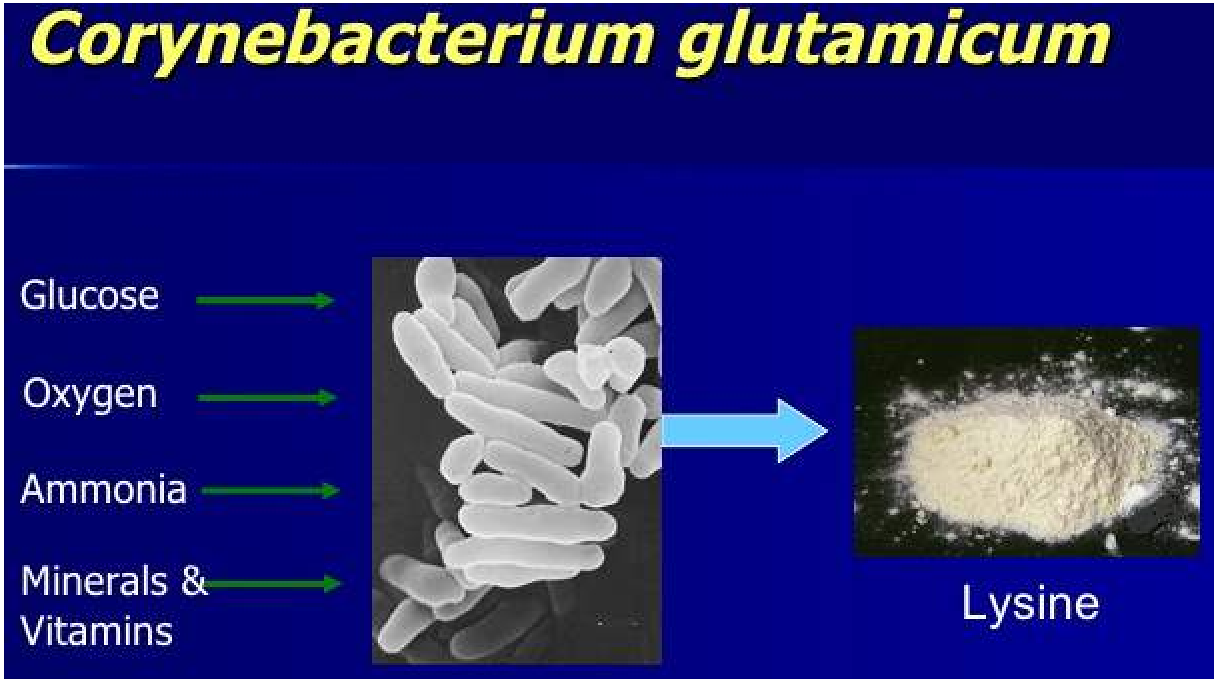
Aminokiseline dobivene iz mikrobioloških ekstrakata različitih bakterija.

Mikrobiološkim putem mogu se dobiti sve aminokiseline.

Vrlo kvalitetni biostimulatori (visoke cijene).

Lizin – *Corynebacterium glutamicum*

Glutamin i glutaminska kiselina – *Escherichia, Bacillus, Brevibacterium*



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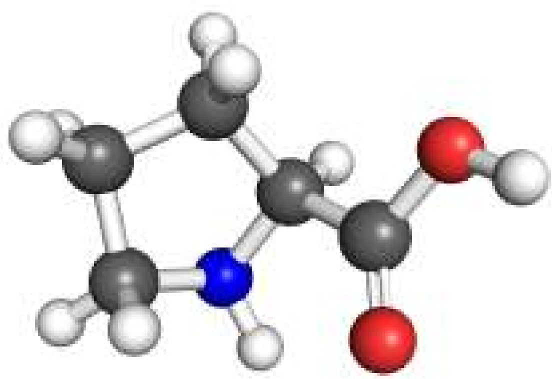
UTJECAJ AMINOKISELINA NA USVAJANJE

Zašto aminokiseline (AK) imaju učinak na usvajanje tvari?

- Neutralne i male molekularne mase
- Lako penetriraju u list
- Ne zahtjevaju dodatnu energiju za usvajanje
- **Nisu povezane sa aktivnošću klorofila**
- Tvore kompleksne organo-mineralne spojeve sa hranivima



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UTJECAJ AMINOKISELINA NA USVAJANJE FUNGICIDA

Fungicid: **RUBIGAN** (aktivna tvar fenarimol)

Product	Dose (ml/100l)	% Surface colonized by fungi
Fenarimol	50	37.5
Fenarimol + AA	50+300	6.5
Fenarimol	35	42.5
Fenarimol + AA	35+300	15

Izvor: Cortellini and Maini (1994) Informatore Fitopatológico Nº 4

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Doze primjene biostimulatora

% slobodnih AK	24,0%	15,0%	10,3%
Doza primjene	1,0-1,5 lit/ha 100-150 mL/100 lit	1,5-2,0 lit/ha 150-200 mL/100 lit	2,5-3,0 lit/ha 250-300 mL/100 lit

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Preporuka primjene biostimulatora u proizvodnji jabuke

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Delfan® Plus

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Delfan® Plus

1 lit = 1,240 kg

Biostimulator sa MAX količinom slobodnih aminokiselina

Sastav: 24% m/m slobodnih aminokiselina

Doza primjene:

1,0-1,5 lit/ha (ili 100-150 mL/100 lit. vode)

Učinak:

- Anti-stres učinak
- Potiče fiziološke procese u biljci (rast, nakupljanje suhe tvari, boja i dr.)

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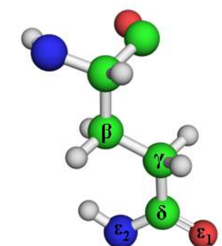
Delfan® Plus

Kada primijeniti biostimulator DELFAN PLUS:

- Ujednačeno kretanje vegetacije
- Veća otpornost na niske temperature
- Bolje usvajanje pesticida



Glutamine
(Gln, Q)

10,3% Glutaminska kis.

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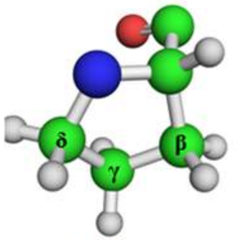
Delfan® Plus

Kada primijeniti biostimulator DELFAN PLUS:

- Priprema jabuke za cvatnju
- Plodnost polena
- Oplodnja i početna faza razvoja ploda



Proline
(Pro, P)

10,3% PROLINA

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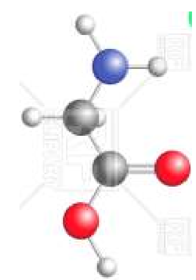
Delfan® Plus

Kada primijeniti biostimulator DELFAN PLUS:

- Pravilna diferencijacija stanica ploda
- Rast i razvoj plodova
- Bolje usvajanje kalcija (Ca)



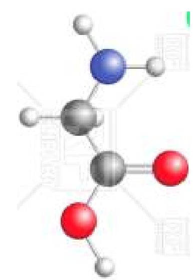
26,1%
GLICIN

tradecorp
nutri-performance

Delfan® Plus

Kada primijeniti biostimulator DELFAN PLUS:

- Pravilna diferencijacija stanica ploda
- Rast i razvoj plodova
- Bolje usvajanje kalcija (Ca)



26,1% GLICIN

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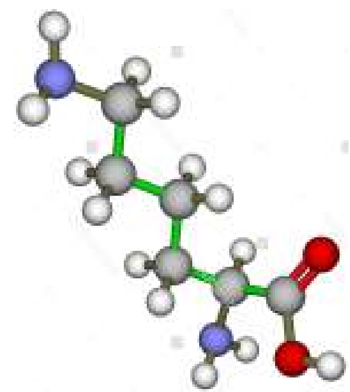
Kada primijeniti biostimulator DELFAN PLUS:

- Bolja obojenost plodova (crvene sorte jabuka)



2,5% LIZIN

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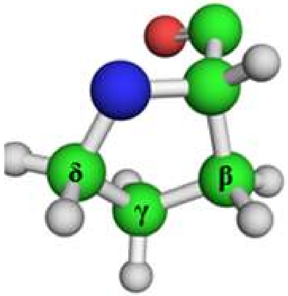
Kada primijeniti biostimulator DELFAN PLUS:

- **Odgovor na sve izvaredne stresne uvjete tijekom vegetacije**



10,3% PROLINA

tradecorp
nutri-performance

Delfan® Plus

Kada primijeniti biostimulator DELFAN PLUS:

- Nakon berbe (prije pada lista) za jesensku folijarnu gnojidbu mikroelementima (Zn, Mn, Fe, B)

10,3% ALANIN

tradecorp
nutri-performance

Phylgreen

nova generacija biostimulatora

HLADNO PREŠANA ALGA

Ekstrakt morske alge *Ascophilum nodosum*

Snažan koncentrat.

Bez teških metala

tradecorp nutri-performance

gentle extraction

Agro Expert d.o.o.

Ascophyllum nodosum

Izgled alge *Ascophyllum nodosum.*

Classical Extraction v Phylgreen Gentle Cold Extraction

Classical Extraction

Usually mechanical or dead seaweed harvest
↓
Cut
↓
Drying — Heat above 120°C
↓
Normally K_2O — Alkaline extraction
↓
Seaweed meal
↓

Classical extract

Phylgreen Gentle Cold Extraction

Fresh seaweed hand cut from rocks
↓
Fine cut
↓
Sorting
↓
Pressure extraction — Gentle
↓
Filtration
↓

Fresh Phylgreen extract

Agro Expert d.o.o.

Phylgreen – nova generacija biostimulatora

Doza primjene:

1- 2 lit/ha (folijarno)

Sadrži:

- ➔*Polifenole*
- ➔*Alginate*
- ➔*Manitol*
- ➔*Aminokiseline*
- ➔*Antioksidante*
- ➔*Antibiotike*
- ➔*Prirodne hormone (citokinin i dr.)*

Humistar

Tekuće huminske kiseline za fertirigaciju

tradecorp
nutri-performance

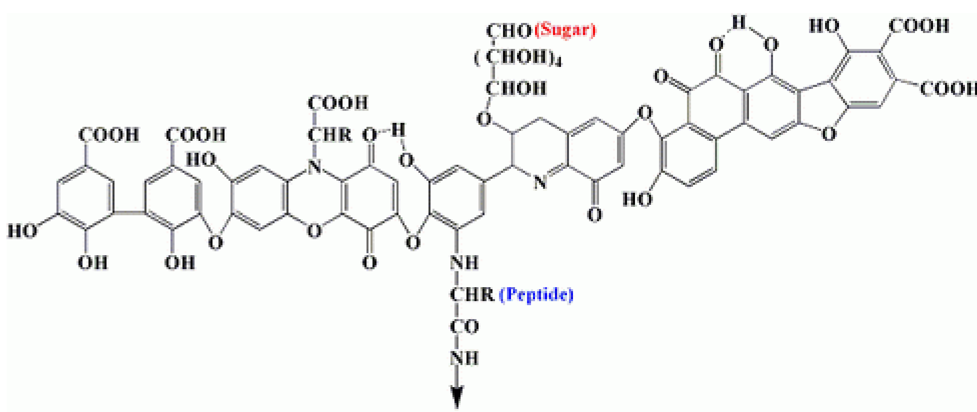
Agro Expert d.o.o.

Humistar

Uloga organske tvari u tlu:

1. Povećava plodnost tla
2. Popravak fizikalnih svojstava tla
3. Veća mikrobiološka aktivnost tla

ORGANSKA TVAR ≠ HUMUS = ORGANSKA TVAR



Agro Expert d.o.o.

Humistar

ORGANSKA TVAR ≠ **HUMUS** = ORGANSKA TVAR

ORGANSKA TVAR

Stajski gnoj (suhi, zreli, peletirani...)

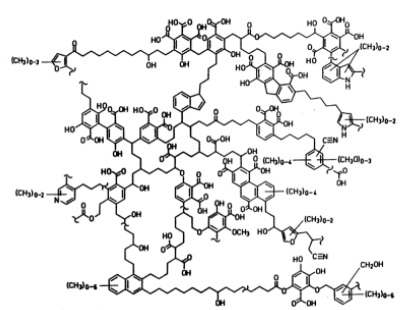
Organski ostaci (trava, slama, sijeno...)

HUMUS

Razgrađen a organska tvar (vlaga, temperatur a, MO)

HUMINSKE KISELINE

Tekući ekstrakt humusa (huminske kiseline, fulvo kiseline, humati)



Agro Expert d.o.o.

Osnovne karakteristike:

1. TEKUĆI ekstrakt HUMUSA
2. BEZ TEŠKIH metala (ne sadrži živu, krom, olovo...)
3. Ima certifikat za primjenu OMRI certifikat za organsku proizvodnju
4. Visoka kompatibilnost sa ostalim preparatima
5. **Primjena kroz sustav FERTIRIGACIJE !!!**

Humistar

tradecorp
nutri-performance

Agro Expert d.o.o.

Humistar

Kada primjeniti:

1. **Kod sadnje** – direktna aplikacija na korijen (prskanjem/potapanjem) – potiče brzu obnovu i rast korijena
2. **Kod primjene helata (Fe)** u tlo prilikom pojave kloroze – brži transport helata u korijen i biljku

tradecorp
nutri-performance

Agro Expert d.o.o.

Humistar

Kada primjeniti:

3. **Za bolje usvajanje-mobilnost hraniva** u tlu-na početku vegetacije (hladno tlo u proljeće)
4. **Povećanje mikrobiološke aktivnosti tla**
5. **Smanjuje EC vrijednost tla kod intenzivne fertirigacije**

tradecorp
nutri-performance

Agro Expert d.o.o.

Humistar

DOZA PRIMJENE:

5-20 lit/ha

(preparat HUMISTAR nema fitotoksičnosti kod primjene)

Agro Expert d.o.o.

Turbo Root WG – NOVO !!!

Agro Expert d.o.o.

turbo root WG

POSEBNO formulirano organsko-mineralno gnojivo

Sastav gnojiva:

- Azot (N)………….. 3,0%
- Fosfor (P_2O_5)….. 16,0%
- Kalij (K_2O)………. 18,0%
- Mikroelementi:
  - Fe-EDDHA….0,1%
  - Mn-EDTA……0,2%
  - Zn-EDTA…….0,2%
  - **Mo (vodotopivi)… 0,25%**
- Organska komponenta:
  - Huminske kiseline…….. 14,0%
  - Fulvo kiseline…….….… 15,1%
  - Aminokiseline…………..22,2%

Agro Expert d.o.o.

turbo root WG

POSEBNO formulirano
organsko-mineralno gnojivo

150 g/kg !!!

50x

HUMINSKIH EKSTRAKATA

3 g/kg ???

20 kg ← **1.000 kg (1 t)**

turbo root WG

POSEBNO formulirano
organsko-mineralno gnojivo

Doza primjene:

FERTIRIGACIJA

20-50 kg/ha

(2-5 kg/1000 m2)

Jesenska gnojidba/Prva gnojidba u proljeće

tradecorp
nutri-performance

Agro Expert d.o.o.

tradecorp
nutri-performance

Trade Corporation International S.A.U.
C/ Alcalá, 498. 2ª Planta
28027 Madrid (Spain)

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- Tradecorp Latvia

Tytanit – nova generacija biostimulatora bazi titana (Ti)

Sastav proizvoda: 8,5 grama titana (Ti)/1 lit. vode

Doza primjene: 200 mL/1 ha

Namjena gnojiva Tytanit:

- Bolja cvatnja
- **Smanjenje steriliteta polena**
- Bolja oplodnja
- Smanjeno opadanje plodova nakon cvatnje

Optysil – nova generacija biostimulatora bazi silicija (Si)

Sastav proizvoda: 200 grama SiO/1 lit. gnojiva

Doza primjene: 0,5 L/1 ha

Namjena gnojiva Optysil:

- Veća otpornost kultura na gljivične bolesti
- Bolja kvaliteta plodova
- Bolje čuvanje plodova

INTERMAG
SKUTECZNOŚĆ DZIĘKI WIEDZY

Dr.sc. David Gluhić

JURANA d.o.o.
Specialisti za enologijo in prehrano rastlin

Agro Expert d.o.o.

Zakaj potrebujemo sredstva za krepitev rastlin iz kategorije stimulatorjev in hranil z regulatornimi učinki?

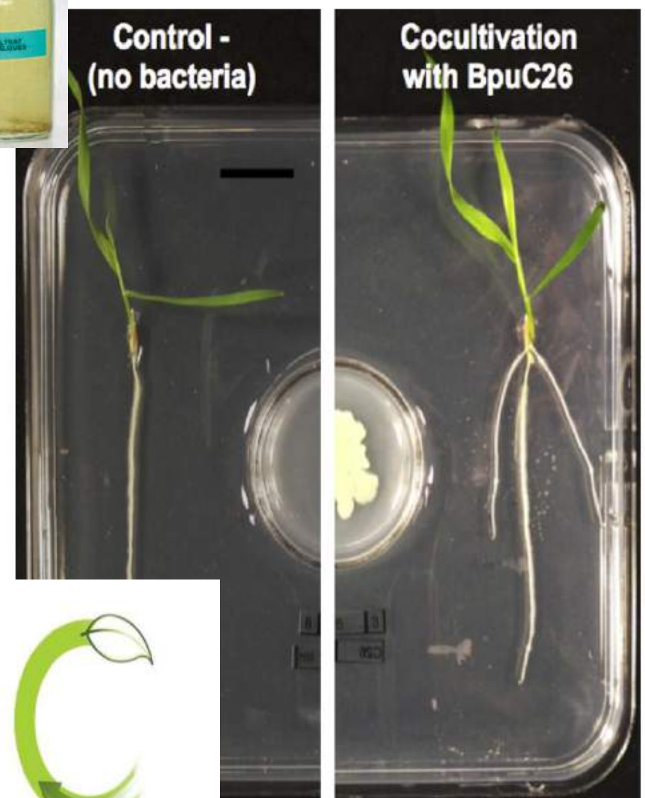
Mario Lešnik
Fakulteta za kmetijstvo in biosistemske vede UM

Posvet Jurana 2017

40 let Univerza v Mariboru

Fakulteta za kmetijstvo in biosistemske vede

P. du Jardin / Scientia Horticulturae 196 (2015) 3–14



...l grass *Brachypodium distachyon* (line Bd21) by volatile compounds emitted by the PGPR *Bacillus pumil*... Delaplace et al., 2015).

European Biostimulants Industry Consortium

BIOSTIMULATORJI ŠE NIMAJO SVOJE DOKONČNE SISTEMATSKE IN TERMINOLOŠKE ŠKATLICE

Biostimulatorje lahko uvrščamo med sredstva za KREPITEV RASTLIN:

Med SKR v EU uvrščamo nekaj tisoč pripravkov katerih formalni status z zakonodajo ni popolnoma urejen.

Zanje uporabljajo številne izraze:
v angleščini (plant strenghtners, **biostimulators**, low-risk plant protection products, plant immuno stimulators, plant resistance improvers, plant growth improvers, **phytostimulants**),

v nemščini (Rezistencinduktor, **Pflanzenstärkungsmittel**),

v italijanščini (**Corroboranti - fitostimulanti**, Potenziatore della resistenza delle piante),

francosko (**Additivs agronomiques biostimulant**, Conditionneur de plantes, Stimulateurs de(s) défense(s) des plantes, Renforceur des Plantes, Les stimulateurs de vitalité)

in špansko (**Otros medios de difesa fitosanitaria**).
Pomembna je razmejitev med pripravki za varstvo rastlin (FFS) in SKR. FFS imajo

OKOLIŠČINE PRIDELOVANJA RASTLIN, KI NAREKUJEJO POVEČANO PORABO BIOSTIMULATORJEV

- VSE VEČJA IZPOSTAVLJENOST RASTLIN STRESU (KLIMATSKE SPREMEMBE – VISOKE TEMPERATURE – ZASTOJI V FOTOSINTETSKI AKTIVNOSTI – POŠKODBE OD UV SEVANJA – NEURJA IN POŠKODBE POVRHNJICE)

- VSE VEČJA IZPOSTAVLJENOST RASTLIN MANJ RODVITNIM TLOM (TEŽJE RAZMERE ODVZEMA HRANIL, NEUSTRZENE pH, ZMANJŠANE MIKROBNE POPULACIJE, PRIMANJKOVANJE DOBRIH ORGANSKIH GNOJIL, PREOZEK KOLOBAR, BOLEZNI PONOVNEGA SAJENJA NA ISTO MESTO)

- POTREBA PO OBNAVLJANJU RASTLINSKEGA FILOSFERNEGA IN RIZOSFERNEGA BIOMA, KI JE PRIZADET OD VELIKE UPORABE KLASIČNIH FFS + PODPORA EDOFITNEMU MIKROBIOMU

- SPREMINANJE PROFILA METABOLITOV RASTLIN, KI SO TRŽNO ZANIMIVI (SPREMEMBA RAZMERIJ MED RAZLIČNIMI SNOVMI IZ SKUPINE SEKUNDARNIH METABOLITOV, KI DEFINIRAJO KAKOVOST)

OKOLIŠČINE PRIDELOVANJA RASTLIN, KI NAREKUJEJO POVEČANO PORABO BIOSTIMULATORJEV

- ZMANJŠANA PONUDBA KLASIČNIH FFS
- ZMANJŠANA UČINKOVITOST KLASIČNIH FFS – POJAVI ODPORNOSTI
- ZAHTEVA PO ZMANJŠANJU OSTANKOV FFS V HRANI

- POTREBA PO ZMANJŠANJU OBČUTLJIVOSTI RASTLIN ZA FITOTOKSIČNOST FFS (NPR. POJAVI MREŽAVOSTI IN DEFORMACIJ PLODOV OD AGRESIVNIH TOPIL V FFS, POŠKODBE HERBICIDI)

- UVAJANJE NOVIH SORT Z DOLOČENIMI TIPI ODPORNOSTI, KI TEMELJI NA SPREMENJENEM FIZIOLOŠKEM ODZIVU RASTLINE (KONTROLA PRETIRANE OBRAMBNE REKACIJE KI VODI V PREVELIKO PORABO ENERGIJE ZA OBLIKOVANJE OBRAMBNIH SNOVI)

OKOLIŠČINE PRIDELOVANJA RASTLIN, KI NAREKUJEJO POVEČANO PORABO BIOSTIMULATORJEV

* PRIČAKOVANJA PO ZELO VISOKIH PRIDELKIH TUDI V TEŽJIH PRIDELOVALNIH RAZMERAH

- ZELO VELIK PRIDELEK JE STRES – SLEDI IZEMENIČNA RODNOST
- LOW INPUT PRIDELAVA (POTREBA PO VEČJIH IZKORISTKIH HRANIL IN VLOŽENE ENERGIJE)

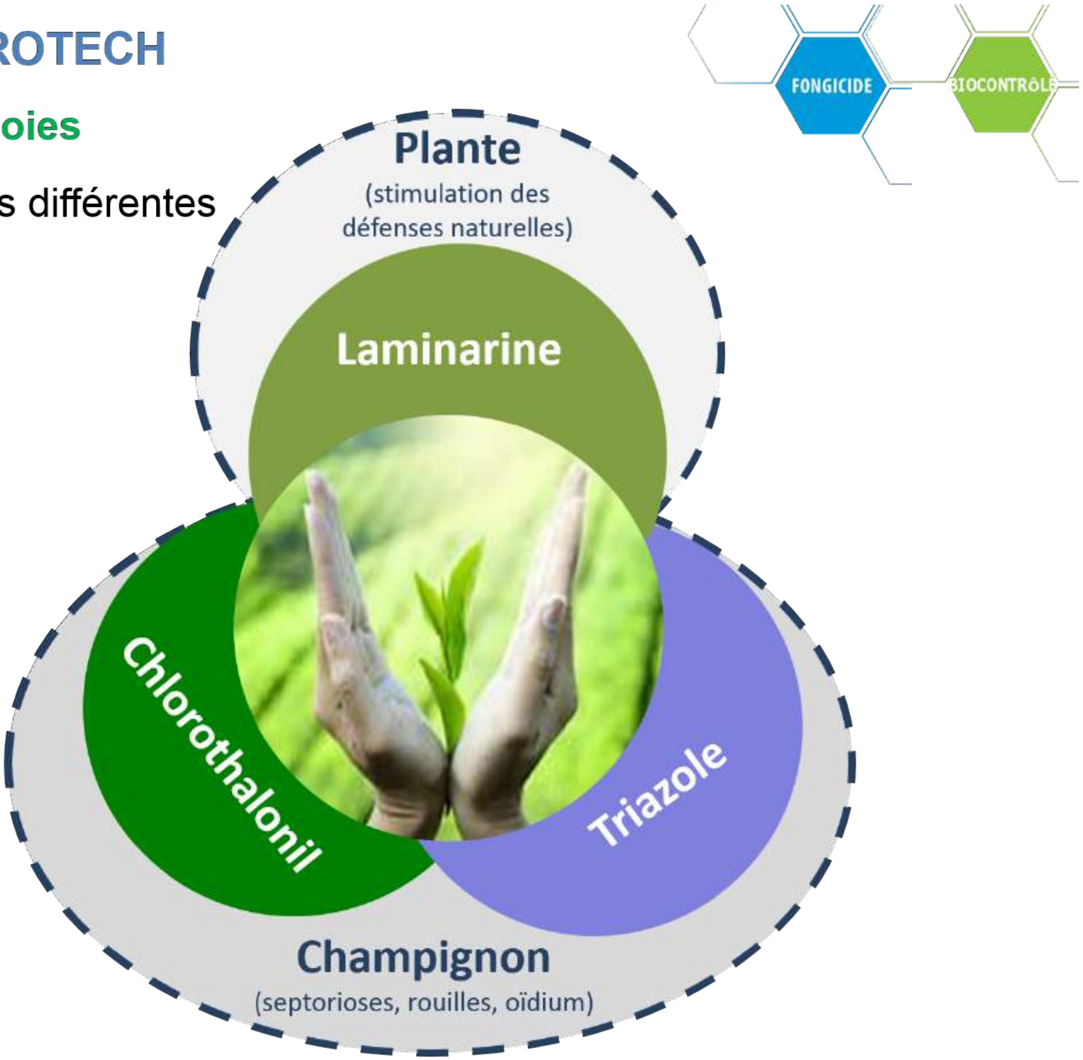
- BOLJŠE PRILAGAJANJE TUJIH SORT LOKALNIM PRIDELOVALNIM RAZMERAM
- BOLJŠE PRILAGANJE SORT RAZMERAM PRI GOJENJU POD MREŽO ALI FOLIJO
- BOLJ ZGODEN ZAČETEK RASTNE DOBE IN PODALJŠEVANJE RASTNE DOBE V JESEN – POVEČEVANJE PRODUKTIVNOSTI
- POVEČANJE SKLADIŠČNE SPOSOBNOSTI SADJA IN ZELENJAVE IN VEČJA ODPORNOST NA POŠKODBE PRI MANIPULACIJI

NOVA STRATEGIJA INTEGRIRANEGA VARSTVA – SINERGISTIČNO DOPOLNJEVANJE
Primer reklame iz Francije za škropilni program

Stratégie Néo PROTECH

Approche Triple voies

- Avec 2 cibles différentes



Synergistic effect of bioregulators with pesticides and herbicides on improving growth, yield quality and crop resistance against pathogens and pests

S. P. Ponomarenko[1], Z. M. Hrytsaenko[2], V. A. Tsygankova[3], O.V. Babayants[4]

ZMANJŠEVANJE PRITISKA ODPORNOSTI

FRAC

FUNGICIDE RESISTANCE ACTION COMMITTEE

FRAC recommendations for fungicide mixtures designed to delay resistance evolution.

INTRODUCTION

RESEARCH ARTICLE

Inhibition of Fungal Plant Pathogens by Synergistic Action of Chito-Oligosaccharides and Commercially Available Fungicides

Md. Hafizur Rahman, Latifur Rahman Shovan, Linda Gordon Hjeljord, Berit Bjugan Aam, Vincent G. H. Eijsink, Morten Sørlie, Arne Tronsmo

Published: April 25, 2014 • http://dx.doi.org/10.1371/journal.pone.0093192

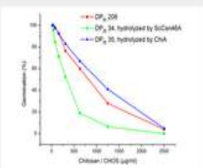
Abstract
Introduction
Materials and Methods
Results
Discussion
Author Contributions
References

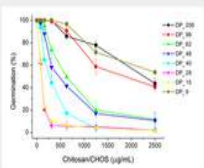
Reader Comments (0)
Media Coverage (0)
Figures

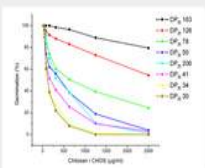
Abstract

Chitosan is a linear heteropolymer consisting of β 1,4-linked *N*-acetyl-D-glucosamine (GlcNAc) and D-glucosamine (GlcN). We have compared the antifungal activity of chitosan with DP_n (average degree of polymerization) 206 and F_A (fraction of acetylation) 0.15 and of enzymatically produced chito-oligosaccharides (CHOS) of different DP_n alone and in combination with commercially available synthetic fungicides, against *Botrytis cinerea*, the causative agent of gray mold in numerous fruit and vegetable crops. CHOS with DP_n in the range of 15–40 had the greatest anti-fungal activity. The combination of CHOS and low dosages of synthetic fungicides showed synergistic effects on antifungal activity in both *in vitro* and *in vivo* assays. Our study shows that CHOS enhance the activity of commercially available fungicides. Thus, addition of CHOS, available as a nontoxic byproduct of the shellfish industry, may reduce the amounts of fungicides that are needed to control plant diseases.

Figures







Citation: Rahman MH, Shovan LR, Hjeljord LG, Aam BB, Eijsink VGH, Sørlie M, et al.

Biotechnol. Agron. Soc. Environ. 2016 **20**(S1), 299-313

Implementing plant biostimulants and biocontrol strategies in the agroecological management of cultivated ecosystems. A review

Geraldine Le Mire [1,2]*, Minh Luan Nguyen [1,3]*, Berenice Fassotte [1,4], Patrick du Jardin [3], Francois Verheggen [4], Pierre Delaplace [3]**, M. Haissam Jijakli [2]**

Appl Microbiol Biotechnol (2009) 84:11–18

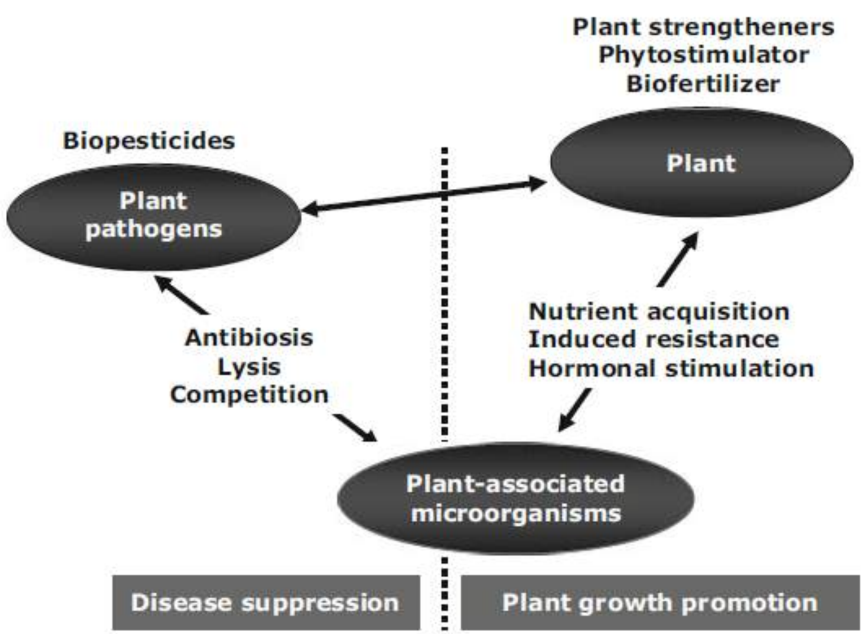


Fig. 1 Plant–microbe interactions promoting plant growth and health: mode of action and potential use in biotechnological applications

Functions of Beneficial Microorganisms

- Production of simple organic molecules for plant uptake
- Production of bioactive compounds
- Solubilization of insoluble nutrient sources
- Production of polysaccharides to improve soil aggregation
- Fixation of atmospheric nitrogen
- Suppression of soil-borne pathogens
- Recycling and increased availability of plant nutrients
- Degradation of toxicants including pesticides
- Complexation of heavy metals to limit plant uptake

Underneath 8 abstracts are shown as presented at the 1st World Congress o use of Biostimulants in Agriculture, November 2012, Strasbourg, France

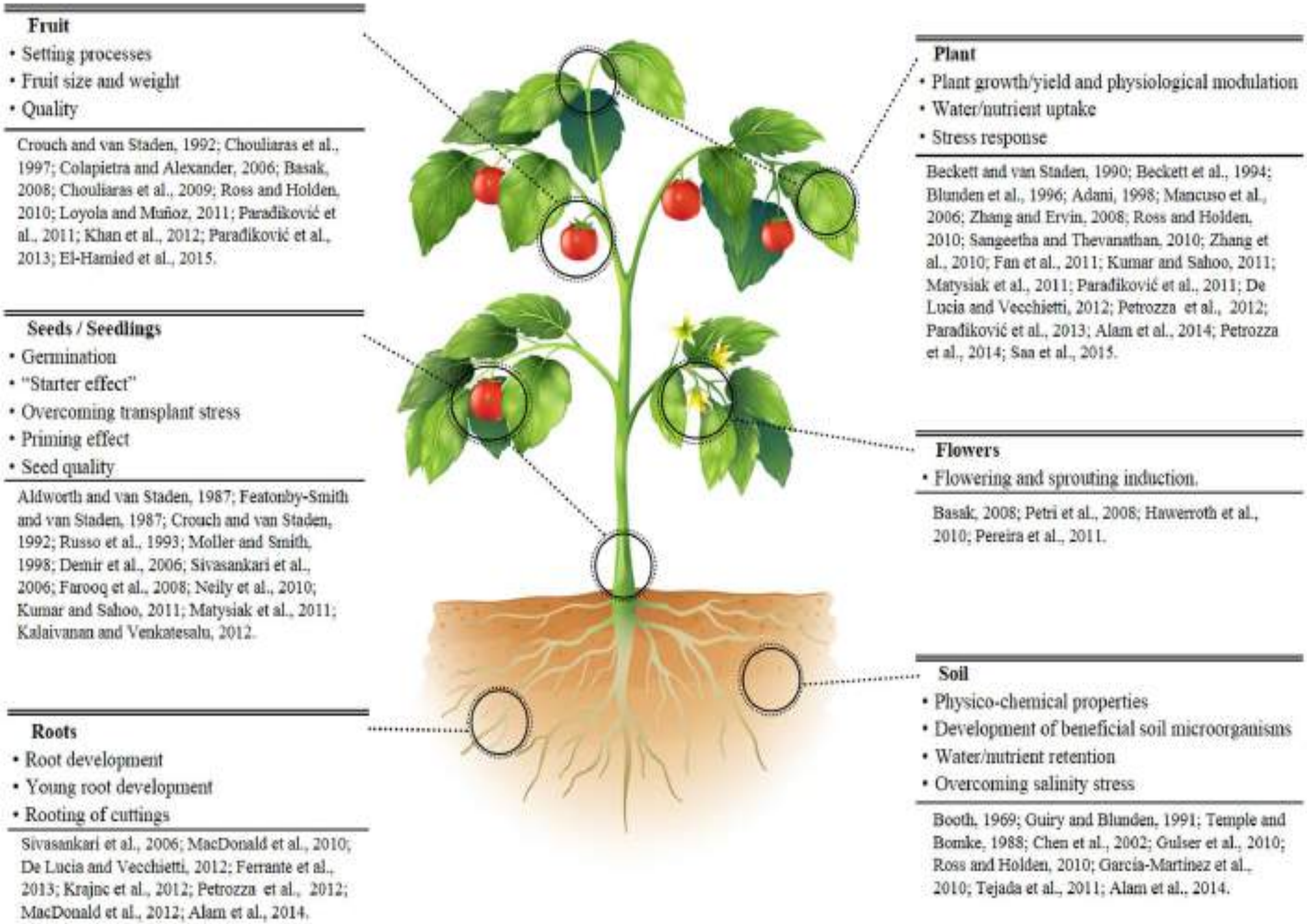
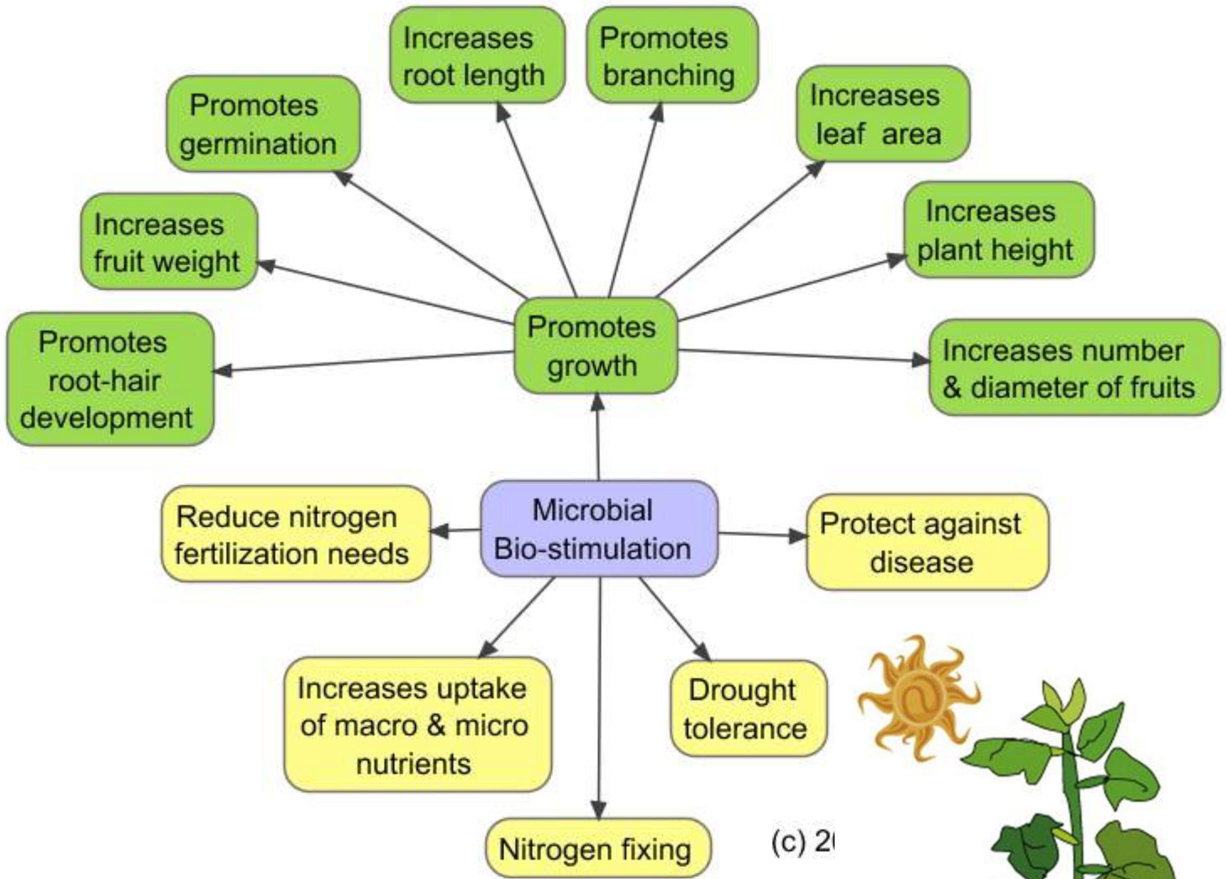
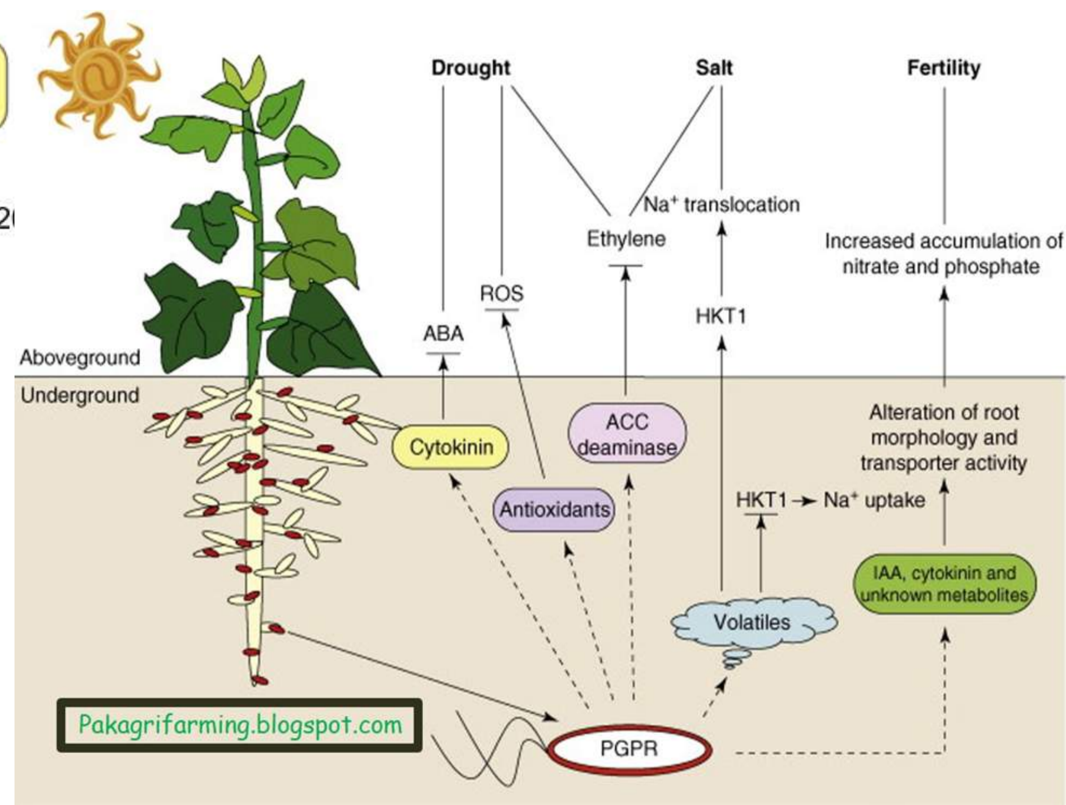
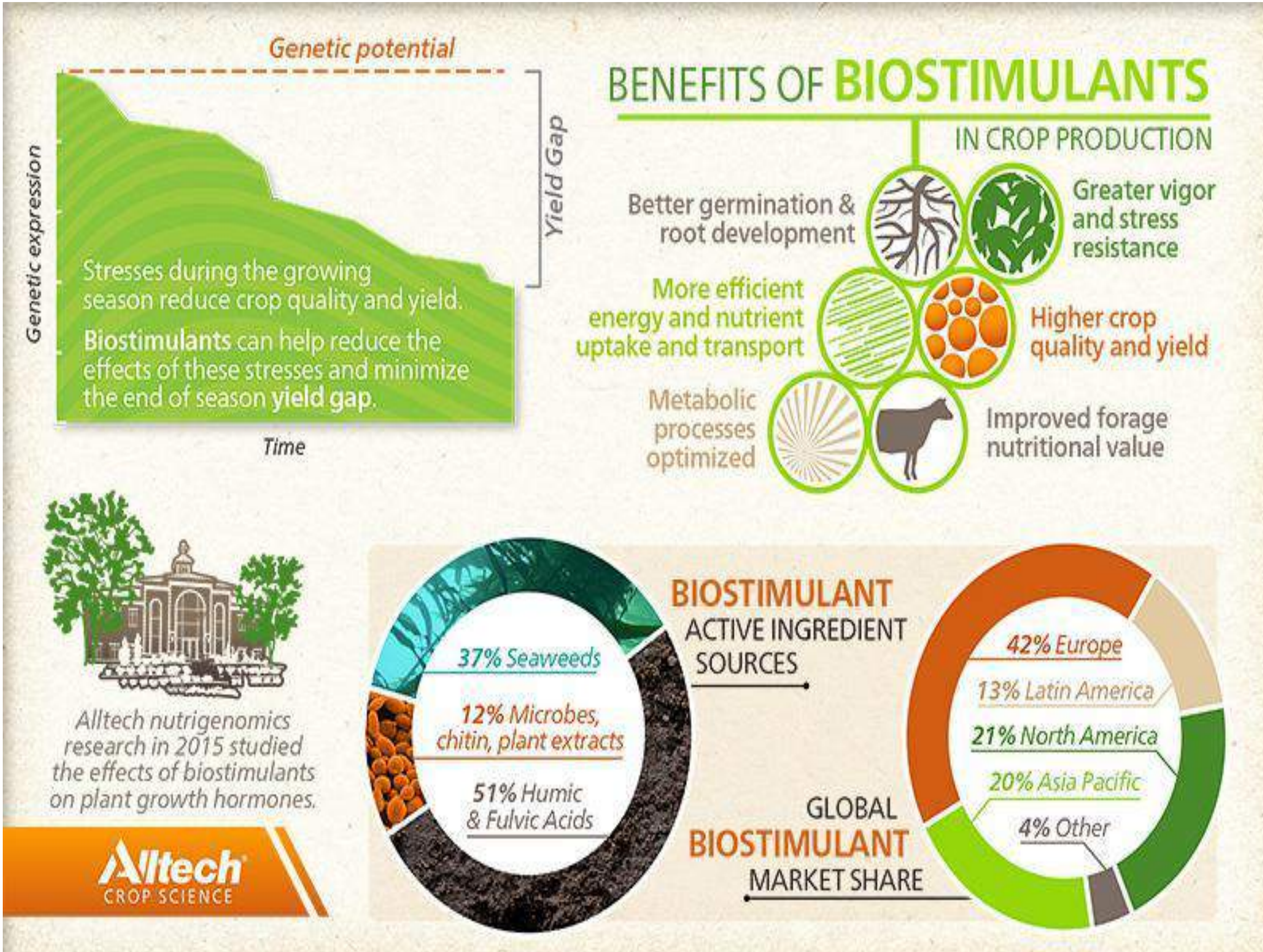


FIGURE 1 | Reported examples of the main effects and physiological actions played by plant biostimulants (PBS).

Področja fiziološkega delovanja






Genetic potential
Yield Gap
Genetic expression
Stresses during the growing season reduce crop quality and yield.
Biostimulants can help reduce the effects of these stresses and minimize the end of season yield gap.
Time
BENEFITS OF BIOSTIMULANTS
IN CROP PRODUCTION
Better germination & root development
Greater vigor and stress resistance
More efficient energy and nutrient uptake and transport
Higher crop quality and yield
Metabolic processes optimized
Improved forage nutritional value
Alltech nutrigenomics research in 2015 studied the effects of biostimulants on plant growth hormones.
Alltech
CROP SCIENCE
37% Seaweeds
12% Microbes, chitin, plant extracts
51% Humic & Fulvic Acids
BIOSTIMULANT
ACTIVE INGREDIENT
SOURCES
GLOBAL
BIOSTIMULANT
MARKET SHARE
42% Europe
13% Latin America
21% North America
20% Asia Pacific
4% Other

UČINKI, KI JIH JE MOŽNO DOSEČI Z UPORABO BIOSTIMULATORJEV

PREMAGOVANJE STRESNIH RAZMER (SUŠA, SLANOST, MRAZ, UV SEVANJE, OZON, NEDOSTOPNOST HRANIL, …)

- BOLŠE DELOVANJE RASTLIN V RAZMERAH STRESA IN TUDI PO POŠKODBAH OD NEURIJ ALI POŠKODBAH OD FFS

TVORBA ZAŠČITNIH SNOVI PROTI UV SEVANJU (ZMANJŠANJE SONČNIH OŽIGOV)

- REPARACIJA POŠKODOVANE POVRHNJICE
- ZMANJŠANJE PORABE VODE NA KG PRIDELANE SUHE SNOVI IN ZMOŽNOST ČRPANJA VODE IZ ZELO SUHIH TAL (KALIJEVA ČRPALKA)

- BOLJŠA LISTNA PREHRANA RASTLIN SKOZI LISTE V PRIMERU PRIZADETOSTI KORENIN ALI USTAVITVE VODNEGA TOKA V RAZMERAH SUŠE
- PODALJŠANJE FOTOSINTETSKE AKTIVNOSTI V RAZMERAH VISOKE TEMPERATURE
- POSPEŠEN RAZVOJ VZNIKAJOČE RASTLINE ALI SADIKE – STARTER EFEKT
- REGULACIJA CVETENJA IN OPLODNJE / REGULACIJA DOZOREVANJA PLODOV

UČINKI, KI JIH JE MOŽNO DOSEČI Z UPORABO BIOSTIMULATORJEV
POSEGI V DOSTOPNOST IN ODVZEM HRANIL V TLEH (root foraging capacity)

- BOLJŠI ODVEZM HRANIL PRI NEPRIMERNEM pH
- BOLJŠE SPROŠČANJE HRANIL IZ TEŽKO VEZANIH KOMPLEKSOV - REGULACIJA MIKORIZE
- REGULACIJA PORABE IN SPROŠČANJA DUŠIKOVIH SNOVI – PREPREČEVANJE IZGUB DUŠIKA
- GOJENJE OBČUTLJIVIH RASTLIN V SLANIH TLEH
- MIKROBNO GNOJENJE NAMESTO ORGANSKIH GNOJIL
- USMERJEN RAZKROJ OSTANKOV GOJENJH RASTLIN ZA PREPREČENJE RAZVOJNEGA CIKLA ŠKODLJIVIH ORGANIZMOV (FUZARIJ, ŠKRLUP, VERTICILIJ, …)
- DODAJANJE MIKROBOV IN HUMINSKIH KOMPLEKSOV ZA USTVARJANJE STRUKTURE TAL (vezivni polisaharidi - npr. glomalinsko lepilo)
- BLOKADA IZPIRANJA FFS SKOZI PROFIL TAL IN VEZAVA TEŽKIH KOVIN
- DODAJANJE HRANE ZA »IN SITU« GOJENJE DEŽEVNIKOV

UČINKI, KI JIH JE MOŽNO DOSEČI Z UPORABO BIOSTIMULATORJEV

RASTLINSKA KOZMETIKA , OKUSNOST PLODOV, PROCESI STARANJA, PROCESI KOPIČENJA ZALOŽNIH SNOVI

- RAZLIČNE OBLIKE GREENING EFEKTA
- REGULACIJA UČINKA ETILENA – PREKINITEV STARANJA – PODALJŠEVANJE PRODUKTIVNEGA OBDOBJA

- POLEPŠANJE VIDEZA PLODOV (BARVANJE PLODOV, USMERJANJE OKUSA PLODOV)
- POVEČANJE KOLIČINE SEKUNDARNIH METABOLITOV V ZELO DEBELIH PLODOVIH
- MIKROBNO USMERJANJE POVEČANE PRODUKCIJE SEKUNDARNIH METABOLITOV IN INTERNA MIKROBNA RAZGRADNJA MIKOTOKSINOV

- IZBOLJŠANJE SKLADIŠČNE SPOSOBNOSTI SADJA IN ZELENJAVE (NANO KONZERVIRANJE)
- POČASNEJŠE STARANJE V SKLADIŠČU IN PODALJŠANO POLIČNO ŽIVLJENJE
- IZBOLJŠANJE RASTLINSKEGA MIKROBIOMA – POVEČANA KAKOVOST ŽIVIL PREKO POVEČANE MIKROBNE PESTROSTI NA NJIH IN V NJIH
- POVEČANO KOPIČENJE ZALOŽNIH SNOVI – VIŠJA KONCETRACIJA ZALOŽNIH SNOVI – BOLJŠE PREZIMOVANJE PO POZNIH JESENIH - MANJ IZMENIČNE RODNOSTI
- POVEČANO KOPIČENJE ZALOŽNIH SNOVI – BOLJŠE SADIKE – HITREJŠI VSTOP V RODNOST

UČINKI, KI JIH JE MOŽNO DOSEČI Z UPORABO BIOSTIMULATORJEV (NEPOSREDNO VARSTVO RASTLIN)

- POVEČANJE ODPORNOSTI PROTI NAPADU ŠKODLJIVIH ORGANIZMOV (SAR, ISR TEHNIKE)

- BOLJŠE CELJENJE RAN PO NAPADU ŠKODLJIVIH ORGANIZMOV
- SINERGISTIČNO DELOVANJE S FFS (BOLJŠE VSTOPANJE FFS V RASTLINO, VEČJA OBSTOJNOST OBLOGE FFS NA POVRŠINI RASTLINE, POVEČANJE OBČUTLJIVOSTI ŠKODLJIVIH ORGANIZMOV NA FFS, FUNKCIJA MOČIL, …)

- VARSTVO PROTI BOLEZNIM S KONCEPTOM MIKROBIOMSKEGA ŠČITA + HITOSANI + KLINOPTILOLITI + LAMINARINI

- ZMANJŠANJE STOPNJE FITOTOKSIČNOSTI FFS ZA GOJENE RASTLINE

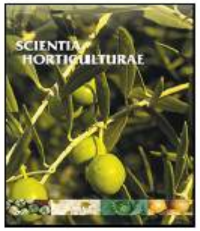
- REGULACIJA PORABE ENERGIJE ZA OBRAMBNE PROCESE RASTLINE (DIREKTNA DOSTAVA PREKURZORJEV OBRAMBNIH SNOVI)
- IZVEDBA 0,0-RESIDUE PRIDELOVALNIH SISTEMOV
- MIKROBNI RAZKROJ OSTANKOV FFS V PLODOVIH NA KONCU SEZONE

Scientia Horticulturae 196 (2015) 3–14

Contents lists available at ScienceDirect

Scientia Horticulturae

journal homepage: www.elsevier.com/locate/scihorti



Review

Plant biostimulants: Definition, concept, main categories and regulation

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ARTICLE INFO

Article history:
Received 21 May 2015
Received in revised form 28 August 2015
Accepted 17 September 2015
Available online 29 October 2015

Keywords:
Biostimulant
Biofertiliser
Definition
Regulation

ABSTRACT

A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content. By extension, plant biostimulants also designate commercial products containing mixtures of such substances and/or microorganisms. The definition proposed by this article is supported by arguments related to the scientific knowledge about the nature, modes of action and types of effects of biostimulants on crop and horticultural plants. Furthermore, the proposed definition aims at contributing to the acceptance of biostimulants by future regulations, especially in the EU, drawing the lines between biostimulants and fertilisers, pesticides or biocontrol agents. Many biostimulants improve nutrition and they do so regardless of their nutrients contents. Biofertilisers, which we propose as a subcategory of biostimulants, increase nutrient use efficiency and open new routes of nutrients acquisition by plants. In this sense, microbial biostimulants include mycorrhizal and non-mycorrhizal fungi, bacterial endosymbionts (like *Rhizobium*) and Plant Growth-Promoting Rhizobacteria. Thus, microorganisms applied to plants can have a dual function of biocontrol agent and of biostimulant, and the claimed agricultural effect will be instrumental in their regulatory categorization. The present review gives an overview of the definition and concept of plant biostimulants, as well as the main categories. This paper will also briefly describe the legal and regulatory status of biostimulants, with a focus on the EU and the US, and outlines the drivers, opportunities and challenges of their market development.

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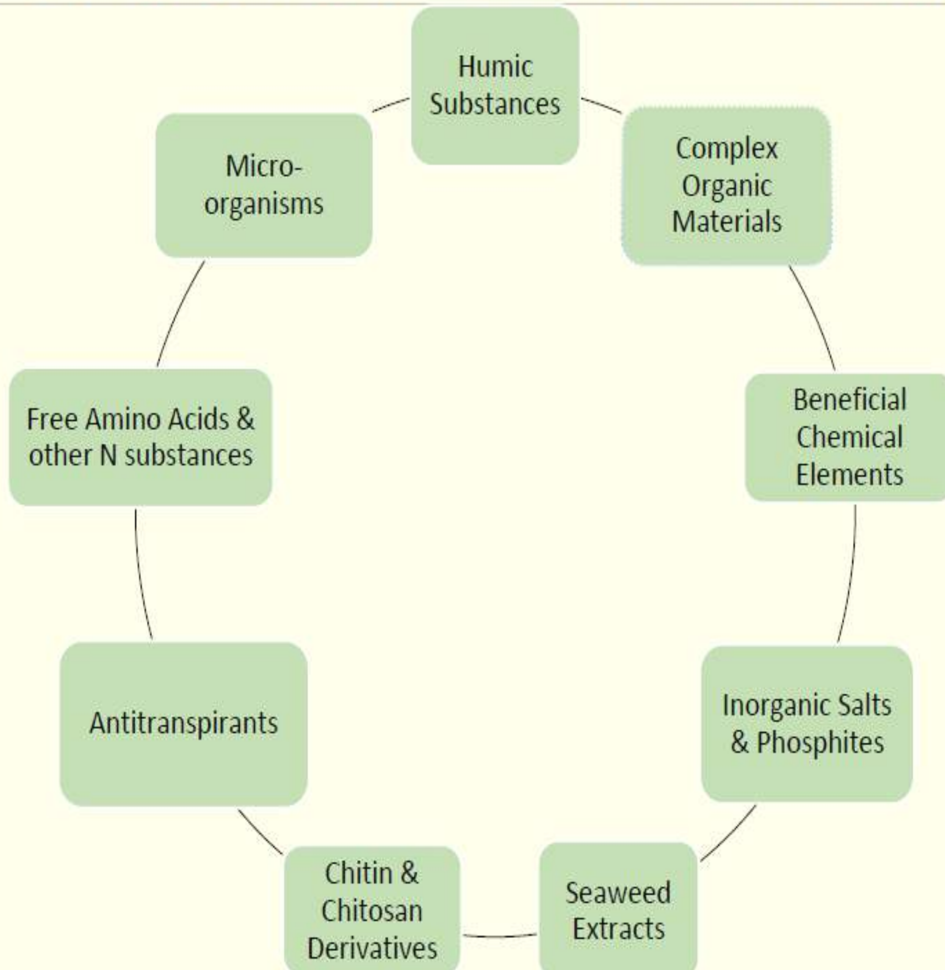
http://dx.doi.org/10.1016/j.scienta.2015.09.021

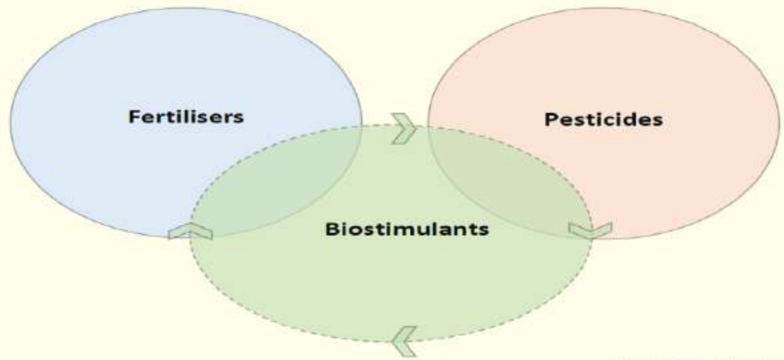
Based on the definitions provided above and in Appendix I, Figure 1 provides a graphical illustration of the various sub-categories contained within the scope of biostimulants in this study. Meanwhile, Figure 2 depicts how biostimulants are positioned in the context of plant nutrients (fertilisers) and pesticides. It also attempts to illustrate that there is some overlap between what constitutes biostimulants and what constitutes pesticides for example. The Andersons Centre understands that discussions are underway at a European level to clarify the regulatory framework for biostimulant products which will formalise their position in the EU market.

Figure 1 – Overview of the Sub-Categories of Biostimulants included within the Scope of this Study



Source: The Andersons Centre, 2015

Figure 2.2 – Biostimulants' Positioning versus Fertilisers and Pesticides



Source: The Andersons Centre, 2015

CROP PROTECTION

"« influencing the life processes of plants, such as substances influencing their growth other than as nutrients or stimulating natural processes to benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress and/or crop quality »

BIOTIC STRESS

BIOSTIMULANT

Plant biostimulant means a material which contains substance(s) and/or microorganisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, and/or crop quality, independently of its nutrient content"

ABIOTIC STRESS
CLAIM APPROACH
FROM PRODUCT TO SOLUTION

FERTILISER

Fertilisers, Soil improvers, Liming materials, Growing media, and…

OPEN UP TO EUROPE TO ALL FERTILISER TYPES

PROTECTION

NUTRITION

Box 1: Glossary of 'biosolutions' contributing to sustainable plant productions

Biostimulant: A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content. By extension, plant biostimulants also designate commercial products containing mixtures of such substances and/or microorganisms.

Biofertiliser: A biofertiliser is any bacterial or fungal inoculant applied to plants with the aim to increase the availability of nutrients and their utilization by plants, regardless of the nutrient content of the inoculant itself. Biofertilisers may also be defined as microbial biostimulants improving plant nutrition efficiency.

Biocontrol: The control of one organism by another. Biocontrol agents used in plant productions are living organisms protecting plants against their enemies, i.e. reducing the population of pests or diseases to acceptable levels. Modes of action may include competition, antibiosis, parasitism and also Induced Systemic Resistance which is mediated by the plant.

Table 1 The main categories of biostimulants

	Humic substances	Complex organic materials	Beneficial chemical elements	Inorganic salts (such as phosphite)	Seaweeds extracts	Chintin & Chitosan derivatives	Antitranspirants	Free amino acid & other N-containing substances
Existence of plant analogs:	No	Yes	Yes	Yes(e.g. phoshate) or No(e.g. phosphite)	Yes (e.g. auxins) or No(e.g. alginates)	No	Yes(e.g. ABA analogs) or No(e.g. di-1-p-menthene)	Yes
Action inside the plant:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Action outside the plant (soil, leaf surface):	Yes(most significantly)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Physical or physico-chemical (osmolytes) effects in/on the plant:	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Motebolic effects (Including antioxydants):	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hormonal(hormone-like) effects:	Yes	Yes	No	No	Yes	No	Yes(e.g. ABA analogs) or No(filn-forming compounds)	Yes
Physiological effects on nutrition efficiency:	Yes	Yes	Yes	Yes(NB:negative impacts on P nutrition described in certain conditions)	Yes	Yes	Yes	Yes
Physiological effects on abiotic stress response:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Physiological effects on biotic stress response:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1
Effects of biostimulants on crop productions, from their cellular targets in plants to whole-plant physiological functions, to agricultural/horticultural functions, and ultima
to expected economic and environmental benefits (Dobbelaere et al., 1999; Huang et al., 2010; Shabala et al., 2012).

	Humic acids	Seaweed extracts	Protein hydrolysate	Glycine betaine	Plant Growth-promoting Rhizobacteria
Cellular mechanism (*i.e.* interaction with cellular components and processes) ↓	Activate plasma membrane proton-pumping ATPases, promote cell wall loosening and cell elongation in maize roots (*Zea mays*) (Jindo et al., 2012)	*Ascophyllum nodosum* extracts stimulate expression of genes encoding transporters of micronutrients (*e.g.* Cu, Fe, Zn) in oilseed rape (*Brassica napus*) (Billard et al., 2014)	Enzymatic hydrolysate from alfalfa (*Medicaco sativa*) stimulates phenylalanine ammonia-lyase (PAL) enzyme and gene expression, and production of flavonoids under salt stress (Ertani et al., 2013)	Protects photosystem II against salt-induced photodamage in quinoa (Shabala et al., 2012), likely via activation of scavengers of reactive oxygen (Chen & Murata, 2011)	*Azospirillum brasilense* releases auxins and activates auxin-signalling pathways involved in root morphogenesis in winter wheat (*Triticum aestivum*) (Dobbelaere et al., 1999)
Physiological function (*i.e.* action on whole-plant processes) ↓	Increased linear growth of roots, root biomass	Increased tissue concentrations and root to shoot transport of micronutrients	Protection by flavonoids against UV and oxidative damage (Huang et al., 2010)	Maintenance of leaf photosynthetic activity under salt stress	Increased lateral root density and surface of root hairs
Agricultural/horticultural function (*i.e.* output traits relevant for crop performance) ↓	Increased root foraging capacity, enhanced nutrient use efficiency	Improved mineral composition of plant tissues	Increased crop tolerance to abiotic (*e.g.* salt) stress	Increased crop tolerance to abiotic (*e.g.* high salinity) stress	Increased root foraging capacity, enhanced nutrient use efficiency
Economic and environmental benefits (*i.e.* changes in yield, products quality, ecosystem services)	Higher crop yield, savings of fertilisers and reduced losses to the environment	Enhanced nutritional value, 'biofortification' of plant tissues (increased contents in S, Fe, Zn, Mg, Cu)	Higher crop yield under stress conditions (*e.g.* high salinity)	Higher crop yield under stress conditions (*e.g.* high salinity)	Higher crop yield, savings of fertilisers and reduced losses to the environment

4. Defining plant biostimulants : aiming at a consensus

In line with the above considerations, the following definition is proposed (Box 1):

« **A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content.** » This definition could be completed by : « By extension, plant biostimulants also designate commercial products containing mixtures of such substances and/or microorganisms.»

A couple of remarks :

1. The nature of the biostimulant is not restrictive : it can be a substance or a microorganism. A substance may be either a single chemical compound or a group of compounds having a well established biological origin, *e.g.* plant extracts, but not necessarily a fully characterized composition. In this sense, it fits with the meaning of the word « substance » in existing regulations. This includes the european REACH regulation (EC No 1907/2006) concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals, which recognizes a category of substances of variable composition : *'UVCB substances (substances of unknown or variable composition, complex reaction products or biological materials) may be registered as a single substance under this Regulation, despite their variable composition, provided that the hazardous properties do not differ significantly and warrant the same classification'*. Another example of complex substances potentially comprising many chemical constituents are plant extracts refered to as 'botanical active substances ' and as ' basic substances ' and approved under regulation (EC) No 1107/2009 on plant protection in the EU. The European Commission 'guidance document on the botanical active substances used in plant protection product ' (http://ec.europa.eu/food/plant/pesticides/guidance_documents/docs/guidance_document_botanicals_rev_8_en.pdf) defines: *'A 'botanical active substance' consists of one or more components found in plants and obtained by subjecting plants or parts of plants of the same species to a process such as pressing, milling, crushing, distillation and/or extractions'*. Clearly, the multicomponent nature of substances of plant origin is acknowledged here, as it is in international forums of the OECD on biopesticides (http://www.oecd.org/env/ehs/pesticides-biocides/env-jm-mono-2012-36-core%20report.pdf). The word substance in the definition of biostimulants should be understood in a similar way. Microorganisms should be identified at the level of the strain, considering that many biological activities are indeed strain-specific. When mixtures (*i.e.* intentional blends) of microorganisms are used, the resulting products would be refered to as biostimulants, following our proposal to extend the definition to commercial preparations.

5. Regulation of plant biostimulants

The regulatory situation of biostimulants is very complex today, in the absence of any specific and harmonized framework in either the EU or the USA. One of the main reasons for this situation is the lack of formal definition and acceptance of the concept by regulatory bodies. In Europe today, biostimulants are placed on the market by following either of two routes : one is the national regulations on fertilisers, the other one is the european pesticides law, which combines both supranational and national provisions for introducing plant protection products on the market. In Europe, the current situation is that the EC regulation No 1107/2009 on plant protection products ('PPPs') is applicable to all categories of biostimulants, considering the very broad definition of PPPs. Indeed, Article 2 of this regulation reads : '*This Regulation shall apply to products, in the form in which they are supplied to the user, consisting of or containing active substances, safeners or synergists, and intended for one of the following uses:*

(a) *(...)*

(b) *influencing the life processes of plants, such as substances influencing their growth, other than as a nutrient.*'

As any biostimulant is intended to influence the life processes of plants by other ways than as a nutrient, it may be regarded as a « plant protection product » from a strict regulatory viewpoint. Synthetic and natural substances (including botanicals and basic substances as mentioned before), and microorganisms, are all covered by this regulation. All plant growth regulators and herbicide safeners have been registered under this PPP regulation until now and these are substances that interact with the physiology of the plant, even though they do not protect the plant against pests or diseases.

Due to the lengthy and costly procedures to place a PPP on the european market, taking into consideration that many companies developing biostimulants are SMEs and that improved plant nutrition and growth are the main scope of biostimulants, an alternative route has been chosen, namely the 'fertilisers route' in which case national legislation is applied. Why not the european law on EC fertilisers (regulation (EC) No 2003/2003) ? Because the definition of fertilisers laid down by this regulation is very restrictive and cannot include biostimulants. Indeed, Article 2 reads:

'*For the purposes of this Regulation the following definitions shall apply:*

(a) *'Fertiliser' means material, the main function of which is to provide nutrients for plants.*
(b) *'Primary nutrient' means the elements nitrogen, phosphorus and potassium only.*
(c) *'Secondary nutrient' means the elements calcium, magnesium, sodium and sulphur.*
(d) *'Micro-nutrients' means the elements boron, cobalt, copper, iron, manganese, molybdenum and zinc essential for plant growth in quantities that are small compared with those of primary and secondary nutrients.*'

Any fertiliser must provide nutrient as its main function. This is clearly not the case of biostimulants, which by definition promote plant growth by other means than by providing nutrients. Annex I of the (EC) No 2003/2003 regulation on EC fertilisers lists types of fertilisers, which are all inorganic materials providing macro- and micronutrients, but also chelating and complexing agents intended to optimize the delivery of micronutrients to plants, allowing chelated and complexed micronutrients to be placed on the market by the way of this regulation. It was later considered that other compounds used as fertilisers additives, *i.e.* nitrification and urease inhibitors, should also be granted market access via this regulation. This led to a breakthrough in the european fertiliser regulation, which was amended by the (EC) No 1107/2008 regulation in order to introduce materials which are not providers of nutrients (fertilisers *sensu stricto*) but additives of fertilisers enhancing fertilisers performance. Many biostimulants may be considered as enhancers of fertilisers performance and this regulatory advance seemed to pave the way to the inclusion of biostimulants into the EU fertilisers law. However, this option is not realistic as amending regulations is a laborious procedure which cannot be followed for all biostimulants. When the national fertilisers laws are used for introducing biostimulants on the european market (mainly those enhancing nutrition and growth, *e.g.* humic acids, seaweed extracts and protein hydrolysates), marked differences exist between member states in terms of data requirements for efficacy, toxicity and ecotoxicity assessment (Traon et al., 2014; La Torre et al., 2015).

Bulgarian Journal of Agricultural Science, 19 (No 6) 2013, 1183-1189
Agricultural Academy

LEGAL ASPECTS OF THE USE OF PLANT STRENGTHENERS (BIOSTIMULANTS) IN EUROPE

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Abstract

LA TORRE, A., V. BATTAGLIA and F. CARADONIA, 2013. Legal aspects of the use of plant strengtheners (biostimulants) in Europe. *Bulg. J. Agric. Sci.*, 19: 1183-1189

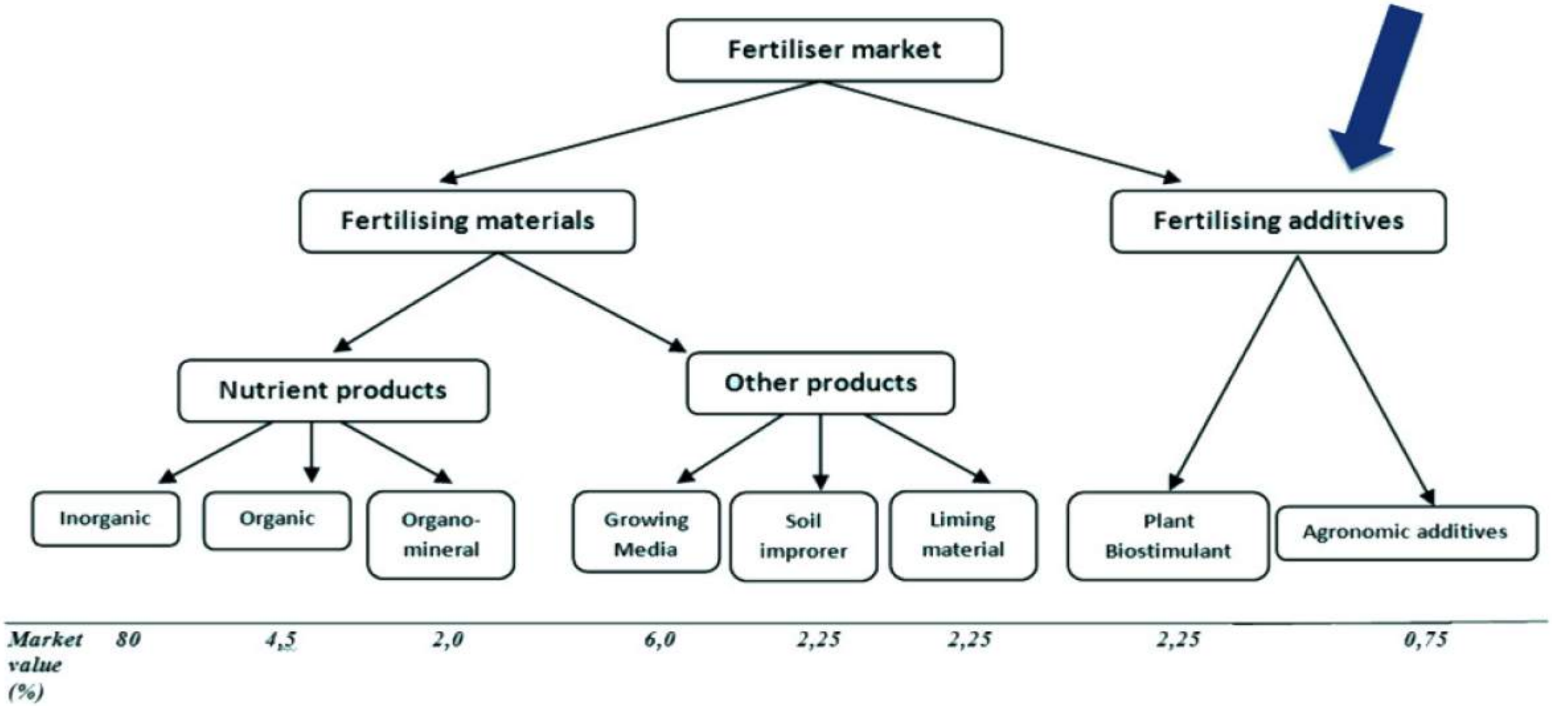
Some EU member states allow the use in agriculture of a class of substances, known as plant strengtheners, under national laws. Plant strengtheners (biostimulants) enhance the resistance of plants to harmful organisms and protect plants against non-parasitic impairments. They are “borderline” products because the boundaries between plant protection products and fertilizers are not clear and univocal. There is no European regulatory framework for these substances. This fragmented and contradictory situation can prejudice the fair productive competitiveness of agriculture systems in Europe.

Key words: grey zone, borderline products, plant strengtheners, biostimulants

Abbreviations: BVL: Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (Federal Office of Consumer Protection and Food Safety); CTGB: College voor de toelating van gewasbeschermingsmiddelen en biociden (Board for the Authorisation of Plant Protection Products and Biocides); D.P.R.: Decree of President of Republic; D.M.: Ministerial Decree; EBIC: European Biostimulants Industry Council; EC: European Community; EEC: European Economic Community; EOCC: European Organic Certifiers Council; EU: European Union; NF: Norme Française; OMDF: Otros medios de defensa fitosanitaria; PflSchG: Pflanzenschutzgesetz (Plant Protection Act); RUB: Regeling Uitzondering Bestrijdingsmiddelen (Regulation exemptions Pesticide); WGB: Wet Gewasbeschermingsmiddelen en Biociden

SISTEM V RAZVOJU - BOLJ SE NAGIBA V SMERI PODSKUPINE GNOJIL – BOLJŠE ZA INDUSTRIJO – MANJŠI STROŠKI ZA TOKSIKOLOGIJO

CURRENT EUROPEAN COMMISSION THINKING



A Legal Framework for Plant Biostimulants and Agronomic Fertiliser Additives in the EU

SISTEM KLASIFIKACIJE V FRANCIJI

Produits de stimulation en agriculture visant à améliorer les fonctionnalités biologiques des sols et des plantes – Étude des connaissances disponibles et recommandations stratégiques

Rapport final – Décembre 2014

Étude commanditée par le Centre d'Études et de Prospective du Ministère de l'Agriculture, de l'Agroalimentaire et de la Forêt (MAAF) et financée par le MAAF dans le cadre du programme 215 (Marché n° SSP-2013-094).

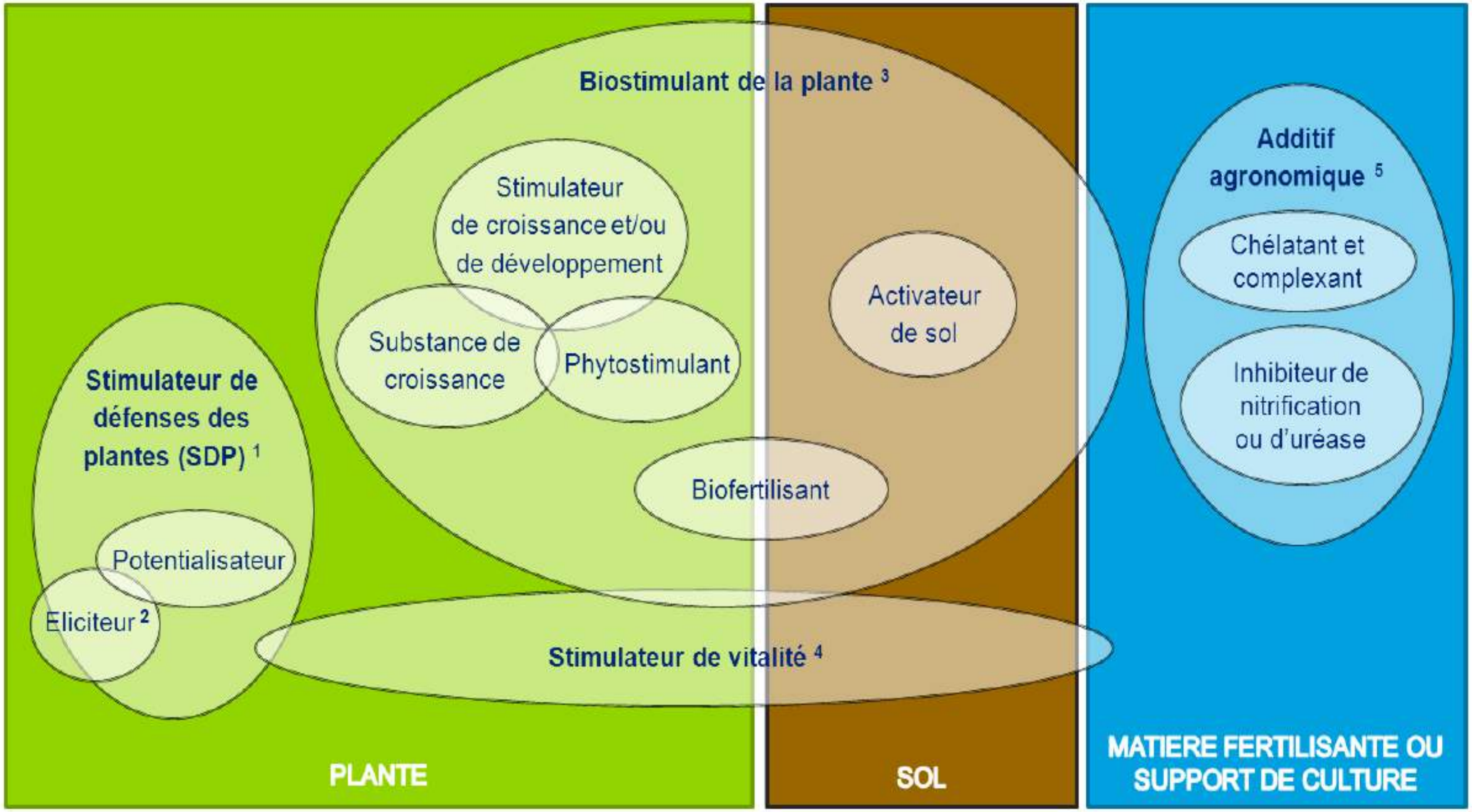
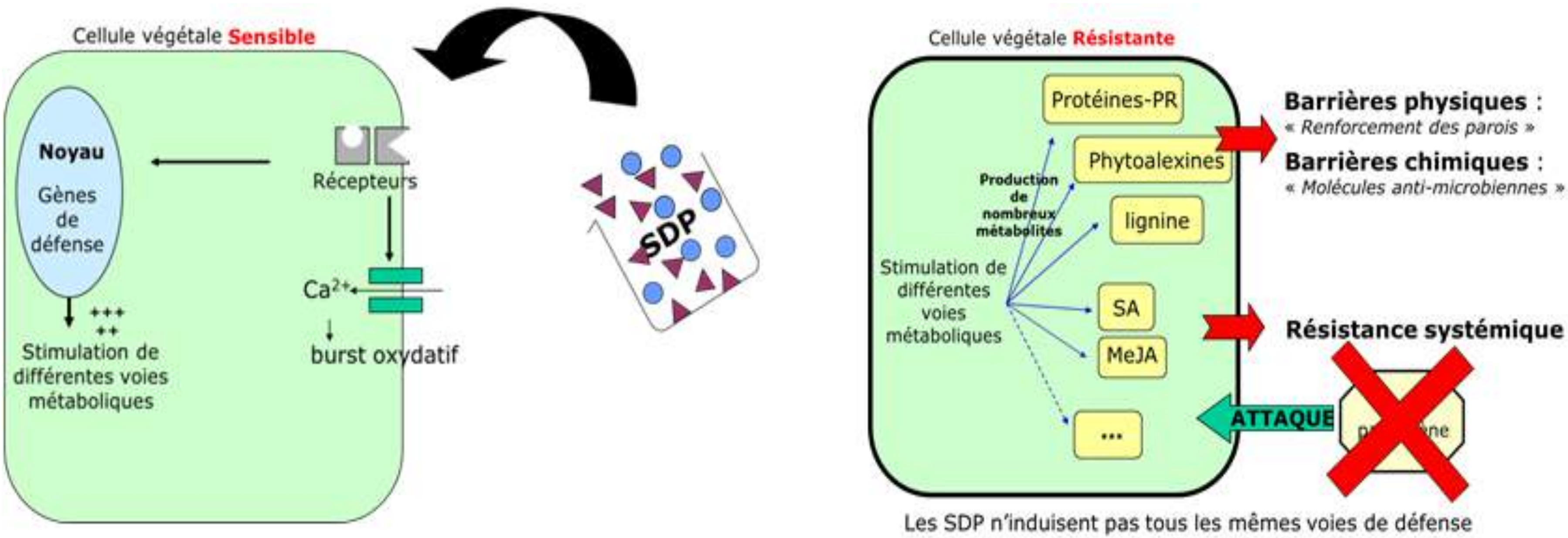


Figure 1 – Cartographie des cibles des principales terminologies identifiées pour les produits de stimulation des plantes

Cibles identifiées : plante (vert), sol (brun) et MFSC (bleu).

Définitions utilisées (termes pour lesquels plusieurs définitions ont été identifiées) : 1 : (RMT Elicitra, 2013) , 2 : (Fardeau & Jonis, 2003) ; 3 : (EBIC, 2014) ; 4 : (MAAF, 2012) ; 5 : (Arcadia, 2014).


Cellule végétale Sensible
Noyau
Gènes de défense
Récepteurs
Ca2+
burst oxydatif
+++
++
Stimulation de différentes voies métaboliques
SDP
Cellule végétale Résistante
Protéines-PR
Phytoalexines
lignine
SA
MeJA
...
Production de nombreux métabolites
Stimulation de différentes voies métaboliques
Barrières physiques :
« Renforcement des parois »
Barrières chimiques :
« Molécules anti-microbiennes »
Résistance systémique
ATTAQUE
Les SDP n'induisent pas tous les mêmes voies de défense

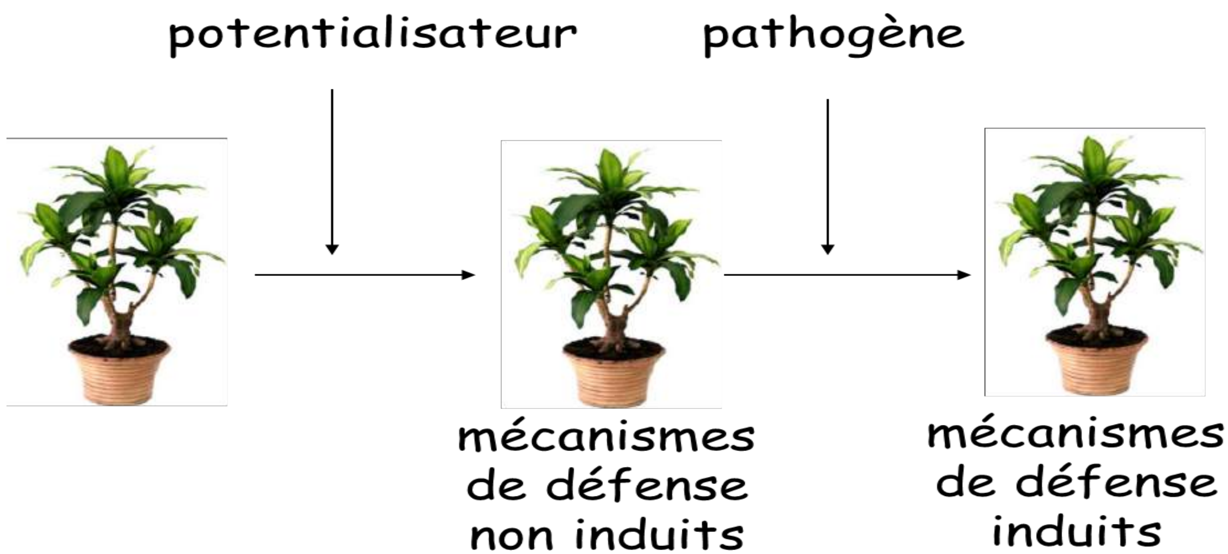

potentialisateur
pathogène
mécanismes de défense non induits
mécanismes de défense induits

Tableau 2 – Origine et nature des produits de stimulation

Légende : B : SDP à action Biocide ; M : substance Mixte à action SDP et biostimulant ; A : SDP à action Antagoniste ; PPP : produit homologué en tant que PPP

Origine / nature	SDP commercialisés et homologués en France (Consultation liste e-phy octobre 2014)	SDP non commercialisés en France (encore au stade laboratoire ou commercialisés à l'étranger)	Biostimulants
Substances issues du vivant	**Micro-organismes vivants**		
	▪ **Bactéries** *Bacillus subtilis* QST 713 [A] *Bacillus pumilus* QST 2808 [A B] *Pseudomonas chlororaphis* [A] ▪ **Virus atténué** *Zucchini yellow mosaic virus* - Weak Strain ▪ **Champignons** *Trichoderma harzianum* [M]	▪ **Bactéries** PGPR (*Plant Growth Promoting Rhizobacteria*) [M] *Bacillus subtilis* [M] *Bacillus pumilus* [A B] *Bacillus amyloliquifaciens* [M] *Bacillus mycoides* *Pseudomonas fluorescens* [M] *Ochrobactrum lupine* *Azospirillum brasilense* ▪ **Spores et mycélium de champignons** PGPF (*Plant Growth Promoting Fungi*) *Fusarium equiseti* *Trichoderma* sp. [M] *Glomus* sp. [M] *Piriforma indica*	▪ **Levures** ▪ **Bactéries** *Bacillus amyloliquifaciens* [M] *Bacillus subtilis* [M] *Pseudomonas fluorescens* [M] PGPR [M] *Azotobacter* sp. *Rhizobium* sp. *Bradyrhizobium* sp. ▪ **Champignons** PGPF *Glomus* sp. [M] *Trichoderma* sp. [M] *Trichoderma harzianum* [M]
	Extraits complexes d'algues		
		▪ **Extraits d'algues** *Ulva* sp. [M] *Ecklonia maxima* [M] *Ascophyllum nodosum* [M] *Laminaria* sp. [M]	▪ **Extraits d'algues** *Ecklonia maxima* *Ascophyllum nodosum* [M] *Lithothamnium calcareum* *Macrocystis pyrifera* *Ulva lactuca* [M] *Sargassum plagiophyllum* *Dictyota dichotama* *Laminaria* sp. [M] *Fucus* sp.
	Extraits complexes de plantes		
	▪ Extrait de Fenugrec	▪ Extraits de plantes ▪ Renouée de Sakhaline [M B] ▪ Ecorce de bourdaine [B] ▪ Extraits de prêle [M B] ▪ Extraits d'ortie [M B]	▪ **Extraits de plantes** Extraits d'ortie [M] Extraits de prêle [M] Renouée de Sakhaline [M]

Origine / nature	SDP commercialisés et homologués en France (Consultation liste e-phy octobre 2014)	SDP non commercialisés en France (encore au stade laboratoire ou commercialisés à l'étranger)	Biostimulants
Substances issues du vivant (suite)	**Extraits purifiés d'algues**		
	▪ Laminarine *(Laminaria digitata)*	▪ Laminarine (*Laminaria* sp.) ▪ Laminarine sulfatée ▪ Ulvane (*Ulva* sp.) ▪ Carraghénane ▪ Extraits d'algues	▪ Extraits d'algues ▪ Acides aminés purifiés
	Extraits purifiés de plantes		
		▪ **Oligosaccharides** Oligosaccharide de bardane Oligogalacturonide ▪ **Monosaccharides** Tréhalose Sucrose Psicose Allose	▪ **Oligosaccharides** Heptamaloxyloglucane[PPP] ▪ Monosaccharides ▪ Protéines purifiées ▪ Acides aminés purifiés ▪ Glycine bétaïne ▪ Lignosulfonate
	Extraits purifiés de micro-organismes		
		▪ **Extraits protéiques** Protéines Peptides Harpines Glycoprotéines Flagellines Protéines virales ▪ **Lipides** Rhamnolipides ▪ **Toxines** ▪ **Chitosane (chitine modifiée)** [M] ▪ **Extraits de levures** [M] Glucane	▪ Extraits de levures [M] ▪ Chitosane (chitine modifiée) [M] ▪ Glycine bétaïne ▪ Extraits protéiques ou peptidiques ▪ Protéines purifiées ▪ Peptides purifiés ▪ Acides aminés purifiés
	Extraits purifiés de macro-organismes		
		▪ Acide cholique ▪ Chitine, Chitosane [M]	▪ Chitine, Chitosane [M] ▪ Protéines purifiées ▪ Acides aminés purifiés

Origine / nature	SDP commercialisés et homologués en France (Consultation liste e-phy octobre 2014)	SDP non commercialisés en France (encore au stade laboratoire ou commercialisés à l'étranger)	Biostimulants
Substances de synthèse d'origine non xénobiotique	**Protéines, Peptides et Dérivés d'Acides aminés**		
		▪ BABA (Acide ß-Amino-Butyrique) ▪ **Lipopeptides bactériens** Fengycine Surfactine	
	Lipides et dérivés lipidiques		
		▪ Jasmonate ▪ Acide jasmonique (JA) ▪ Methyljasmonate (MeJA) ▪ Cis-jasmonate	
	Autres substances non xénobiotiques		
		▪ **Phytohormones** Ethylène Acide abscissique [M]	▪ **Phytohormones** Auxine Cytokinine Brassinostéroïdes Acide abscissique [M] ▪ **Vitamines** Acide folique (B9) ▪ **Antioxydants** Tocophérol
Substances de synthèse d'origine xénobiotique	**Analogues fonctionnels de l'acide salicylique**		
	▪ ASM [B] (acibenzolar-S-méthyl)	▪ BTH [B] (Benzothiadiazole) et ASM [B] (acibenzolar-S-méthyl) ▪ INA (Acide isonicotinique) ▪ DCINA (acide 2,6-dichloroisonicotinique) ▪ Probénazole ▪ Acétyl SA ▪ Heptanoyl de SA	
	Autres substances xénobiotiques		
	▪ Prohexadione-Calcium ▪ Fosétyl-Aluminium [B]	▪ **Analogue fonctionnel du MeJa** Coronatine ▪ Saccharine ▪ Prohexadione ▪ Isotianil	▪ ATCA (Acetyl-Thiazolidine-4-Carboxylic-Acid) ▪ Nitrophénolate

Origine / nature	SDP commercialisés et homologués en France (Consultation liste e-phy octobre 2014)	SDP non commercialisés en France (encore au stade laboratoire ou commercialisés à l'étranger)	Biostimulants
Substances organo-minérales	**Extrais minéraux**		
	▪ Phosphite de potassium [B]	▪ **Poudres de roche** [M] Silicate ▪ **Ions minéraux** Phosphonate [B] et Phosphite [B] de potassium Sel de cuivre [B], Sel de zinc	▪ **Substances humiques** (extraites de léonardite) Acide humique Acide fulvique ▪ **Poudres de roche** [M] Silicate

classification of plant bios... | Biostimulants

www.strategyr.com/MarketResearch/Biostimulants_Market_Trends.asp

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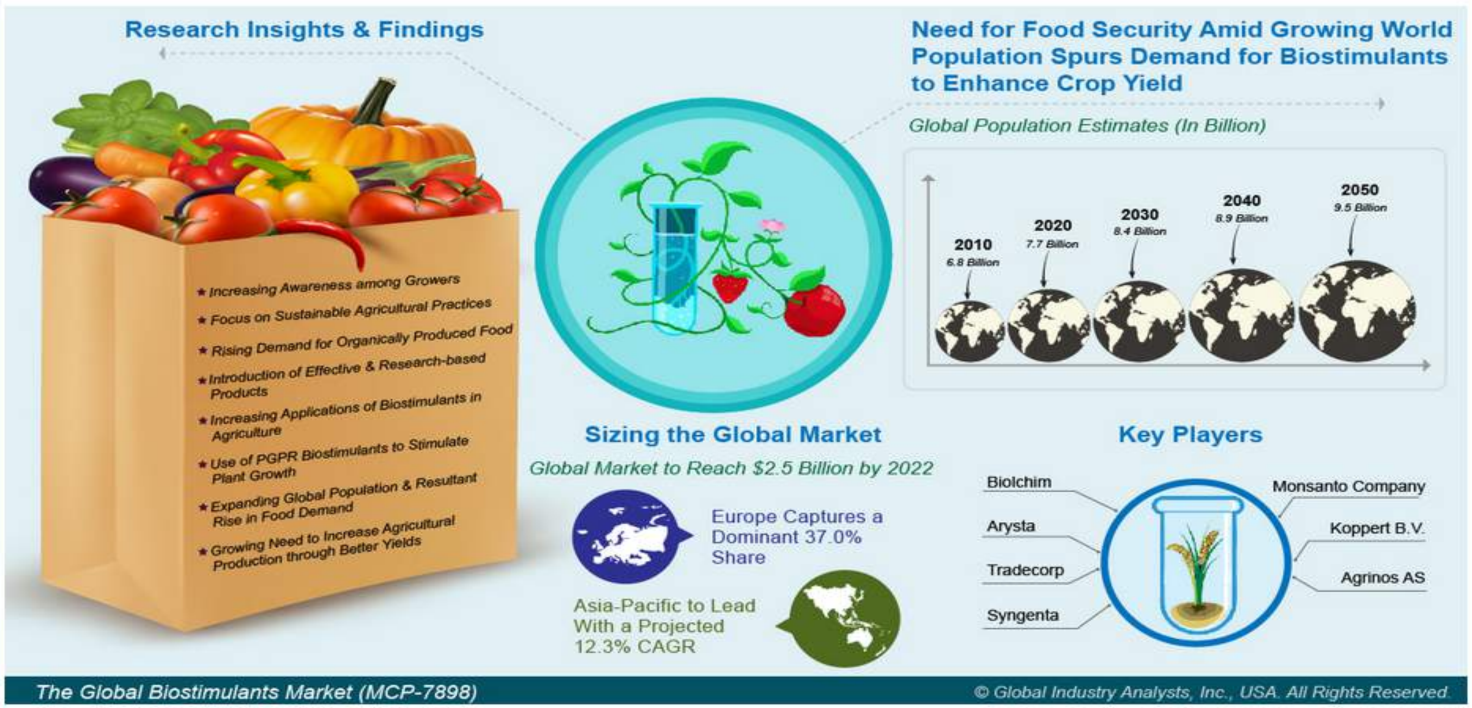
Growing Need to Expand Agricultural Yield Drives Biostimulants Market

Published: July 2016



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Start

NA VOLJO MNOŽICE PREPARATOV

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BLUPRINS®

Improver of bud burst, sprouting and flowering

FOLIAR APPLICATION

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Improver of fruit set and fruit growth based on seaweed cream

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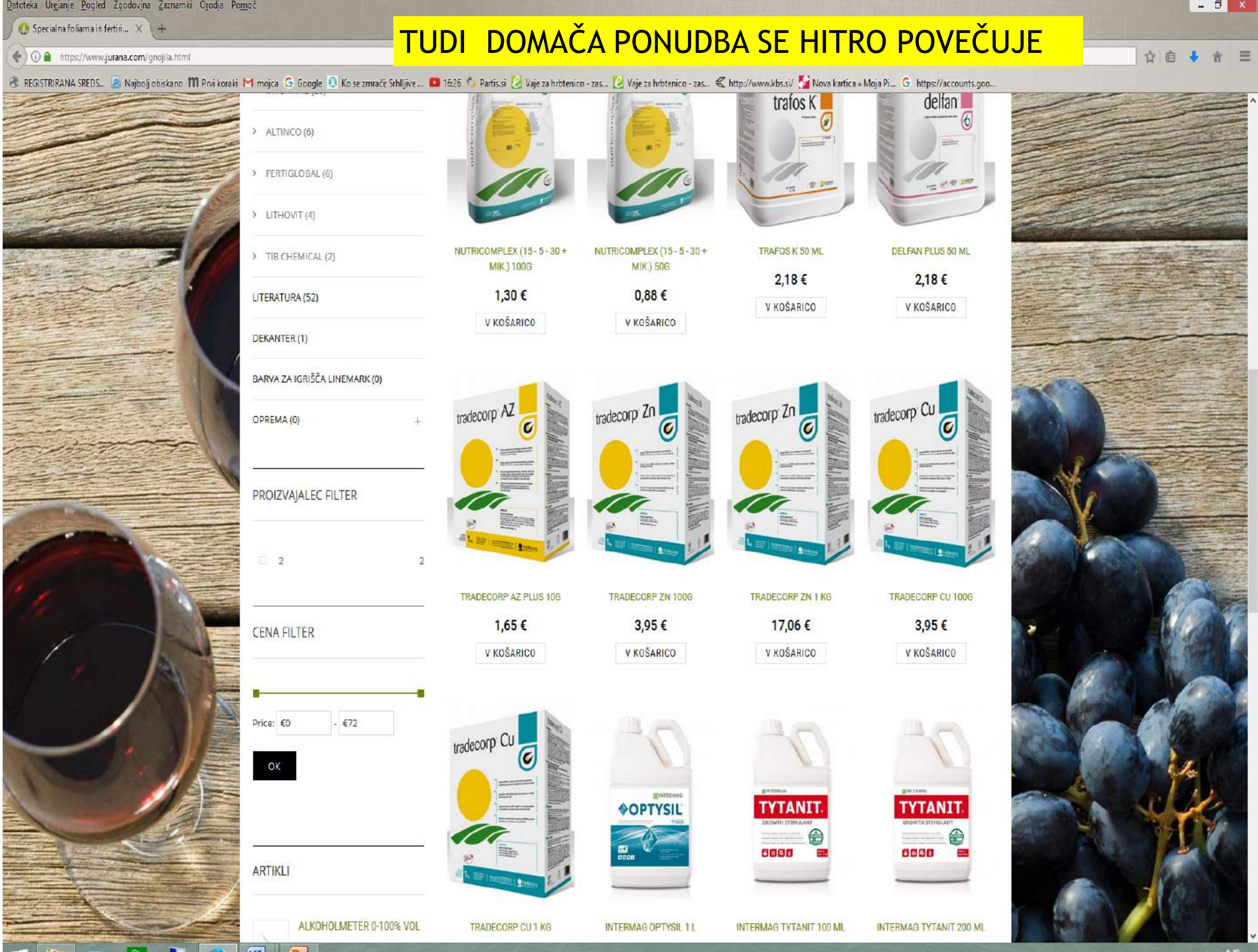
TUDI DOMAČA PONUDBA SE HITRO POVEČUJE



STANJE V SLOVENIJI

- DEJANSKO V UPORABI MAJHNO ŠTEVILO BIOSTIMULATORJEV V PRIMERJAVI Z DRUGIMI DRŽAVAMI ČEPRAV JE VERJETNO NA TRGU VSAJ 200 PRIPRAVKOV
- POJEMO VELIKO UVOŽENEGA SADJA IN ZELENJAV KI JE S TEM TRETIRANO

- SMISELNO BI BILO NAREDITI VEČ APLIKATIVNIH RAZISKAV GLEDE UPORABNOSTI
- PRIDELOVALCI MORAJO NAREDITI ČIM VEČ PRAKTIČNIH POSKUSOV ZA BOLJŠO PRESOJO UPORABNOSTI RAZLIČNIH PRIPRAVKOV V NAŠIH RAZMERAH

- BIOTEHNOLOŠKEGA RAZVOJA SE NE DA USTAVITI – potrebno ga je inkorporirati v naš sistem pridelave
- POTREBNO JE BOLJ DOREČENO STALIŠČE GLEDE UPORABE TEH SNOVI V EKOLOŠKI PRIDELAVI
- Z UPORABO TEH SREDSETV JE MOŽNA NADGRADNJA INTEGRIRANIH SISTEMOV V SMERI 0,0-RESIDUE
- POTREBNO BI BILO IMETI STROKOVNO SKUPINO ZA PRESOJO SPREJEMLJIVOSTI RAZLIČNIH PRIPRAVKOV IN KRITIČEN ODNOS DO RAZNIH PREVAR

PHYTO-MIKRO-BIOMIKA

MIKROBNA REGULACIJA RASTI IN PRODUKTIVNOSTI RASTLINE

Clean Eating, Latest Gut Health Articles

We Are More a Product of Our Microbiome and Food than of Our Genes

By Gut Health Project | December 11, 2016

16 SHARES 14 Facebook 0 Twitter 2 Pinterest

By Dr. Berkson

• Get my free food-gasm recipe booklet from Dr. Berkson's Kitchen

Many diets claim to give you the best results for gut and overall health. But figuring out what's best to eat for your own life and gut, is not always easy. Until now.

Two different studies out of the University of Sydney and the University of Wisconsin at Madison have found the " exact best foods" that are "good" or "bad" for your microbiome. Your microbiome is the several pounds of bacteria, fungi and viruses that live inside your gut. They live inside you and in return help protect your health. But only if you feed them appropriately.

The microbiome is turning out to be a major influential player in diverse aspects of health, from gut health, to lung health, to mood, cognition, autoimmune diseases, heart health, and even winning or losing the battle of obesity.

Now hot off the press, the microbiome is also turning out to be the middleman between your food choices and how your genes turn on and off to try to keep you well.

Table 1 Representatives of microbial inoculants

Microorganisms	Name of the product	Plants, pathogens, or pathosystems	Company
Ampelomyces quisqualis M-10	AQ10 Biofungicide	Powdery mildew on apples, cucurbits, grapes, ornamentals, strawberries, and tomatoes	Ecogen
Azospirillum spp.	Biopromoter	Paddy, millets, oilseeds, fruits, vegetables, sugarcane, banana	Manidharma Biotech
Bacillus subtilis FZB24	FZB24 li, TB, WG RhizoPlus	Potatoes, vegetables, ornamentals, strawberries, bulbs, turf, and woods	AbiTep
Bacillus subtilis strain GB03	Kodiak	Growth promotion; *Rhizoctonia* and *Fusarium* spp.	(Gustafson); Bayer CropScience
Bacillus pumilus GB34	YiedShield	Soil-borne fungal pathogens	(Gustafson); Bayer CropScience
Bacillus subtilis QST716	Serenade	Tobacco, tomato, lettuce, spinach	AgraQuest
Bacillus subtilis GB03, other *B. subtilis*, *B. lichenformis*, and *B. megaterium*	Companion	*Rhizoctonia*, *Pythium*, *Fusarium*, and *Phytophthora*	Growth Products
Bradyrhizobium japonicum	Soil implant+	Soy bean	Nitragin
Coniothyrium minitans	Contans WG, Intercept WG	*Sclerotinia sclerotiorum*, *S. minor*	Prophyta Biologischer Pflanzenschutz
Delftia acidovorans	BioBoost	Canola	Brett-Young Seeds Limited
Paecilomyces lilacinus	Bioact WG	Nematodes	Prophyta Biologischer Pflanzenschutz
Phlebiopsis gigantea	Rotex	*Heterobasidium annosum*	E~nema Biologischer Pflanzenschutz
Pseudomonas chlororaphis	Cedomon	Leaf stripe, net blotch, *Fusarium* sp., sot blotch, leaf spot, etc. on barley and oats	BioAgri AB
Pseudomonas fluorescens A506	BlightBan A506	Frost damage, *Erwinia amylovora*, and russet-inducing bacteria on almond, apple, peach, pear, etc.	NuFarm
Pseudomonas trivialis 3Re-27	Salavida	Lettuce	Sourcon Padena
Pseudomonas spp.	Proradix	*Rhizoctonia solani*	Sourcon Padena
Serratia plymuthcia HRO-C48	RhizoStar	Strawberries, oilseed rape	Prophyta Biologischer Pflanzenschutz
Streptomyces griseoviridis K61	Mycostop	*Phomopsis* spp., *Botrytis* spp., *Pythium* spp., *Phythophora* spp.	Kemira Agro Oy
Trichoderma harzianum T22	RootShield, PlantShield T22, Planter box	*Pythium* spp., *Rhizoctonia solani*, *Fusarium* spp.	Bioworks

Endomycorrhizae:

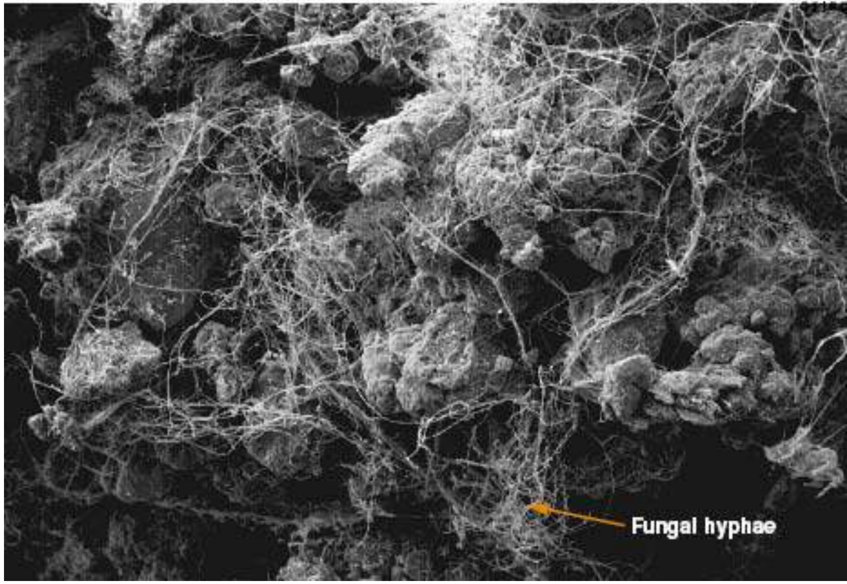
(Around 90% percent of plants and crop species.):

Right at the moment of germination, roots are able to recognize specific fungi and let them "infect" their roots to become colonized.

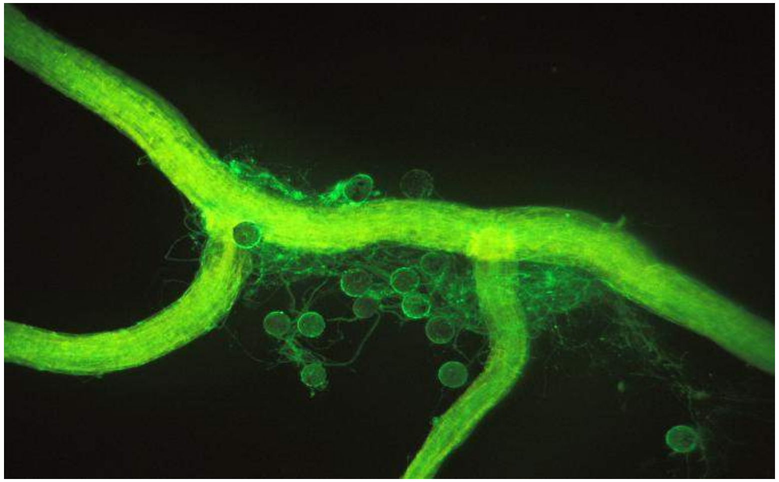
These fungi continue growing inside the root and produce structures know as "arbuscules", too small to see with the naked eye.

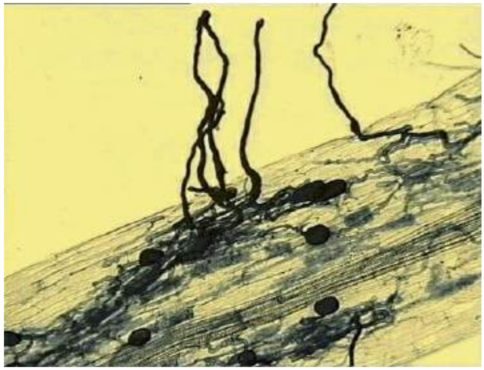
Glomus fungi are particularly important and widespread around the world. They synthetize a sticky protein named Glomalin, which has some special properties to help bind the soil and greatly improve its structure.

*Glomalin is one of the largest carbon deposits of all and is very stable.

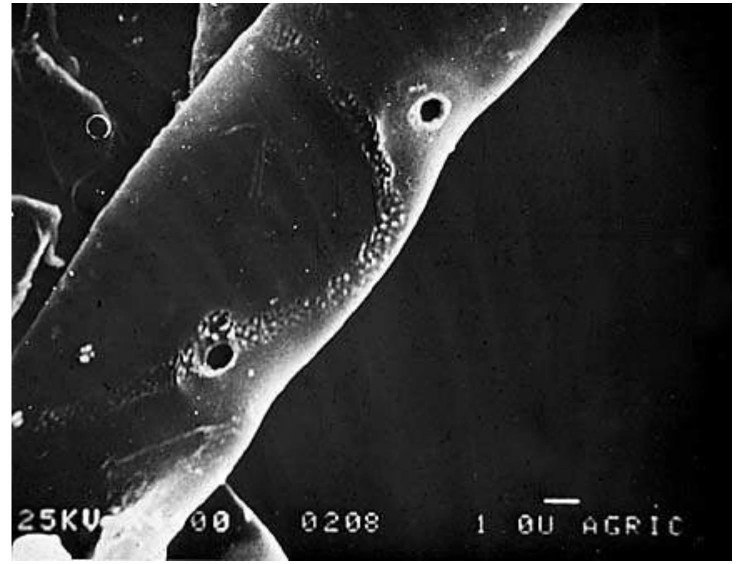


Primer uporabe glive Glomus





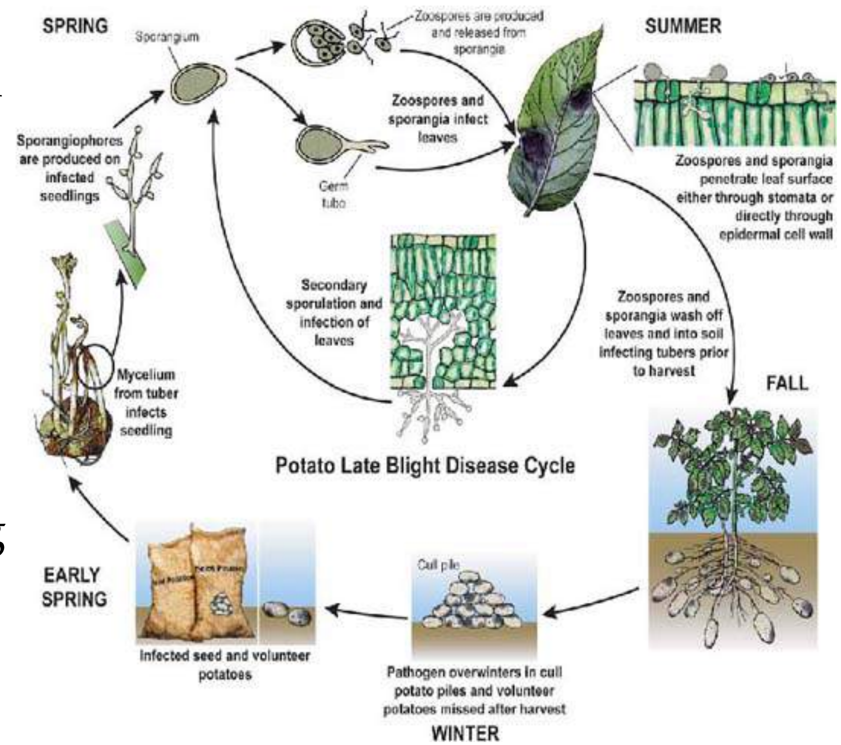
*Further info at USDA: http://agresearchmag.ars.usda.gov/2002/sep/soil

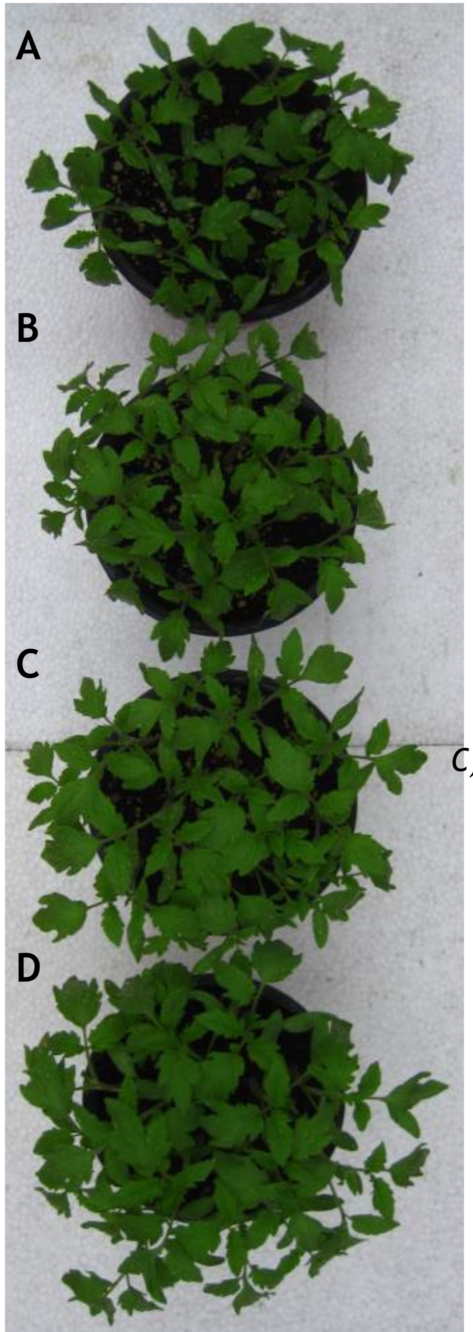


Kombinirani učinki trihodrem

Trichoderma sp's. also function as a Mycorrizhae, with the added benefit of paratizing various pests such as: *Fusarium, Pythium, Rhizoctonia, Cylindrocladium, Thielaviopsis, Sclerotinia y phytophthora.*

It grows around the root protecting against a great number of root pathogens and does not compete with other mycorrhizae. It also aids in mobilizing nutrients: N and P.





Mycorrhizal Symbiosis:

A)Control:

Kombinacija učinkov biotičnega varstva

B) Harpin Treatment:

"Harpin Proteins are produced in nature by certain bacterial plant pathogens. Many of the plants that those pathogens attack have developed receptors on their seeds, roots, and foliage to detect the presence of Harpin Proteins. This "early warning system" triggers signals throughout the plants to activate certain defensive and growth responses. These vigorous responses to the threat of disease help the plants survive the stresses and other threats the diseases present."

C) *Inoculated with Glomus fungi +Bacillus sp´s*

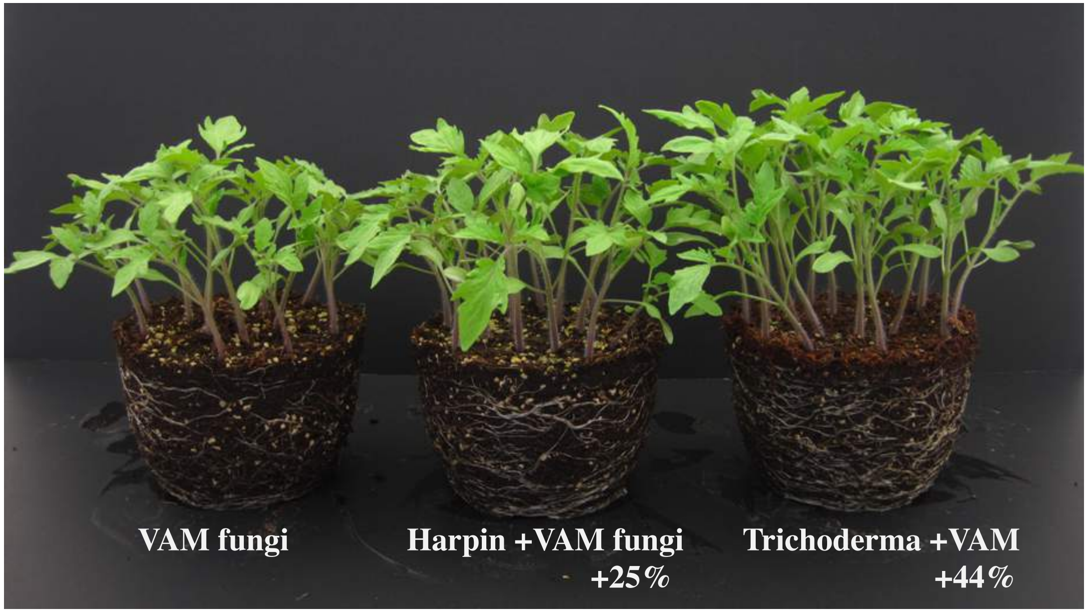
"Soil microorganisms improve plant nutrition, defense and stress tolerance"

D) Harpin + VAM fungi + Bacillu´s sp ´s

"New roots are quickly colonized when harpin induces plant metabolism and growth"

Kombinacija učinkov biotičnega varstva

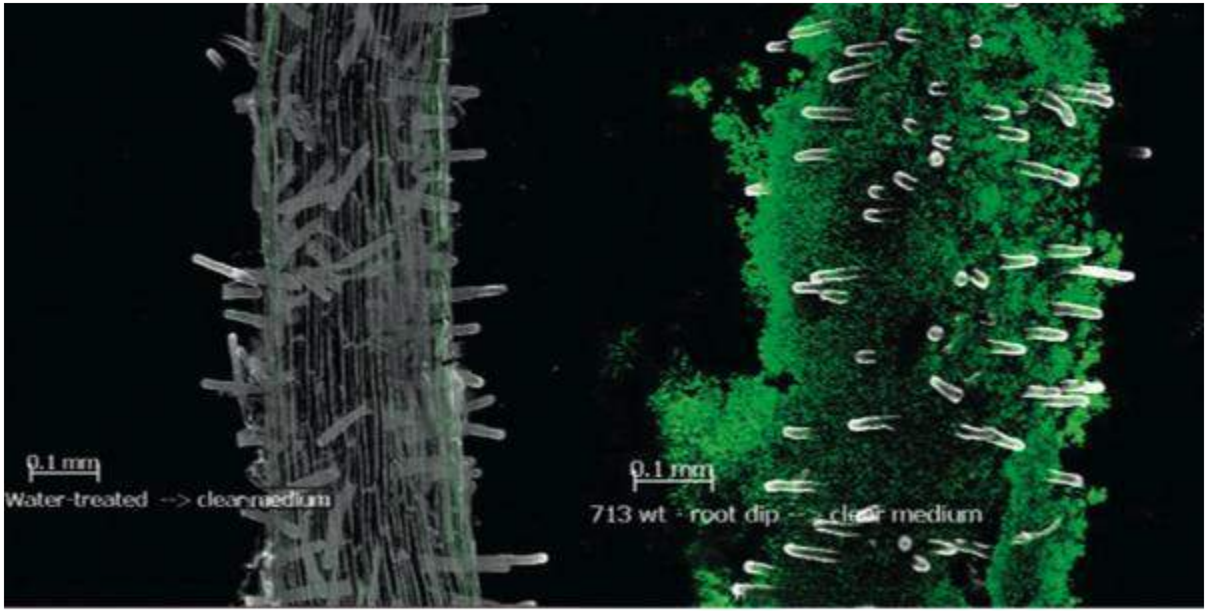
-Percentage represents biomass gain in relation to the first treatment (far right)
-All experiments used quality coconut coir and 10% sterilized compost as a substrate



-Percentage represents biomass gain in relation to the first treatment (far right)
-*Trichoderma* did not perform as a disease control agent, but still improved seedling development

MIKROBNI INOKULANTI - SMER MIKROBIOMSKA DIVERZITETA

NA RAZPOLAGO NA TISOČE VRST MIKROBOV KI DELAJO OBRAMBNI ŠČIT OKROG RASTLIN, OMOGOČAJO ODVZEM HRANIL IN IZLOČAJO IZLOČKE, KI SPODBUJAJO RAZVOJ RASTLINE Z NAMENOM DA RASTLINA IZLOČA SNOVI, KI JIH ONI IZKORIŠČAJO



Učinki na RASTLINA – MIKROBIOM RAZMERJA

Mention du Jury - Prix Ecoproduit pour le développement durable
Prix Entreprises & Environnement ÉDITION 2005

FRANCE CHITINE

Plant protection by restoration of antagonistics microorganisms population in agro-ecosystems.

Sol-Actif® as natural agent of bio-stimulation.

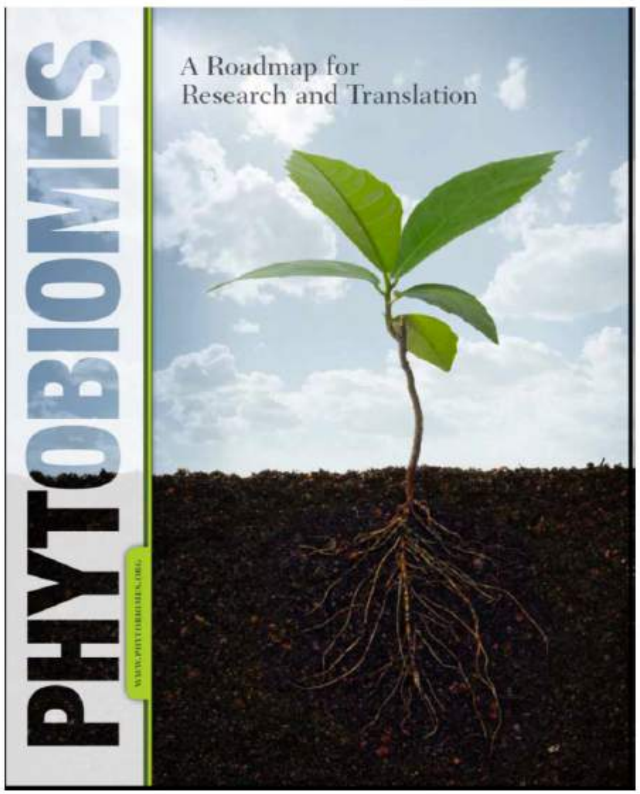
Biodiversity as an alternative to pesticides.

Soil organisms contribute to a wide range of essential services to the sustainable function of all agro-ecosystems, by acting as the primary driving agents of nutrient cycling, regulating the dynamics of soil organic matter, degrading organic matters, modifying soil physical structure and water regimes, enhancing the amount and efficiency of nutrient acquisition by the vegetation, enhancing plant health, neutralisation of pesticides. These services are not only essential to the functioning of natural agro-ecosystems but constitute an important resource for the sustainable management of agricultural systems. Soil biodiversity is a key to sustainable development.

Systematic recourse to pesticides has been a short-term response to damages caused to

> **Sol-Actif** (*3) is a soil organic amendment, it causes a very strong increase of bacterial faune. Antagonist micro-organism in greater number will colonise plants roots and enter in conflict with phytopathogen responsible for verticillioses, sclerotinoses, fusarioses and other diseases. Those micro-organisms will réduce capacity of pathogens to colonise roots of germinating seeds, plantlets and cuttings but also of adult plant after transplantation. **Sol-Actif** favour roots development, plant growth and production.

How Do We Get There: Phytobiomes Roadmap for Research and Translation



A new vision for agriculture:

Achieve sustainable crop productivity through a systems-level understanding of diverse interacting components

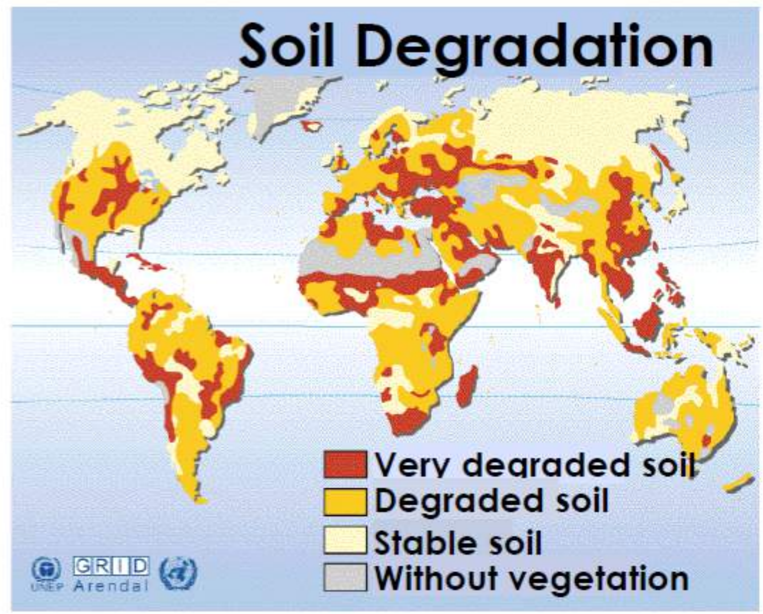
www.phytobiomes.org

Outcomes of this new vision for agriculture

Managed or engineered phytobiomes that promote:

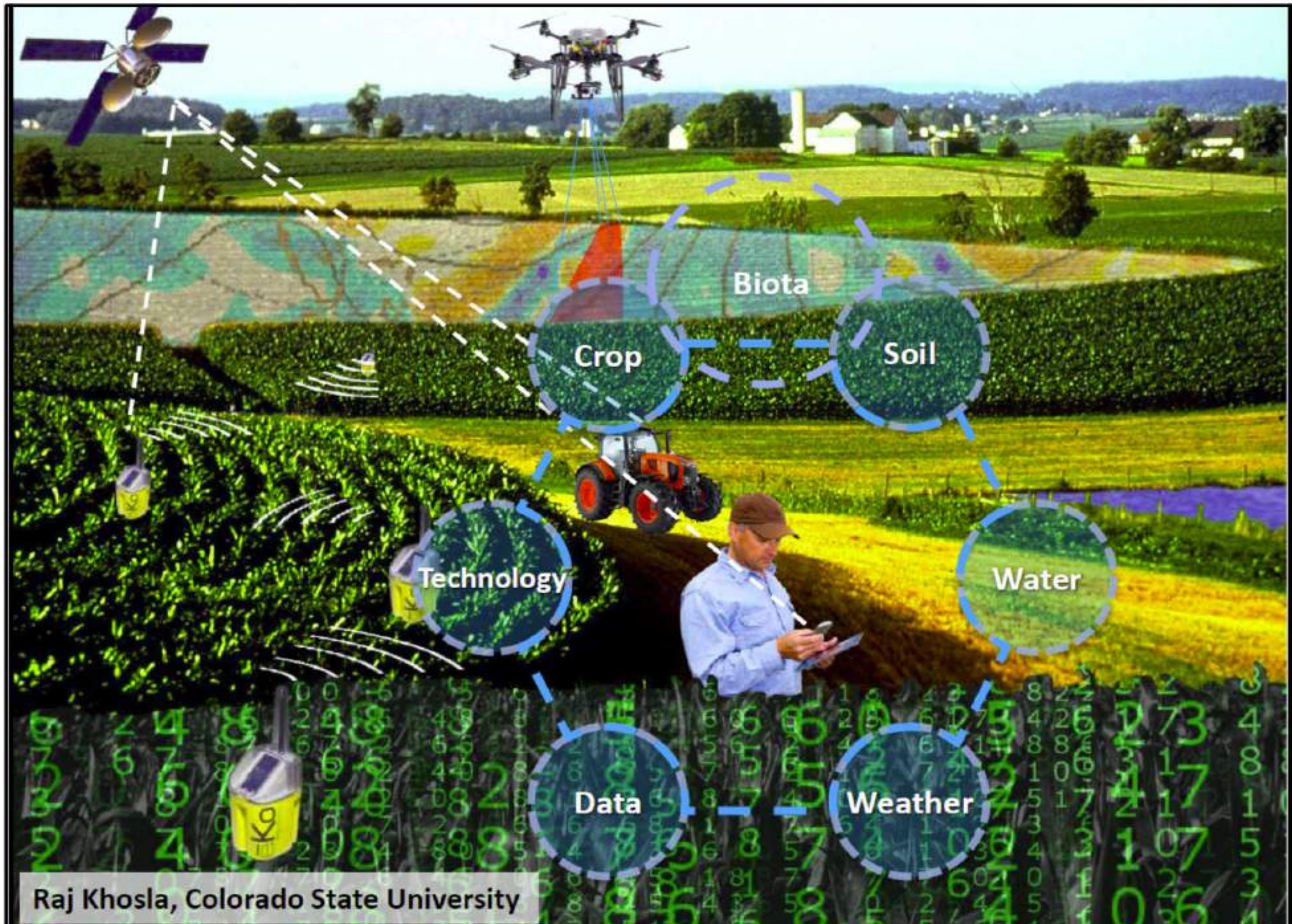
- **Effective rehabilitation of degraded and depleted lands worldwide**

***1.5 billion people depend on degraded lands for survival!**

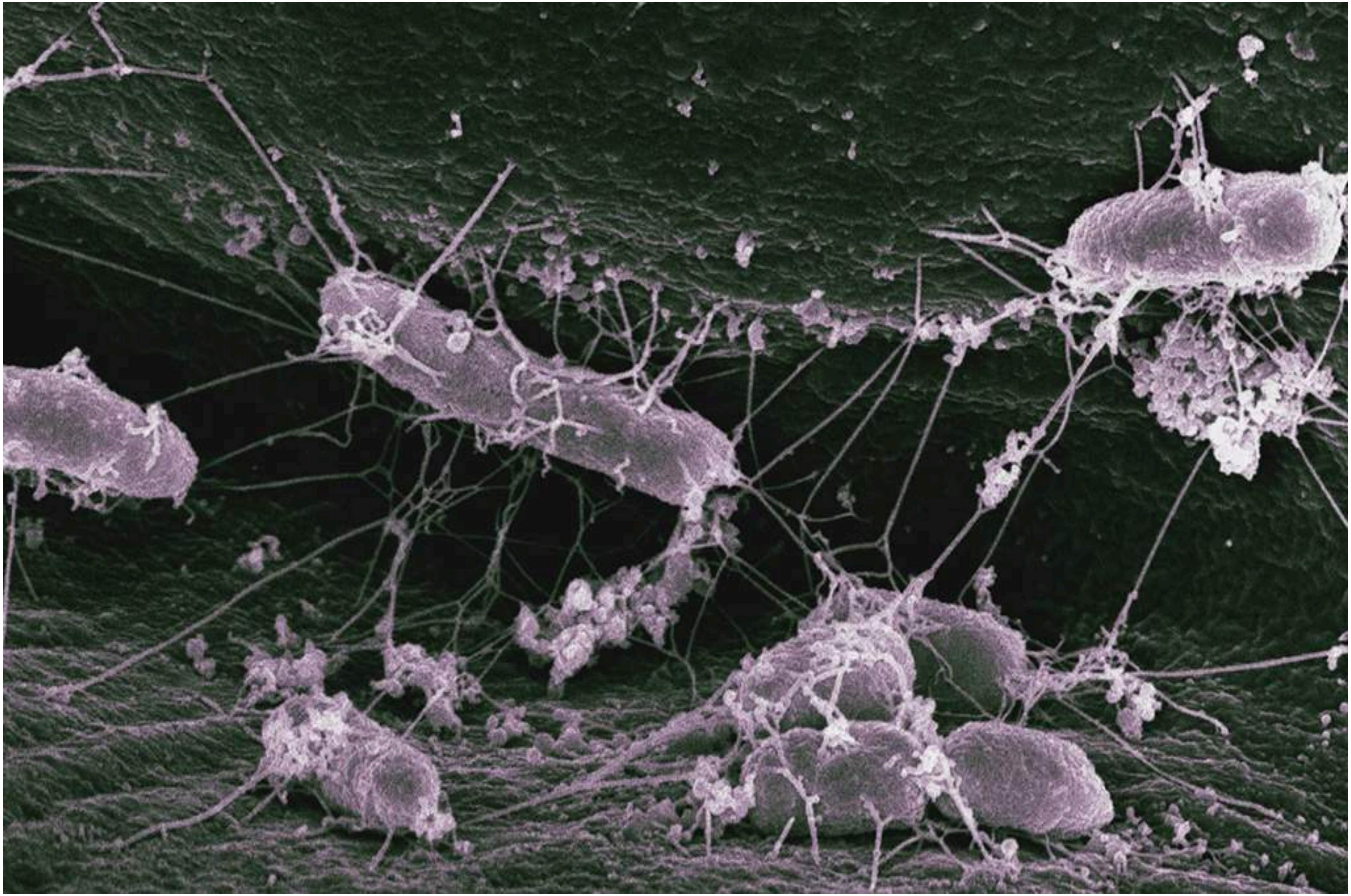


Source: UNEP

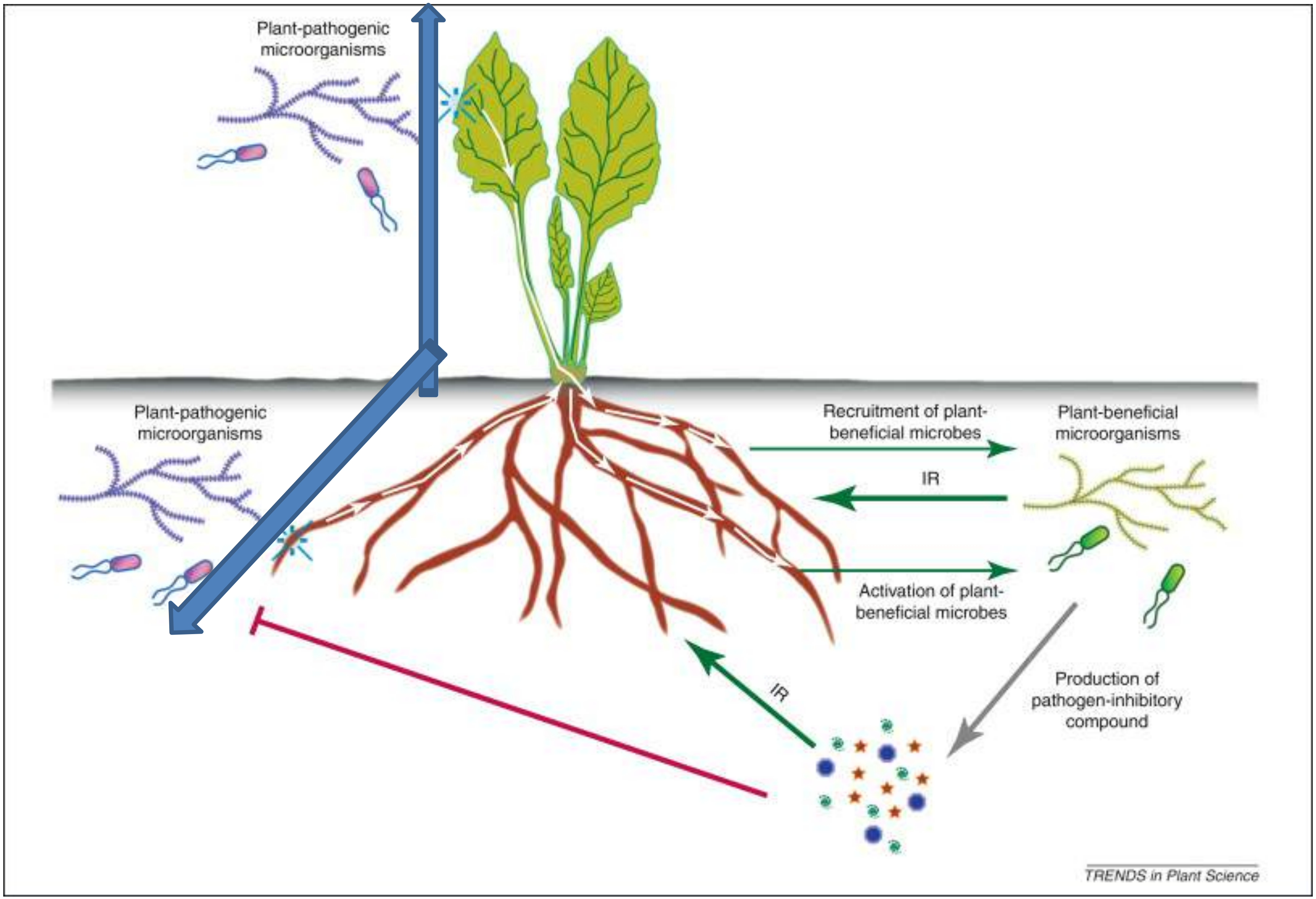
Result: Phytobiome Enabled-Next Generation Precision Agriculture



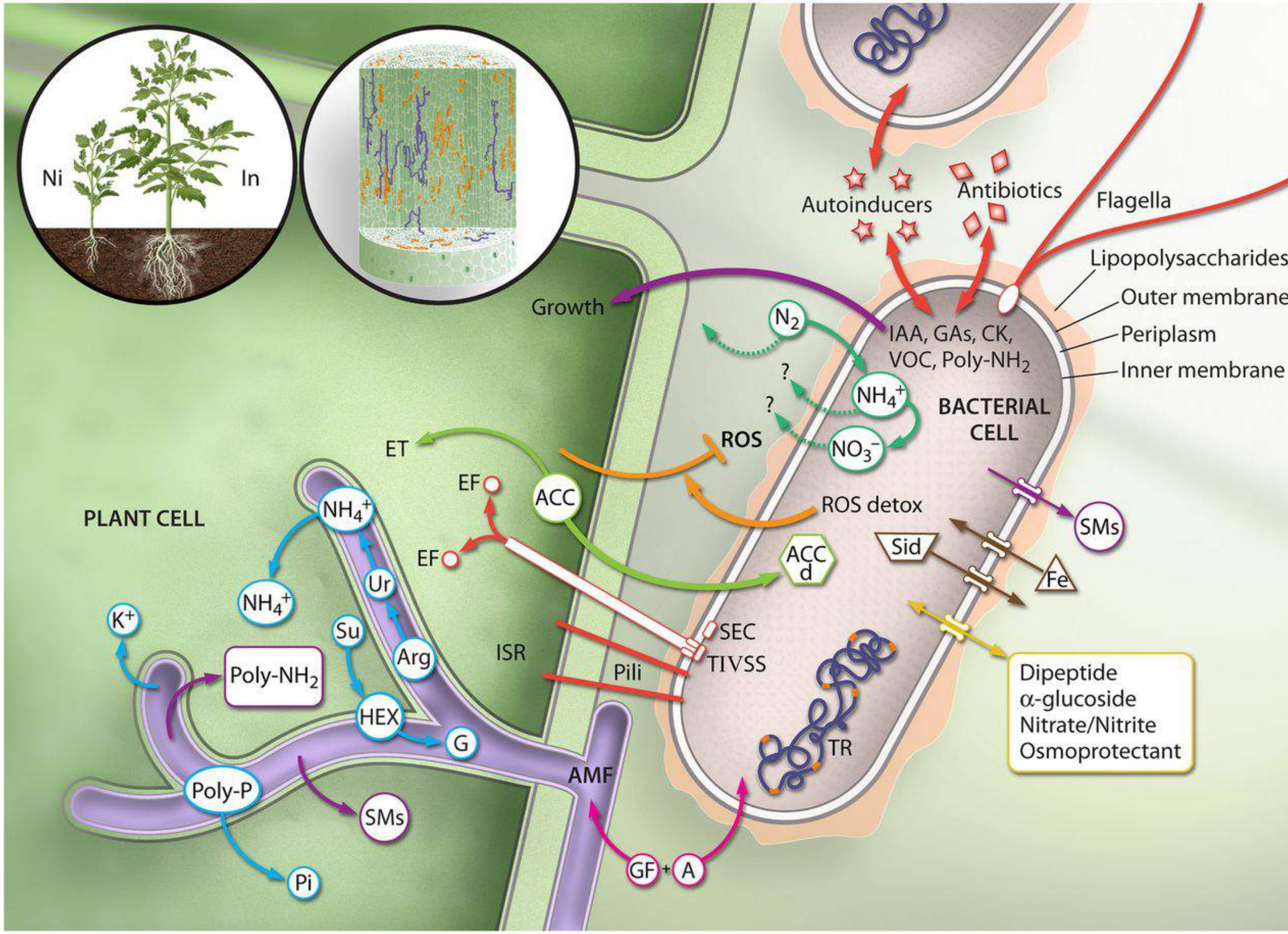
SPREMEMBE V DELOVANJEU RASTLINSKEGA MIKROBIOMA



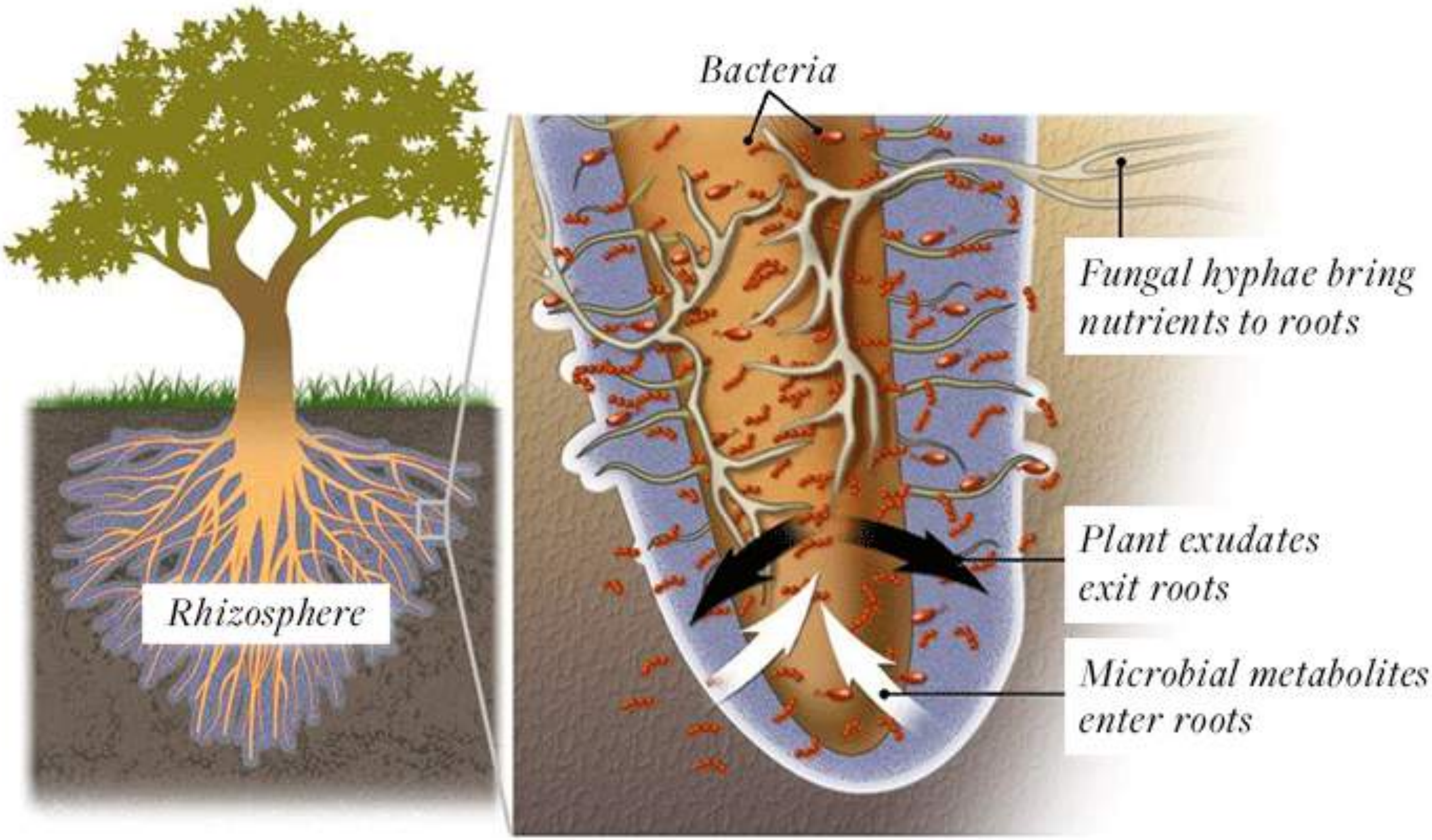
TEORIJA: RASTLINA S PRFEKTNO DELUJOČIM MIKROBNIM BIOMOM PRAKTIČNO NE MORE BITI USPEŠNO NAPADENA OD PATOGENIH MIKROORGANIZMOV



Beneficial properties of endophytes.



Pablo R. Hardoim et al. Microbiol. Mol. Biol. Rev. 2015;79:293-320


Bacteria
Fungal hyphae bring nutrients to roots
Plant exudates exit roots
Microbial metabolites enter roots
Rhizosphere

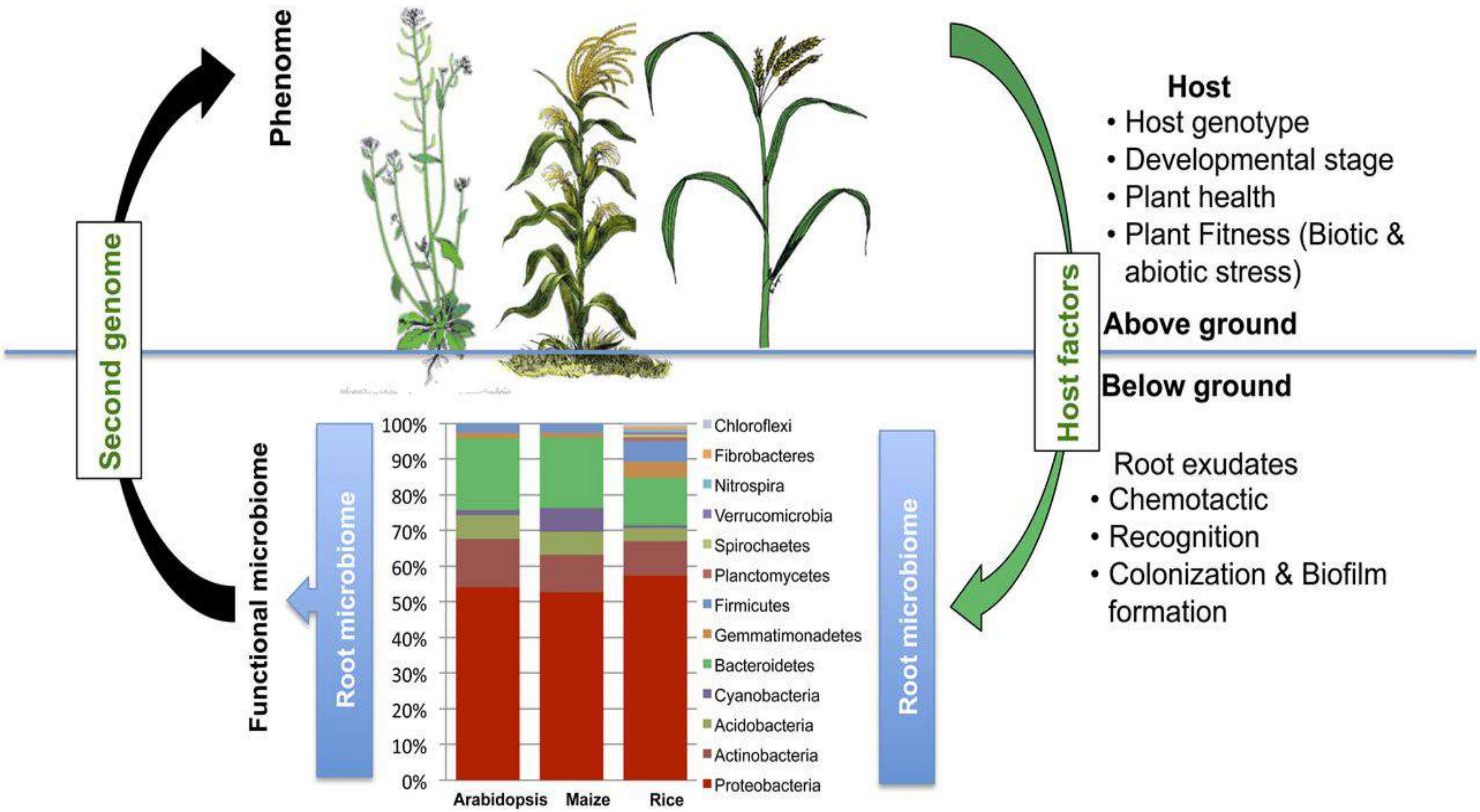
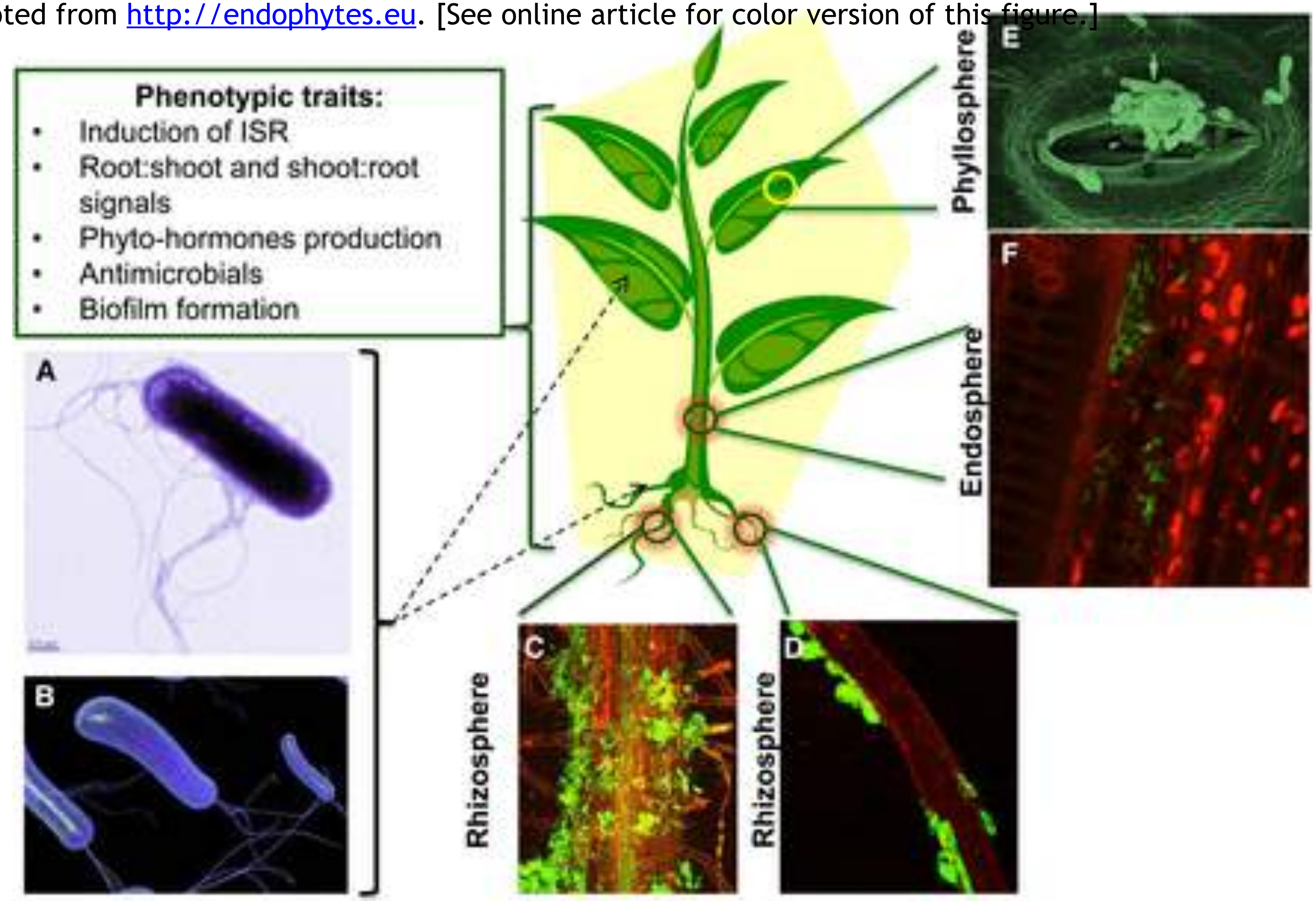


Figure 1. Rhizospheric microbiome composition based on a high-throughput analysis of three plant species, Arabidopsis, maize, and rice (adapted from Ikeda et al. [2011], Lundberg et al. [2012], and Peiffer et al. [2013]). The possible involvement of plant-derived factors involved in shaping the rhizospheric microbiome composition is shown. The usefulness and potential applications of the microbiome to host phenome establishment are discussed. [See online article for color version of this figure.]

Figure 2. Impact of single-isolate studies on model systems. To date, the majority of single-isolate studies have shown the impact on plants of both biotic and abiotic stress regimes. The phenotypes induced by single-isolate treatments are encouraging, yet several fundamental questions remain unanswered and are discussed. A and B, Electron microscopic images of *B. subtilis* FB17 (A) and a single isolate of *Pseudomonas fluorescens* (B). C and D, Visualization on biofilm of *B. subtilis* on Arabidopsis roots (C) and *P. fluorescens* on potato roots (D). E and F, Phyllosphere-associated *Methylobacterium* spp. (E) and endophytic *Burkholderia phytofirmans* strain PsJN-inside grapevine (*Vitis vinifera*; F). The dotted arrows show the application of single isolates through roots or leaves. Image sources are as follows: B is from http://www.buzzle.com/articles/pseudomonas-fluorescens.html; D is reproduced, with permission, from Krzyzanowska et al. (2012); E is reproduced, with permission, from Kutschera (2007); and F is adapted from http://endophytes.eu. [See online article for color version of this figure.]



Rastlinski, glivični in bakterijski stimulatorji ter huminske kisline za vnos v zemljo pred setvijo ali sajenjem

- Actiwave – hormonski prekurzorji iz alg
- Kalijev humat in leonarditna gnojila
- Mikrobi **Ogrod**, **EM-5**, drugi EM mikrobno obogateni organski dodatki, **NovaFermMulti**, **GHE Bio Root Plus**, **GHE Bio Worm**, **Hesi Root Complex**
- Pseudomonas fluorescens ali Rhyzobakterije (angl. Plant growth promoting Rhyzo-bacteria)
- Iz rastlinskih izvlečkov + fulvične kisline **HB-101**
- **Humistar, Bio Plantella Humin in Vita, Vigor Liquid, Humo-3G, GHE Daimond Black, Biobizz Topmax**
- **PRP GNOJILA**

Rastlinski, glivični in bakterijski stimulatorji za tretiranje semen, sadik in substratov rodnih grud

FFS

- Trichoderma (npr. **Trichodex**), Conyothirium minitans (npr. **Contans**), Phytium oligandrum (npr. Polyversum) in bakterij rodu Streptomices (npr. **Actinovate, FZB 53**), Bacillus (npr. **FZB 24, Rhyzo Vital 42 ali FZB 42**) in Pseudomonas (npr. **Proradix, Cedomon, Cerall**).
- Tretiranje semen - rastlinski izločki, ki prepojijo semensko lupino ali površje gomoljev in čebulic. Izločki zavrejo razvoj ŠO na semenih (primer **Biosept 33 SL** – ekstrakt iz grejpfruta, **Tillecur** – ekstrakt iz ogrščičnih semen za razkuževanje žit proti snetem).

- NI FFS
- Rizosferni organizmi z dodatki, ki so njihova hrana ali mikorizne glive. Primer so glive iz rodu Glomus (pripravka **Aegis SYM, Team micorriza in Tifi**). Lahko se le obogateni izločki alg (npr. **Alginure Wurzel**).
- Stimulatorji kalitve in razvoja prvih korenin in mladih rastlinic (npr. pripravek iz kokalja **Agrostimin** in Cirkon is ameriškega slamnika). Učinke pospešenega razvoja imajo natrijevi nitrofenolati (npr.

Kompostni in humusni čaji ter predelan živinski gnoj obogaten s rastlinskimi izvlečki

- Obstaja več postopkov priprave (tudi biodinamični postopki), ki se razlikujejo po tem, katere rastline (mahove, humosne substrate, deževniške komposte - lumbrihumus, žagovine) uporabimo in v kateri starosti, kako poteka fermentacija v kompostu, ali dodamo mikrobe (npr. **EM Bokashi, Brottrunk**) in hranila (minerale, melase, sirotke, …), v kakšnih razmerah poteka fermentacija (dostop zraka), s kakšnim postopkom in pri kateri temperaturi pridobimo končno brozgo za uporabo na rastlinah.

- Primer kombiniranih pripravkov iz predelanega živinskega gnoja, huminskih kislin in rastlinskih izvlečkov pri nas je **EkoBooster 1 in 2 in Eko Vital**, verjetno tudi **Bio Vega** tekoča gnojila in **Cofuna bio gnojila**. V to kategorijo lahko uvrstimo tudi fermentirane rastlinske materiale s strani različnih bakterij (npr. mlečnokislinskih). Na našem trgu je primer tekoči **žitni ferment (Bukovec)**.

NITROFENOLATI – POPRAVLJENA NARAVNA KEMIJA

frontiers in Plant Science

Front Plant Sci. 2014; 5: 713.
Published online 2014 Dec 16. doi: 10.3389/fpls.2014.00713
PMCID: PMC4267195

Biological mode of action of a nitrophenolates-based biostimulant: case study

Arkadiusz Przybysz,[1,*] Helena Gawrońska,[1] and Janina Gajc-Wolska[2]

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Abstract

The challenges facing modern plant production involve (i) responding to the demand for food and resources of plant origin from the world's rapidly growing population, (ii) coping with the negative impact of stressful conditions mainly due to anthropopressure, and (iii) meeting consumers' new requirements and preferences for food that is high in nutritive value, natural, and free from harmful chemical additives. Despite employing the most modern plant cultivation technologies and the progress that has been made in breeding programs, the genetically-determined crop potential is still far from being fully exploited. Consequently yield and quality are often reduced, making production less, both profitable and attractive. There is an increasing desire to reduce the chemical input in agriculture and there has been a change toward integrated plant management and sustainable, environmentally-friendly systems. Biostimulants are a category of relatively new products of diverse formulations that positively affect a plant's vital processes and whose impact is usually more evident under stressful conditions. In this paper, information is provided on the mode of action of a nitrophenolates-based biostimulant, Atonik, in model species and economically important crops grown under both field and controlled conditions in a growth chamber. The effects of Atonik on plant morphology, physiology, biochemistry (crops and model plant) and yield and yield parameters (crops) is demonstrated. Effects of other biostimulants on studied in this work processes/parameters are also presented in discussion.

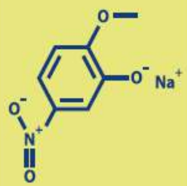
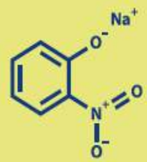
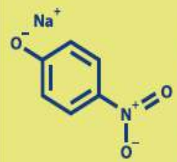
Keywords: biomass accumulation, efficiency of photosynthetic apparatus, growth and development, nitrophenolates, water status, yield, yield parameters

Introduction

The challenge facing modern plant production nowadays is to respond to the increasing demand for food and resources of plant origin by the world's rapidly growing population. Yield is negatively affected by various adverse environmental conditions and increasing anthropopression and despite employing the most

For decades plant growth regulators (PGRs) have been used to manage the growth of cotton plants, expedite maturity, and improve yield. One such PGR is Atonik (Asahi Co.,Ltd.; Nara Prefecture, Japan), a commercially available product containing the active ingredients, sodium 5-nitroguaiacolate ($NaC_7H_6NO_4$) 1.25 g L^{-1}, sodium ortho-nitrophenolate ($NaC_6H_4NO_3$) 2.5 g L^{-1}, and sodium para-nitrophenolate ($NaC_6H_4NO_3$) 3.75 g L^{-1}. These active ingredients, termed nitrophenolates, are found naturally in plants and stimulate plant growth by altering the activity of specific antioxidant enzymes, such as superoxide dismutase (SOD), catalase (CAT), and peroxidase (POX) (Djanaguiraman et al., 2004). These antioxidant enzymes are involved in the scavenging of reactive oxygen species (ROS), such as hydrogen peroxide (H_2O_2), hydroxyl (OH^-), and singlet oxygen (O_2^-) (Shanker et al., 2004). The ROS are able to attack polysaccharides, proteins, and nucleic acids (Matysik et al., 2002). Oxidative stress can occur when more ROS are produced than are metabolized (Dhindsa et al., 1981), so the ability to ameliorate or lessen the impact of ROS on the physiology and subsequent yield of the crop species is a desirable objective. Atonik has been used on various crops in more than 20 countries and was registered for pesticide use in cotton (*Gossypium hirsutum*), rice (*Oryza sativa*), and soybeans (*Glycine max*) in 1995 as ARYSTA-Exp-NP321 (Asahi Co.,Ltd.; Nara Prefecture, Japan). ARYSTA-Exp-NP321 has the trade name Chaperone, which was registered by the Environmental Protection Agency (EPA) with the patent pending in 2000. Chaperone was introduced into the cotton market in 2004, as a protein transport enhancer, and is currently the only agrochemical registered for cotton containing these nitrophenolates.

Active substances

Common name	Sodium 5-nitroguaiacolate	Sodium o-nitrophenolate	Sodium p-nitrophenolate
Chemical name	Sodium 2-methoxy-5--nitrophenolate	Sodium 2-nitrophenolate	Sodium 4-nitrophenolate
CAS No	67233-85-6	824-39-5	824-78-2
Molecular formula	$C_7H_6NNaO_4$	$C_6H_4NNaO_3$	$C_6H_4NNaO_3$
Molecular mass	191.1 g/mol	161.1 g/mol	161.1 g/mol
Structural formula			

Physical and Chemical properties

Appearance	Brown yellow liquid
pH	8.36 at 21°C
Explosives properties	Risks of explosion almost none in the recommended conditions of storage. Real risk in case of fire or accumulation of the emanations
Relative density	1 about
- Water	Miscible with water in all proportions. Gives limpid solution.
- Organic solvents	Non miscible with almost all organic solvents.

Toxicological information

Acute toxicity	
Ingestion (rat)	LD50 > 2000 mg/kg
Skin contact (rat)	LD50 > 2000 mg/kg b.w
Inhalation (rat)	LC_{50} (4 h) > 6.7 mg/l
Skin irritation (rabbit)	Not irritant
Eye irritation (rabbit)	Not irritant
Skin sensitization (guinea-pig)	Not a skin sensitizer (M&K)
Chronic toxicity	
Carcinogenicity	No suspected carcinogenic effects
Mutagenicity effects	No suspected mutagenic effects

Ecological information

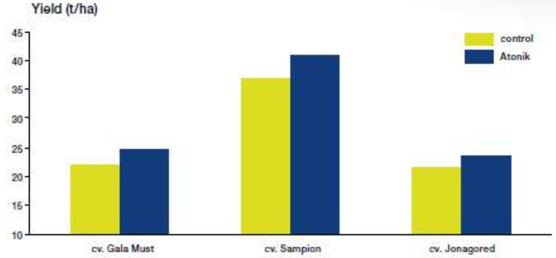
Aquatic organisms	
Fish	LC_{50} (96 h) *Cyprinus carpio* > 100 mg/l NOEL (96h) *Cyprinus carpio*> 100 mg/l
Daphnids	EC_{50} (48 h) daphnia > 100 mg/l NOEC 48 h) daphnia > 100 mg/l
Algae	ECr_{50} and ECb_{50} (72 h) *Scenedesmus subspicatus* > 100 mg/l NOEC $_r$ and $_b$ (72 h) *Scenedesmus subspicatus*: 100 mg/l
Aquatic plants	Acute (7d) Lemna EC_{50} >100 mg/l
Terrestrial organisms	
Birds	LD50 bird > 2000 mg/kg bw (pNP) LD50 bird = 1046 mg/kg bw (oNP) LD50 bird = 2067 mg/kg bw (5-NG)
Bees	LD50 oral = 61.2 µg/bee (pNP) LD50 oral = 123.2 µg/bee (oNP) LD_{50} oral = 131.6 µg/bee (5-NG) LD50 contact = 111 µg/bee (pNP) LD50 contact > 100 µg/bee (oNP) LD_{50} contact > 100 µg/bee (5-NG)
Earthworms	Earthworms (Eisenia fetida) LC50 = 310 mg/kg soil 8 weeks NOEC = 37.0 mg/kg soil
Persistence and degradability	
Soil	DT50 in soil = 3.3 days (pNP) DT50 in soil = 5.5 days (oNP) DT50 in soil = 0.6 days (5-NG)

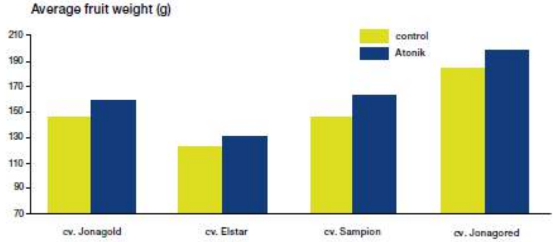
Atonik

Atonik has a very good profile regarding end user, consumer and environnement.

Apple

Rate:	0,6 l/ha
Nb of treatments	4
Timing:	BBCH 57 BBCH 65 BBCH 69 BBCH 71
Benefits:	higher resistance to spring frost better fruit setting better flower bud setting for next season higher efficiency of fruit thinning higher tolerance for low temperatures higher yield and quality

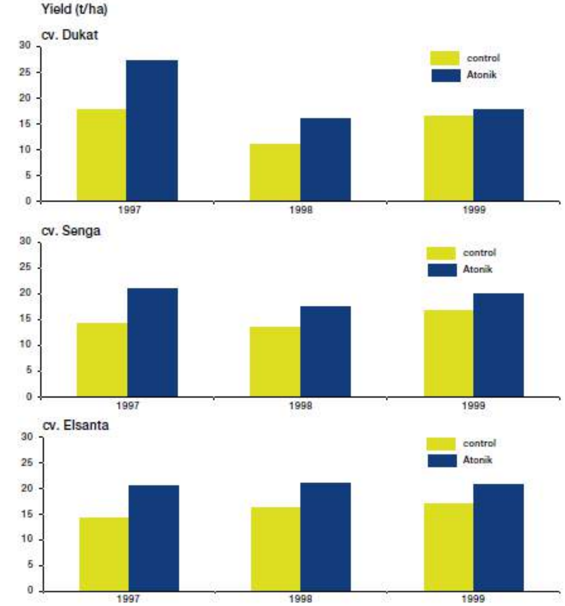




Atonik

Strawberry

Rate:	0,5 l/ha
Nb of treatments	4
Timing:	BBCH 12-14 BBCH 55-57 BBCH 65-67
Benefits:	higher leaf area earlier harvest better fruit setting higher yield and fruit quality



Seaweed extracts as biostimulants in horticulture

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A R T I C L E   I N F O

Article history:
Received 10 June 2015
Received in revised form 7 September 2015
Accepted 9 September 2015
Available online 28 September 2015

Keywords:
Seaweed extracts
Phytohormone
Plant biostimulant
Abiotic stress
Anti-stress effect

A B S T R A C T

Seaweeds are green, brown and red marine macroalgae. Extracts of brown seaweeds are widely used in horticulture crops largely for their plant growth-promoting effects and for their ameliorating effect on crop tolerance to abiotic stresses such as salinity, extreme temperatures, nutrient deficiency and drought. The chemical constituents of seaweed extract include complex polysaccharide, fatty acids, vitamins, phytohormones and mineral nutrients. Recent researches have shed light on the possible molecular mechanisms activated by seaweed extracts. In this review we give an update of the current state of our understanding of the chemical constituents of brown seaweed extracts and the physiological effects they induce on plants with particular reference to horticultural crops.

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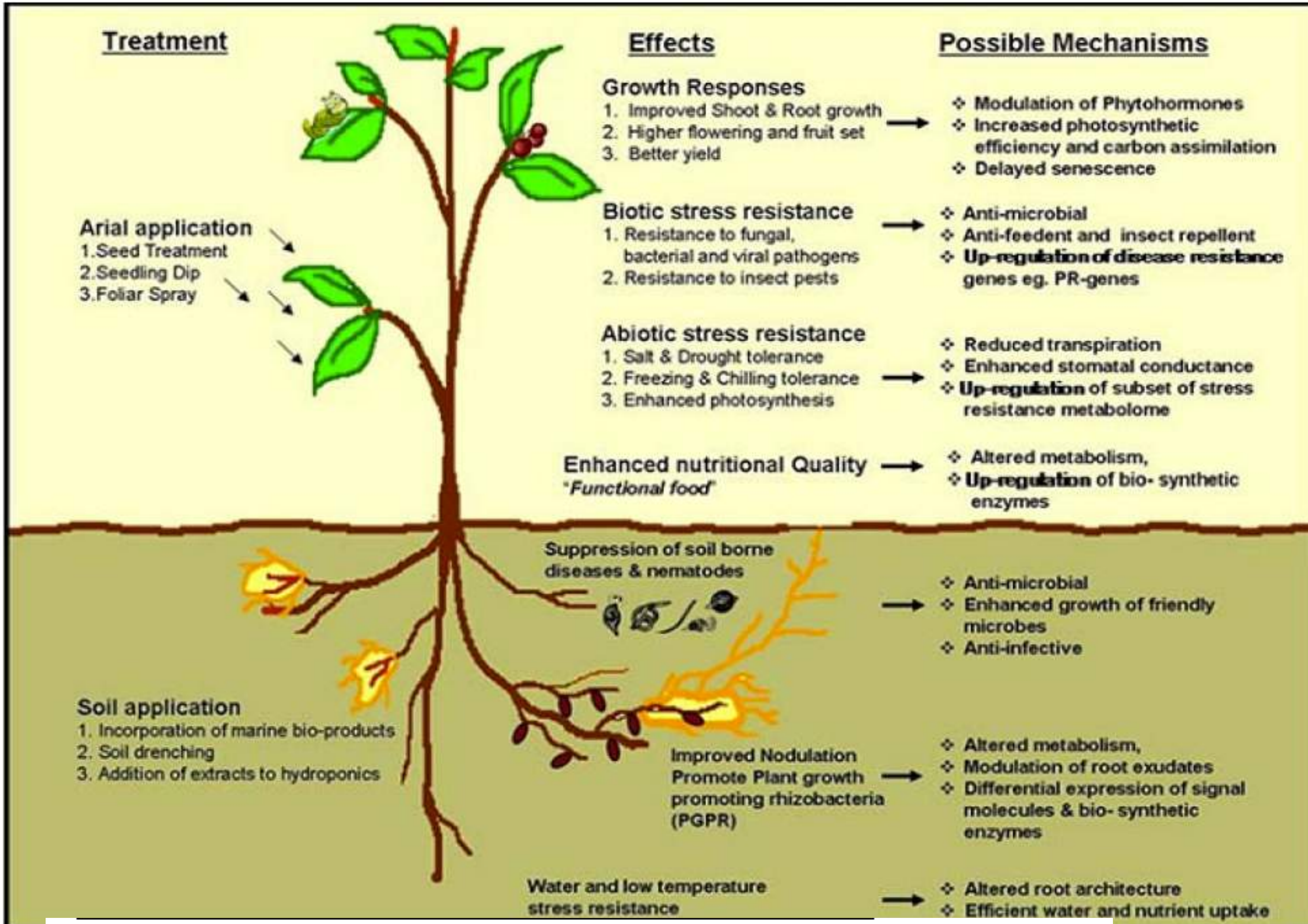


Fig. 1 Schematic representation of physiologic effects elicited by seaweed extracts and possible mechanism(s) of bioactivity(Cited from Wajahatullah, *et al.*,2009)

Nekaj učinkov pri pripravkih iz morskih alg (mešanica hranil, protinov, hormonov, bakterij, obrambnih prekurzorjev, SAR aktivatorjev, prostih encimov, …)

- Neposredno prehranjevanje rastline
- Vstopanje prekurzorjev za obrambne snovi proti patogenom
- Direktna aktivacija SAR preko elicitorskega sistema
- Vstopanje snovi za obvladovanje stresa (alge na obali so pod velikim stresom in imajo sisteme za obvladovanje stresa – velika nihanja fiziološkega stanja celic)
- Vstopanje hormonov
- Naselitev z bakterijami, ki branijo rastlino od zunaj in od znotraj
- Stimulacija rastline za oblikovaje in izločanje izločkov za stimulacijo obrambnega mikrobioma

Seaweed products

Table 2 Commercial seaweed products used in the agriculture and horticulture industries

Product name	Seaweed name	Company	Application
Acadian®	*Ascophyllum nodosum*	Acadian Agritech	Plant growth stimulant
Acid Buf	*Lithothamnium calcareum*	Chance & Hunt Limited	Animal feed
Agri-Gro Ultra	*Ascophyllum nodosum*	Agri Gro Marketing Inc.	Plant growth stimulant
AgroKelp	*Macrocystis pyrifera*	Algas y Bioderivados Marinos, S.A. de C.V.	Plant growth stimulant
Alg-A-Mic	*Ascophyllum nodosum*	BioBizz Worldwide N.V.	Plant growth stimulant
Bio-Genesis™ High Tide™	*Ascophyllum nodosum*	Green Air Products, Inc.	Plant growth stimulant
Biovita	*Ascophyllum nodosum*	PI Industries Ltd	Plant growth stimulant
Emerald RMA	Red marine algae	Dolphin Sea Vegetable Company	Health product
Espoma	*Ascophyllum nodosum*	The Espoma Company	Plant growth stimulant
Fartum®	Unspecified	Inversiones Patagonia S.A.	Biofertilizer
Guarantee®	*Ascophyllum nodosum*	MaineStream Organics	Plant growth stimulant
Kelp Meal	*Ascophyllum nodosum*	Acadian Seaplants Ltd	Plant growth stimulant
Kelpak	*Ecklonia maxima*	BASF	Plant growth stimulant
Kelpro	*Ascophyllum nodosum*	Tecniprocesos Biologicos, S.A. de C.V.	Plant growth stimulant
Kelprosoil	*Ascophyllum nodosum*	Productos del Pacifico, S.A. deC.V.	Plant growth stimulant
Maxicrop	*Ascophyllum nodosum*	Maxicrop USA, Inc.	Plant growth stimulant
Nitrozime	*Ascophyllum nodosum*	Hydrodynamics International Inc.	Plant growth stimulant
Profert®	*Durvillea antarctica*	BASF	Plant biostimulant
Sea Winner	Unspecified	China Ocean University Product Development Co., Ltd	Plant biostimulant
Seanure	Unspecified	Farmura Ltd.	Plant growth stimulant
Seasol®	*Durvillea potatorum*	Seasol International Pty Ltd	Plant growth stimulant
Soluble Seaweed Extract	*Ascophyllum nodosum*	Technaflora Plant Products, LTD	Plant growth stimulant
Stimplex®	*Ascophyllum nodosum*	Acadian Agritech	Plant growth stimulant
Synergy	*Ascophyllum nodosum*	Green Air Products, Inc.	Plant growth stimulant
Tasco®	*Ascophyllum nodosum*	Acadian Agritech	Animal feed

Cited from Wajahatullah Khan,2009

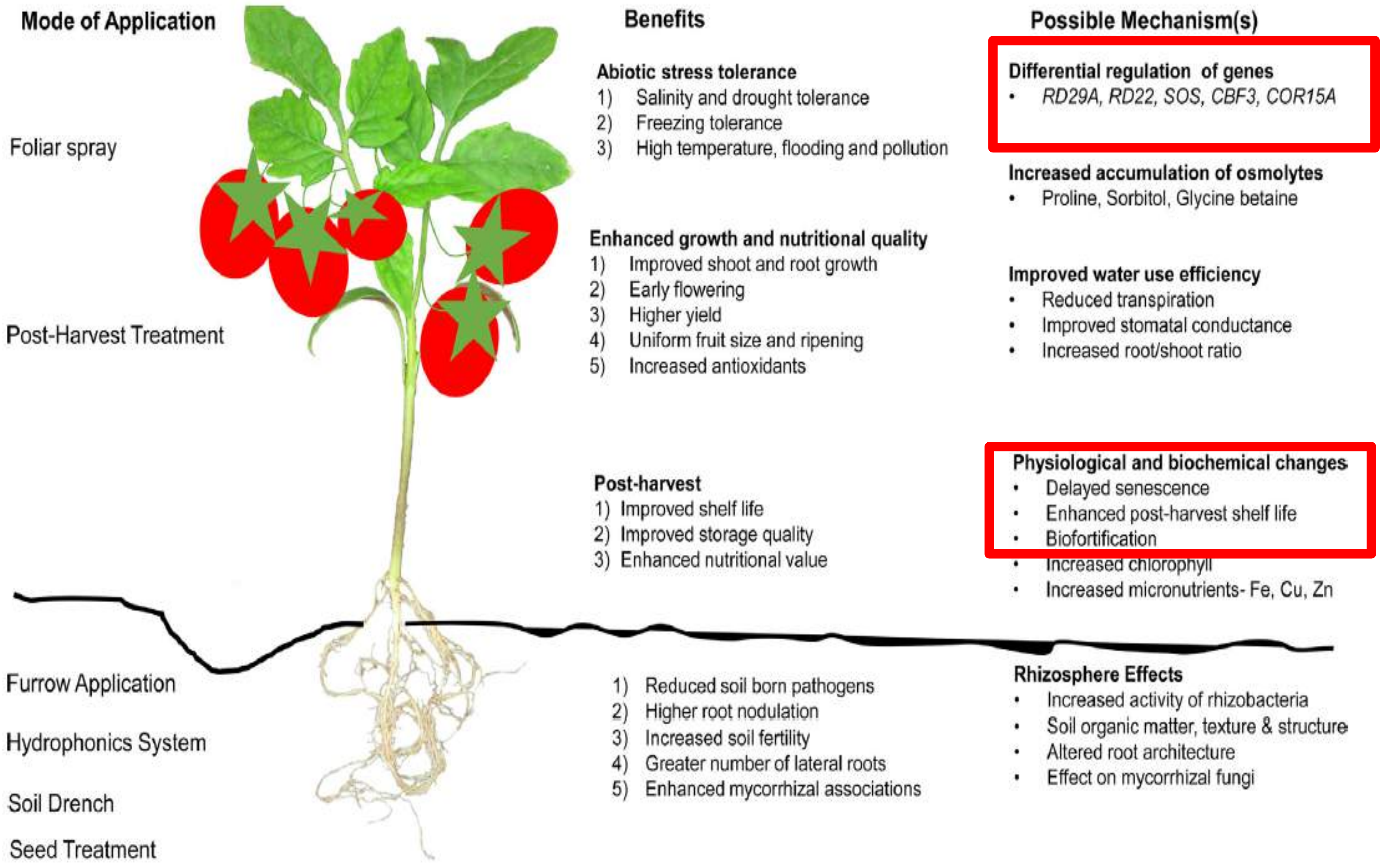


Fig. 1. Schematic diagram depicting methods of application of seaweed extracts, and their effects on plant and mechanisms of action.

- **Rastlinski stimulatorji in hidrolizirani proteini za nanos na nadzemne dele rastlin**

- **Izhodišče alge**
- Primeri pripravkov na našem trgu so: **Algo-plazmin, AlgoVital, Algomin, Goëmar BM86, OceanGreen, Alga95, Prestress, GHE BioWeed, Plagron Alga** in številni drugi. Drugače zelo znani so pripravki **Kelpak, Algimag, Maxicrop in Wuxal Ascofol**.

PREHAJANJE PREPARATOV IZ ALG V kategorijo SAR FITOFARMACEVTSKA SREDSTVA

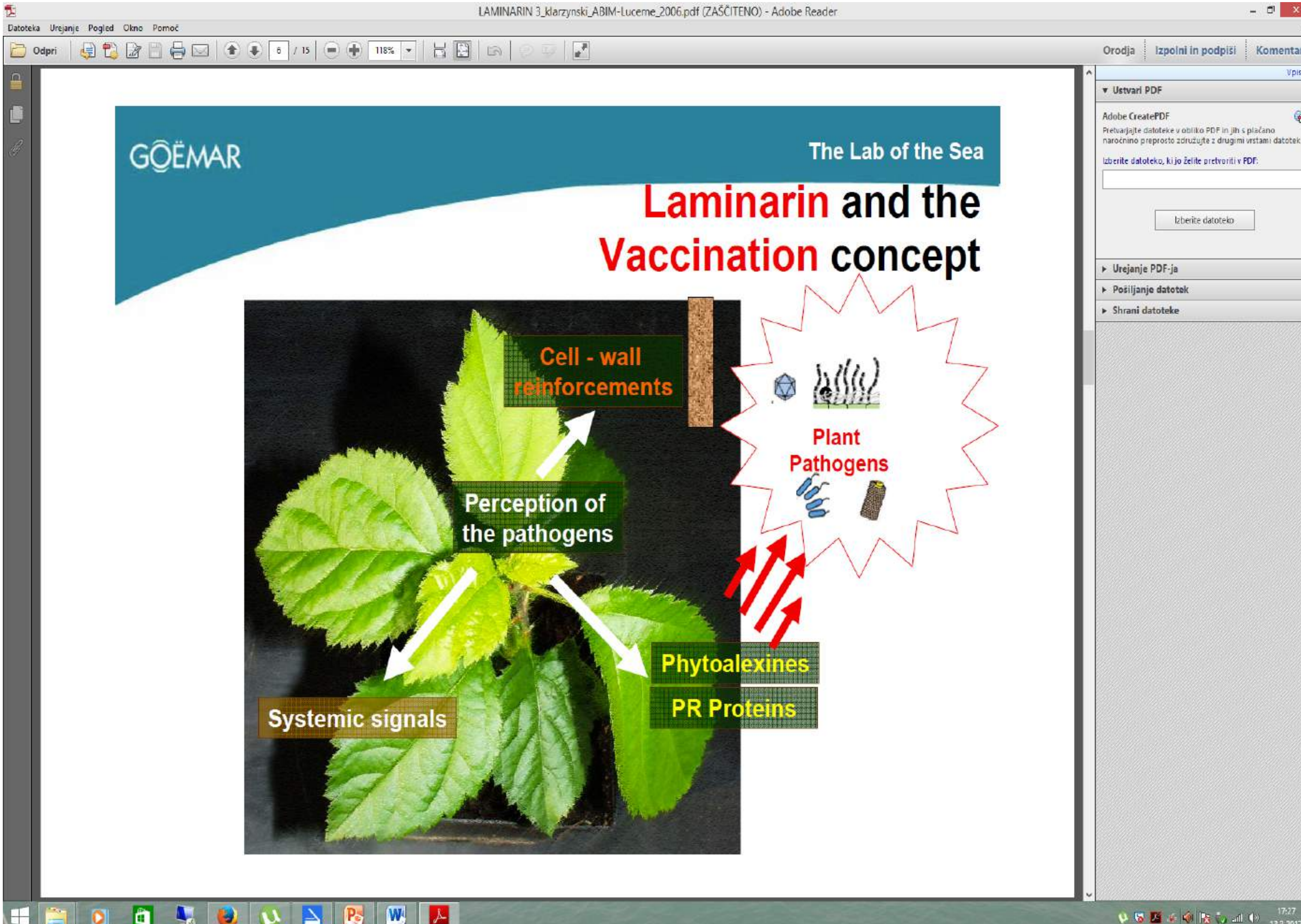
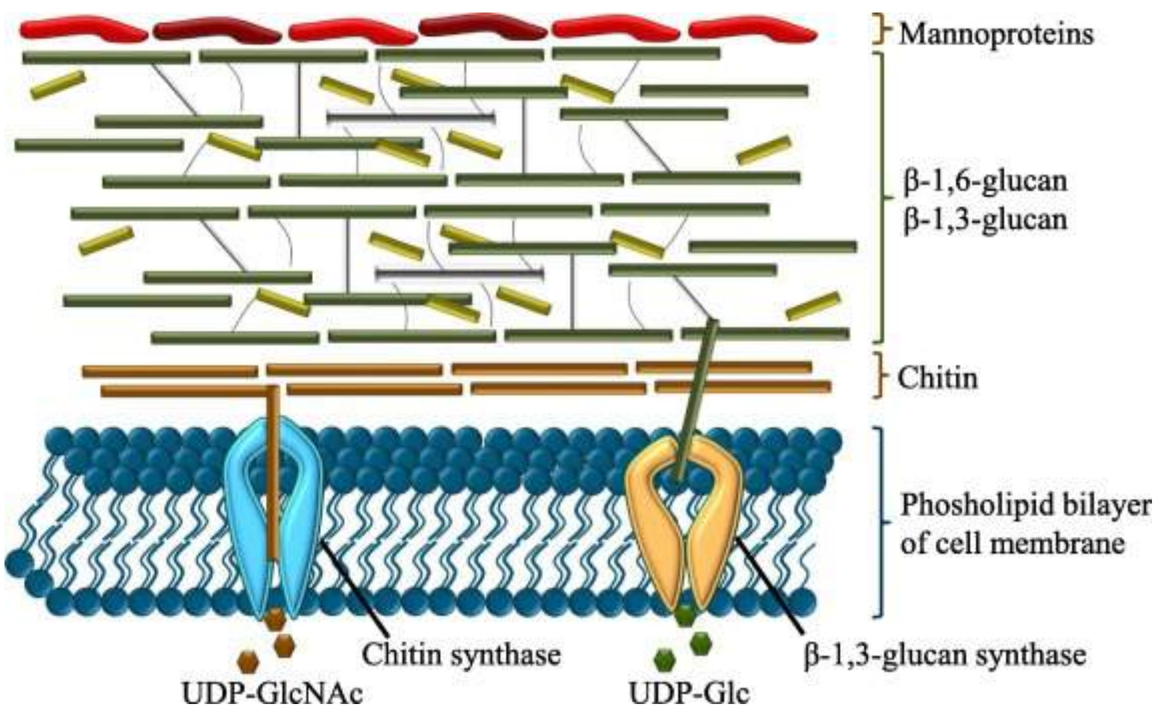


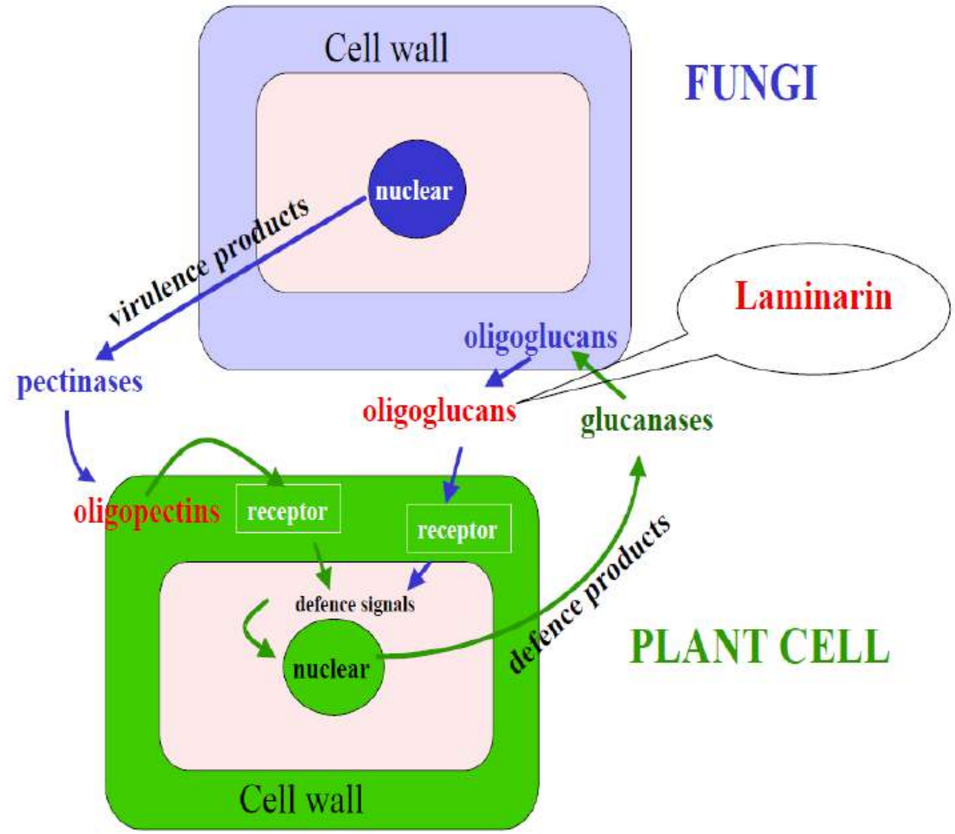
Fig. 1.
Schematic overview of fungal cell wall composition. The fungal cell wall mainly consists of chitin (brown) located close to the cell membrane, β-1,3- and β-1,6-glucan (green) adjacent to the chitin fibers and mannoproteins (red) as the outermost part of the cell wall. Chitin is synthesized by transferring N-acetylglucosamine residues from uridine diphosphate-N-acetylglucosamine (UDPGlcNAc; brown hexagon) to a growing fiber that is shuttled through the cell membrane by the transmembrane chitin synthase (light blue). β-1,3-glucan is synthesized by a β-1,3-glucan synthase (yellow) that uses uridine diphosphate-N-glucose (UDPGlc; green hexagon) as a donor to transfer glucose to the extruded β-1,3-glucan fiber.



GOËMAR

The Lab of the Sea

Elicitors and plant-pathogen relations



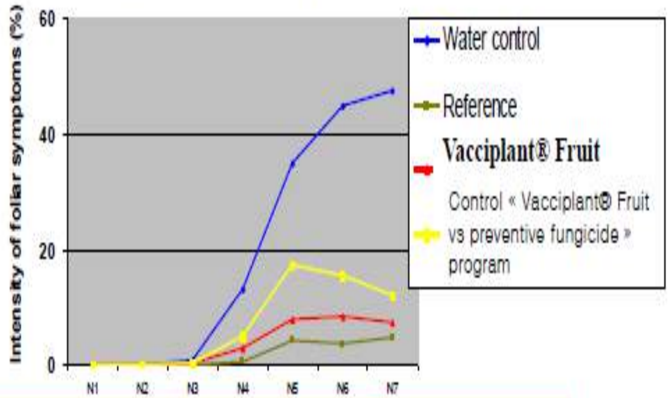
GOËMAR
LE LABORATOIRE DE LA MER

Vacciplant®

3. Vacciplant® Fruit management within an anti powdery mildew program

EVALUATION ON LEAVES

Average 3 trials (CATE, PROMOVERT 2006, SAA 2007)
Vaccipant F. efficacy on young leaves



In the Vacciplant® Fruit program, the 2 thirds of the fungicide applications have been replaced by Vacciplant® Fruit, with a protection efficacy equivalent to the reference « all fongicide ».

La natu... i stimule la nature.

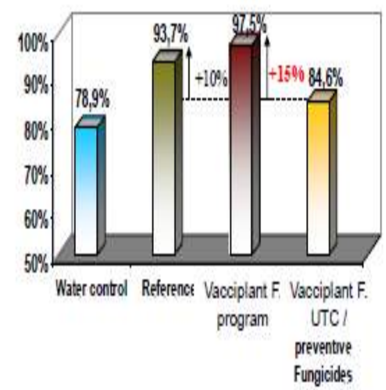
GOËMAR
LE LABORATOIRE DE LA MER

Vacciplant®

3. Vacciplant® Fruit management within an anti powdery mildew program

EVALUATION ON FRUITS

Average 2 trials HORTIS et PHYTEX
Proportion of marketable fruits



Benefits of Vacciplant® Fruit as a program :

- Trial Hortis : Vacciplant® Fruit enabled to replace 5 fungicides applications out of 8
- Essai Phytex : Vacciplant® Fruit enabled to replace 4 fungicides applications out of 6
- On both trials : Vacciplant® Fruit enabled to obtain 15 % of extra marketable fruits. Under the same conditions, preventive fungicides enabled to obtain only 10 % extra.

The proportion of marketable fruits obtained with the Vacciplant® Fruit program is higher than the one obtained by the reference program.

La natu... stimule la nature.

GOËMAR
LE LABORATOIRE DE LA MER

Vacciplant®

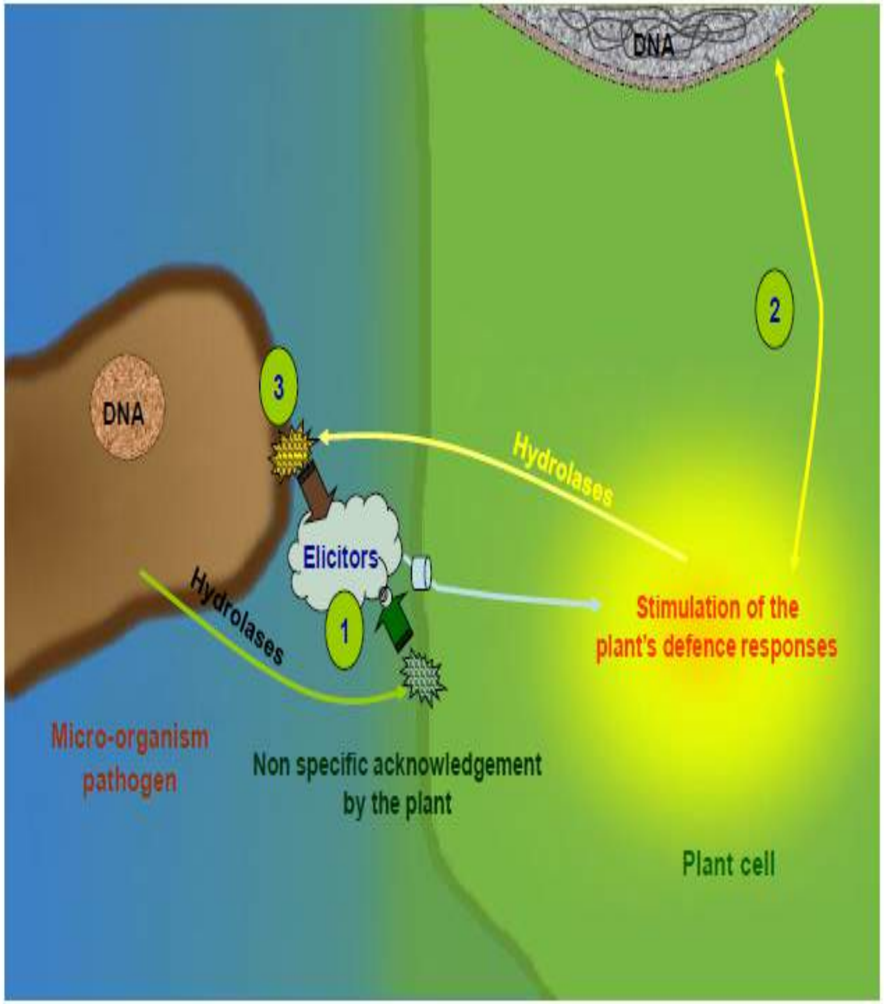
Plants have developed defence systems to resist against their aggressors' attacks.

1. Acknowledgement = Elicitors from the degradation of the plant walls or of the pathogen

2. The plant sets up its own defences:
   - Reinforcement of the cellular walls
   - Production of the active components on the aggressor

3. The aggressor suffers the consequences of its attack

La nature qui stimule la nature.



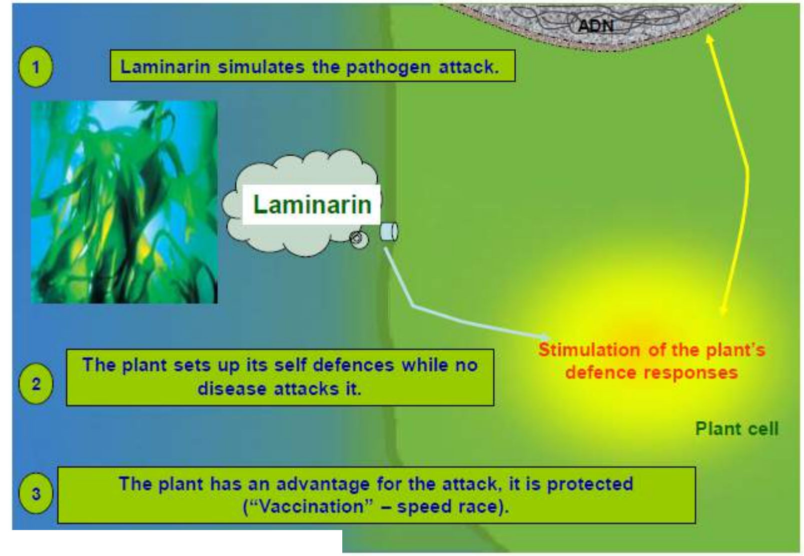
GOËMAR LE LABORATOIRE DE LA MER — Vacciplant®

Laminarin : mode of action

Reserve oligosaccharide of seaweed, Laminarin looks just like fungi wall degradation products:

It's an elicitor.

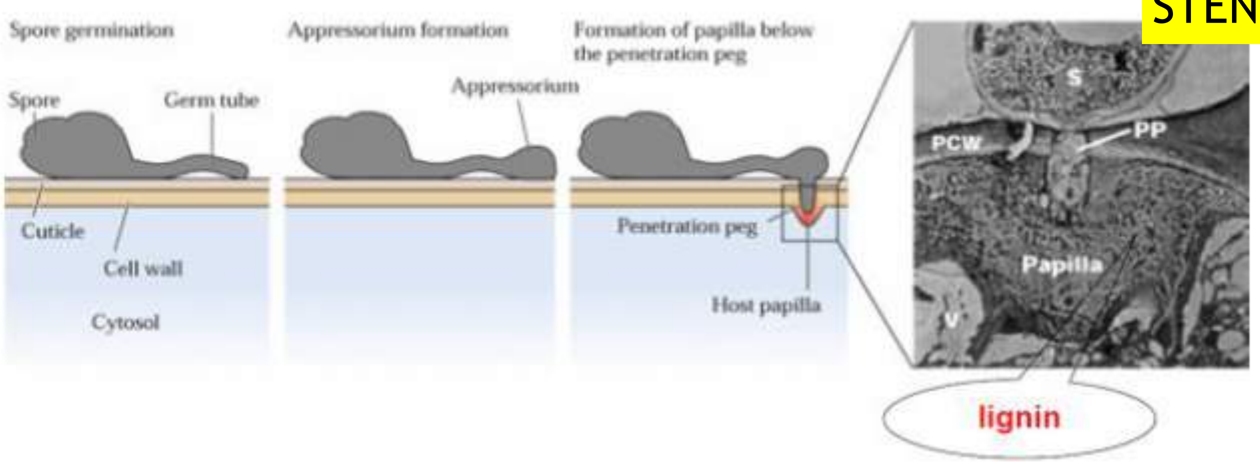
ELICITORSKI UČINEK



GOËMAR LE LABORATOIRE DE LA MER — Vacciplant®

Cell wall strengthening

UČINEK OJAČEVALCA CELIČNIH STEN



Protein hydrolysates as biostimulants in horticulture

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ARTICLE INFO

Article history:
Received 21 June 2015
Received in revised form 21 August 2015
Accepted 24 August 2015
Available online 4 September 2015

Keywords:
Amino acids
Biostimulants
Enzymatic hydrolysis
Horticultural crops
Peptides
Product quality

ABSTRACT

In recent years, new strategies have been proposed in order to improve the sustainability of production systems for horticultural crops. A promising tool would be the use of substances and/or microorganisms defined also as 'biostimulants' able to enhance crop quality parameters, nutrient efficiency and abiotic stress tolerance. Protein hydrolysates (PHs) are an important group of plant biostimulants based on a mixture of peptides and amino acids that have received increasing attention in the recent years due to their positive effects on crop performances. PHs are mainly produced by enzymatic and/or chemical hydrolysis of proteins from animal- or plant-derived raw materials. The current review gives an overview of the biostimulant properties of PHs on productivity and product quality of horticultural crops, in particular fruit trees, vegetables, flower crops and ornamentals. After a brief introduction on PHs as plant biostimulants, this review focuses on the classification and chemical composition of PHs according to the source of proteins and method of protein hydrolysis. The plant uptake and transport of amino acids and peptides and the effects of PHs on primary and secondary metabolism as well as the biochemical and physiological processes conferring tolerance to abiotic stress are also covered. The review concludes by proposing several perspectives for future research aiming to understand the mode of action of PHs based on their composition and also to define the suitable time and dose of application.

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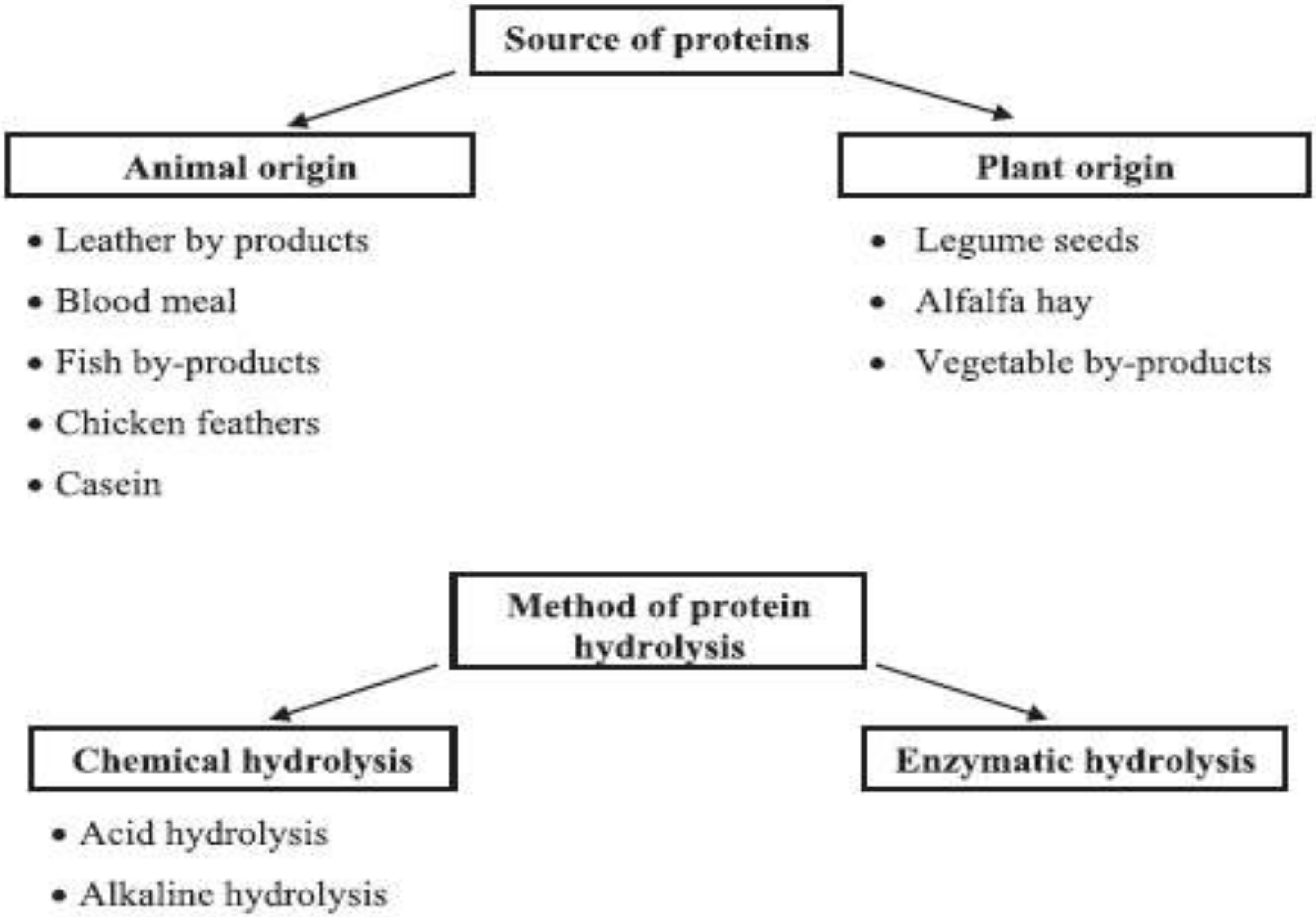


Fig. 1. Classification criteria of protein hydrolysates on the basis of protein source and the method of protein hydrolysis used in the production process.

Table 2
Effects of protein hydrolysates (PHs) on horticultural crops.

Crop	Type of PH	PH application mode	Experimental conditions	Effects	References
Banana	Chicken feather derived PH	Root and foliar	Field trial	Early flowering; increased nutrient, chlorophyll content, and proline in leaves; reduced sugars, proteins, amino acids, phenolics and flavonoids in fruits	Gurav and Jadhav (2013)
Corn	PHs from meat flour or alfalfa	Root	Hydroponic system under growth chamber	Increased root and leaf growth, and nitrate reductase and glutamine synthetase activities	Ertani et al. (2009)
Corn	Alfalfa derived PH	Root	Hydroponic system under growth chamber	Increased crop salinity tolerance, nitrogen assimilation and activity of antioxidant systems	Ertani et al. (2013)
Grapevine	PH of distiller's dried grains and carob germ flour	Root	Field trial	Increased total phenolics, and anthocyanin content in grape juice	Parrado et al. (2007)
Grapevine	PHs from soybean or casein	Foliar	Field trial	Up-regulated defense genes encoding pathogenesis-related proteins and the stilbene synthase enzyme; increased resistance to *Plasmopara viticola*	Lachhab et al. (2014)
Grapevine	Plant derived PH	Foliar	Field trial	Increased tolerance to drought, soluble solids, total phenols and anthocyanins in fruits	Boselli et al. (2015)
Kiwifruit	Animal derived PHs with different molecular weights	Foliar	Pot trial	Shoot and root biomass were increased by PH fractions with the lowest molecular weight especially at low rates	Quartieri et al. (2002)
Lettuce	Plant derived PH (Trainer)	Root and foliar	Pot culture under greenhouse using saline and non-saline solution	Increased crop tolerance to salinity, chlorophyll fluorescence, nitrogen and phosphorus content of leaves	Lucini et al. (2015)
Lettuce	Plant derived PH (Trainer)	Root	Hydroponic system with two concentration of nutrient solution	Increased yield, SPAD index, and nitrogen content of leaves	Colla et al. (2013)
Lettuce	Plant derived PH (Aminol 16)	Root and foliar	Greenhouse crop during winter season; foliar and soil application of PH	Increased crop uniformity, and antioxidant activity; reduced nitrates in leaves	Tsouvaltzis et al. (2014)
Lettuce	Animal derived PH (Terra-Sorb Foliar)	Foliar	Pot culture in growth chamber under cold stress conditions	Increased plant fresh weight and stomatal conductance	Botta (2013)
Lily	Animal derived PH and alfalfa derived PH	Foliar	Pot culture under greenhouse conditions	Reduced the length of crop cycle; increased leaf area, diameter of flower buds, and stem and bulb dry weight	De Lucia and Vecchietti (2012)
Olive	Animal derived-PH (Siapton)	Foliar	In vivo and in vitro trials	Increased pollen tube elongation	Viti et al. (1990)
Papaya	Animal derived-PH (Siapton)	Foliar	Field trial	Increased yield	Morales-Pajan and Stall (2003)
Passionfruit	Animal derived PH	Foliar	Nursery	Increased seedling growth	Morales-Pajan and Stall (2004)
Pepper	Alfalfa derived PH	Foliar	Pot culture under greenhouse conditions	Increased fresh weight and number of fruits, and secondary metabolites in fruits	Ertani et al. (2014)
Pepper	Animal derived PH plus micronutrients (Fosfonutren)	Foliar	Pot culture under greenhouse conditions during fall-winter season	Decreased growth, yield and efficiency and utilization of nitrates	Ruiz et al. (2000)
Persimmon	Animal derived PH containing Ca (Stressal)	Root	Field trial under saline conditions	Decreased Cl uptake, leaf necrosis, and leaf water potential	Visconti et al. (2015)
Spinach	Animal derived PH (Siapton)	Foliar	Field trials in spring and autumn seasons using two cultivars	No effect on yield; positive or no effect on dry matter and nitrate content of leaves	Kunicki et al. (2010)
Strawberry	Animal derived PH (Aminoflor)	Foliar	Bag culture under greenhouse conditions	Decreased weight of daughter plants	Lisiecka et al. (2011)
Tomato	Carob germ derived PH	Root	Pot culture under greenhouse condition	Increased plant height, number of flowers, and number of fruits	Parrado et al. (2008)
Tomato	Animal and plant derived PHs	Root and foliar	Hydroponic system with plants grown in Fe-sufficient nutrient solution or in lime-induced Fe deficiency	Growth depression with animal derived PH while plant derived PH enhanced root Fe(III)-chelate reductase activity, chlorophyll concentration, and leaf Fe concentration under lime conditions	Cerdán et al. (2013)
Tomato	Plant derived PH (Trainer)	Root	Soilless culture in growth chamber	Increased rooting and shoot growth	Colla et al. (2014)

- **Rastlinski stimulatorji in hidrolizirani proteini za nanos na nadzemne dele rastlin**

- Pripravki z hitrim prehranskim in SAR učinkom:
- Delfan Plus, **Poly-amin, Alga prox, Multi pepton, Protifert,** Drin, **Auxigro, Aminovital, Diaglutin,** Trainer,
- Na trgu je vse več pripravkov, ki kombinirajo izločke alg, hidrolizirane proteine, vitamine (npr. C in K), polisaharide in rastlinske hormone (betaini, giberelini, citokinini, …) in **metabolne prekurzorje (glutation**). Primer je serija visoko koncentriranih biostimulantnih pripravkov proizvajalca Valagro: Kendal, **Megafol**, Svit, Viva in drugi.
- Poznamo tudi tako imenovane »harpin« pripravke, ki vsebuje proteine patogenih bakterij (harpin αβ), ki zelo hitro aktivirajo SAR mehanizme rastlin (primer **Halo harpin**).

Vedno bolj kompleksne mešanice – aminokisline, proteini, vitamini, bakterije, fulvične kisline, specifični sladkorji, ………………………………..

Direktno poseganje v ciklus glutaminske kisline

ZELO DOLG SPISEK IZVLEČKOV IZ RASTLIN

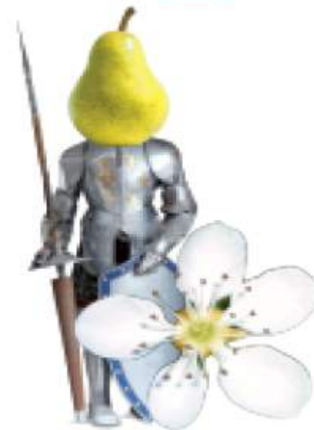
Izvlečki iz rastlin, rastlinski hidrolizati, po naravni poti pridobljeni koncentrati rastlinskih hormonov in izvlečki rastlin z epifitno floro

- Komercialni RI se uporabljajo samostojno ali pa v kombinaciji z minerali glin in eteričnimi olji. Nekaj primerov takšnih sredstev: **Milsana** (iz japonskega dresnika), Plantonic (iz kopriv in vrbe), **Equisetum Plus** (preslica), **Bio Plantella Natur F** (preslica), **Biobizz Acti vera** (iz Aloe vera), **Biocin** (taro), **Bio Plantella Thymi** (timijan in brin), Cirkon **(ameriški slamnik)**, **Grevit in Biosept (lupine in peške agrumov), HF-Pilzvorsorge (komarček), Elot-Vis (mešanica več rastlin).**

- Pri nekaterih RI pripravkih imajo izvlečki značaj **prekurzorjev hormonov** ali pa so koncentrati rastlinskih hormonov. Primer prvih je pripravek na podlagi **brasinosteroidov (epibrasinolid**) iz križnic Epin Extra in primer drugih pripravek **Auxym**.
- MNOŽICA LECITINSKIH PRIPRVAKOV

Primer mešanice aminokisline LIZIN z rastlinskimi izločki

Matrifruit



Biodegradable product. Dries and disperses honeydew (psylle, white fly, etc.) and avoids subsequent proliferation of fungi.

Plant extract + Lysine + Manganese · Mn (0.5%) + Zinc · Zn (1.5%)

Product characteristics

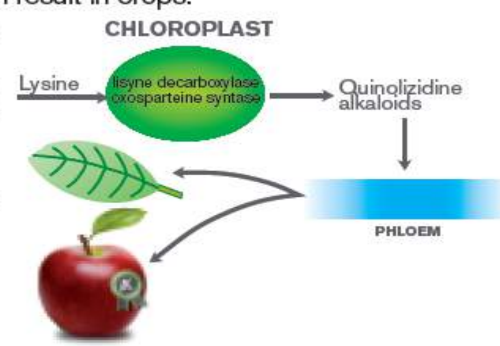
Matrifruit is a liquid mixture of plant extract of the *Fabaceae* family, lysine, surfactants, manganese and zinc that can be used to clean honeydew and other debris deposited on leaves and fruits of horticultural crops and fruit trees from petal fall.

Stabilizes and protects complementary treatments with pesticides. **Matrifruit** is recommended to be used in programs to avoid resistance to other products.

Matrifruit expresses its activity as a **self-defense response enhancer** of crops, through the following ways:

1) It acts as a surface cleaning detergent of honeydew leaving larvae unprotected and preventing subsequent formation of fungi (sooty mould).
2) It has a barrier effect due to the activity of the plant extract, which reduces or mitigates the attack and damage from some pests.
3) contains lysine, an essential amino acid which is a precursor of the alkaloids of plants that some are able to biosynthesize autoimmune response natural defense against the attack of sucking and eating insects to prevent or delay the damage that can result in crops.

Lysine is a quinolizidine alkaloid precursor, which is produced by plants, for its defense against pests. The lysine transformation to alkaloids, takes place in chloroplasts, then they pass to the phloem and from there to the whole plant resting protected.



Advantages

· Leaves without honey dew produce more photosynthesis and therefore, the crop yield increases.
· It does not create phytotoxicity.
· There is no safety period after its application.
· No risk to people who apply it.
· No risk to consumers.

Solutions for...

Humic and fulvic acids as biostimulants in horticulture

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ARTICLE INFO

Article history:
Received 24 April 2015
Received in revised form 7 September 2015
Accepted 9 September 2015
Available online 26 September 2015

Keywords:
Humic substances
Physiological effects
Nutrient uptake
Bioactivity
Abiotic stress

ABSTRACT

Maintaining food production for a growing world population without compromising natural resources for future generations represents one of the greatest challenges for agricultural science, even compared with the green revolution in the 20th century. The intensification of agriculture has now reached a critical point whereby the negative impacts derived from this activity are now resulting in irreversible global climate change and loss in many ecosystem services. New approaches to help promote sustainable intensification are therefore required. One potential solution to help in this transition is the use of plant biostimulants based on humic substances. In this review we define humic substances in a horticultural context. Their effects on nutrient uptake and plant metabolism are then discussed and a general schematic model of plant-humic responses is presented. The review also highlights the relationship between the chemical properties of humified matter and its bioactivity with specific reference to the promotion of lateral root growth. Finally, we summarize and critically evaluate experimental data related to the overall effect of humic substances applied to horticultural crops. Current evidence suggests that the biostimulant effects of humic substances are characterized by both structural and physiological changes in roots and shoots related to nutrient uptake, assimilation and distribution (nutrient use efficiency traits). In addition, they can induce shifts in plant primary and secondary metabolism related to abiotic stress tolerance which collectively modulate plant growth as well as promoting fitness. In conclusion, the exogenous application of humic substances within agronomic systems can be used to aid the development of sustainable intensification. As most humic substances used in agriculture are currently derived from non-renewable resources like coal and peat, the promotion of this technology also requires the development of new sustainable sources of humic products (e.g. organic wastes).

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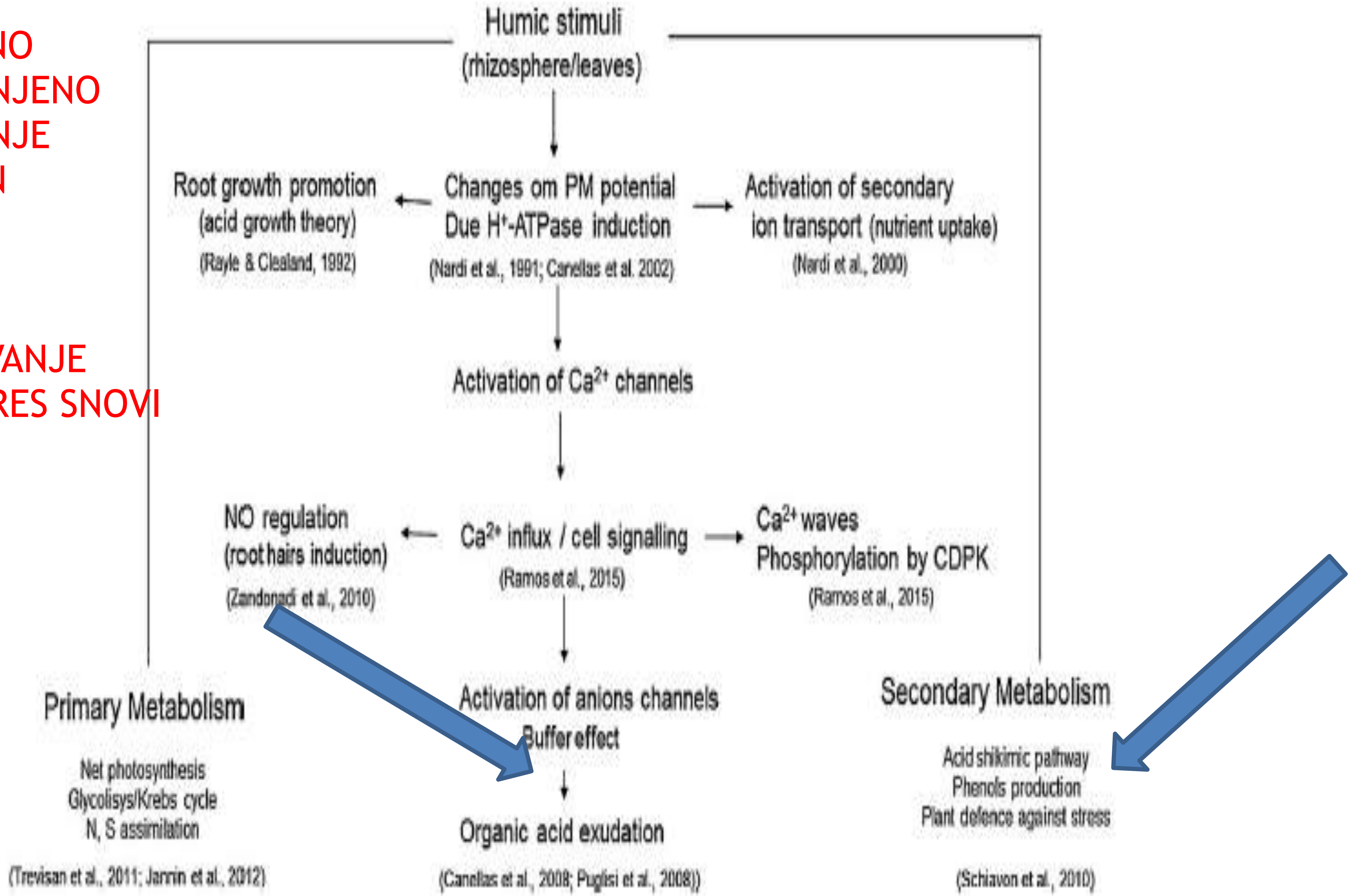


Fig. 2. General picture showing the modes of action of humic substances, in line with the acid growth theory, as elicitor of cell signalling by induction of plasma membrane (PM) H^+-ATPase. NO– nitric oxide; CDPK– calcium-dependent protein kinase.

MNOŽICA RAZLIČNIH SESTAVIN

Figure 1. Generalized features of the three major humic substances

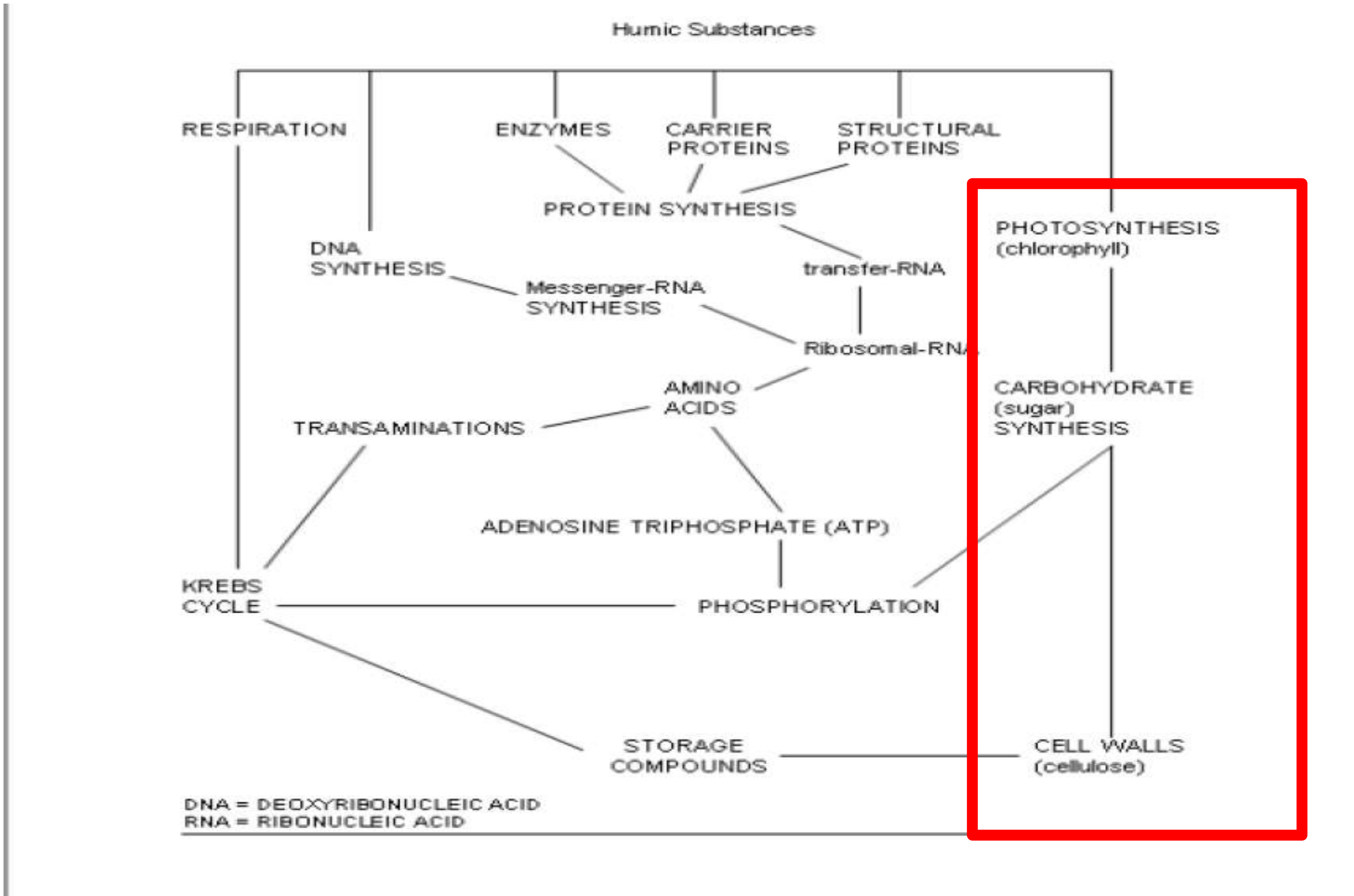
HUMIN	HUMIC ACID		FULVIC ACID	
Molecular weight decreasing				
10,000,000	100,000		10,000	1,000
Cation exchange capacity (c mol/kg) and acidity increasing				
100	300		500	1,000
Carbon content (g/kg) decreasing				
550	620	560	520	430
Oxygen content (g/kg) increasing				
340	290	360	440	510
Nitrogen content (g/kg) decreasing				
46	55		43	7
Hydrogen content (g/kg) variable				
55	29	67	33	so
Fertilizer properties - plant response increasing				
Slow response			Rapid response	

Modified from Dixon, J. B. and S. B. Weed, 1989. Page 95 In "Minerals in Soil Environments". Soil Science Society of America, Madison, Wisconsin, 1244 pages.

ORGANIC MATTER, HUMUS, HUMATE, HUMIC ACID, FULVIC ACID AND HUMIN: THEIR IMPORTANCE IN SOIL FERTILITY AND PLANT HEALTH

Dr. Robert E. Pettit
Emeritus Associate Professor Texas A&M University

Figure 2. The following schematic diagram illustrates some reported effects of humic substances on metabolic activities in plant cells.



Plant Soil (2014) 383:3–41
DOI 10.1007/s11104-014-2131-8

MARSCHNER REVIEW

Agricultural uses of plant biostimulants

Pamela Calvo · Louise Nelson · Joseph W. Kloepper

Received: 20 December 2013 / Accepted: 25 April 2014 / Published online: 8 May 2014

Abstract
Background Plant biostimulants are diverse substances and microorganisms used to enhance plant growth. The global market for biostimulants is projected to increase 12 % per year and reach over $2,200 million by 2018. Despite the growing use of biostimulants in agriculture, many in the scientific community consider biostimulants to be lacking peer-reviewed scientific evaluation.
Scope This article describes the emerging definitions of biostimulants and reviews the literature on five categories of biostimulants: i. microbial inoculants, ii. humic acids, iii. fulvic acids, iv. protein hydrolysates and amino acids, and v. seaweed extracts.
Conclusions The large number of publications cited for each category of biostimulants demonstrates that there is growing scientific evidence supporting the use of biostimulants as agricultural inputs on diverse plant species. The cited literature also reveals some commonalities in plant responses to different biostimulants, such as increased root growth, enhanced nutrient uptake, and stress tolerance.

Keywords Microbial inoculants · Humic acid · Fulvic acid · Protein hydrolysates · Amino acids · Seaweed extracts · Biostimulants

Introduction

Plant biostimulants, or agricultural biostimulants, include diverse substances and microorganisms that enhance plant growth. The global market for biostimulants has been projected to reach $2,241 million by 2018 and to have a compound annual growth rate of 12.5 % from 2013 to 2018 (Anonymous, 2013). According to the same study, the largest market for biostimulants in 2012 was Europe. The European biostimulants industry council (EBIC) reported that in 2012 over 6.2 million hectares were treated with biostimulants in Europe (defined as the European Economic Area) (European Biostimulants Industry Council 2013).

The definition and concept of plant biostimulants is still evolving, which is partly a reflection of the diversity of inputs that can be considered to be biostimulants. The breadth of the concept of biostimulants is evident by reviewing two initiatives from consortia of biostimulant

Table 1 Summary of reported effects of humic substances on plant growth, nutrient uptake, and plant physiology

Crop	Type of Humic Substance	Reference	Study Conditions	Reported Effects on Growth and Nutrient Uptake	Effects on Plant Physiology
Cucumber (Cucumis sativus)	Humic acid	Aguirre et al. 2009	Growth chamber	No effect on root growth	Increased transcription of genes encoding Fe(III) chelate-reductase (CsFR01) and an Fe(II) root transporter (CsIRT1); increase H^+-ATPase activity
Cucumber	Humic acid	El-Nemr et al. 2012	Field tests in two years with foliar sprays	Increased plant growth and yield; enhanced uptake of N, P, K, Ca, and Mg	
Cucumber	Humic acid	Karakurt et al. 2009	Yield and fruit- quality study in ground in organic production greenhouse conducted in two years	Increased total fruit yield, total soluble sugars, reducing sugars, and chlorophyll b	
Cucumber	Humic acid	Mora et al. 2010	Hydroponic culture in growth chamber	Increased shoot growth; increased NO_3 in shoots and decreased NO_3 in roots	Increased H^+-ATPase activity and significant changes in root-to-shoot distribution of NO_3, cytokinins, and polyamines.
Cucumber	Fulvic acid	Rauthan and Schnitzer 1981	Growth chamber hydroponic culture	Increased shoot and root dry weight, numbers of flowers per plant, and uptake of N, P, K, Ca, Mg, Cu, Fe, and Zn	
Multiple, including vegetables, tomato, cereals, ornamentals and grape (Vitis vinifera)	Humic substance	Morard et al. 2011	Hydroponic culture and field trial (grape)	With some of the tested plants, increased plant fresh weight, number of flowers, and water use efficiency. With grape, increased N content of must	
Grape (Vitis vinifera)	Humic substance	Sánchez-Sánchez et al. 2006	Field trials over two years testing combination of Fe chelates with humic substances	Increased uptake of P and Fe; decreased uptake of Na	
Micro-Tom tomato (Solanum lycopersicum)	Humic substances	Canellas et al. 2011	Germination paper in growth chamber	Enhanced number of lateral roots	Auxin-like activity detected by activation of the auxin synthetic reporter DR5: GUS
Arabidopsis thaliana, tomato, maize (Zea mays)	Humic substances	Dobbss et al. 2010	Growth chamber	Increased lateral root emergence	Increased H^+ -ATPase activity in root vesicles, activated auxin synthetic reporter DR5: GUS
Arabidopsis thaliana, micro-Tom tomato	Fulvic acid	Dobbss et al. 2007	For Arabidopsis, mini-hydroponic system in growth chamber.	Increased lateral root growth in Arabidopsis and wild-type micro-Tom tomato.	No promotion of lateral root emergence with dgt tomato mutant insensitive to IAA
Tomato	Humic acids	Adani et al. 1998	Hydroponic culture	Increased growth of roots and shoots; enhanced uptake of N, P, Fe, and Cu	
Tomato	Humic acid	Yildrim 2007	In-ground greenhouse test for yield conducted during two growing seasons	Increased early and total yield in both years; increased total soluble solids and ascorbic acid content in fruit	
Tomato	Fulvic acid and humic acid	Lulakis and Petsas 1995	Growth chamber tests with seedlings in Petri plates	Enhanced root and shoot growth at 14 days after seeding	
	Fulvic acid and humic acid	Chen et al. 2004			

Table 1 (continued)

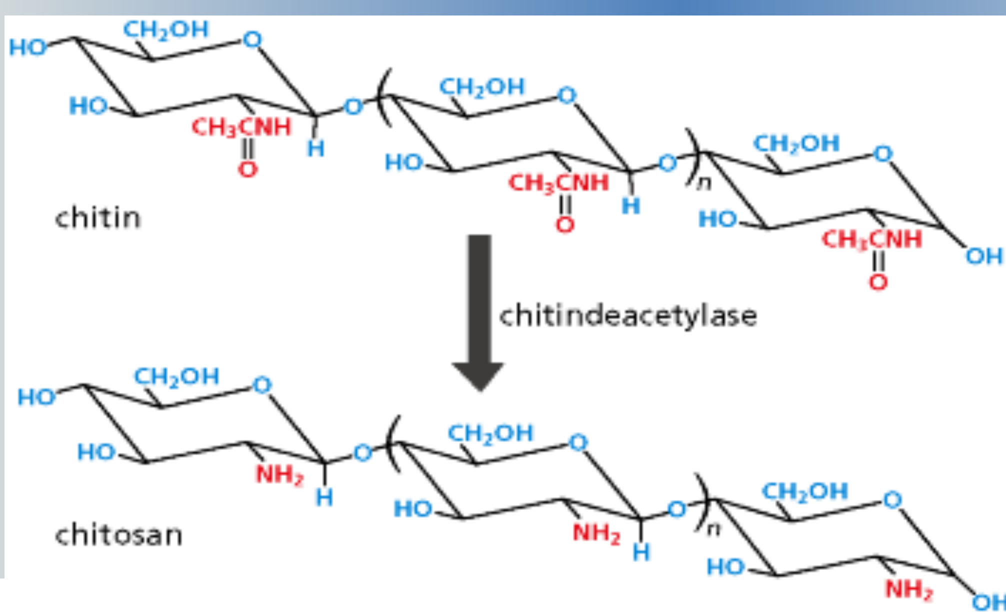
Crop	Type of Humic Substance	Reference	Study Conditions	Reported Effects on Growth and Nutrient Uptake	Effects on Plant Physiology
Soybean (Glycine max), melon (Cucumis melo), and ryegrass (Lolium perenne)			Hydroponic culture in growth chambers with differing levels of Fe and Zn	Increased SPAD readings (chlorophyll measure) in all three plant systems with fulvic acid and humic acid	
Basil (Ocimum basilicum)	Humic acid with and without PGPR	Befrozfar et al. 2013	Field tests with seed treatments and foliar sprays	Increased yield of oil with humic acid alone and in combination with PGPR	
Okra (Abelmoschus esculentus)	Humic acids	Kim et al. 2010	In-ground test inside wire house	Increased yield (fruits per plant) at recommended fertility but not at 50 % fertility level	
Potato (Solanum tuberosum)	Humic acid	Selim et al. 2012	Field study with different water regimes; application through fertigation system	Enhanced tuber yield; increased percent protein and ascorbic acid content in tubers; increased SPAD readings (chlorophyll indicator) in leaves	
Wheat (Triticum aestivum)	Humic acid	Tahir et al. 2011	Pot trial with calcareous and non-calcareous field soils with three levels of N, P, and K	Increased plant height and dry weight of roots and shoots; enhanced uptake of N	
Wheat	Fulvic acid	Dunstone et al. 1988	Glasshouse, growth chamber, and field trials with foliar sprays of fulvic acid	Increased plant growth in some studies but not in others. No increases in yield or water use in field tests	Decreased stomatal conductance in many studies but no relation to plant growth response
Wheat	Fulvic acid	Xudan 1986	Pot and field experiments with foliar sprays of fulvic acid	Enhanced chlorophyll content; increased roots uptake of ^{32}P; partial alleviation of grain yield depression by moderate drought	Decreased stomatal conductance
Wheat	Fulvic acid	Peng et al. 2001	Hydroponics with varying levels of Se as sodium selenite	Enhanced seedling root growth with low levels of Se; reduced symptoms of Se toxicity with high levels of Se	Reduction in Se-induced cell membrane permeability and free-proline content with fulvic acid
Wheat	Fulvic acid	Gu et al. 2001	Hydroponics with 8 concentrations of 3 rare earth elements (La^{3+}, GD^{3+}, and Y^{3+})	Increased bioaccumulation of La^{3+}, GD^{3+}, and Y^{3+} in roots and shoots, resulting in less buildup in soil	Activation of glutamic oxaloacetic transaminase (GOT) enzyme
Maize (Zea mays)	Humic acids	Jindo et al. 2012	Lab assays in minimal liquid medium	Promotion of root growth; increased number of mitotic sites on roots	Increased number of mitotic sites and proton pump activity in roots
Maize	Humic substances	Schiavon et al. 2010	Growth chamber test in hydroponics	Not assessed	Enhancement of phenylpropanoid pathway, decrease in phenylalanine and tyrosine, increase in phenolic compounds and some amino acids
Maize	Humic acids	Canellas et al. 2002	Lab assays in minimal liquid medium	Increased root elongation, proliferation of secondary roots, and root surface area	Simulated H^+-ATPase activity of plasma membrane and mitotic sites of lateral root development
Maize	Fulvic acid	Anjum et al. 2011b	Pot trials in net house under drought and no drought conditions	Increased leaf area, plant dry weight, chlorophyll content, and yield under drought stress; increased yield under non-drought conditions	Increased assimilation rate of CO_2 and content of proline
Maize	Fulvic and humic acids	Eyheraguibel et al. 2008			

Table 1 (continued)

Crop	Type of Humic Substance	Reference	Study Conditions	Reported Effects on Growth and Nutrient Uptake	Effects on Plant Physiology
			Application to 10-day old seedlings with growth in hydroponic culture until cob filling stage	Increased root length of seedlings; increased total plant biomass at 2 months; enhanced plant development as noted with increased numbers of leaves and flowers per plant; increased lateral root development; increased nutrient uptake	
Maize	Humic acids	Canellas et al. 2009	Lab assays in minimal liquid medium	Stimulated root growth and root length	Activated proton pump activation in root plasma membrane vesicles
Maize	Humic acids	Asli and Neumann 2010	Growth chamber study in hydroponic culture and in soil with multiple applications	Inhibition of shoot but not root growth with high concentrations of humic acid; reduced transpiration	Reduced hydraulic conductivity reduced water transport from root medium to shoot
Maize	Fulvic acid and humic acid	Harper et al. 1995	Seedling growth for four days in nutrient solution with and without aluminum	Enhanced root elongation in absence of Al; in presence of Al, alleviated Al toxicity limitation of root elongation	
Pear (Pyrus communis)	Humic acid	Marino et al. 2010	In vitro micropropagation conditions of shoot cultures	Improved acclimatization and micropropagation; increased rooting, plant height, chlorophyll content, and nutrient uptake	Reduced activity of catalase and malondialdehyde
Pepper (Capsicum annuum)	Humic acid	Cimrin et al. 2010	Growth chamber in soil mix	Increased shoot and root weights, also increased N, P, K, Ca, Mg, S, Mn, and Cu under moderate salt stress conditions	Suggested that supramolecular agglomerates of humic acid limit root water transport, resulting in restricted shoot growth
Pepper	Humic acids	Karakurt et al. 2009	In-ground greenhouse test for yield conducted during two growing seasons	Increased total yield, early yield, mean fruit weight, total soluble sugars, and chlorophyll b	
Pepper	Fulvic acid	Aminifard et al. 2012	Field trial with drenches of fulvic acid during vegetative growth	Not recorded	Increased fruit content of carbohydrate, total phenolics, capsaicin, and carotenoids; increased antioxidant activity in fruit
Lantana camara	Humic acid and fulvic acid	Costa et al. 2008	Greenhouse test in soilless mix for propagation	Increase biomass of roots and shoots, earlier flowering of rooted cuttings	Upregulation of AGAMOUS-like gene (AGL)
Lemon trees (Citrus limon) on C. macrophila rootstock	Fulvic acid	Sánchez-Sánchez et al. 2002	Field test in orchard with calcareous soil	Increased foliar uptake of Fe and Cu; increased yield (fruit weight), fruit equatorial diameter, juice pH, and vitamin C	
Wild olive (Olea europaea)	Fulvic acid	Murillo et al. 2005	Field tests in soils polluted by trace elements under semi-arid conditions	Increased N and chlorophyll content in plants without increases to phytotoxic levels of Cd, Cu, Pb, Tl, or Zn	
Greek fir (Abies cephalonica)	Fulvic acid	Zancani et al. 2011	Study with embryonic cell lines to evaluate the hormone-like effects		Fulvic acid interacted with the plant hormonal signaling pathway;

Chitosan (HITOSANSKI PRIPRAVKI) VEČINOMA ŽE PREHOD V FFS

- Chitosan (2-amino-2deoxy-(1→4)-β-D-glucopyranan), a polyaminosaccharide, normally obtained by alkaline deacetylation of chitin is the principal component of living organisms such as fungi and crustacea.



- Moreover, it is known that chitosan at low molecular weight acts as a potent biotic elicitor, able to induce plant defence responses and to activate different pathways that increase the crop resistance to diseases [13, 15, 28, 42, 43]. The most studied plant responses to chitosan treatment are the formation of chemical and mechanical barriers and the synthesis of new molecules and enzymes involved in the defence response [15, 37]. In some cases, chitosan causes the induction of the hypersensitive response, mainly around the infection site, that leads to the programmed cell death [44]. This hypersensitive response can be followed by systemic response of the plant defence mechanisms. These latter mainly include the synthesis and accumulation of secondary metabolites with active roles in defence: phenolic compounds such as lignin, callose, phytoalexins, PR proteins (pathogenesis-related proteins) and the modulation of the activity of key enzymes of metabolic pathways involved in the defensive response, such as the PAL, peroxidases and chitinase (Figure 2) [45-48].

Chitosan in Agriculture: A New Challenge for Managing Plant Disease

Laura Orzali[1], Beatrice Corsi[1], Cinzia Forni[2] and Luca Riccioni[1*]

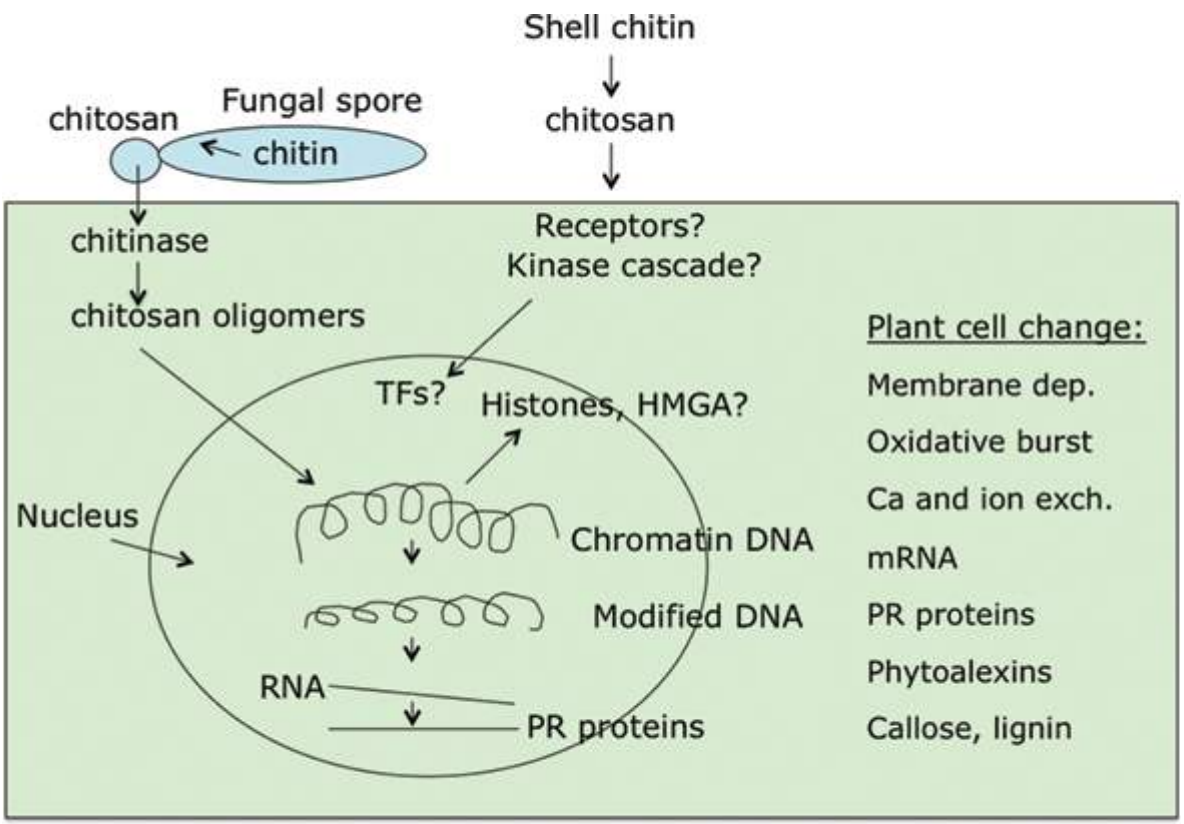
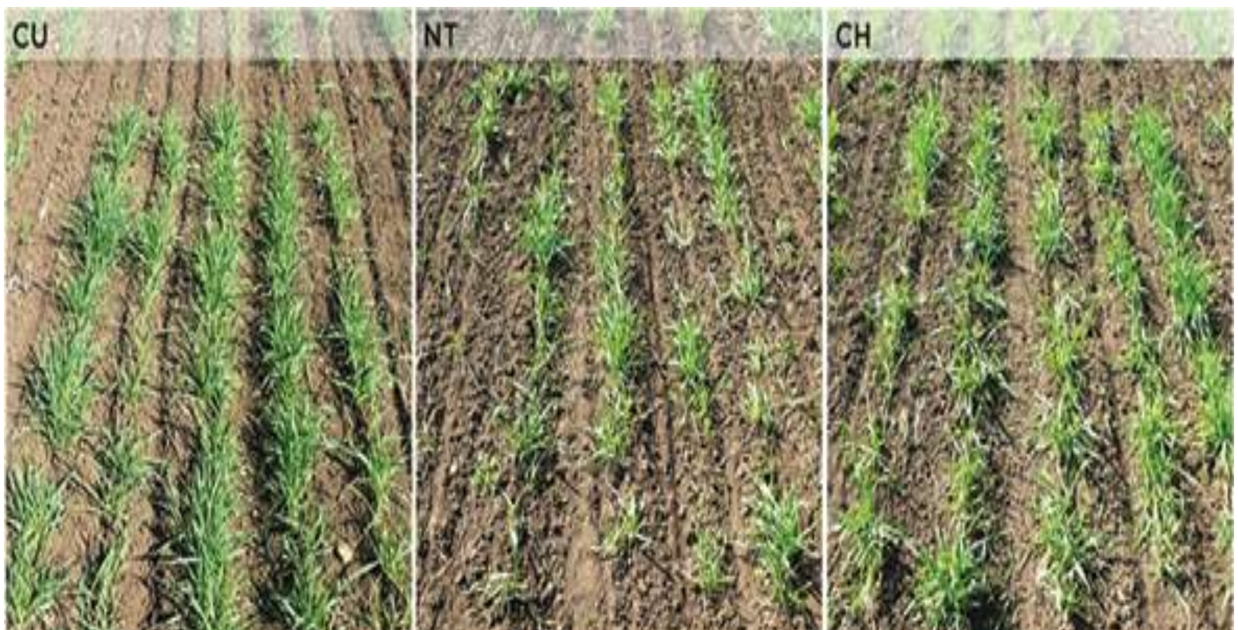


Figure 2. Some proposed effects of chitosan as elicitor of plant defence responses [43]. The cellular and molecular changes elicitated by chitosan can be summarized in: membrane depolarization, oxidative burst, influx and exit of ions such as Ca2+, activation of MAP-kinases, chromatin and DNA alteration, increase in PR gene mRNA, PR proteins synthesis, phytoalexins accumulation, lignification and callose deposition. TFs: transcriptional factors. HMG A: architectural transcription factor high mobility group. PR proteins: pathogenesis-related proteins.

Blotter test for seed health analysis after 7 days of incubation at 25°C of durum wheat seeds artificially infected with *F. graminearum*, one of the causal agents of root and foot rot in cereals. Seeds were then coated with a solution of chitosan and tea tree oil. The chitosan/ tea tree oil treatment reduced significantly the fungal infection on seeds (right) compared with the inoculated and not treated seeds (left).



Parcels of field trial (Italy) sowed with durum wheat seeds cv. Simeto artificially infected with *F. graminearum* and then treated with chitosan (CH) or with a copper sulphate-based treatment (CU), commonly used as chemical treatment in organic farming. Chitosan treatment enhanced the number of emerged plants, if compared with no treatment (NT), as well as copper treatment.

2.1. Mechanism of CHT Action

The mode of action of CHT is not yet completely unraveled. The different mechanisms for its antimicrobial effect, summarized in Table 1, include interaction with plasma membrane phospholipids and histone proteins as well as chelation of trace metal elements [33–41].

Table 1. Proposed mechanisms for the antimicrobial effect of CHT.

Proposed CHT Action	Effect	Microorganism	References
Interaction with the phospholipids of microbial cell plasma membrane (CHT concentration <0.2 mg/mL)	Agglutination	gram-negative and gram-positive bacteria.	[33]
Interaction with the phospholipids of microbial cell plasma membrane	Disruption of bacterial cell membrane with leakage of intracellular substances	*E. coli*, *Staphylococcus aureus*	[34]
Interaction with proteins of microbial cell plasma membrane	Disruption of bacterial cell membrane integrity	*E. coli*, *Staphylococcus aureus*	[35]
Interaction with negatively charged components of the cell surface	Inhibition of H^+-ATPase activity and chemiosmotic-driven transport	*Rhizopus stolonifer*	[36]
Interaction with microbial cell wall components	Disruption of cell wall integrity and alteration of intracellular ultrastructure	*Streptococcus sobrinus*, *Neisseria subflava*, *Candida albicans*	[37]
Chelation of metals	Inhibition of toxin production and microbial growth	*Alternaria alternata*	[38]
Interaction with the charged phosphate groups of DNA/RNA	Inhibition of the synthesis of mRNA and proteins	*E. coli*	[39]
Deposition on the bacterial surface (high m.w. CHT)	Blockage of nutrient flow	*E. coli*, *Bacillus cereus*	[40]

Mar. Drugs **2010**, *8*, 968-987; doi:10.3390/md8040968

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Marine Drugs

ISSN 1660-3397

www.mdpi.com/journal/marinedrugs

Review

Chitosan in Plant Protection

Abdelbasset El Hadrami [1], Lorne R. Adam [1], Ismail El Hadrami [2] and Fouad Daayf [1,*]

Abstract: Chitin and chitosan are naturally-occurring compounds that have potential in agriculture with regard to controlling plant diseases. These molecules were shown to display toxicity and inhibit fungal growth and development. They were reported to be active against viruses, bacteria and other pests. Fragments from chitin and chitosan are known to have eliciting activities leading to a variety of defense responses in host plants in response to microbial infections, including the accumulation of phytoalexins, pathogen-related (PR) proteins and proteinase inhibitors, lignin synthesis, and callose formation. Based on these and other proprieties that help strengthen host plant defenses, interest has been growing in using them in agricultural systems to reduce the negative impact of diseases on yield and quality of crops. This review recapitulates the properties and uses of chitin, chitosan, and their derivatives, and will focus on their applications and mechanisms of action during plant-pathogen interactions.

Keywords: chitin; chitosan; biocidal activity; plant defenses; resistance; biological control

Hitosani gredo v skupino SAR tehnologij – CIKLI SALICILNE / CIKLI JASMONSKE KISLINE

Table 12.1 Commercial products with good evidence for inducing disease resistance in plants.

Trade names	Chemical name	Mode of action	Key biological properties	Reference
BION, ACTIGARD	Acibenzolar-*S*-methyl	Mimics SA in natural SAR	Broad spectrum including fungi, bacteria and viruses on many crops	Kessmann *et al.* (1996), Ruess *et al.* (1996)
MESSENGER, ProAct	Harpin protein	Mimics local lesion in natural SAR (depends on SA production)	Enhanced crop growth, quality and yield, suppression of nematode egg production	Jones (2001)
V-GET	Tiadinil	Mimics SA	Controls rice blast	Yasuda *et al.* (2004)
ORYZEMATE	Probenazole	Induces various PR proteins and lipids on rice (may depend on SA)	Fungal and bacterial protection of rice and some vegetables	Watanabe *et al.* (1979), Yoshioka *et al.* (2001)
OXYCOM A & B	Reactive oxygen and plant stimulant (acetic acid, hydrogen peroxide, plant nutrients, proprietary stabilizers and salicylic acid)	Stimulation of various defence genes involving a MAPK pathway	Increased plant cell wall strength and improved root health – reduction of nematodes, bacteria in a range of crops	Yang *et al.* (2002)
ELEXA 4	Chitosan	Unknown, may require SA	Fungal protection of fruit, vegetables, ornamentals, cereals, turf and rice	Manufacturer literature (www.plantdefenseboosters.com/elexa.html)
IODUS 40	β-1,3-Glucan	Stimulation of induced resistance (SA and JA pathways)	Fungal diseases of various crops	Manufacturer literature (www.goemar.com)

Australian Government

Rural Industries Research and
Development Corporation

Evaluation of potential for chitosan to enhance plant defence

A report for the Rural Industries Research and Development Corporation

by Rachel Walker, Suzanne Morris, Phil Brown
and Alistair Gracie

Table 1.1 Summary of scientific papers reporting plant defence responses to chitosan application.

Crop	Disease	Chitosan rates	Comments/Results	Reference
Bell pepper fruit	*Botrytis cinerea*	10 mg/mL of chitosan on fruit stem scars	Chitosan treated fruit had reduced lesion development after inoculation with *Botrytis cinerea* & lesions developed slower and were smaller than in the untreated control. Chitosan reduces ability of the fungus to initiate infection, also shows chitosan induces active defence responses in plant tissue.	El Ghaouth *et a* 1994
Brassicas	Club root *(Plasmodiophora brassicae)*	2% chitosan in water solution root dip.	Chitosan significantly reduced club weights – potential for club root control, but did not increase the top weights of the plants.	Cheah, and Page 1997
Capsicum	*Phytophthora capsici*	0.2% w/v root dip amended with Tween-20	Chitosan applied as a root dip prior to planting resulted in disease suppression through antimicrobial activity in the plant.	Kim *et al.*, 199
Capsicum	*Botrytis cinerea*	10 mg/mL solution dip	Post harvest treatment. Chitosan restricted cellulose breakdown by preservation of pectin binding sites and prevented maceration of plant tissue by pathogenic enzymes.	El Ghaouth *et a* 1997
Carrot	NA	10 mg/L chitosan glutamate	Inclusion of chitosan glumate in fluid drilling gel resulted in increased numbers of somatic embryo-derived plantlets.	Kitto *et al.*, 199
Celery	Fusarium yellows and *Fusarium oxysporum f. sp. apii*	Root dip 3 mg/ml chitosan solution or chitin incorporated in soil + root dip chitosan	*F. oxysporum f. apii* progressively and uniformly inhibited by chitosan. Incidence of Fusarium yellows in chitin + chitosan treatments was reduced.	Bell *et al.*, 199
Cucumber	*Pythium aphanidermatum*	100, 400 ug/L	Induction of structural barriers in root tissues. Stimulation of antifungal hydrolases in roots and leaves. Adverse growth effects on pathogenic fungi.	El Ghaouth *et a* 1994.
Cucumber		(chitosan) 1 mg/mL Sigma, sprayed to runnoff	3 isoforms of chitosan were observed, could have different functions in defense.	Zhang and Punja 1994
Cucumber	*Colletotrichum lagenarium*		Chitinase levels increase naturally upon infection, this increase is associated with reduced lesion formation.	Siegrist and Kauss., 1989
Cucumber	Fusarium wilt *(Fusarium oxysporum* f. sp. *Cucumerinum)*		Applying *Paenibacillus* sp 300 and *Streptomyces* sp. 385 which produce chitinases and ß-1,3-glucanases provided excellent control in potting medium. Mixing the two strains in 1:1 or 1:4 ratio provided best suppression.	Singh *et al.*, 199
Eustoma grandiflorum		1% w/w to soil mix or 1% chitosan in lactate to coat seed	Chitosan soil treatment resulted in greater shoot length, stem diameter, cut-flower weight and numbers of flowers. But seed coating was less effective.	Ohta, K. *et al.*, 2001
Grape	Mildew (disease not stated)	0.01% or 0.1%	Sprayed grapes had reduced mildew infection.	Gorbatenko *et a* 1994
Grapevine (*Vitis spp.*)	Powdery mildew (*Uncinula necator*)		Those vines with higher assays of chitinase or ß-1,3-glucanase had greater resistance to powdery mildew, and when combined had even greater field resistance.	Giannakis *et al.*, 1998

Table 1.1 Summary of scientific papers reporting plant defence responses to chitosan application (cont.).

Green Peas	Ascochyta root rots	10 mL/kg seed of chitosan as Yea!	Coating seeds with Yea! (chitosan) did increase disease control, but the combination of Yea! And a fungicide slurry as a seed dressing was most effective, yielding well. Recommends further work.	Wiberg, 1990
Potato	*Phytophthora infestans*	200 ug/disc	Technical paper on phytoalexin production. Chitosan used as an elicitor for phytoalexin accumulation.	Ellis *et al.*, 1993
Radish		20 g/L	Soaking seeds in a chitosan solution resulted in increased chitinase activity during germination and seedling growth.	Hirano *et al.*, 1990
Tomato	*Fusarium* wilt (*Fusarium oxysporum* f. sp. *Radicislycopersici*	1, 2, 3 & 4 mg/ml	Increased resistance of bacterised tomato roots to Fusarium infection triggered by changes in the physiology of host plant due to effects of chitosan.	Benhamou *et al.*, 1997
Tomatoes	Decay eg. by *Botrytis cinerea*	1% or 2% chitosan solutions	Coating fruit with chitosan solutions reduced respiration rate & ethylene production and internal O_2, increased internal CO_2, fruit were firmer, less decayed	El Ghaouth *et al.*, 1992
Tomato			Chitosan used as an elicitor for production of phenolic compounds.	Pearce *et al.*, 1998
Tomato	Potato spindle tuber viroid	0.001, 0.01, 0.1% added to inoculum prior to inoculation	The infectivity of PSTV was reduced by chitosan. Knives were dipped in chitosan and this eliminated viroid from tools.	Pospieszny, 1997
Tomato	*Fusarium oxysporum f.sp. radicis-lycopersici*	12.5, 37.5 mg/L	Chitosan reduced plant mortality, root rot symptoms and yield loss in greenhouse tomatoes (var. Capello). No adverse effect on plant growth and fruit yield. Cytological observations on pathogen penetration into host cells.	LaFontaine and Benhamou, 1996
Tomato	*Alternaria alternata f. sp. Lycopersici*	100-6400 ug/mL chitosan incorporated into PDA	Chitosan inhibited fungal growth and toxin production.	Bhaskara Reddy *et al.*, 1998
Tomato	*Fusarium oxysporum f.sp. radicis-lycopersici*	0.1 –1 mg/mL seed soak 0.1-1 mg/mL media incorporated	Seed soaking (1mg/mL) and treating growing media with chitosan (1mg/mL) was the best treatment for disease control. Chitinase probably not the first antimicrobial compound involved in defence, maybe phenolic compounds.	Benhamou *et al.*, 1994
Tomato		0.01%, 0.05%	Chitosan was incorporated into the growing media resulted in increased root length at 0.01%, but retardent effect at 0.05%.	Gorbatenko *et al.*, 1994

NEKAJ PRIMEROV UČINKOV HITOSANOV

NEPOSREDNA AKTIVACIJA GENOV

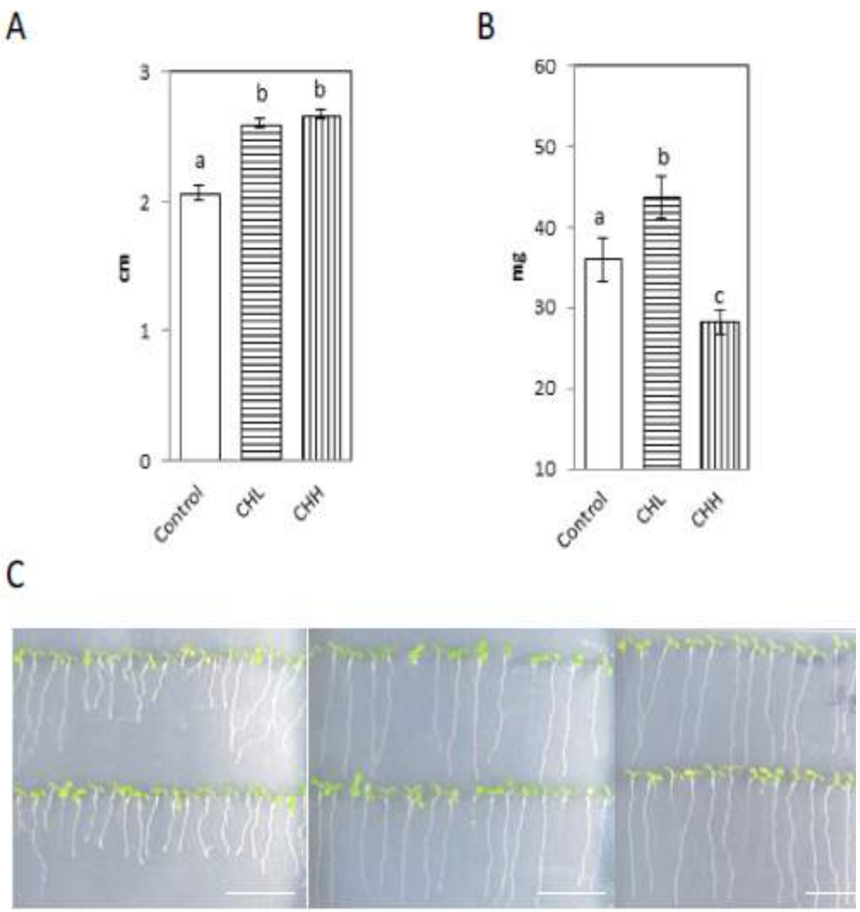


Figure 3. Chitin increased plant growth in vitro. **(A)** The radicle length of controls and pl
treated with low-molecular-weight chitin mix (CHL) or high molecular weight chitin mix (CH
(B) Fresh weight of controls and plants treated with CHL or CHH. The plants were grown for 20 d
(C) Representative plates of control seedlings (left), seedlings treated with CHL (center) and tre
with CHH (right) after seven days. The experiments were performed at least three times with sin
results. The data were analyzed using one-way analysis of variance (ANOVA) and the Statgrap
program Centurion XVI.II. Different letters indicate significant (*p*-value < 0.05) differences betw
treatment groups, according to Duncan's test. Bars: 2 cm.

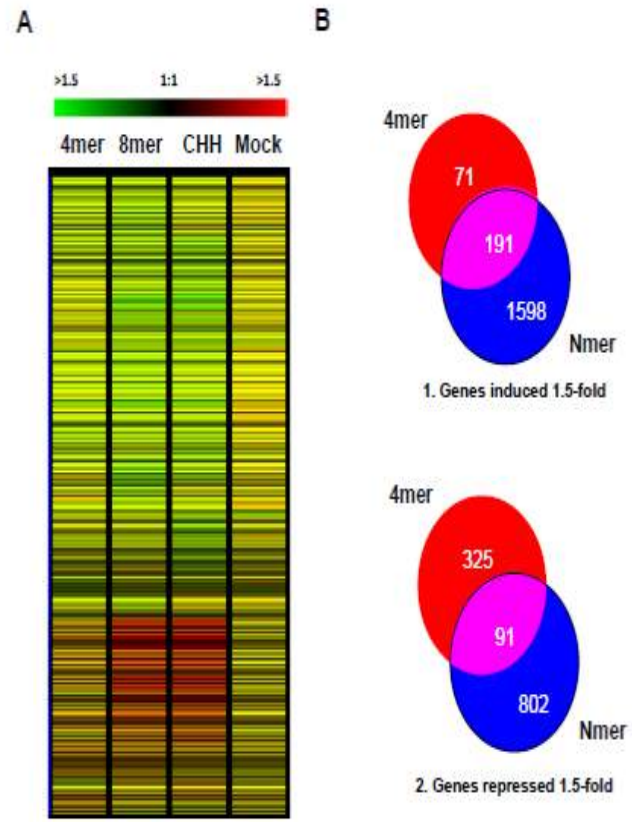


Figure 1. Microarray analysis of Arabidopsis after chitin treatments. **(A)** Hierarchical cluster of the ratio values of the genes that responded to different sizes of chitin, 4mer, 8mer and high-molecular-weight chitin mix (CHH). Each gene is represented by a single row, and each column represents an individual treatment. Red represents upregulated genes, green downregulated genes and black genes with no change (the signals are relative to the control treatment, which was water). **(B)** Venn diagrams of hierarchical clustering results; **(B1)** Venn diagram of genes showing a ≥1.5-fold increase in expression after 4mer treatment and 8mer or high-molecular-weight chitin (CHH) treatments (i.e., Nmer treatments); **(B2)** Venn diagram of genes showing a ≥1.5-fold decrease in expression after 4mer treatment and Nmer treatments. Two-way analysis of variance (ANOVA) was used for clustering. The genotypes and treatment groups were analyzed using a *p*-value of 0.5, with *p*-value > 0.5 = not significant and *p*-value < 0.5 = significant. Three array data replicates were used for the analysis.

Klinoptiloliti – zeoliti

crystalline, hydrated aluminosilicates of metals, including calcium, magnesium, sodium, potassium, strontium and barium. Due to their inner structure they are characterized by unique physicochemical properties: high and cation exchange sorption capacity, ion-selectivity, molecular sieving, catalytic activity and high thermal stability up to 750°C (Hubicki, 2000, Pitcher et al., 2004). The general chemical formula of zeolitesis written as [Barrer 1978, Chen 1978]:

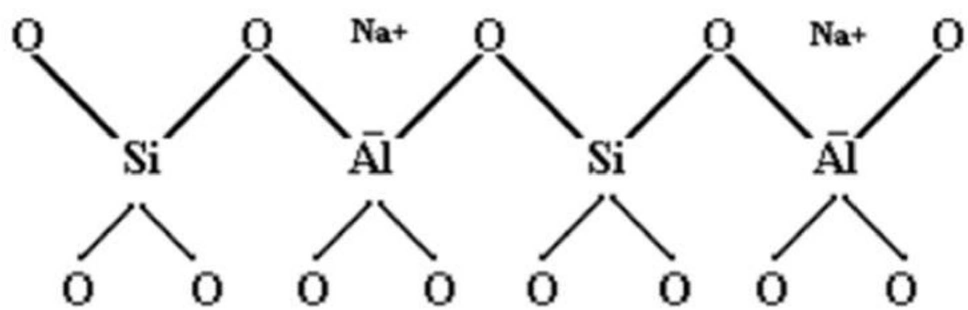
$$Mx/n[AlxSiyO_2(x+y)]\cdot pH_2O$$

where M is (Na, K, Li) and/or (Ca,Mg, Ba, Sr), n is cation charge; y/x = 1–6, p/x = 1–4.Other formulas are also being used e.g. using patterns of oxide (Ciciszwili G.W. et al., 1990):

$$M_{2/n}O\ Al_2O_3xSiO_2yH_2O$$

for example for clinoptilolite: $(K,Na,1/2Ca)_2O\ Al_2O_3\ \ 10SiO_2\ \ 8H_2O$

The primary building unit of zeolite framework istetrahedron, the centre of which is occupied by a silicon oraluminum atoms, with four oxygen atoms at the vertices.Substitution of Si^{4+} by Al^{3+} provides the negative charge of theframework, which is balanced by monovalent or divalentcations located at the surface. The aluminosilicate framework,definingthe structure type, is the most stable component.



(Kowal, D., 2009).

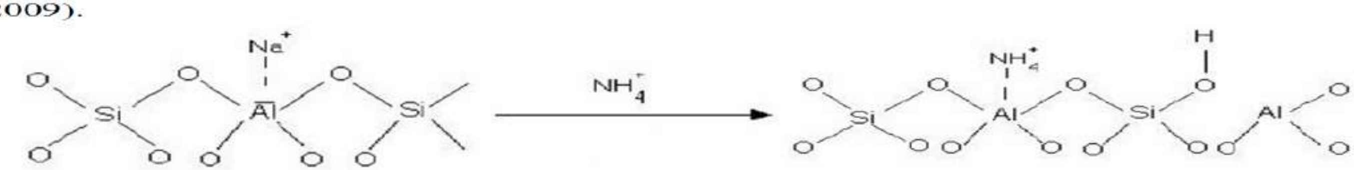


Fig.2. Scheme ion exchange of ammonium ion for sodium

A review: Insecticidal potential of Zeolite (Clinoptilolite), toxicity ratings and general properties of Turkish Zeolites

Eroglu, N.*#
The Scientific and Technological Research Council of Turkey, Food Institute, Gebze, Kocaeli, Turkey

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DOI: 10.14455/DOA.res.2014.116

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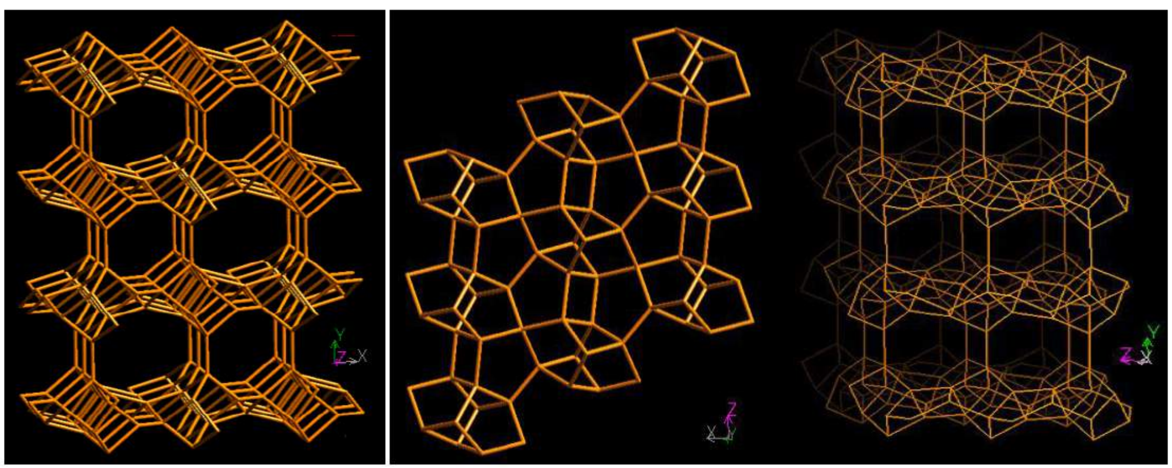


Figure 1 Diagrammatic picture of Clinoptilolite under framework type of HEU by 2007 Structure Commission of the International Zeolite Association (IZA-SC).

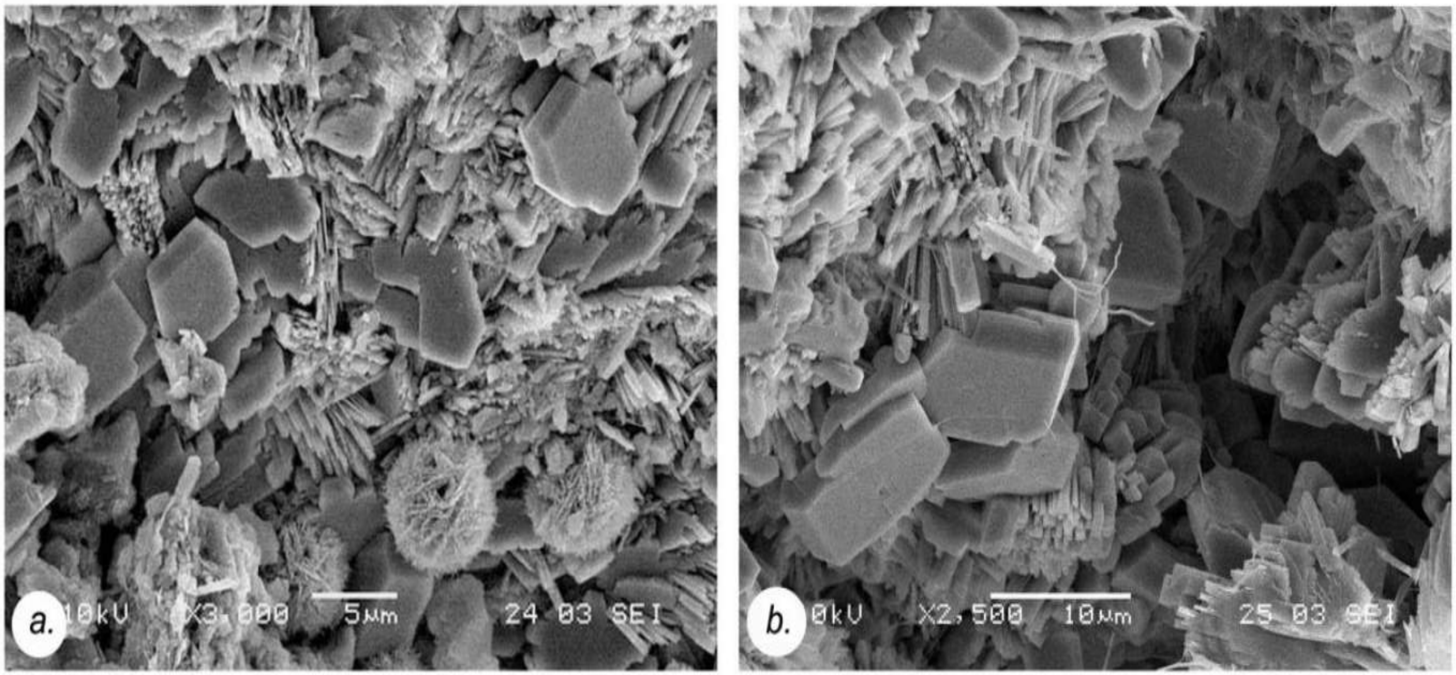


Figure 2 The shape and size of clinoptilolite crystals were elucidated using SEM imaging (Bedelean et al., 2010).

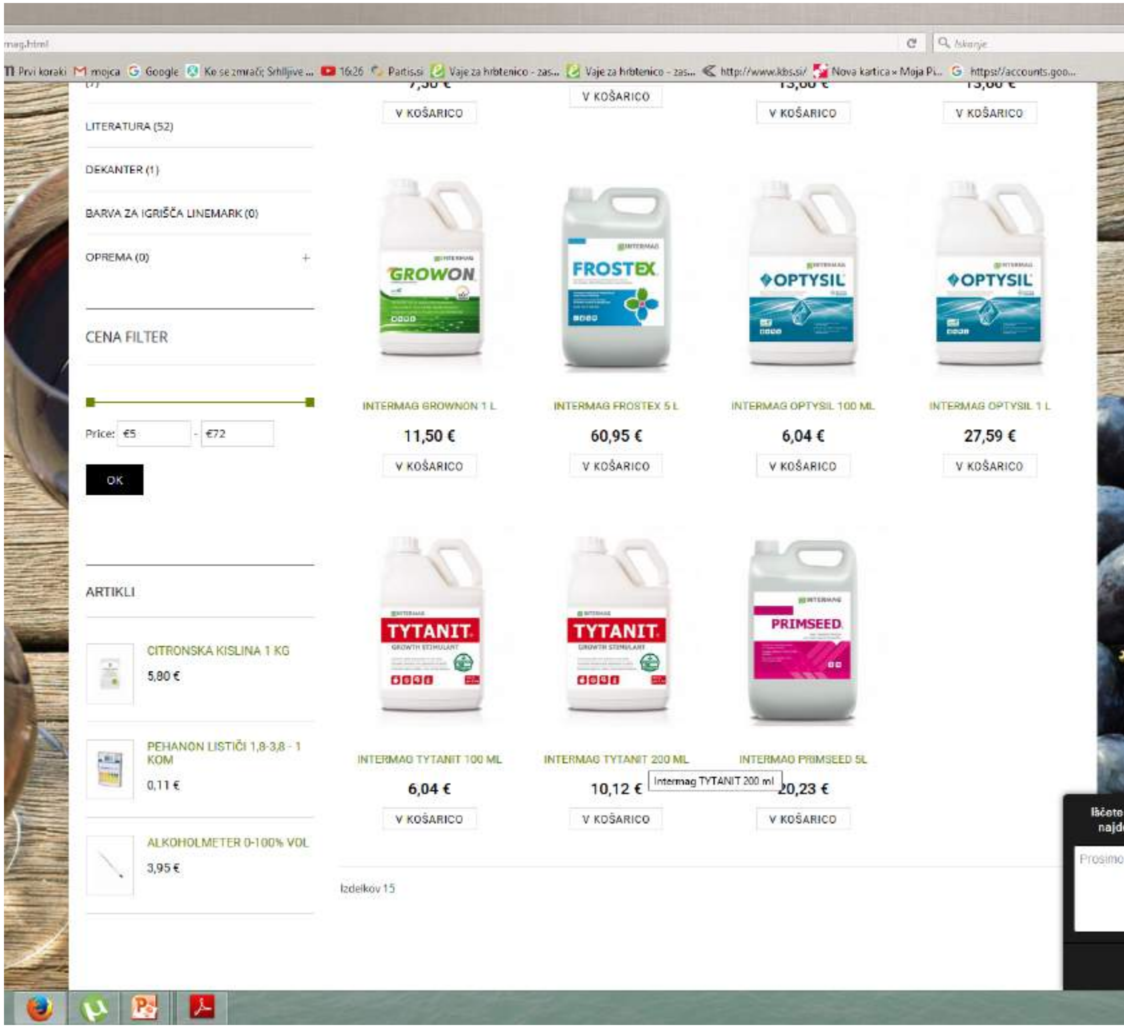
NA SPLOŠNO SILICIJEVE SPOJINE MODIFIKACIJE VODNIH STEKEL

http://intermag.eu/optysil-anti-stress-agent

OPTYSIL

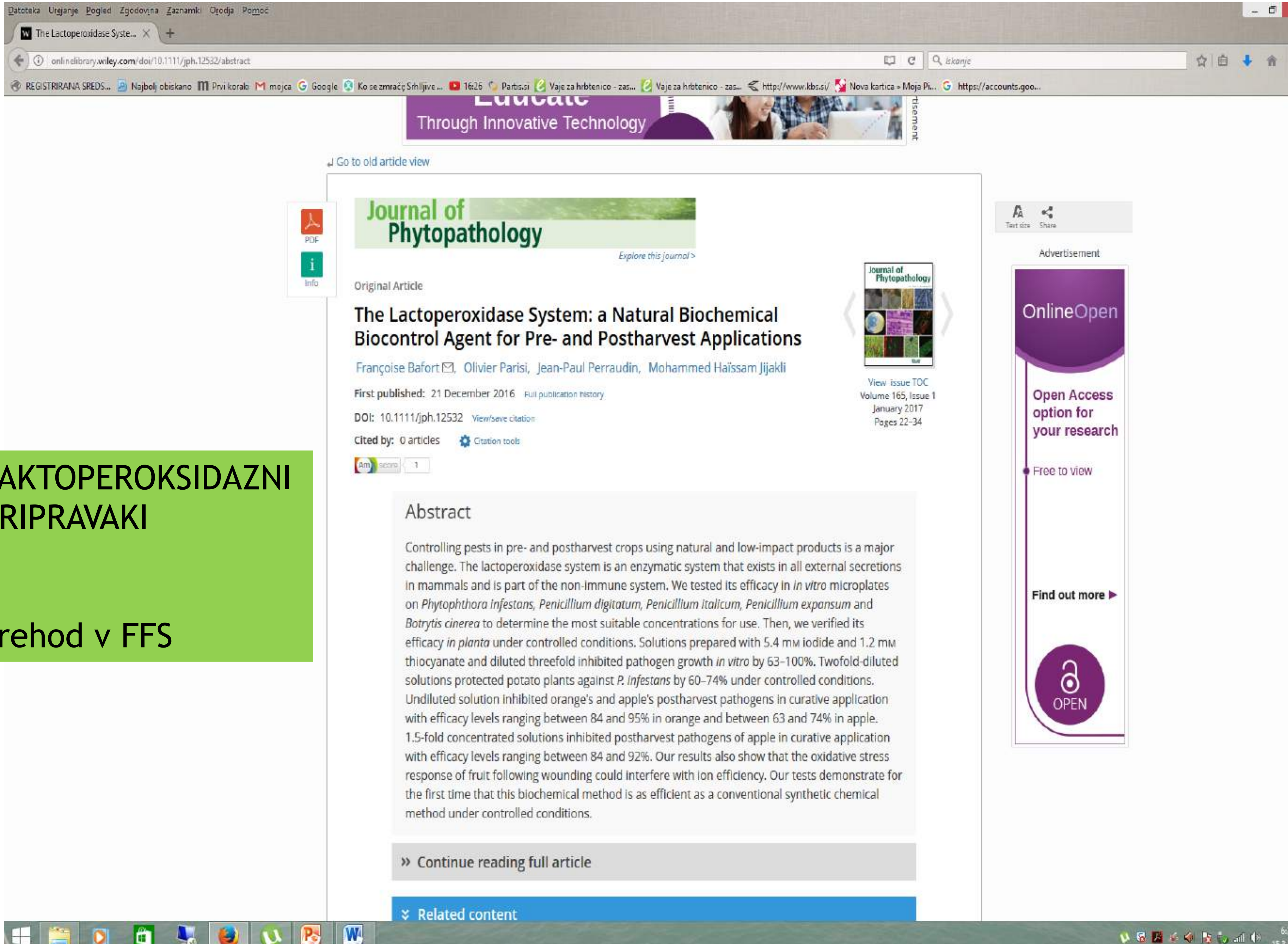
Composition

Nutrients	Content [g/l]	Content in % by mass
Iron (Fe)	24.0	2.0
Silicon dioxide (SiO_2)	200.0	16.5



LAKTOPEROKSIDAZNI PRIPRAVAKI

Prehod v FFS



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Original Article

The Lactoperoxidase System: a Natural Biochemical Biocontrol Agent for Pre- and Postharvest Applications

Françoise Bafort, Olivier Parisi, Jean-Paul Perraudin, Mohammed Haïssam Jijakli

First published: 21 December 2016 Full publication history

DOI: 10.1111/jph.12532 View/save citation

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Volume 165, Issue 1
January 2017
Pages 22–34

Abstract

Controlling pests in pre- and postharvest crops using natural and low-impact products is a major challenge. The lactoperoxidase system is an enzymatic system that exists in all external secretions in mammals and is part of the non-immune system. We tested its efficacy in *in vitro* microplates on *Phytophthora infestans, Penicillium digitatum, Penicillium italicum, Penicillium expansum* and *Botrytis cinerea* to determine the most suitable concentrations for use. Then, we verified its efficacy *in planta* under controlled conditions. Solutions prepared with 5.4 mM iodide and 1.2 mM thiocyanate and diluted threefold inhibited pathogen growth *in vitro* by 63–100%. Twofold-diluted solutions protected potato plants against *P. infestans* by 60–74% under controlled conditions. Undiluted solution inhibited orange's and apple's postharvest pathogens in curative application with efficacy levels ranging between 84 and 95% in orange and between 63 and 74% in apple. 1.5-fold concentrated solutions inhibited postharvest pathogens of apple in curative application with efficacy levels ranging between 84 and 92%. Our results also show that the oxidative stress response of fruit following wounding could interfere with ion efficiency. Our tests demonstrate for the first time that this biochemical method is as efficient as a conventional synthetic chemical method under controlled conditions.

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Related content

Na kaj moramo paziti pri uporabi SKR:

- Da vedno preverimo registracijski status. Če je pripravek v kateri drugi državi EU registriran kot FFS, pri nas pa ne, ga ne moremo uporabiti. Najbolje je status vedno preveriti pri UVHVVR. Večkrat se zgodi, da je v posameznih državah enak pripravek FFS v drugih pa SKR.
- Da je pripravek od priznanega proizvajalca, z znano vsebino in da ima minimalne deklaracije za določitev formalnega statusa glede na pravila uredbe 889/2008/ES ter pravilnikov združenj in certifikacijskih organov.
- Da nima velike vsebnosti težkih kovin in dodanih gnojil, ki niso skladna s prej omenjenimi pravili ali drugih nedovoljenih snovi. Takšne tvegane snovi so na primer fosfonati (npr. K_2HPO_3).

Na kaj moramo paziti pri uporabi SKR:

- Da ne vsebujejo mikrobov, ki so škodljivi človeku ali domačim živalim (npr. možno v kompostnih čajih, pripravkih iz živalskih iztrebkov, pripravkih iz mleka in drugih odpadnih živil živalskega izvora, …).

- Da ne vsebujejo velikih količin rastlinskih izločkov, ki so škodljivi človeku in domačim živalim (npr. doma narejeni izvlečki iz rastlin, ki vsebujejo alkaloide, laktone, pirolizidine, oksalate, terpene in druge splošno znane škodljive snovi).

- Da substrati za pripravo medija za mikrobe ali rastlinske izvlečke (npr. melasa, droži, kvas, sirotka, ….) izvirajo iz certificirane ekološke pridelave.

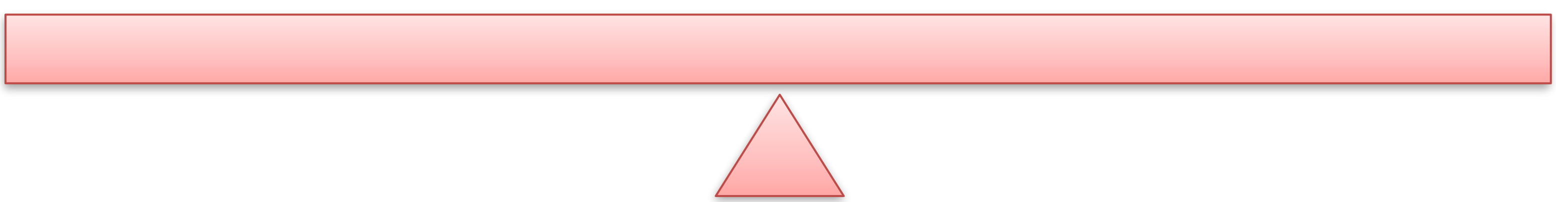
- Pogosta uporaba velikih količin SKR lahko povzroča fitotoksičnost, škoduje naravnim sovražnikom, opraševalcem in lahko vpliva na videz in okus pridelkov. Pri vrtninah se pri številnih izogibamo uporabi tik pred obiranjem pridelkov.

Kako v praksi vsako leto pridelati 70 in več ton jabolk na ha

Prof. dr. Franci ŠTAMPAR

Univerza v Ljubljani
Biotehniška fakulteta

Pričakovanja



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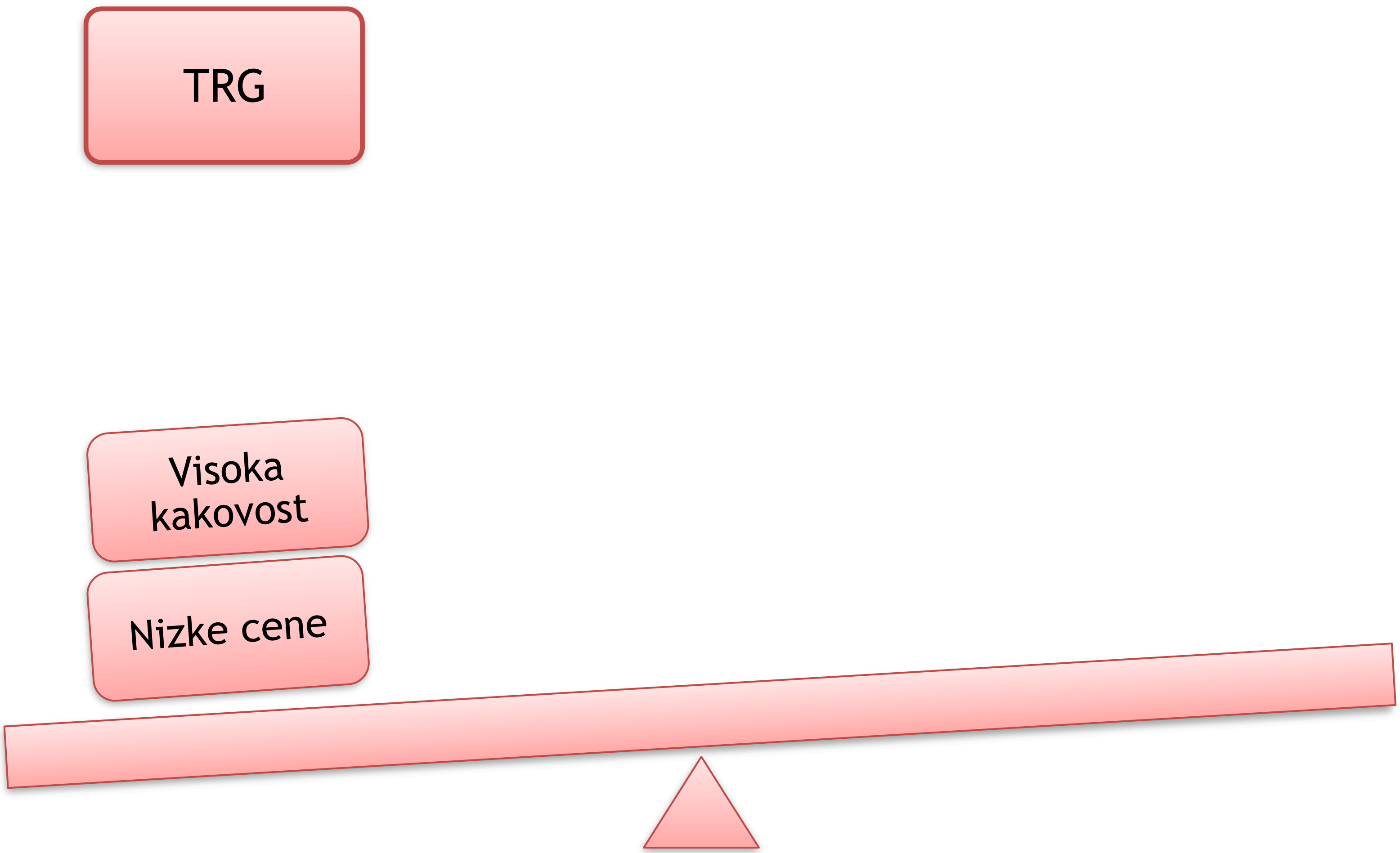

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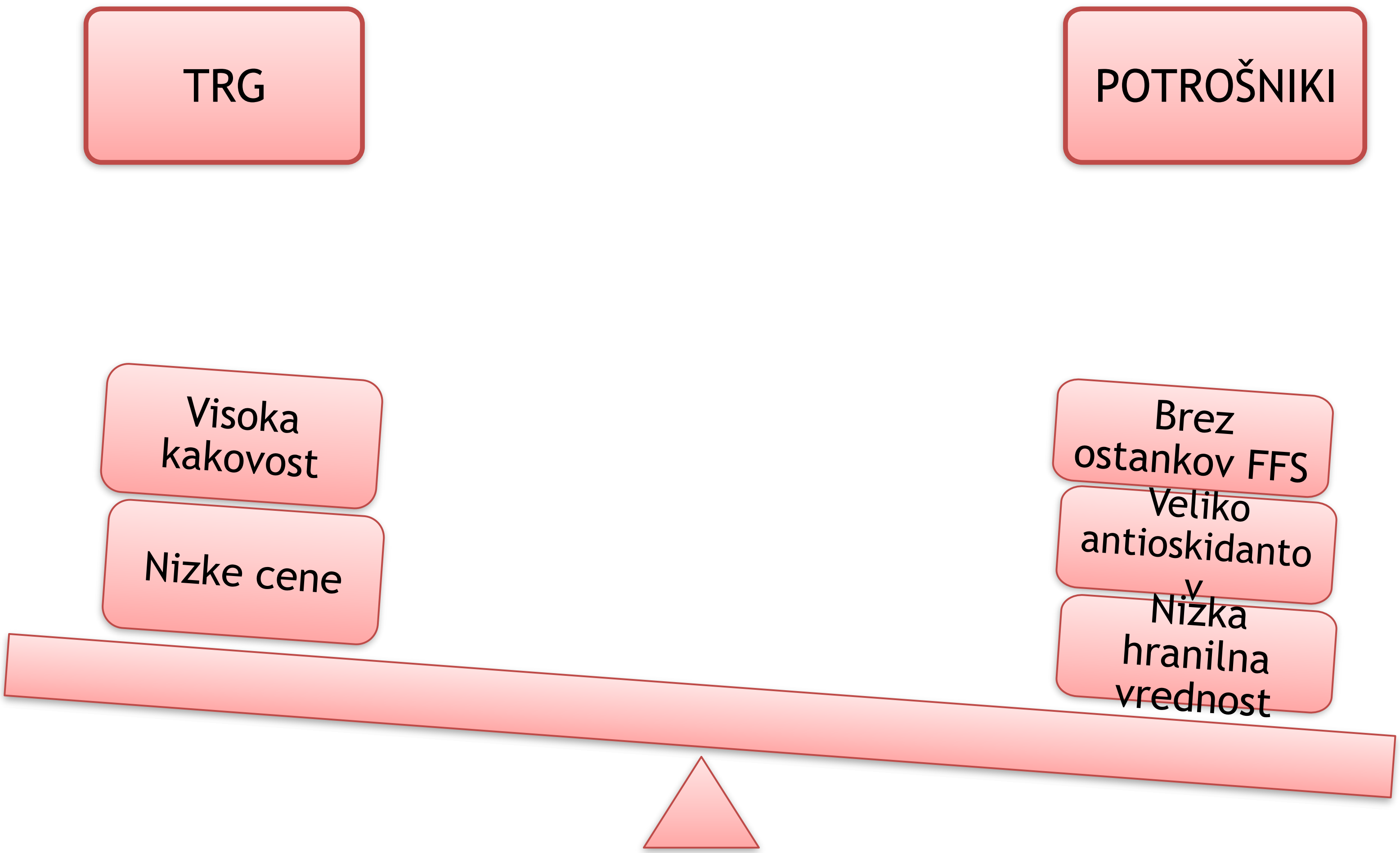

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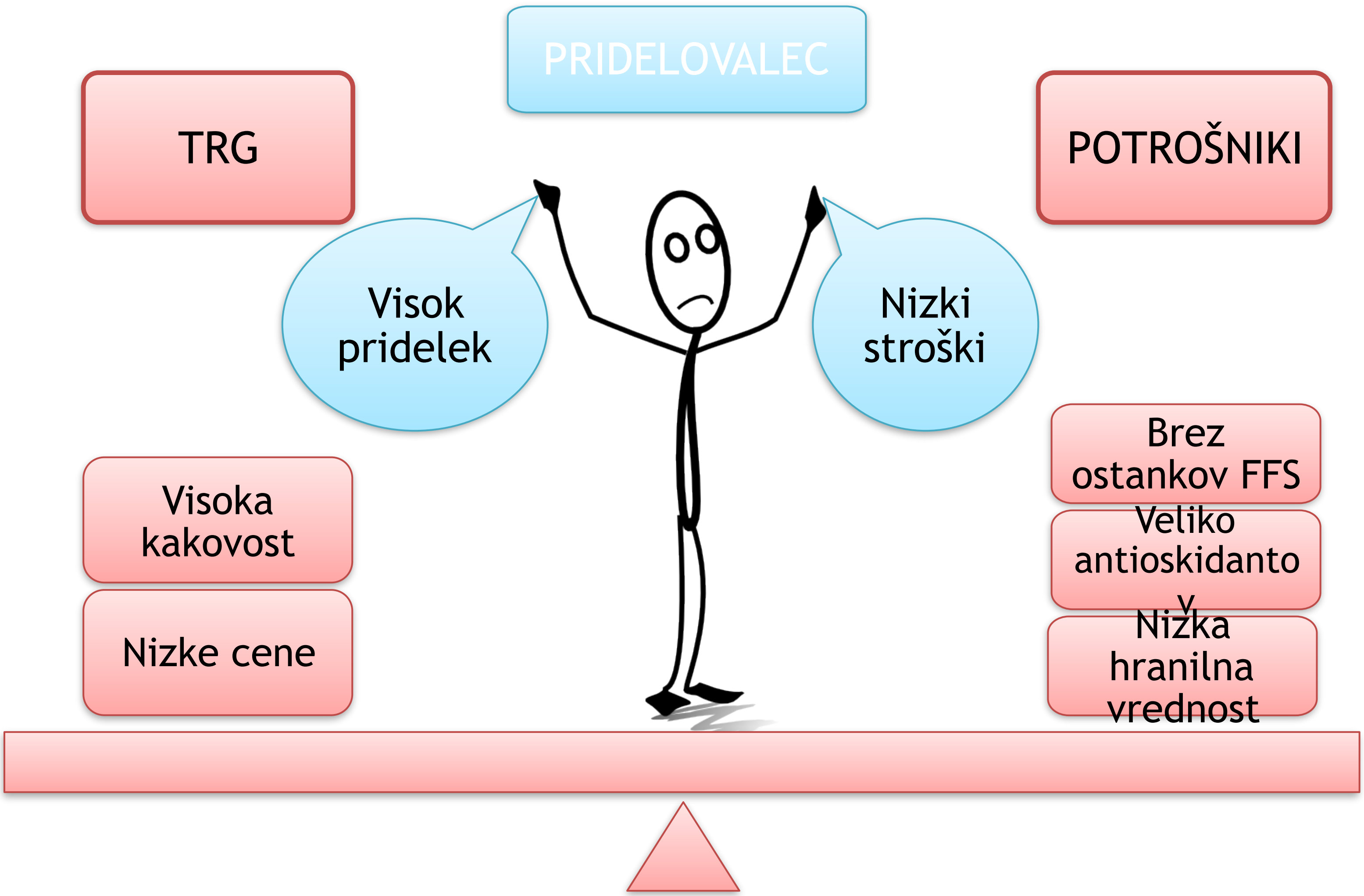


1 Andorre
2 Monaco
3 Saint-Marin
4 Vatican
5 Luxembourg
6 Liechtenstein
7 Slovénie
8 Monténégro
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Suède
Finlande
Russie
Estonie
Lettonie
Lituanie
Danemark
Irlande
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Arménie
Portugal
Espagne
Macédoine
Albanie
Grèce
Turquie
Iran
Maroc
Syrie
Irak
Malte
Chypre
1
2
3
4
5
6
7
8

x 1000 tons

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	F2016	(1)	(2)
Austria	193	159	185	169	199	157	155	188	177	22	-88	-87
Belgium	358	336	344	288	305	220	220	318	285	234	-18	-15
Croatia	40	49	60	89	83	59	96	62	101	35	-65	-59
Czech Rep	113	157	145	103	79	118	121	131	156	113	-28	-17
Denmark	32	26	24	21	20	18	23	26	24	22	-8	-10
France	1,676	1,528	1,651	1,579	1,701	1,169	1,576	1,444	1,674	1,564	-7	0
Germany	1,070	1,047	1,071	835	953	972	804	1,116	973	1,052	8	9
Greece	236	231	224	254	305	242	236	245	242	263	9	9
Hungary	203	583	514	488	301	750	585	920	522	449	-14	-34
Italy	2,196	2,164	2,237	2,179	2,293	1,939	2,122	2,456	2,280	2,282	0	0
Latvia	31	34	13	12	8	9	15	10	8	8	0	-27
Lithuania	40	74	74	46	49	39	40	27	46	38	-17	1
Netherlands	396	376	402	334	418	281	314	353	336	332	-1	-1
Poland	1,100	3,200	2,600	1,850	2,500	2,900	3,170	3,750	3,979	4,150	4	14
Portugal	258	245	274	251	265	221	284	272	329	263	-20	-11
Romania	362	329	379	423	412	351	387	382	336	371	10	1
Slovakia	10	42	48	32	33	36	42	46	40	17	-58	-60
Slovenia	80	68	64	66	73	45	56	68	71	12	-83	-82
Spain	599	528	470	486	507	391	464	505	482	509	6	5
Sweden	16	18	18	20	17	14	17	16	21	20	-5	11
UK	196	201	212	214	226	162	204	225	243	250	3	12
Total:	9,206	11,395	11,008	9,740	10,746	10,095	10,929	12,560	12,325	12,005	-3	1

(1) Percentage difference between F2016 and 2015
(2) Percentage difference between F2016 and the average of 2013 - 2014 - 2015

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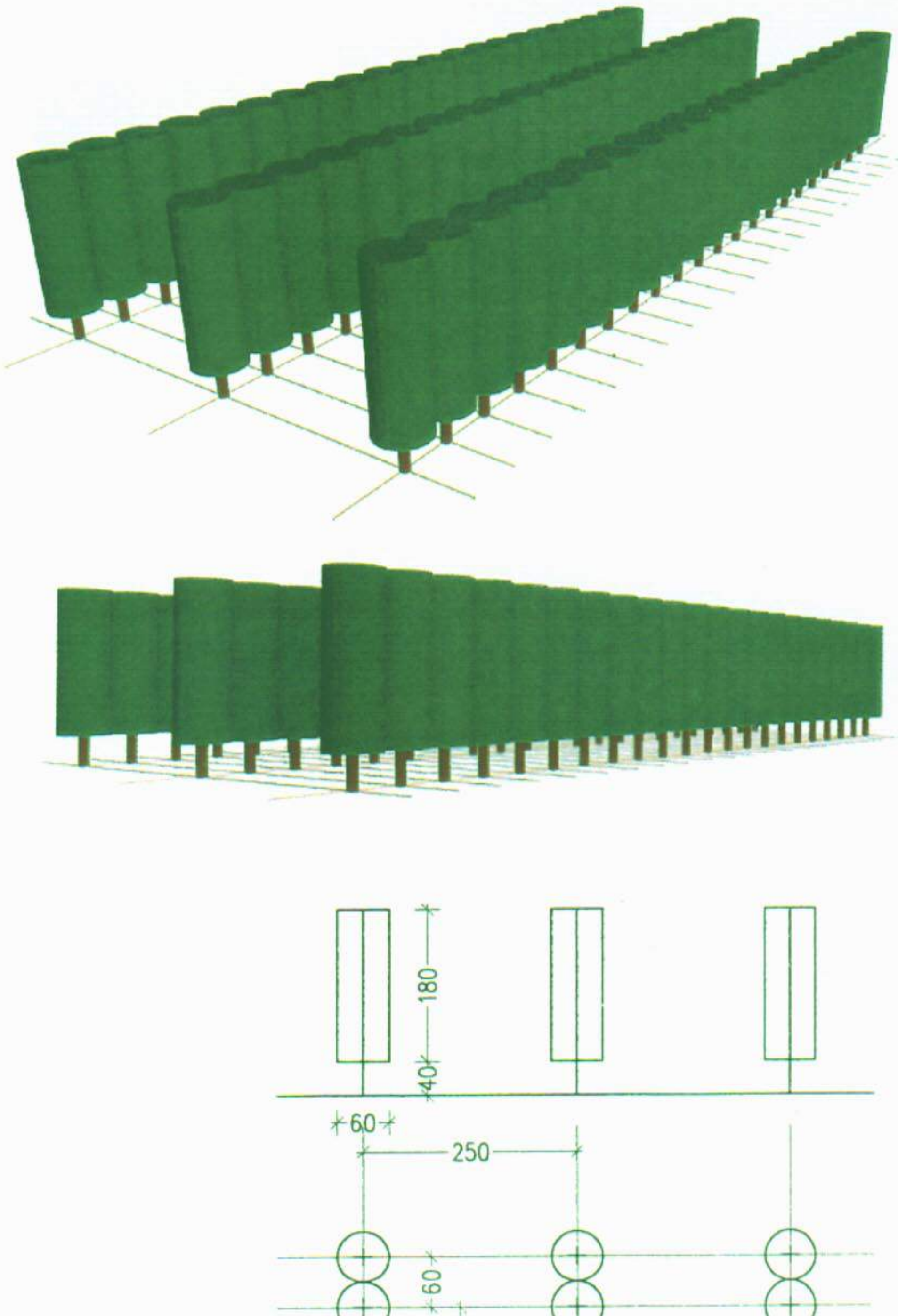
OBRAVNAVANJE 3

Enovrstni sistem

vertikalni kordon

2,5 x 0.6 m

6000 trees/ha



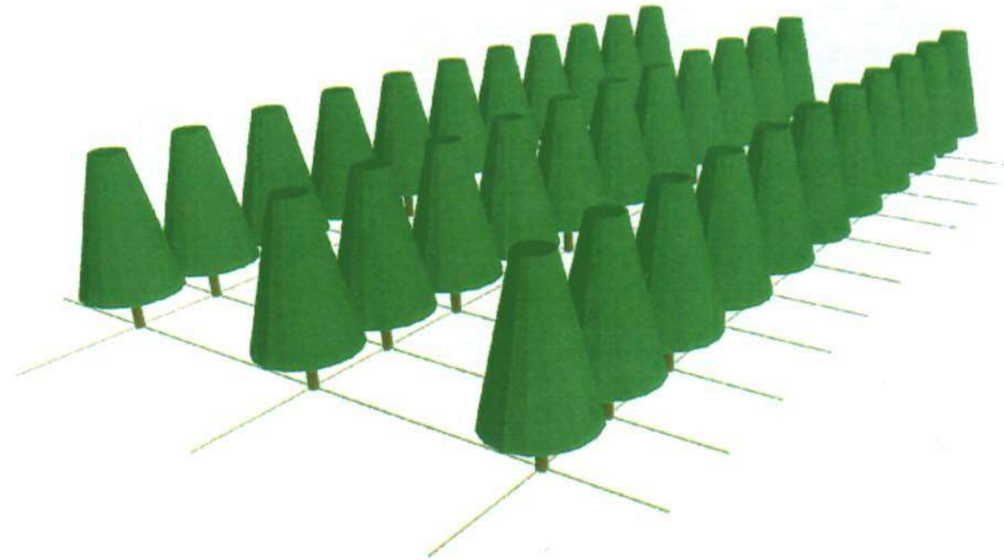
OBRAVNAVANJE 1

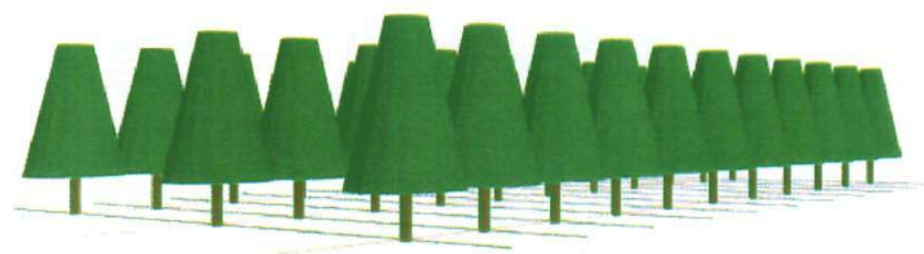
Enovrstni sistem

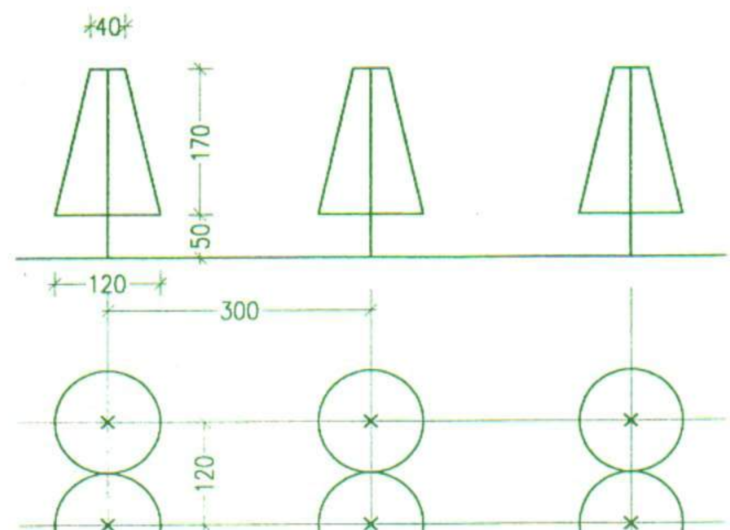
ozko vreteno

3 x 1,2 m

2500 trees/ha







Enostavna kalkulacija

Pridelek kg/ha	Povprečen strošek pridelave v €	Cena na/ kg v €	Prihodek pri prodajni ceni 0,25 €	Povprečen strošek pridelave v €	Cena na/ kg v €	Prihodek pri prodajni ceni 0,25 €
40.000	9.000	0.225	10.000	10.000	0.25	10.000
50.000	9.000	0,18	12.500	10.000	0.2	12.500
55.000	9.000 !!!!!?	0.163	13.750	10.000	0.181	13.750
60.000	9.000 !!!!!?	0.15	15.000	10.000	0.166	15.000
70.000				10.000	0.143	17.500
75.000				10.000	0.133	18.750

Na poti do potrošnika

Struktura stroškov dobavne verige – primer kartona jabolk, ki stane **17,00 €** (12,5 kg) = **1,36 €** iz južne hemisfere na evropskem trgu v letu 2014

Maloprodajna marža

4,42 €

26 % maloprodajna marža

Stroški prevoza

2,72 €

3 % prevoz znotraj države
5 % provizija uvoznika
8 % logistika znotraj države

Stroški izvoza in odprema tovora

3,74 €

15 % odprema tovora
3 % provizija izvoznika
4 % zavarovanja/stroški pristanišča/prevoz/industrijske takse

Pakiranje in embalaža

2,72 €

10 % stroški sortiranja in pakiranja
6 % embalaža

Stroški na kmetiji in prihodek kmeta

3,40 €

3,4 :12,5 = **0,272 €**

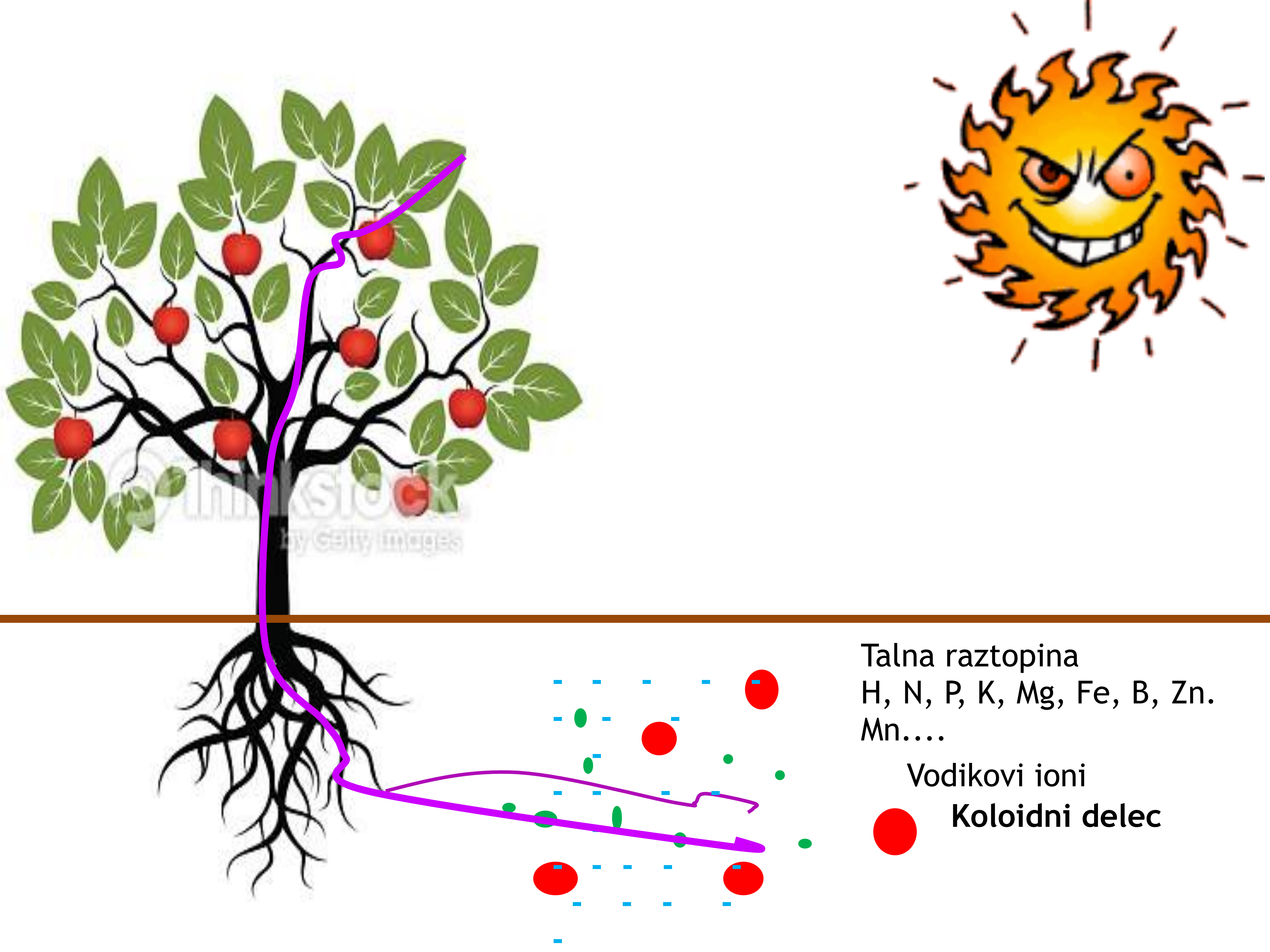
2 % stroški na kmetiji (ne vključuje kapitala in financ)
8 % gnojila, kemična sredstva + ostali stroški pridelave
10 % fiksni stroški in prihodek/ 12, 5 kg karton


DAH
COLLECTIVE SELF-DEFENSE
DANGER THIN ICE
CRACK

V zadnjih se je vreme zelo spremenilo

- vročinska obdobja
- pozno pomladi, poleti, sušna obdobja
- izrazito močna padavinska obdobja

- Gnojenje preko tal – foliarno gnojenje


Talna raztopina
H, N, P, K, Mg, Fe, B, Zn.
Mn....
Vodikovi ioni
Koloidni delec

FOLIARNO GNOJENJE – ZAKAJ?

Je to mogoče?

Zakaj je vegetativna rast tako pomembna?

Zakaj je vegetativna rast tako pomembna?

- pH 6-7
- 2,5 % organske snovi
- 25-35 mg P_2O_5/100 g zemlje
- 30-40 mg K_2O/100 g zemlje

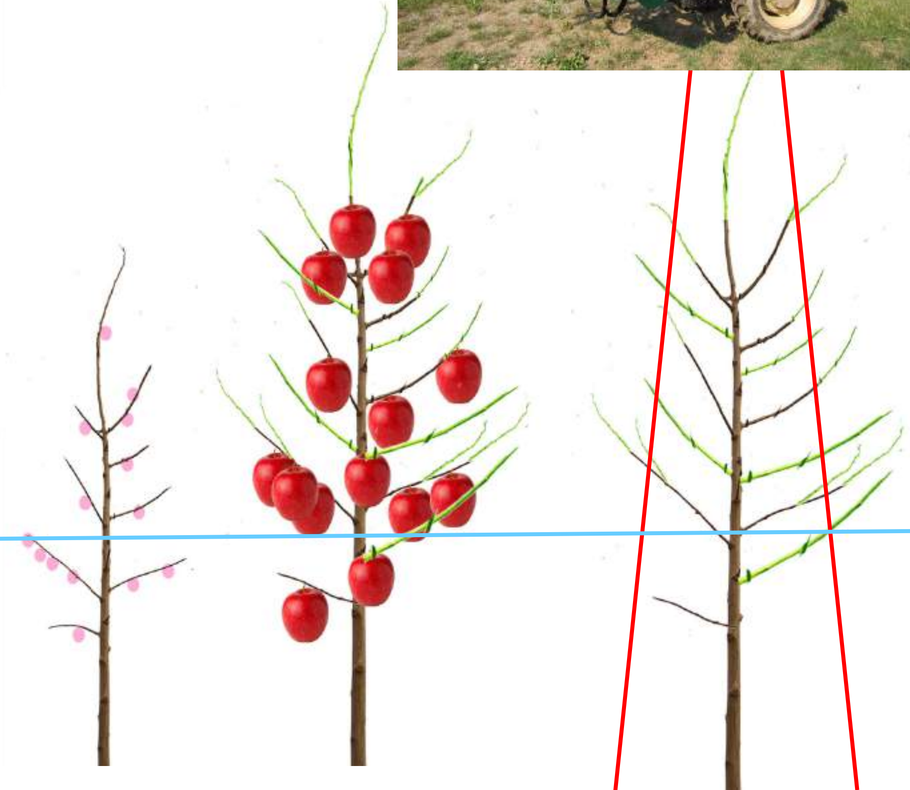



Zn, aminokisline, B, Ti, P+Ca, N+CA, Ca, Si

Alge, P, mikoriza...

10-15 plodov

2-3kg/drevo 10.000 kg/



Foliarno gnojenje po 20. avgustu
P+K – 3 X

Pred odpadanjem listja
N – 2 X
Zn, B




Alge - Phylgreen

P

Mikoriza

Huminske kisline

Zn - Maxflow Zn

Aminokisline - Delfa

B - Foliarel

Ti - Tytanit




Alge - Phylgreen

Aminokisline - Delfan

B - Foliarel

Ti - Tytanit

GLINA

N+Ca i mikroelementi -

Calitech

P + Ca -

Phostrade Ca

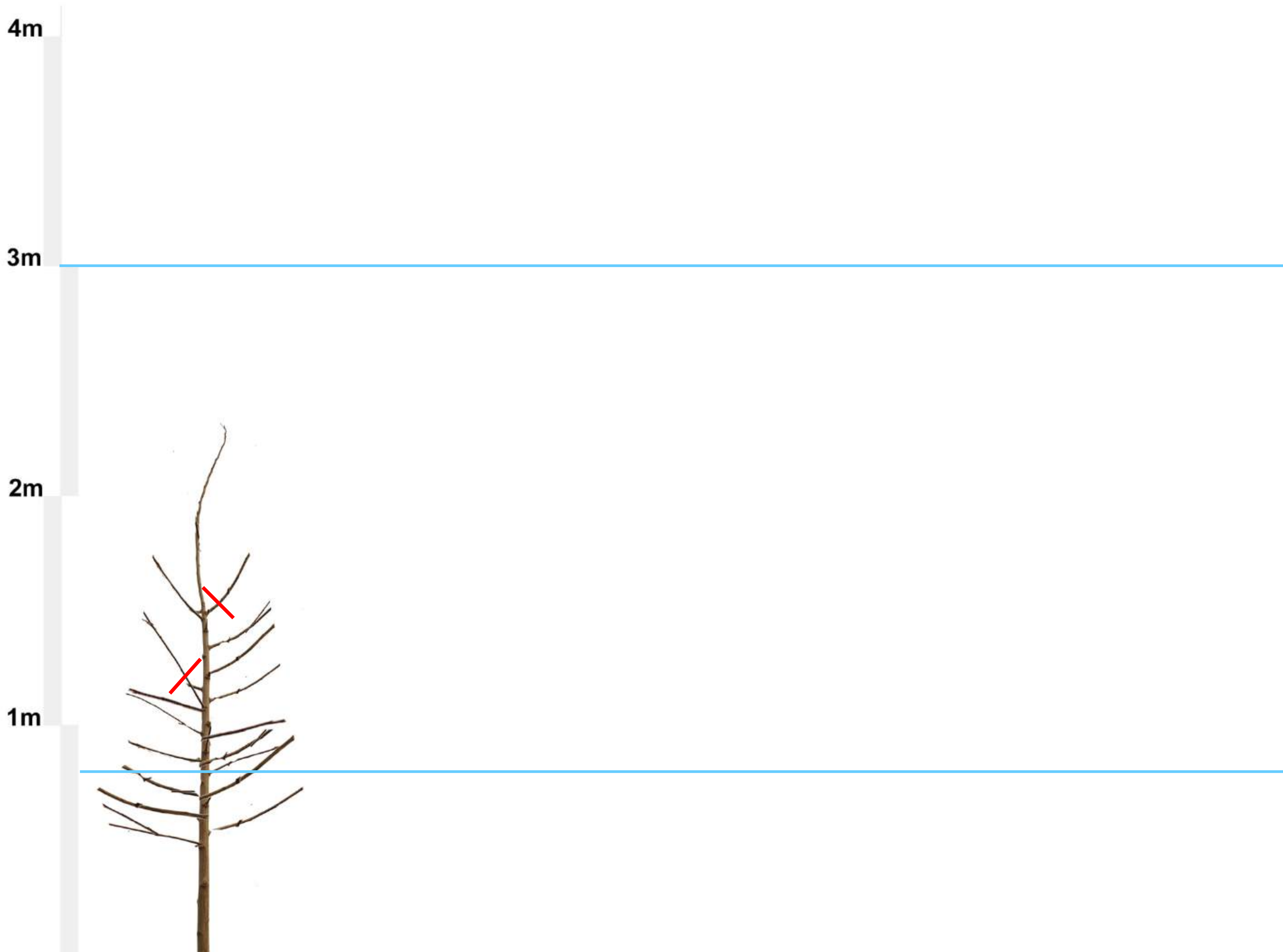
Ca -

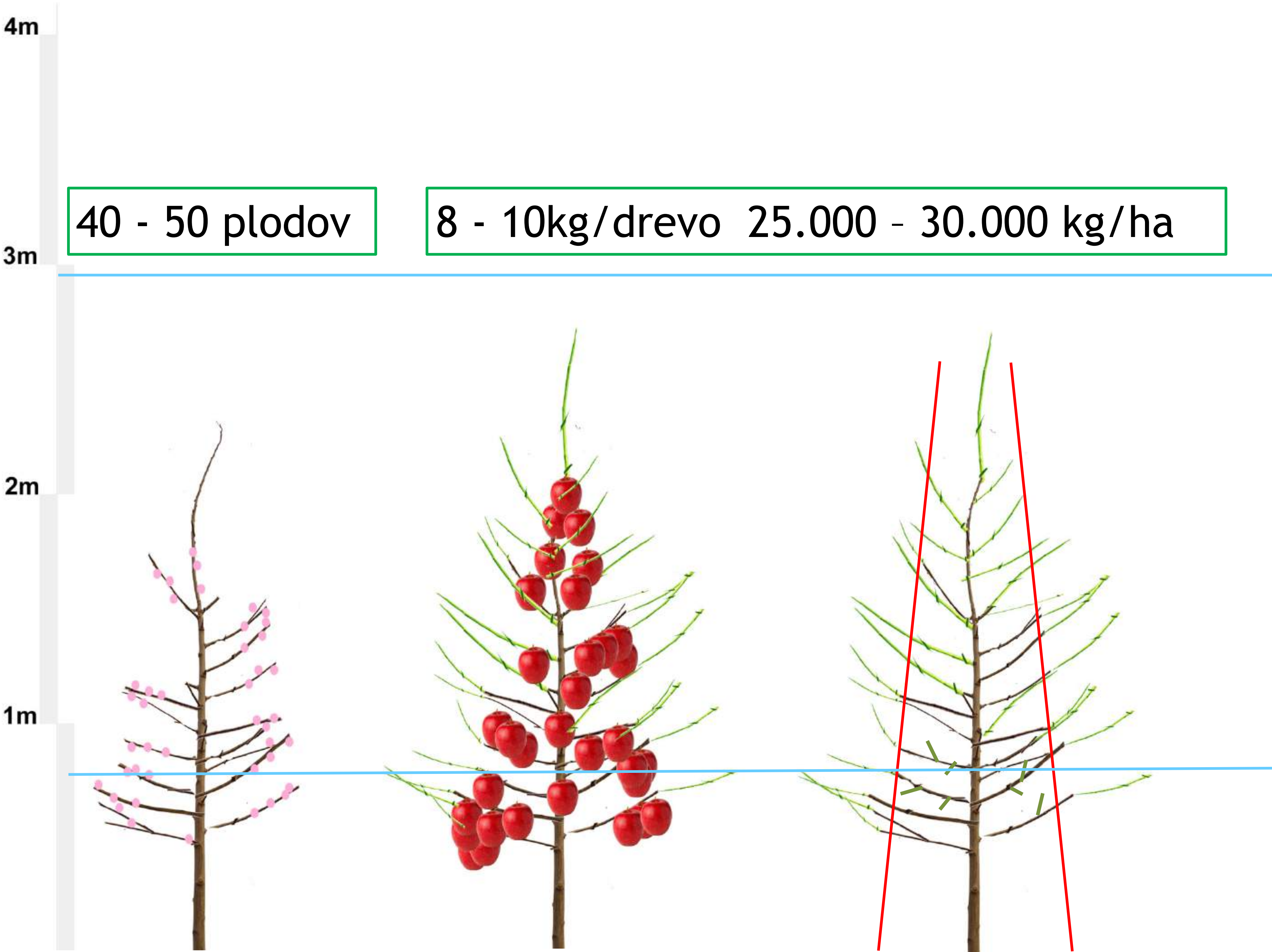
Maxflow Ca

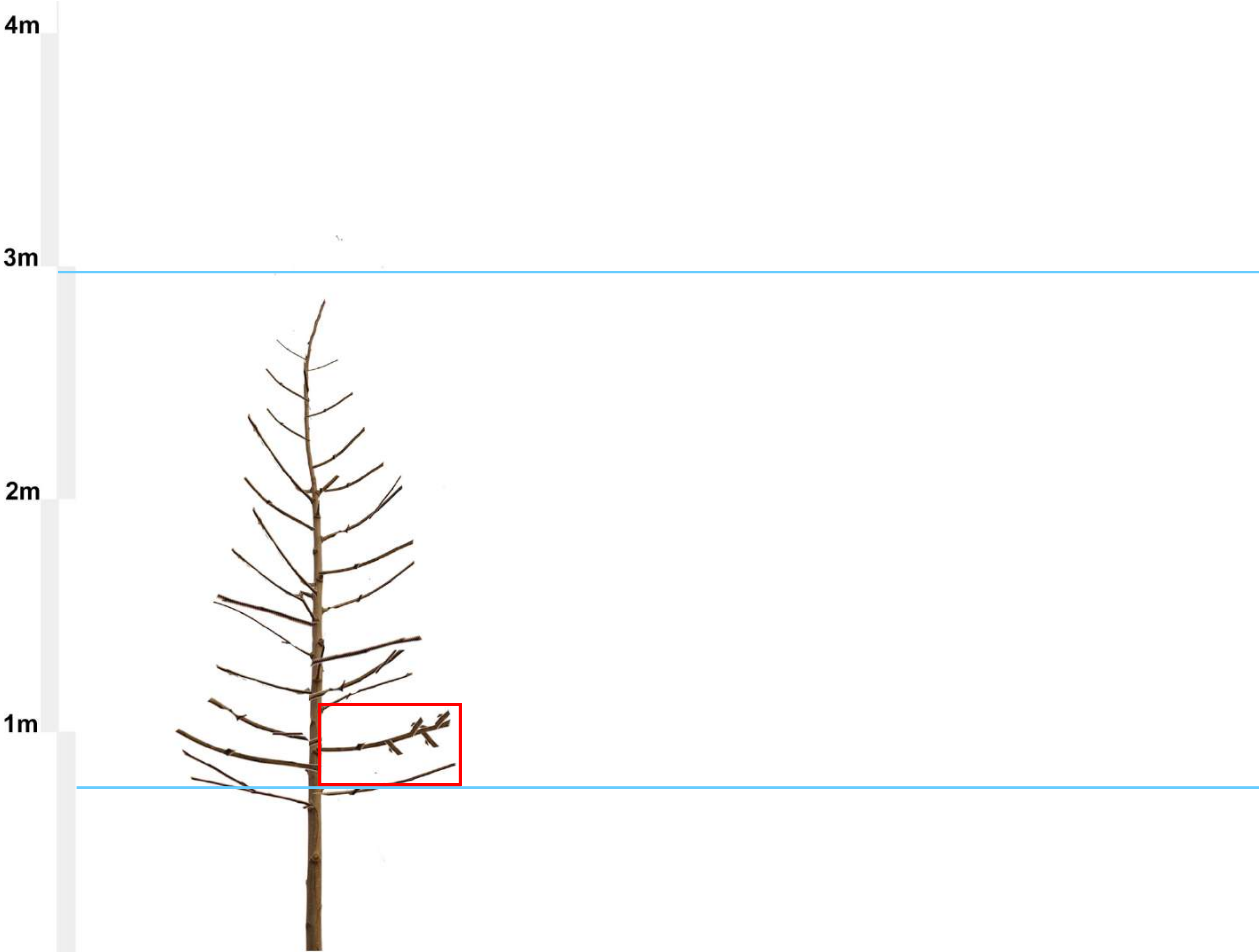
Ca -
Maxflow Ca
Si sa željezom - Otpysil

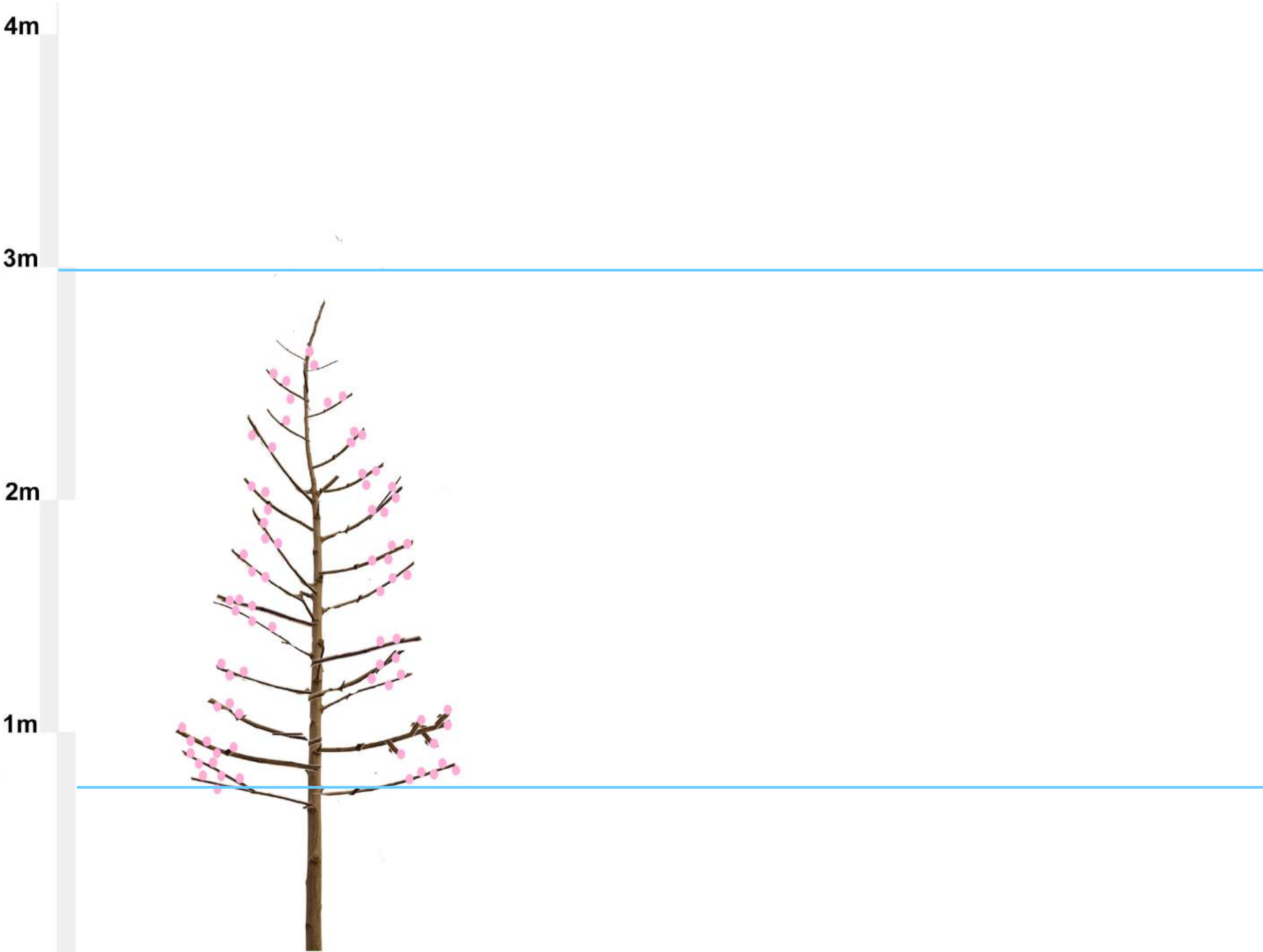
Mn - Maxflow Mn

2X P + Ca - **Ph**ostrade
Ca
3X P + K -
Trafos K


4m
3m
2m
1m

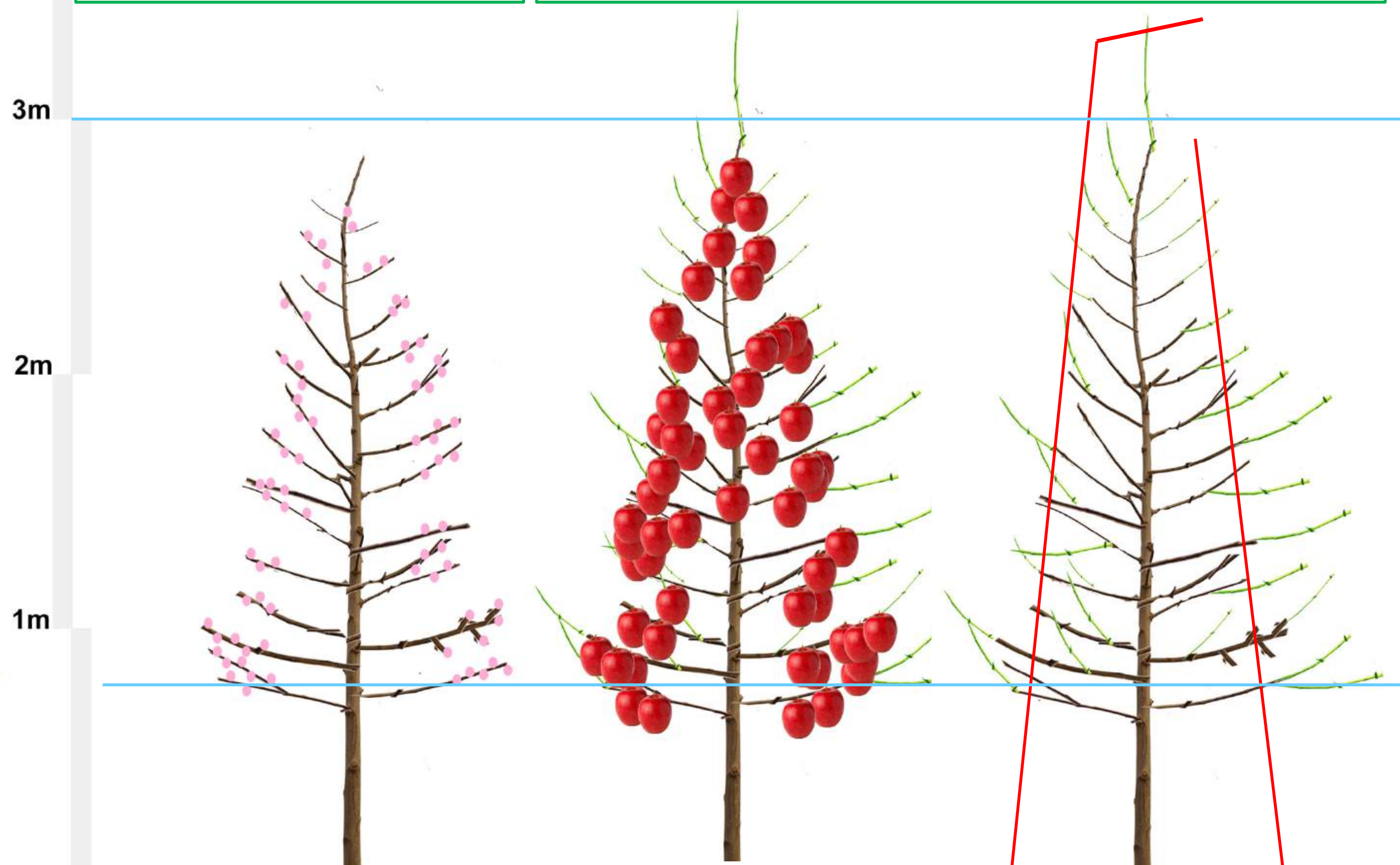

4m
3m
2m
1m
40 - 50 plodov
8 - 10kg/drevo 25.000 – 30.000 kg/ha


4m
3m
2m
1m

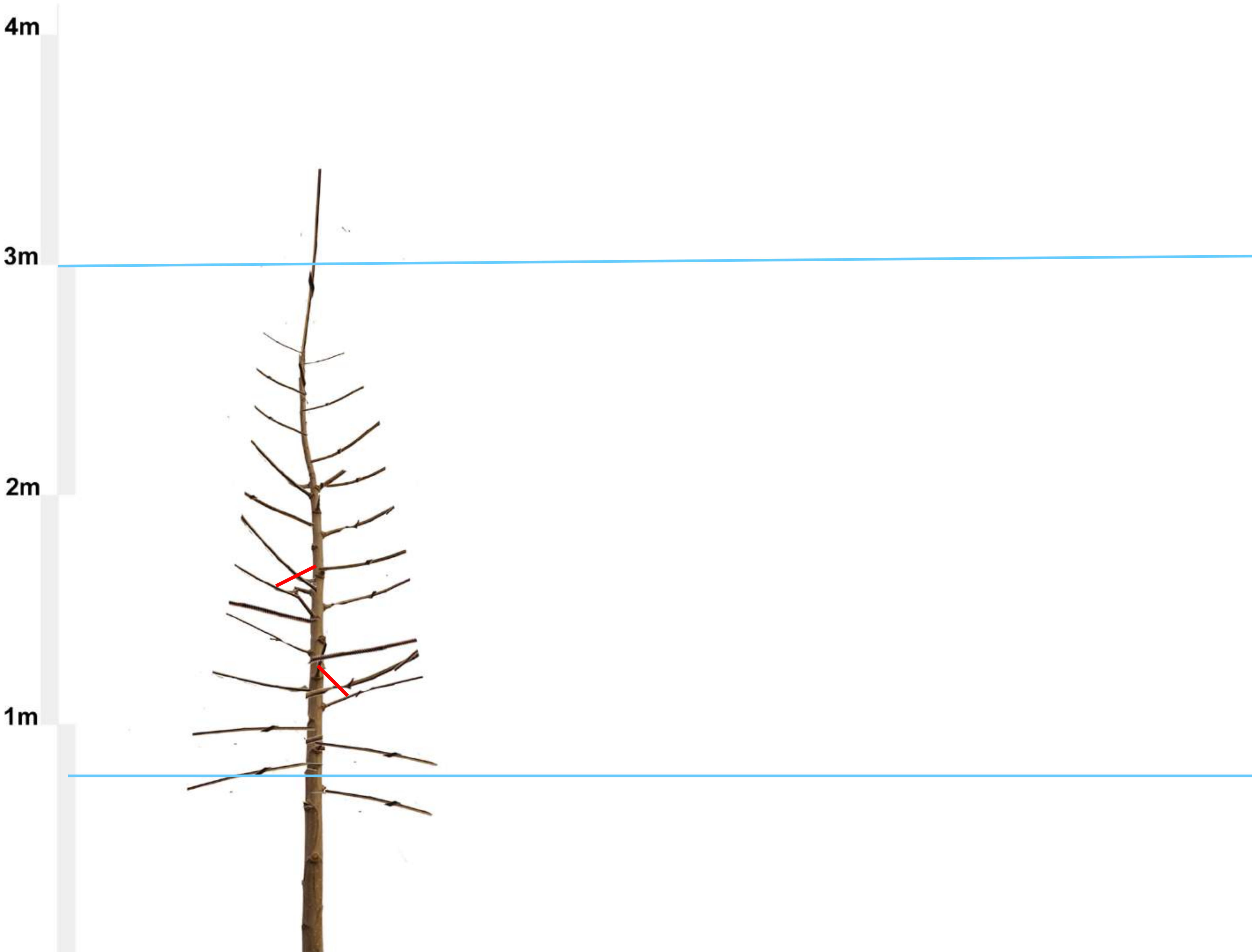

4m
3m
2m
1m

70 -100 plodov/ drevo

15 – 20 kg/drevo 48.000 -55.000 kg/ ha



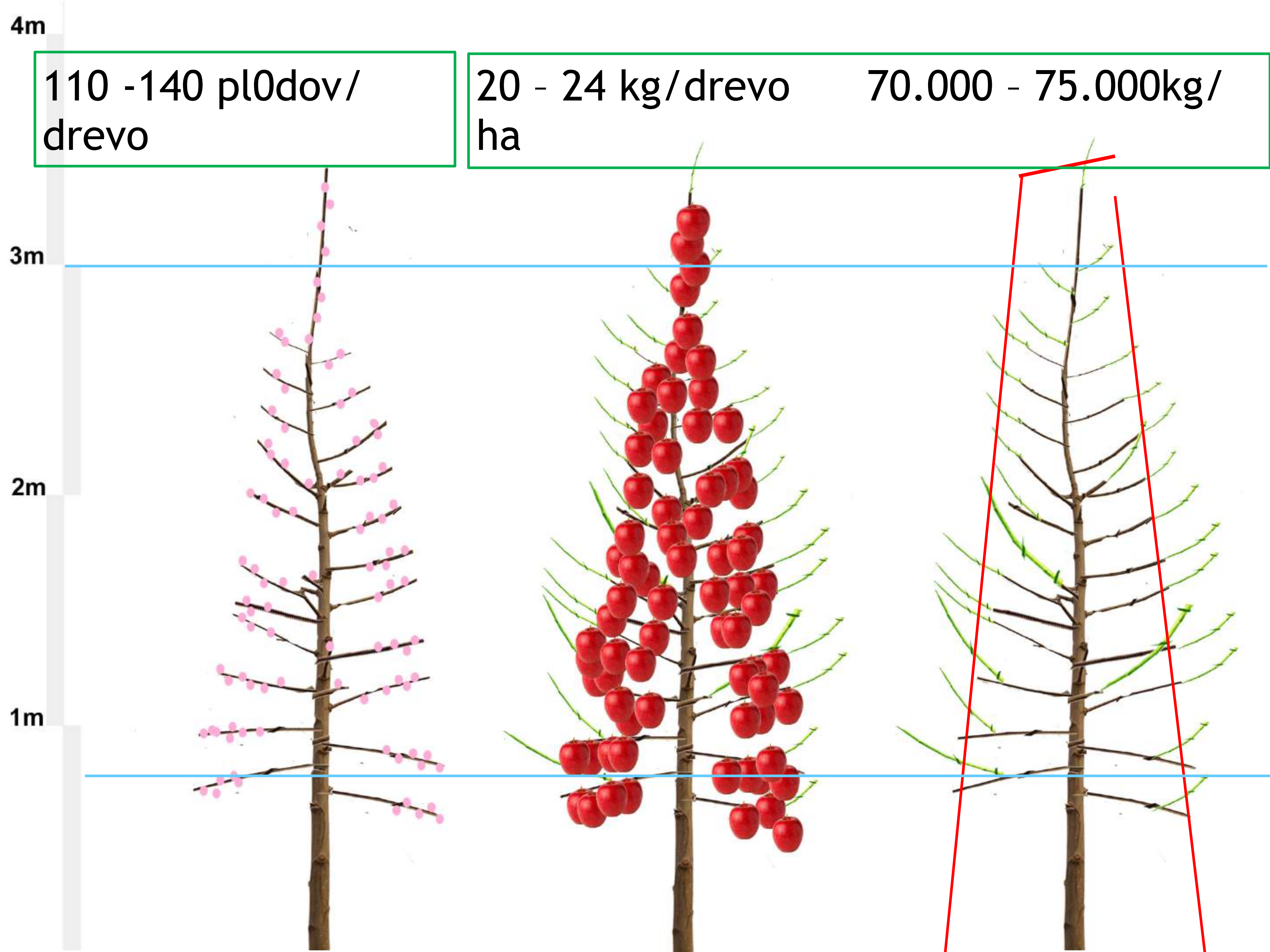

FAMA
FAMA


4m
3m
2m
1m


4m
3m
2m
1m

110 -140 pl0dov/ drevo

20 – 24 kg/drevo 70.000 – 75.000kg/ ha



Zamenjava zimske rezi s poletno rezjo

Kjer neznanje se šopiri, tam hudič se ne umiri!

JURANA d.o.o.

Limbuška cesta 64 a
2000 Maribor

GORDANA VEBER

POME FRUIT TREES
NUTRITION SOLUTIONS

Delfan® Plus

proste amino kisline

28,8% w/v (24% w/w)

N : 10,8% w/v (9% w/w)

C : 27,6% w/v (23% w/w)

O.S. : 44,4% w/v (37% w/w)

JURANA

TRADECORP
NUTRI-PERFORMANCE

DELFAN PLUS - biostimulator

100% aktiven odgovor na stresne siruacije

Delfan® Plus

- **Količina uporabe:**
  - 1,0-2,0 l/ha – foliarno
  - 10-20 l/ha - fertirigacija

DELFAN PLUS - aminogram

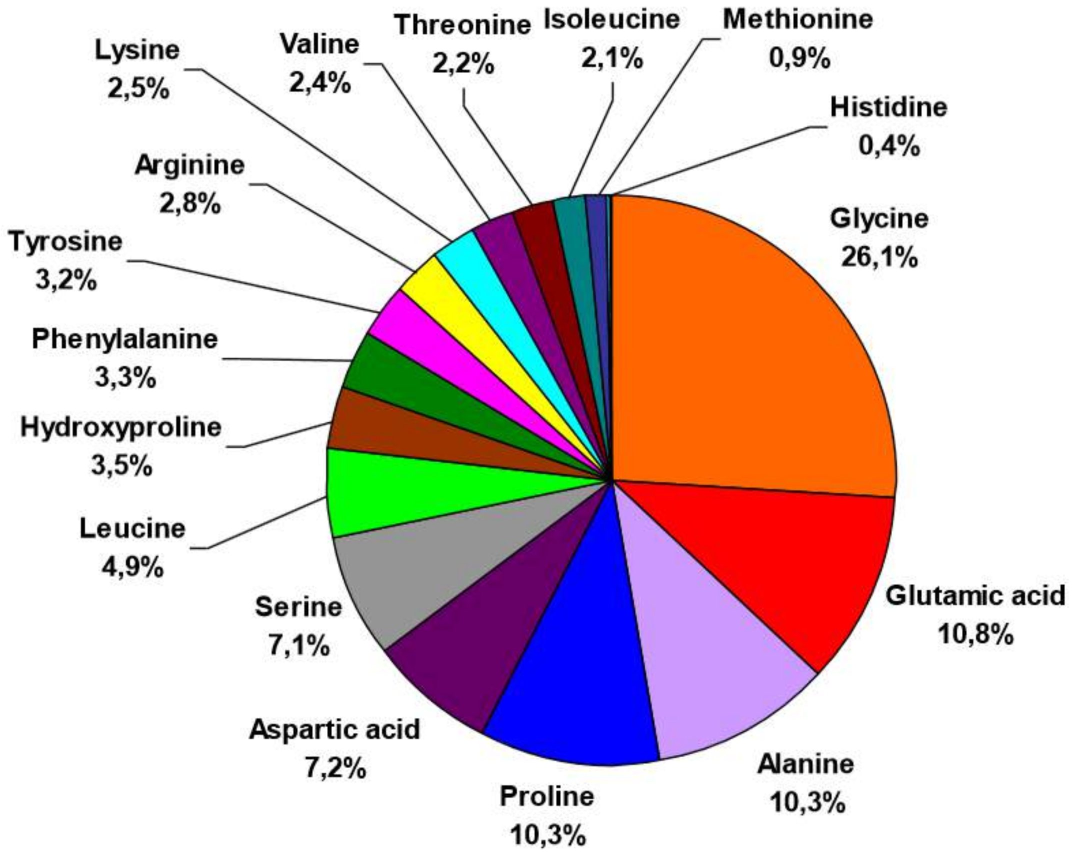
AMINOGRAM

Predstavlja sastav/odnos aminokiselina u preparatu

DELFAN PLUS

Optimalni odnos između količine:

- **Glicina**
- **Glutaminske kiseline**
- **Alanina**
- **Prolina**



POME FRUIT TREES

NUTRITION SOLUTIONS

Delfan Plus

JURANA

REŠITEV ZA STRESNE SITUACIJE

Suša
Ožigi
toča
Pozeba
Nizke temperature
……

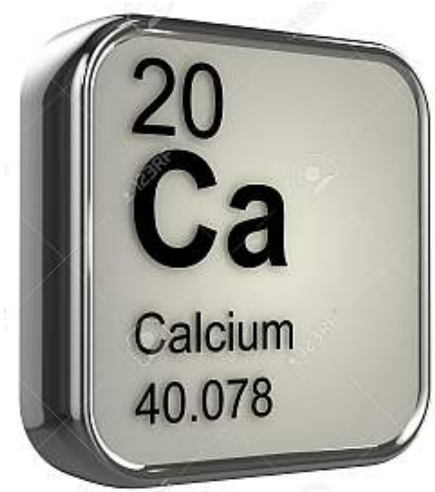
TRADECORP
NUTRI-PERFORMANCE

tradecorp
nutri-performance

JURANA

Pomen Ca v pridelavi sadja

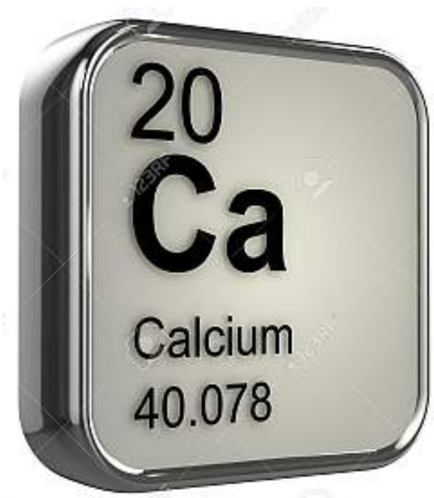
Kalcij (Ca)



Fiziološka vloga Ca:

1. Kakovost plodov
2. Vsebnost suhe snovi
3. Okus plodov
4. Obarvanost plodov
5. Boljše skladiščenje plodov
6. Večja odpornost rastline na fiziološke motnje

Kalcij (Ca) – konkurenca:



P

Mg

Zn

Mn

K

foliarna prehrana s kalcijem

2.

1.

3.

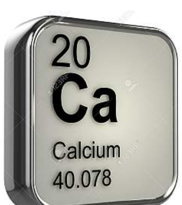
Maxflow Ca

KONCENTRIRANA RAZTOPINA KALCIJA, BREZ NITRATOV, KLORIDA, SULFATA.

CONCENTRAZIONE DI CALCIO

- **53,8 % CaO**
- **1 lit. = 1,60 kg !!!**

Količina 3,5-4 l/ha



tradecorp
nutri-performance

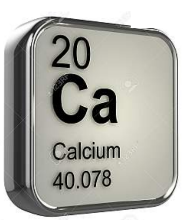
Calitech

KONCENTRIRANA RAZTOPINA KALCIJEVEGA NITRATA Z MAGNEZIJEM IN MIKROELEMENTI

AKTIVATOR RASTI !!!

- **10,0 % CaO**
- 15,0% N; 2% MgO
- mikroelementi

Doza: 5 l/ha

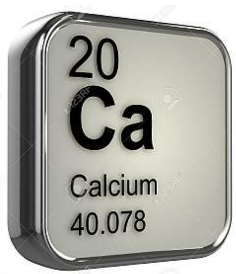


tradecorp
nutri-performance

MAX. učinek kalcija (1):

Maxflow Ca

Boramin Ca

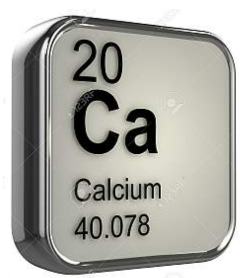


64,2% Ca !!!

MAX. učinek kalcija(2) :

Maxflow Ca

Calitech



79,0 % Ca !!!

Phostrade Ca

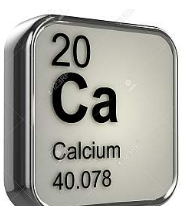
KONCENTRIRANA RAZTOPINA FOSFORJA IN KALCIJA

NP CON CALCIO

P+Ca

- **<u>5,6 % CaO</u>**
- 30,7 % P_2O_5
- 3,9 % ukupni N

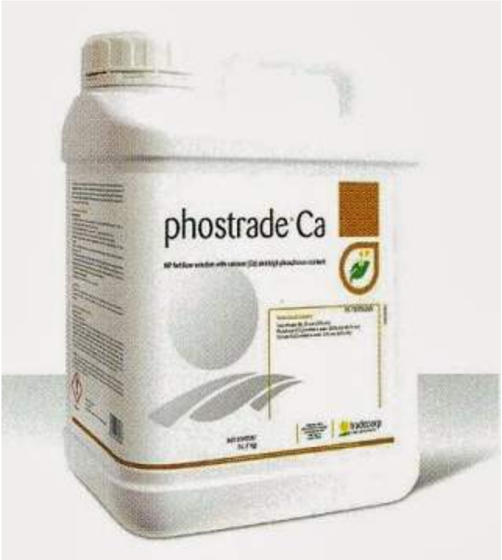
Doza: 5-10 l/ha



tradecorp
nutri-performance

Phostrade Ca

- večji plodovi
- Boljša barva
- boljše skladiščenje



TRADECORP
NUTRI-PERFORMANCE

POME FRUIT TREES

NUTRITION SOLUTIONS

TRAFOS K (kalijev-fosfit)

1 l = 1,4 kg

- Gnojilo na bazi Kalijevega-fosfita (H_2KO_3P - fosfonati)
- PK 30-20 (50%)
- Količina uporabe 3l/ha večkrat v času vegetacije, skupaj s pesticidi
- Pomemben za:
  - Oskrbo rastlin s fosforjem in kalijem
  - Veča odpornost (FITOALEKSINI) na bolezni. NI FUNGICID (NIMA KARENCE!!!)

Humistar ®

Tekoči humus, na osnovi
Ameriškega leonardita.
Izboljša fizikalne, kemične in biološke
lastnosti tal.

Skupni huminski ekstrakt 15%
Huminske kisline 12%
Fulvo kisline 3,3%
K_2O 5%
Poraba 50-70 l/ha, v 2-3 obrokih, od
začetka vegetacije

Humistar® Humifirst®

Osnovne lastnosti:

1. TEKOČI ekstrakt HUMUSA
2. BREZ TEŽKIH kovin (ne vsebuje Hg, Cr, Pb..)
3. Ima eko certifikat
4. Visoka kompatibilnost z ostalimi preparati

Kdaj uporabiti:

1. **Pri sajenju** – direktno na korenine (škropljenjem/ potapljanjem) – vpliva na hitro obnovo in rast korenin
2. **Pri uporabi kelatov(Fe),** v tla, ob pojavi kloroze-hitrejši transpor kelata v korenine in v rastlino

Humistar

Humistar

3. **Izboljša kemijsko fizikalne lastnosti tal**-razmerje voda-zrak (glinasta tla); zadržuje hranila (peščena tla)

4. **Zakisanje karbonatnih/ slanih tal** pri uporabi ATS (amonijevega-tiosulfata)

5. **Za boljše osvajanje in mobilnost hranil** v tleh na začetku vegetacije (hladna tla spomladi)

6. Za **povečanje mikrobiološke aktivnosti tla** (uporaba mikorize)

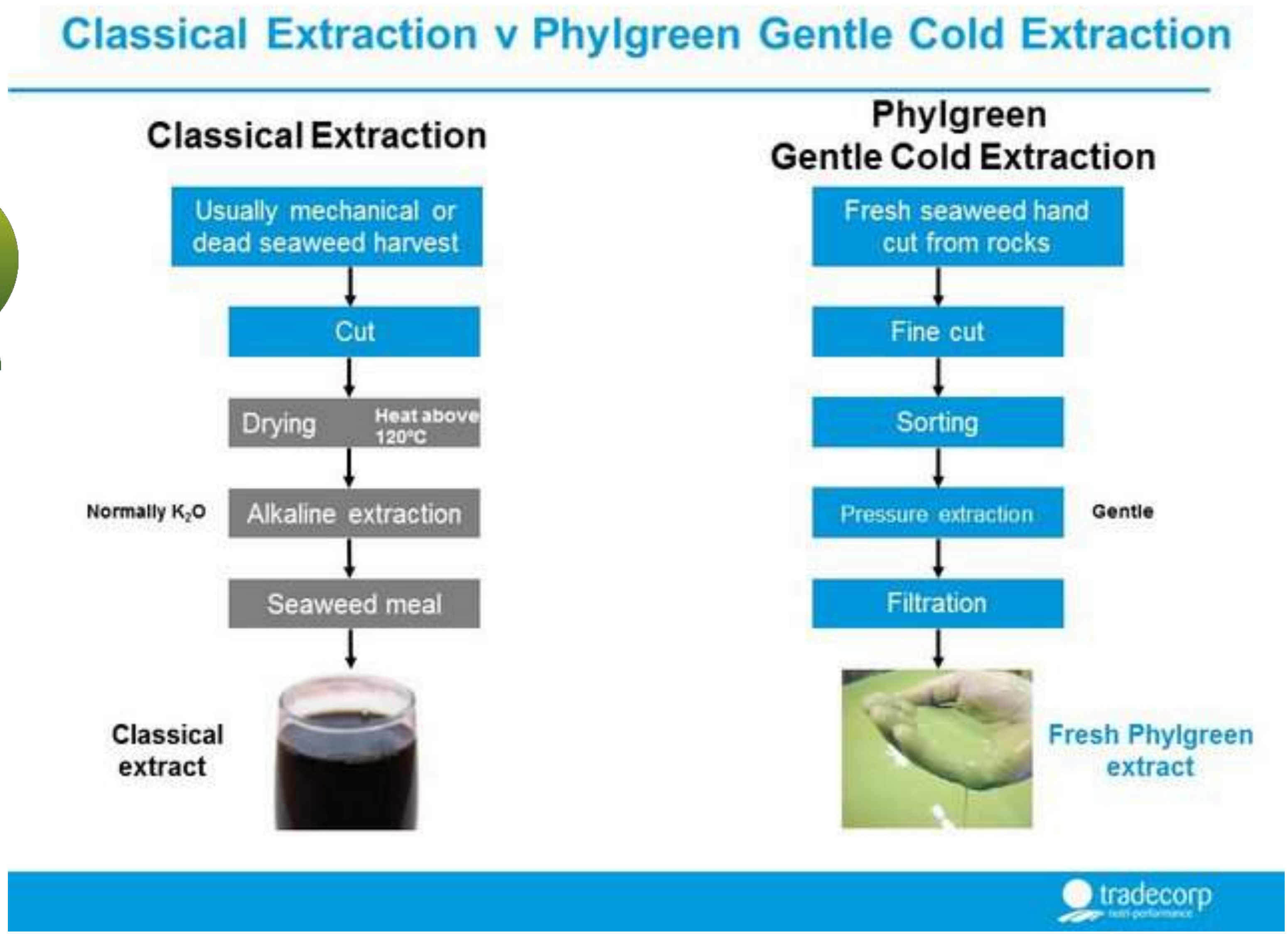
Phylgreen®

HLADNO STISKANE ALGE

Ekstrakt morske alge Ascophyllum nodosum

Visoka koncentracija, brez težkih kovin

Razlika v načinu ekstrakcije



END

GNOJILA TRADECORP ZA EKOLOŠKO PRIDELAVO:

ULTRAFERRO, Fe v kelatni obliki, za talno aplikacijo, 6% Fe

TRADECORP Ca, Ca v kelatni obliki, za fertirigacijo, 14% Ca

TRADECORP Cu, 14,5% Cu

TRADECORP Mn, 13% Mn

TRADECORP Zn, 14% Zn

TRADECITRUC, 6% Mn, 8% Zn

TRADECORP AZ, mikroelementi, Fe+B+Mn+Mo+Cu+Zn

HUMISTAR, 12% huminskih kislin, 3% fulvo kislin

HUMICAL huminske kisline s Ca

HUMIFIRST WG, 54% huminskih kislin+14% fulvo kislin

ATON Fe, aminokisline s Fe

ATON Mn, aminokisline z Mn

ATON Zn, aminokisline z Zn

TRADEBOR, 11% B

AMIKOL K, aminokisline s K, 31% K

MAXFLOW Ca, 33,6 % Ca

MAXFLOW Mg, 36,7% Mg

MAXFLOW Mn, 28% Mn

MAXFLOW Zn, 40% Zn

MAXFLOW Zn+Mn, 14% Mn, 19,6 % Zn

DELFAN PLUS, aminokisline 24%

PHYLGREEN, alge

JURANA

jurana

Altincoagro

JURANA


Algasil
Ut nulla. Vivamus bibendum, nulla ut congue fringilla, lorem ipsum ultricies risus, ut rutrum velit tortor vel purus. In hac habitasse platea dictumst.
SIN RESIDUOS
Altincoagro


PROTECCIÓN DE CULTIVOS
Copfort
Fitofortificante + Inductor de respuestas de defensa frente a situaciones adversas + Tratamiento cúprico de fácil absorción y rápida translocación a todos los órganos de la planta (sistémico)
ECOCERT
FOLIAR
RADICULAR
SIN RESIDUOS
ECOLÓGICO
Altincoagro

JURANA

$CaCO_3$ **77,9%**

CaO 45%

$MgCO_3$ **8,7%**

SiO_2 **7,4%**

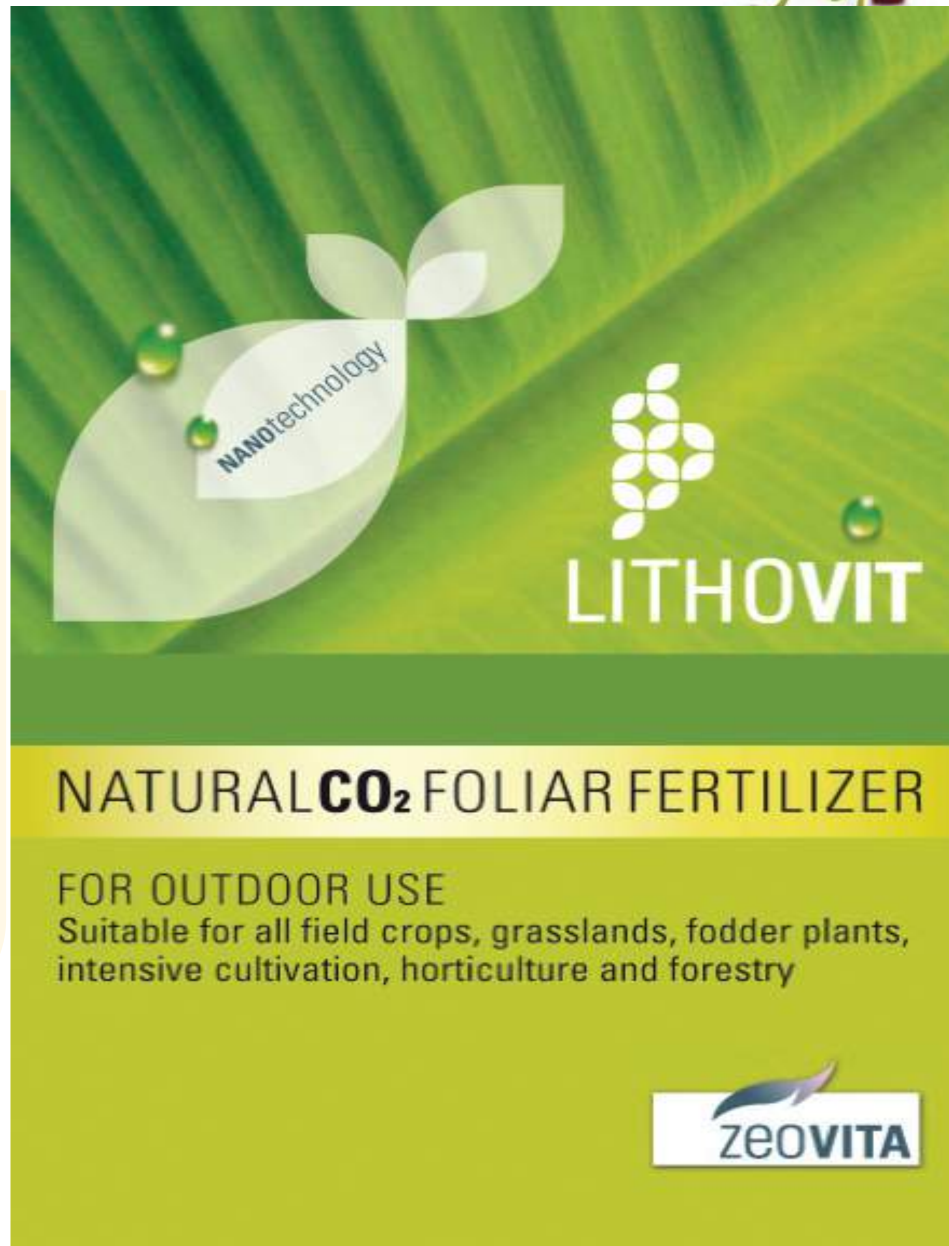
K_2O 0,1%

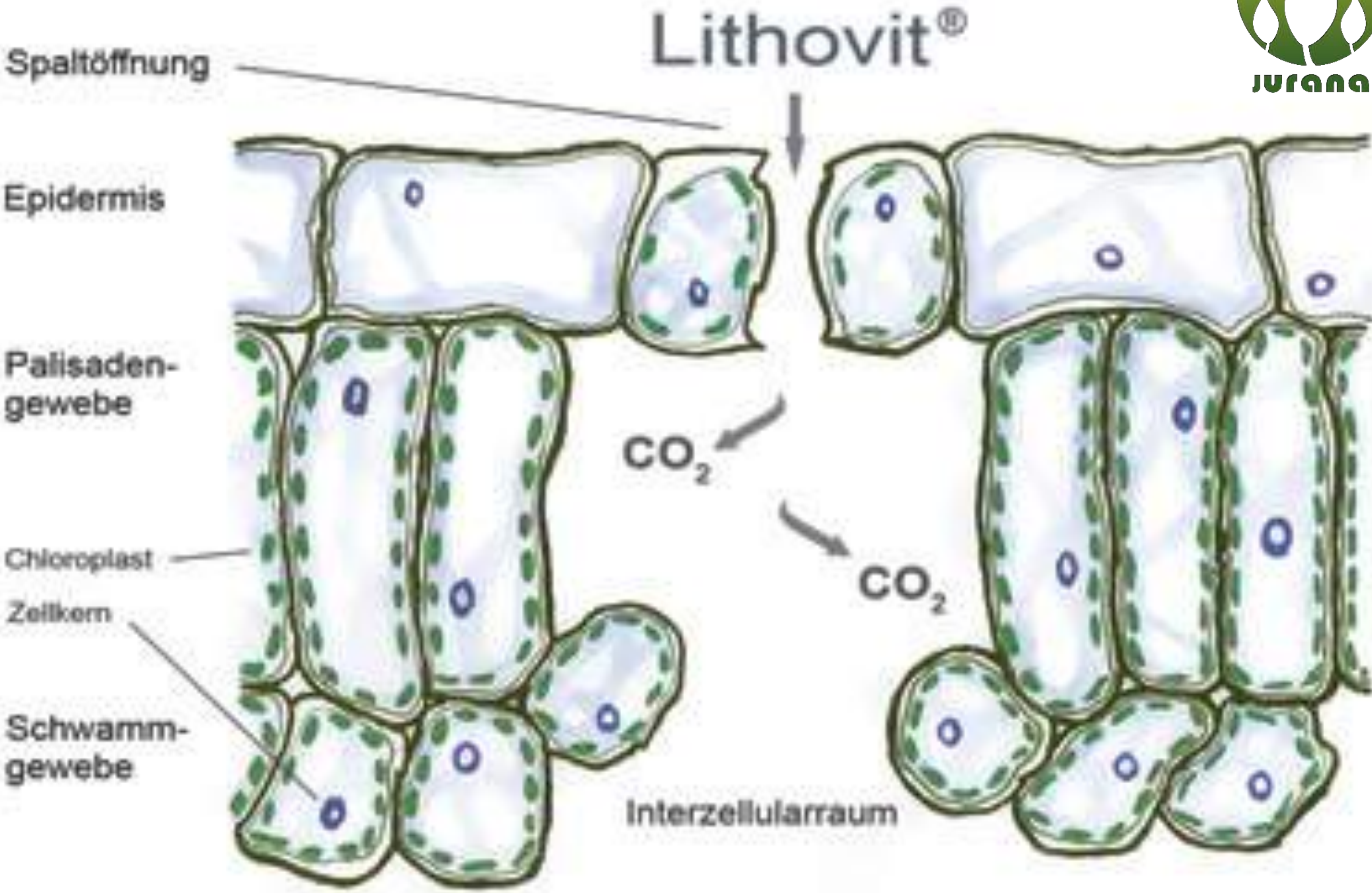
P_2O_5 > 0,02%

Fe 7,418 mg/kg

Mn 172 mg/kg

Zn 10 mg/kg




Lithovit®
Spaltöffnung
Epidermis
Palisaden-
gewebe
Chloroplast
Zellkern
Schwamm-
gewebe
CO_2
CO_2
Interzellularraum


LITHOVIT®

LITHOVIT®

Mycogel - mikoriza

Kaj JE mikoriza?

Simbioza **korenin rastline** (enoletnih ali večletnih) z **micelijem gljive**, ki živi v tleh (najpogosteje rod Glomus sp., je pa tudi nekja posebnoh rodov)

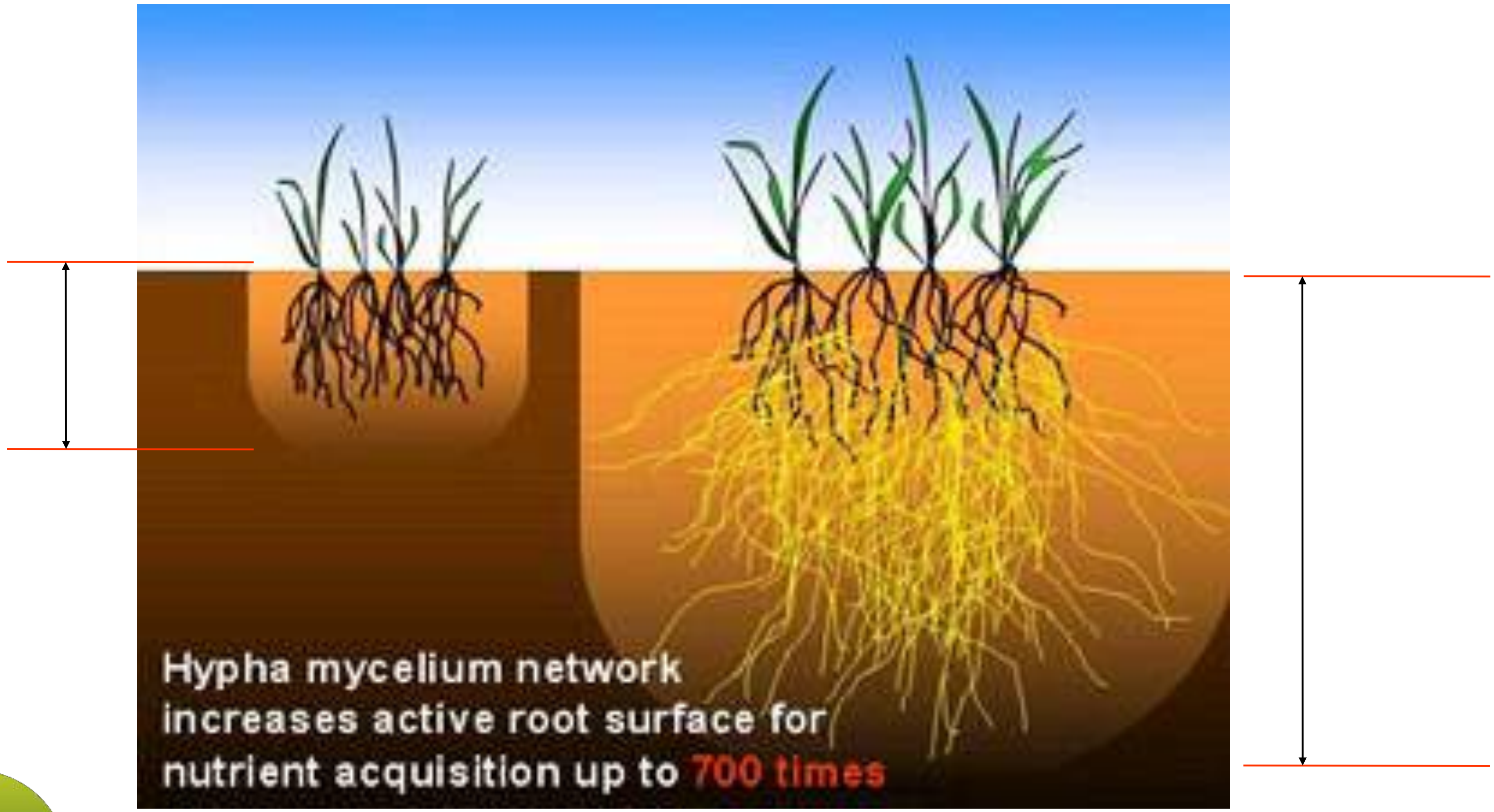
Poveča absorbcijo vode in hranil
Vpliva-poveča topnost fosforja
Stimulira rast rastlin in njihovo preživetje v času stresnih situacij (suša, slanost, siromašna tla, extremni pH
Poveča odpornost rastlin na bolezni in škodljivce

JURANA

To JE učinek mikorize

JURANA

Mikoriza poveča odpornost na sušo



Do 700x !!!!

END

POME FRUIT TREES
NUTRITION SOLUTIONS

JURANA

ATS
Amonijev tiosulfat

Tudi za redčenje jablan, sliv, češenj, breskev

12 % N
26 % S

ASPANGER glina

uporaba gline

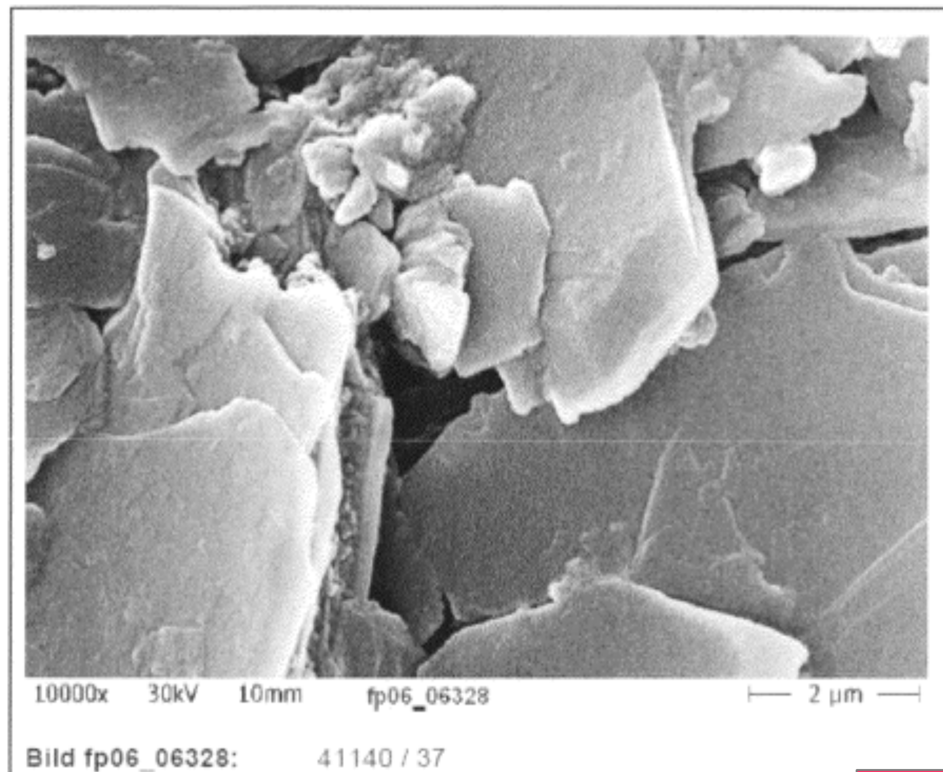
Učinki uporabe gline v pridelavi jabolk:

- Zmanjša se škoda zaradi ožigov
- Zmanjša se pojav "**mrežavosti**" plodov pri Zlatem delišesu
- Zaščita rastlin pred visokimi temperaturami
- Moti življenski cikel številnim insektom
- Boljše zdravstveno stanje listne mase

uporaba gline

ASPANGER glina

- količina: 2,5-30 kg/ha
- KOMPATIBILNOST s pesticidi
- Nima karence
- ASPANGER glina je MUSKOVIT (ni kaolinit)



Glavne skupine gnojil Intermag

- Biostimulatorji in aktivatorji hranil
- Vodotopna NPK gnojila z mikroelementi
- Tekoča gnojila za posamezne kulture
- Tekoča gnojila na osnovi mikroelementov
- Gnojila na osnovi mikroelementov v kelatni ob
- Druga gnojila za profesionalno uporabo
- Gnojila za dom – hob
- Agrokemični pro

INTERMAG
AGROINNOVATIONS

AGRO
INNOVATIONS

Intermag gnojila in biostimulatorji – rešitve za moderno pridelavo

Grzegorz Cieśliński, Ph.D.

OPTYSIL

- OPTYSIL je tekoči proizvod, ki spodbuja rast rastlin in strpnost na stres
- uporablja se kot vodno raztopino.
- 100% topen v vodi

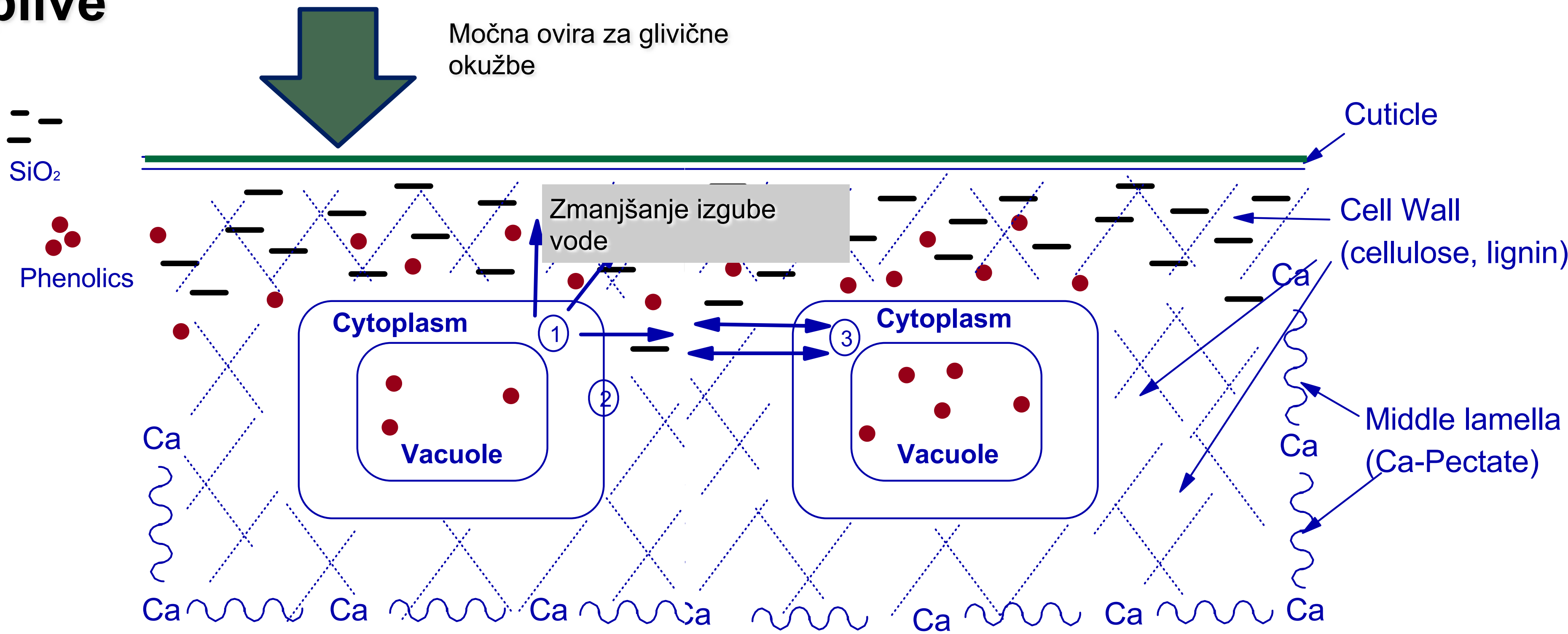
Koncentracija hranil	% (m/m)	g/l
Silicij (SiO_2)	16.5	200
Żelezo	2,0	24
pH	6,0 +- 0,5	

OPTYSIL vpliv na rastline - zmanjšanje stresa

- Izboljša odpornost celične stene do patogenov
- Povečuje odpornost rastlin "na nizke temperature
- Zmanjšuje izgubo vode v času suše
- poveča fotosintezo v slabih svetlobnih pogojih
- Odpravi toksični učinek aluminija na rast korenin

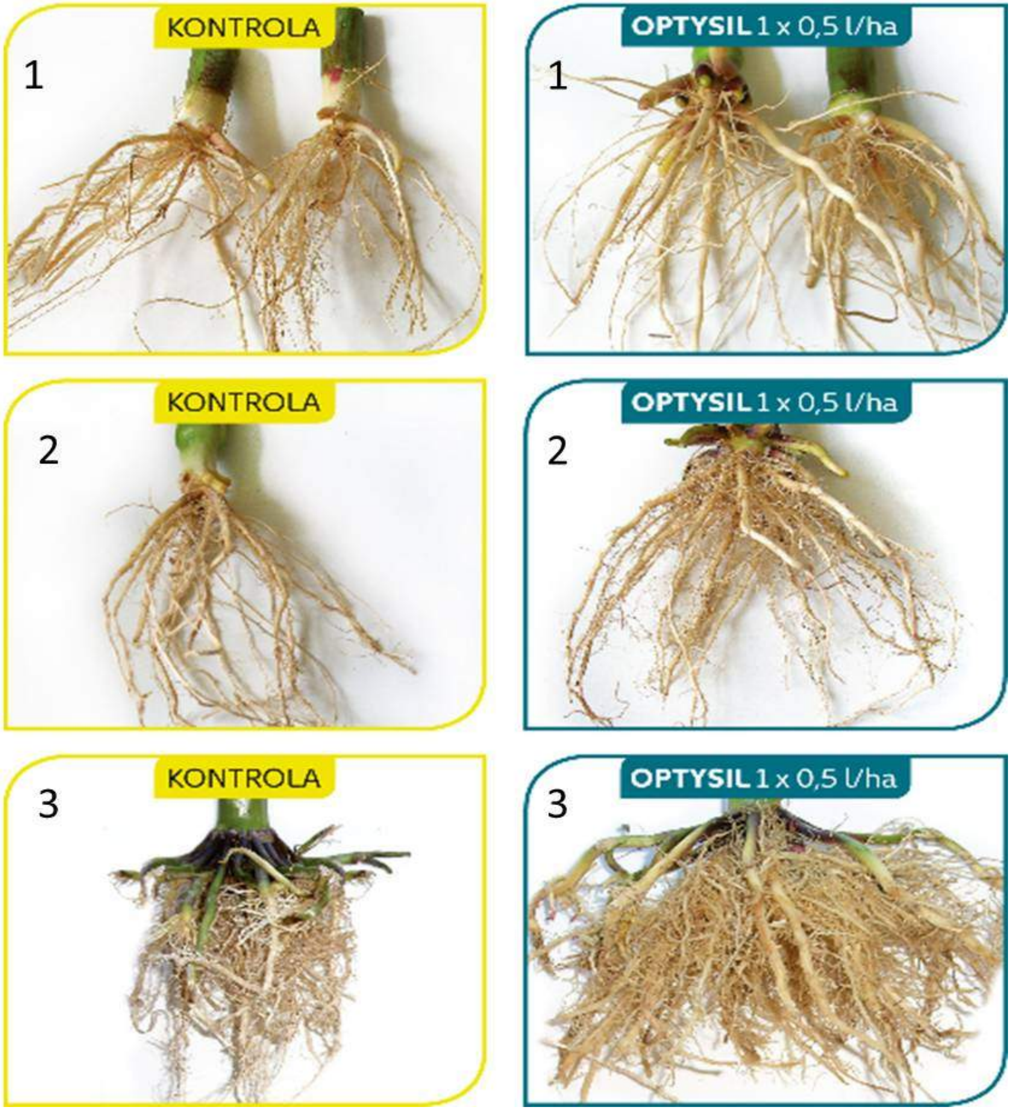
kalcij in silicij integrirana dela celične stene

Celična stena je močnejša in bolj odporna na mehanske vplive



Vir: Marschner, H. (1986); Mineral Nutrition of Higher Plants

Učinek OPTYSIL na razvoj korenin koruze sorte Vitras za silažo.



1. Korenine rastlin, 7 dni po uporabi OPTYSILa.

2. Korenine rastlin, 14 dni po uporabi OPTYSILa.

3. Korenine rastlin, 21 dni po uporabi OPTYSILa.

Tytanit

- **Tytanit je tekoči proizvod, ki stimulira rast rastlin**
- 100% vodotopen
- Se meša z večino gnojil in sredstvi za varstvo rastlin

sestava	% (w/w)	g/l
Titan (Ti)	0,7	8,5
Magnezij(MgO)	5,0	65,0
žveplo (SO_3)	10,0	130,0

Tytanit

Izboljša

poveča aktivnost Ca kationa v cvetovih

Poveča pridelek 10-20 %

Tytanit

Poveča sprejem hranil iz tal

Izboljša kalivost peloda

Poveča odpornost rastlin na abiotične strese

Stresne situacije

Pozeba

Delfan plus 1,5-2l/ha

Phylgreen 2l/ha

Frosteks 5-7l pri porabi vode 500-750l/ha

Toča

Delfan plus 1,5-2l/ha

+ **Phylgreen** 1-2l ha

Vročine

Delfan plus1,5l/ha+ **Optysil 0,5l/ha** ali pa

Lithovit forte 2kg/ha

Ožigi **Optysil0,5l/ha** ali pa **Aspanger glina** 10kg/ha

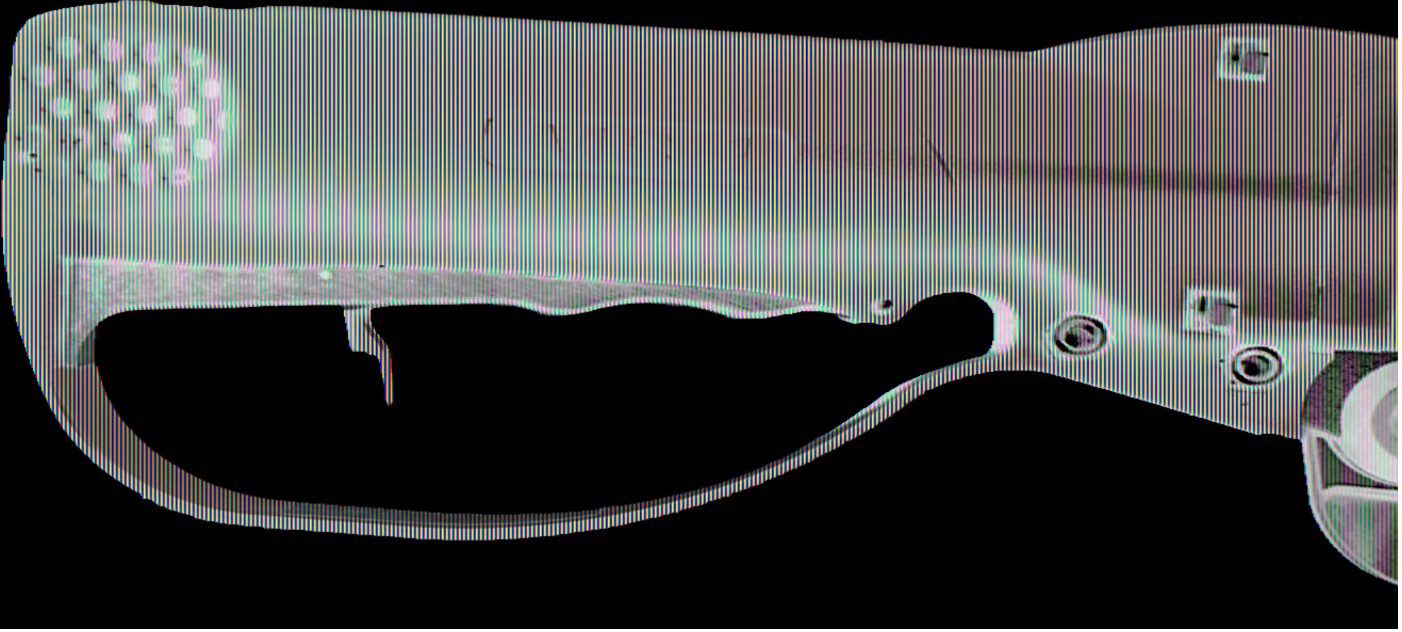
www.gnojidba.info

ELECTROCOUP F 3010

Castellari s.r.l.

COSTRUZIONE FORBICI PER L'AGRICOLTURA

JURANA



Castellari s.r.l.
COSTRUZIONE FORBICI PER L'AGRICOLTURA

JURANA

Castellari s.r.l.
COSTRUZIONE FORBICI PER L'AGRICOLTURA

JURANA

HVALA!




Varstvo sadnega drevja

Aleš GROBIN

metrob®

Jamstvo izvorne kakovosti

Novosti v letu 2017

Jamstvo izvorne kakovosti

- Sercadis® (Fluksapiroksad - Xenium)
- Delan® Pro (Delan + K fosfid)
- Scala® (Pirimetanil)
- Vitisan® (K – hidrogen sulfat)
- Curatio® (Žveplenoapnena brozga)
- Pol-Sulphur® 80 SC (tekoče žveplo)
- Cuprovin® (bakrov oksiklorid 50% - gnojilo)
- Wetcit®
- Agree®/Delfin ® (Bacillus thuringhiensis)
- Prestop® (Gliocladium catenulatum)

Sercadis®

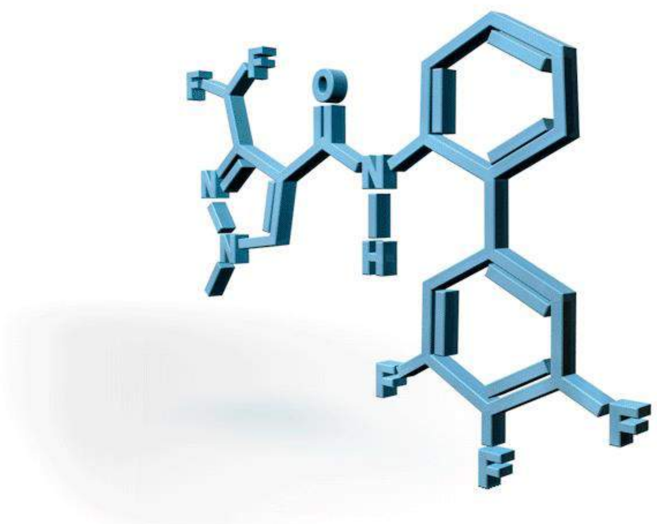
Jamstvo izvorne kakovosti

Proizvod	Sercadis®
Uporaba	**Pečkato sadje**, vinska trta
Spekter delovanja	Jablanov, hrušev škrlup, jablanova pepelovka, oidij vinske trte
Odmerek	**0,25 – 0,3 l/ha škrlup in pepelasto plesen**, 0,15 l/ha oidij, stransko delovanje na alternarije
Število tretiranj	**3** krat v sezoni
Formulacija	SC – 300 g as/l
Mešanje	Z registriranimi fungicidi po priporočilih imetnika registracij
Aktivna snov	Nova aktivna snov Fluksapiroksad - **Xemium**® (SDHI)
Karenca	35 dni
Razmiki med škropljenji	7 – 10 dni

Zakaj je Xemium® unikaten ?

Jamstvo izvorne kakovosti

- Xemium® se prenaša po rastlini na dva načina
- Hidrofilno in lipofilno – različna način delovanja



Hidrofilno:
Važno za premeščanje skozi celične stene in žilni sistem

Lipofilno:
Važno za premeščenje v voščenem sloju in membranah

Xemium® je edini po sposobnosti premeščanja po lipofilni in hidrofilni sredini kar omogoča, da zelo hitro pride do ciljnih procesov v glivi

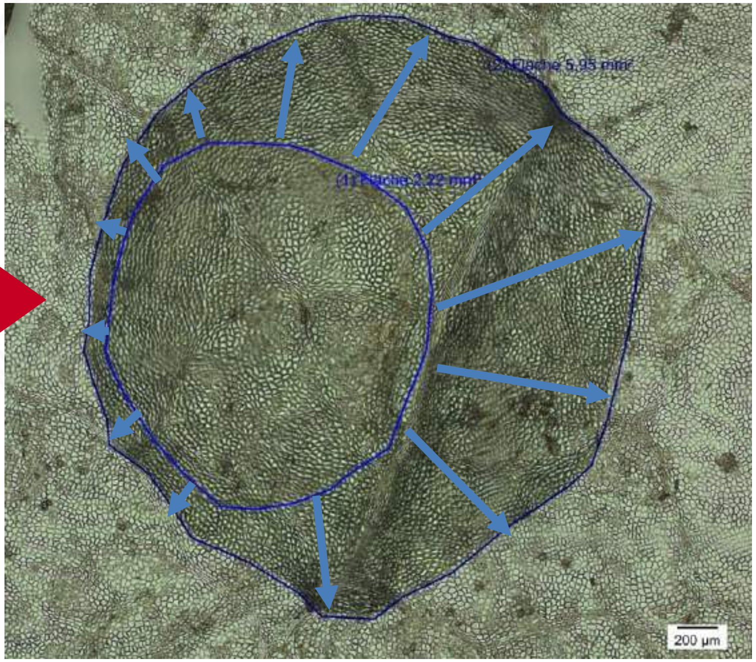
Sercadis®

Jamstvo izvorne kakovosti

Depozit Sercadisa
(pokrita površina = 2mm²)

Novo vlaženje

Depozit Sercadisa po rosi
(pokrita površina = 6mm²)



Visoka vlažnost in jutarnje rose omogočajo premeščanje Sercadisa in boljše pokrivanje površine lista

Sercadis - pozicioniranje

metrob
Jamstvo izvorne kakovosti

Pred cvetenjem	Cvetenje / razvoj plodov	Obiranje

Karenca
90 d

Karenca
35 d

Registracija od BBCH 53 do 81, karenca 35 dni

Strategija bez ostankov, uporaba do BBCH 71-72

Delan Pro

Naziv proizvoda	Delan Pro
Aktivna snov	125 g/l Ditianon + 561 g/l Kalijev - fosfit
Registracija	Jablana in hruška
Uporaba	Jablabov, hrušev škrlup (*Venturia inaequalis*, *Venturia pyrina*)
Število aplikacij	6 x letno
Odmerek	**2,5 L/ha**
Formulacija	Koncentrirana suspenzija **(SC)**

Delan Pro

Novo:

- Tekoča SC formulacija ditianona
- Dodant fungicidno delujoči Kalijev-Fosfit
  - Prva registracija Kalijevega-Fosfita kot fungicida v EU
- Kombinacija preventivnega „multi-site“ in sistemičnega SAR aktivatorja
- Potencijalno širši spektar (Nectria, pepelovka...)

Zadržano iz Delan WG:

- Zanesljivo delovanje na škrlup v deževnih pogojih
- Dobro poznana „multi-site“ aktivna snov
- Nadaljevanje samostojne uporabe ditianona

Delan Pro - Spekter bolezni

Jamstvo izvorne kakovosti

Trenutna spoznanja o delovanju Delan Pro:

Delovanje na Alternaria sp.:

- Visoka aktivnost na rast glive

Delovanje na Nectria galigena:

- Visoka aktivnost na rast glive

Delovanje na Colletotrichum:

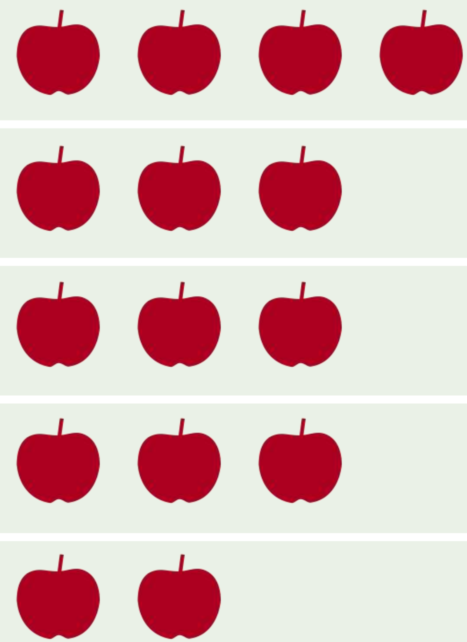
- Visoka aktivnost na rast glive

Delovanje na Gloeosporium:

- Visoka aktivnost na rast glive

Delovanje na Botrytis:

- Zmerno delovanje



Delan Pro – pozicioniranje

Jamstvo izvorne kakovosti

Pred cvetenjem	Cvetenje	Razvoj plodov	Obiranje

Registracija od BBCH 53 do 81, karenca 35 dni

Priporočena uporaba

Vitisan

- **Vitisan** je FFS na osnovi **Kalijevega hidrogen karbonata**
- Vitisan spremeni Ph vrednost na površini rastline. Ion K – hidrogen karbonata na podlagi ozmotskega pritiska izsuši glive
- **Preventivno in kurativno delovanje** (24 ur po okužbi)
- **Uporaba:**

- **na jablani** za zatiranje **jablanovega škrlupa (*Venturia* sp.),**
- zmanjševanje okužb z **mušjo pegavostjo (*Schizothyrium pomi*),**
- odmerek 2,5 kg/ha na meter višine krošnje – **5 kg/ha,**
- **stransko delovanje** na **pepelasto plesen in skladiščne bolezni,**
- Vitisan se lahko tretira **šest krat**, v razmiku od 8 do 10 dni,
- **karenca 1 dan,**
- **Registracija; vinska trta, hmelj, vrtnine – špargelj, buče, motovilec, endivija, okrasne rastline, jagode, jagodičje, zelišča za pepelovke**

Vitisan – pozicioniranje

Jamstvo izvorne kakovosti

Pred cvetenjem | Cvetenje | Razvoj plodov | Obiranje

Registracija od BBCH 72 do 89

Curatio

Jamstvo izvorne kakovosti

- **Žveplenoapnena brozga – izjemno dovoljenje od 1.3. do 31.7. 2017**

- **UPORABA:** Curatio® - žvepleno apnena brozga se uporablja kot kontaktni, preventivni in kurativni fungicid in baktericid na **jablanah** za zatiranje okužb z:

- **jablanovim škrlupom (*Venturia inaequalis*)** od razvojne faze mišjega ušesca dalje (od BBCH 09) v odmerku 6 L na ha na meter višine krošnje,

- **jablanovo pepelovko (*Podosphaera leucotricha*)** od razvojne faze razvoja socvetij dalje (od BBCH 50) v odmerku 6 L na ha na meter višine krošnje,

- **hruševim ožigom (*Erwinia amylovora*)** od razvojne faze venenja cvetov do konca cvetenja (BBCH 67-69) v odmerku 6 L na ha na meter višine krošnje,

- **listno pegavostjo (*Marssonina coronaria*)** od razvojne faze plodov, ki presegajo debelino 40 mm (BBCH 74) v odmerku 6 L na ha na meter višine krošnje

- **Registracija tudi na ostalih pečkarjih, koščičarjih in aktinidiji**

Pol-sulphur 800 SC

- **Tekoča** oblika žvepla

- **Registracija na**:
- Jablanah
- Breskvah
- Vinski trti
- Vrtnicah

- **Uporaba**:
- **Jablane do cvetenja** v odmerku **6 – 7,5 l/ha**

Cuprovin 50

- **Anorganska mineralno foliarno gnojilo z bakrom (oksiklorid)**
- Uporaba:

- **Jablane in hruške:** za prvo spomladansko tretiranje, v času brstenja in po obiranju plodov in preden listi odpadejo, tretiramo v odmerku **2 kg/ ha.**
- Breskve, marelice in nektarine 2 – 3 kg/ha
- Oreh 2 - 3 kg/ha
- Oljke, jagode…
- Vinska trta
- Zelenjava

Wetcit

Jamstvo izvorne kakovosti

- **Sredstvo za omočenje, porazdelitev in penetracijo**
- **Aktivna snov - Alkoholni etoksilat, pomarančno olje, terpeni**
- **Odmerek; 0,1 – 0,3 % koncentraciji,**

- **Način delovanja;**

- WETCIT izboljša delovanje pesticidov, tako da izboljša stik z voskastimi plastmi insektov in zunanjimi hidrofobnimi strukturami gliv.

- **Uporaba;**

- **krvava uš - Wetcit 3 l/ha + insekticid**
- **bolšice – Wetcit 3 l/ha + insekticid**
- **Spomladansko škropljenje 5 - 8 l/ha (BBCH 55 – 57).**

- **Mešanje;** vsa FFS in gnojila

Agree WG® Bacillus Thuringhiensis var. Aizawai 50%

Biološki selektivni insekticid za zatiranje škodljivcev na vrtninah iz skupine:

- **plodovk** (plodovke iz družine razhudnikov in **bučnice** z užitno in neužitno lupino), gojenih v zaščitenih prostorih, za **zatiranje gosenic škodljivih metuljev** v **odmerkih 0,5-1 kg/ha**
- **listnatih in stebelnih vrtninah** ter **vrtninah** iz **skupin kapusnic, gomoljnic, korenovk in stročnic**,
- v **vrtninah iz skupine čebulnic, na zeliščih, okrasnih rastlinah in zelenicah** v **zaščitenih prostorih in na prostem**, za zatiranje gosenic škodljivih metuljev (Lepidoptera spp.) v **odmerku 1 kg/ha**.

Prvo tretiranje se opravi, ko se **izležejo prve ličinke škodljivih metuljev** in do **tri krat ponov v časovnem intervalu 7 dni.**

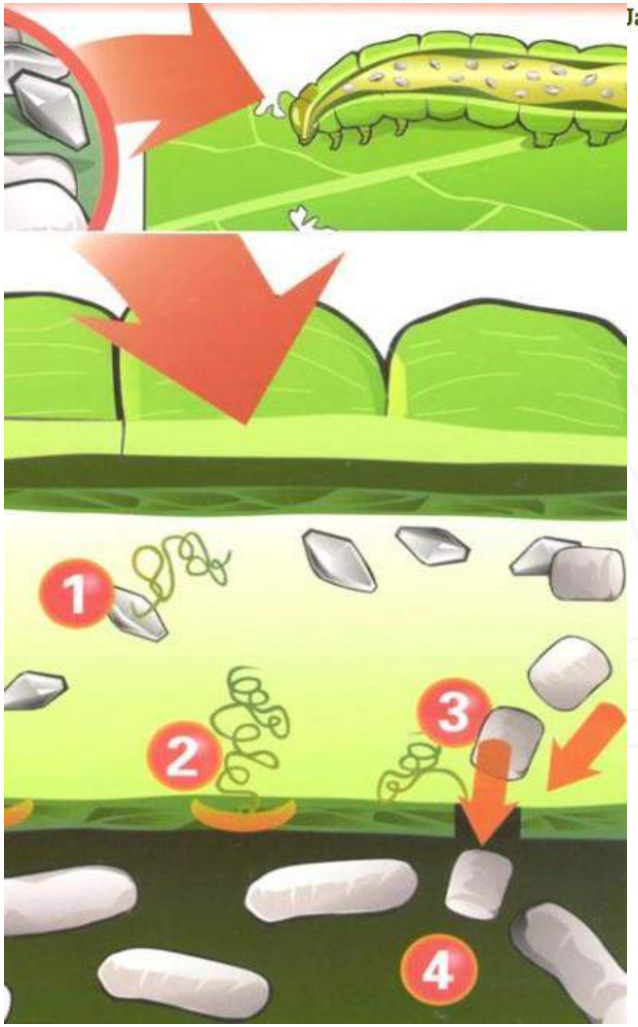
Mešanje ni dovoljeno s sredstvi na osnovi aktivne snovi **baker (baktericidno delovanje) in močno alkalnimi sredstvi (Vitisan, kalijeva mila maščobnih kislin, vodno steklo),** **dobro se meša** z **MycoSin, močljivimi žvepli in Neem Azal T/S.**

Pakiranje: 10 g, 1 kg.
Brez karence.
Razvrščen izven skupine strupov!

Agree WG - način delovanja

Z uporabo Agree-ja se ličinka preneha prehranjevati v nekaj minutah:

1. Bt (kristali) vstopijo v telo ličinke in se aktivirajo.
2. na novo ustvarjeni toksini Bt delujejo na receptorje v črevesni steni.
3. uničenje črevesne stene, posledično Bt toksini vse bolj vstopajo v telo.
4. ličinka posledično umre.



Regalis® Plus: več kot zgolj regulator rasti

metrob® Jamstvo izvorne kakovosti

	Regalis®	Regalis® Plus
Formulacija	Močljiva zrnca (WG)	Močljiva zrnca (WG)
Aktivna snov	10 % Prohexadion kalcij	10 % Prohexadion kalcij
Sredstvo za zakisanje	Ne	**Ja**
Uporaba	Jablane in hruške	**Jablane in hruške (slive, češnje)**
Odmerek pečkarji	2,5 kg/ha	Jablane 2,5, **hruške 3,0 kg/ha**
Prvo tretiranje	3 - 5 cm dolžina poganjkov	BBCH 60 - 79
Deljenje odmerkov	1. aplikacija pri dolžini poganjkov 3 - 5 cm, ponovitev po 3 -5 tednih	**Fleksibilno deljenje odmerkov: BBCH 60 - 69: max 2.5 kg BBCH 71 - 75: max 1.5 kg**
Delovanje	Rastni regulator, omejevanje sekundarnih okužb hruševega ožiga	Rastni regulator, omejevanje sekundarnih okužb hruševega ožiga
Količina vode	500 l	300 - 500 l
Karenca	55 dni	55 dni
Sprejem aktivne snovi	Dobra	**Izboljšana**

Regalis® Plus: regulator rasti

metrob
Jamstvo izvorne kakovosti

50 %

35 % **15%**

Faza cvetenja (BBCH 60 – 69)
1. odmerek: **1,2** kg/ha

Razvoj plodov (BBCH 70 – 75)
0,9 kg/ha **0,4** kg/ha

Ne uporabljati po BBCH 79

Največ 2,5 kg/ha letno je možno

SCAB 80 WG - kaptan

metrob
Jamstvo izvorne kakovosti

- Kontaktni fungicid s preventivnim delovanjem na **jablanah** in **hruškah** za zatiranje **jablanovega škrlupa (*Venturia inaequalis*)** in **hruševega škrlupa (*Venturia pyrina*)**
- Odmerek **1,9 kg/ha**
- Vsebuje **80% kaptana v WG formulaciji**
- Izvede se lahko **10 tretiranj** na leto
- Priporočeni razmiki 7 – 10 dni oz. odvisno od padavin in pritiska škrlupa
- Karenca **21 dni**
- Sredstvo ne povzroči poškodb na gojenih rastlinah, če se ga uporablja v skladu z navodili za uporabo
- Možnost mešanja z ostalimi FFS in gnojili
- Pakiranje **5 in 25 kg**
- **Ugodna cena proizvoda**

SHYFO: glifosat

metrob
Jamstvo izvorne kakovosti

- **GLIFOSAT (cist) 360 g/L**
- Uporaba na **jablanah, hruškah, breskvah, marelicah, slivah, višnjah**
- Odmerek **5 L/ha** (50 ml na 100 m2) ob uporabi 200-400 L vode na ha
- Drevesa v nasadu ne smejo biti mlajša od 2 let
- S sredstvom lahko v istem odmerku zatiramo tudi **koreninske izrastke, vendar le pozno spomladi**
- **Pakiranje 1 L in 20 L**

Super Blisk

močilo oz. adjuvant
multifunkcijski dodatek škropilni brozgi

Jamstvo izvorne kakovosti

Povprečni odmerek: 150 -250 ml/ha

Super Blisk deluje kot:

Jamstvo izvorne kakovosti

- **aktivator**: izbolšanje nanosa oz. pokrovnost ciljne površine (kontaktna sredstva)
- **penetrator:** hitrejše prehajanje skozi povrhnjico rastline (kombinirana oz. sistemična sredstva)
- **omočilo**: boljša omočenost (voščenost oz. dlakavost listov)
- **lepilo**: povečanje obstojnosti nanosa (spiranje, VU stabilnost)
- **anti-penilec: ODPRAVLJA PENJENJE**
- **napredna formulacija:** omogoča široko rabo (dodatek herbicidom, fungicidom in insekticidom)
- **manj „drifta“ oz. zanašanja:** (optim. velikost kapljic 100-300µm)

Najkompleksnejši aktivator za izboljšanje kakovosti škropljenja in učinkovitosti FFS

Sortiment feromonskih vab za sadjarstvo

Jamstvo izvorne kakovosti

- *Cydia pomonella* **– jabolčni zavijač**
- *Adoxophyes orana* **– sadni zavijač**
- *Pandemis heparana* **– pasasti sadni duplinar**
- *Anarsia lineatella* **– breskov molj**
- *Grapholita lobarzewski* **– mali sadni zavijač**
- *Grapholita janthiana* **– glogov zavijač**
- *Hendya nubiferana* **– sivi brstni sukač**
- *Synanthedon myopaeformis* **– jablanova steklokrilka**
- *Archips rosana* **– rjavi šibkov zavijač**
- *Zeuzera pyrina* **– modro sitce**
- *Archips podana* **– rjavi sadni luplinar**
- *Grapholita funebrana* **– češpljev zavijač**

RAK® 3: Konfuzija-metoda zbeganja jabolčnega zavijača *(Cydia pomonella)*

Vsebuje: 225 mg feromona/ampulo Codlemone

<u>Uporaba:</u>

- **500- 550 ampul / ha / 4m krošnjo**
- **mini. strnjena površina za uspešno delovanje konfuzije je 1 ha**

- **1 ampula / 20m² razporeditev (3,3 – 3,5 m x 6 m)**
- **ampule obešamo v senco**
- **ampule izobešamo na eno višino 1,8 – 2 m**

- **spremljanje leta metuljčkov – feromonske vabe Phero net**
- **tudi vabe obešam na različne višine**

metrob
Jamstvo izvorne kakovosti

Wülfel®: Vaba za voluharja

Jamstvo izvorne kakovosti

- **WÜLFEL VABA ZA VOLUHARJA** se uporablja kot rodenticidna vaba na korenčkovi osnovi, impregnirana z aktivno snovjo ***cink fosfid***
- Za neselektivno zatiranje **voluharja (*Arvicola terrestris*) v nasadih sadnega drevja, vinogradih, poljščinah, vrtninah, nasadih okrasnih rastlin ter na travinju in v gozdnih drevesnicah**
- Atraktivnost sredstva za voluharje zvišuje korenčkova osnova, ki v stiku z vlago v tleh nabrekne
- Aktivna snov v stiku s kislino v prebavnem traktu glodavcev tvori strupen plin fosfin

Wülfel®: Vaba za voluharja

metrob®
Jamstvo izvorne kakovosti

- **Odmerek:** 5 g sredstva za 8-10 dolžinskih metrov rova, pri čemer najvišja dovoljena količina vab po hektarju znaša 2,5 kg

- **Način uporabe**: Vabe je treba vnesti globoko v tla, kjer bodo nedostopne domačim živalim, ptičem in drugim glodavcem. Za vnos se uporablja strojni deponator s krtičarjem in potisnim valjem za zatesnitev rovov po aplikaciji. Po končani aplikaciji je treba obvezno zatesniti rove

- **Opozorila**: Sredstvo je namenjeno samo za profesionalno uporabo s strojnimi deponatorji. Ostankov vab se ne sme puščati na površini tal. Vaba ne sme priti v stik z domačimi živalmi. Sredstvo se sme na istem zemljišču uporabljati le en krat letno

Masai®

Jamstvo izvorne kakovosti

- Masai® je **<u>akaricid</u>** na osnovi aktivne snovi *tebufenpirad*. *Tebufenpirad* je akaricid in insekticid, ki preprečuje nastajanje ATP

- Sredstvo Masai® se uporablja **na <u>jablanah in hruškah</u>** za zatiranje **rdeče sadne pršice** (***Panonychus ulmi***) in drugih pršic prelk v fenološki fazi od konca cvetenja do faze, ko je sadje zrelo za obiranje (BBCH 69-87), v odmerku **<u>0,5 kg/ha</u>**

<u>Glavne prednosti uporabe</u>:

- **Delovanje na vse gibljive stadije pršic (vključno z letnimi jajčeci), razen zimskih jajčec**
- Zelo dobro začetno in dolgotrajno delovanje
- Translaminarno delovanje

Masai®: Lastne izkušnje

Jamstvo izvorne kakovosti

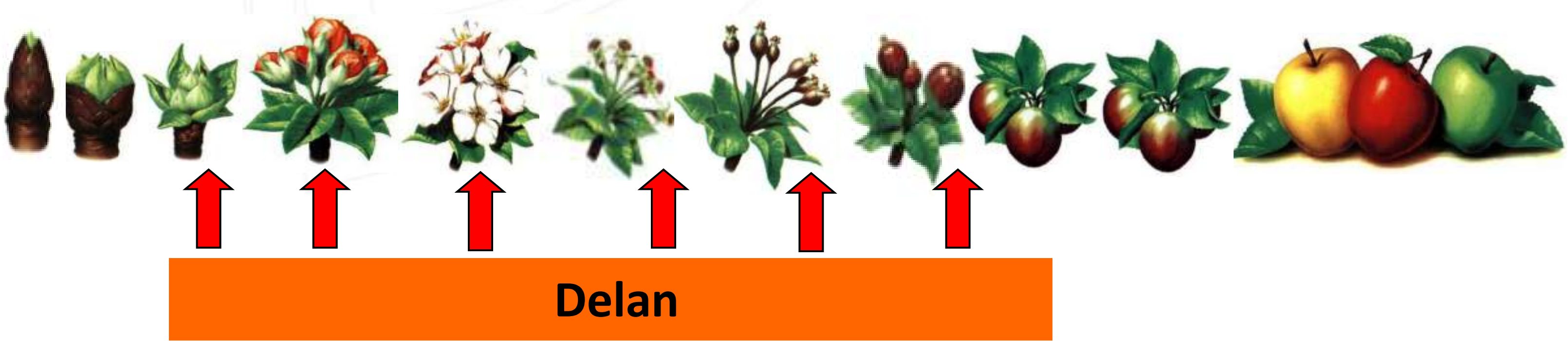
- Učinkuje postopoma, pršice odmrejo po približno 14 dneh. Ima dolgotrajno delovanje
- Izkušnje so pokazale, da je najprimernejši čas uporabe, ko je izleženih 60 - 70% ličink iz zimskih jajčec
- Najboljši čas zatiranja pršic je najkasneje do konca junija, oz. ko so temperature še pod 25°C
- **Ne priporočamo tretiranja pri temperaturah nad 25 °C**

Delan® 700 WG

Jamstvo izvorne kakovosti

- Najbolj uporabljen **kontaktni fungicid** v Evropi
- Odmerek: 0,25 kg/meter višine krošnje (max. **0,75 kg/ha**)
- **Nova registracija nektarine, breskve, marelice, češnje, višnje, slive in mandelj po obiranju za listno luknjičavost, ožig skorje**
- Idealen partner vsem ostalim fungicidom (kombiniranje aktivnih snovi)

- **Uporaba 6 krat v rastni sezoni**



Stroby® WG

metrob®
Jamstvo izvorne kakovosti

- škrlup in pepelasta plesen
- preventivno delovanje na listih in plodovih
- blokira celični in dihalni organ glive
- green efekt

pepelovka

škrlup

Dva na en mah!

SCALA® /Mythos®

Prednosti:

Učinkovito delovanja pri nižjih temperaturah

- **25% več aktivne snovi**
- **Registracija pečkato sadje na škrlup 1,25 l/ha**
- **Jagode, maline, robide - botritis 2 l/ha**
- Dopolnilno učinkovanje na gnilobo (*Botrytis*) in monilije

Venturia inequalis

Kumulus® DF

(80% močljivo žveplo)

- pepelovke in škrlup (**5-8 kg/ha**)
- vodotopna zrnca
- volumsko odmerjanje brez usedline
- biološka in integrirana pridelava
- zavira razvoj sadne pršice
- dobra oprijemljivost
- dovoljenih **14 tretiranj**

Rovral® Aquaflo

Jamstvo izvorne kakovosti

- Kontaktni fungicid s preventivnim in kurativnim delovanjem
- Zelo široka registracija na 31 kultur – **koščičarji, pečkarji,** vinska trta, zelenjava, okrasne rastline
- Delovanje na sivo plesen, **monilijo, alternarije**, listne pegavosti, rizoktonije, belo gnilobo…
- Kratka karenca

Odmerek: 0,5–2,25 L/ha

Pakiranje: 0,25 L, 1 L

MADEX MAX

- NOV IZOLAT (Iranski soj) virusa granuloze
- Optimalni čas škropljenja v času pred izleganjem ličinke iz jajčeca
- Visoka ekotoksikološka srejemljivost (nastrupena za ribe, čebele in človeka) - ni kemičnih ostankov na rastlinah
- Samostojna uporaba **6 – 8 aplikacij v odmerku 50 - 100 ml/h**
- Madex se uporabljata kot samostojni ukrep ali kot dopolnilo k metodi zbeganja
- **Mešamo** ga lahko z večino FFS in gnojil
- Mešanje pa ni priporočljivo z pripravki na osnovi kislih glin in bakra

BREAK® THRU: močilo

Jamstvo izvorne kakovosti

Break® Thru® se uporablja kot dodatek škropilnim brozgam.
Sredstvo izboljšuje omočljivost listov tretiranih rastlin.

Glavne prednosti uporabe:

- Zmanjšuje površinsko napetost na listju.
- Izboljšuje pokritost listja.
- Zaradi optimalne porazdelitve kapljic jo po površini ustvarja enakomerna plast, ki doseže tudi težje dostopna mesta.
- Olajšuje in pospešuje sprejemanje sistemičnih sredstev v rastlino.
- Zmanjšuje spiranje zaradi dežja.

Odmerek: 0,2 – 0,3 L/ha.

Stomp® Aqua

Jamstvo izvorne kakovosti

NAČIN DELOVANJA:

Stomp® Aqua je herbicid za zatiranje **enoletnega ozkolistnega in nekaterih vrst širokolistnega plevela.**

Aktivna snov	**Pendimetalin (455 g/l)**
Formulacija	Kapsulirana suspenzija (CS)
Uporaba	Jablane, hruške, češnje, slive, marelice, kutina,jagode, črni, rdeči, beli ribez, kosmulje, maline (vključno s hibridi), robide, ameriške borovnice, brusnice, bezeg
Odmerek	2,9 L/ha (29 ml na 100 m^2)
Način delovanja	Talni in listni herbicid
Število aplikacij	Aplikacija do brstenja
Karenca	Zagotovljena s časom uporabe
Pakiranje	1 in 5 L

REBELL: lepljive barvne plošče

REBELL BIANCO so bele plošče za nadzor leta

- jabolčne grizlice (Hoplocampa testudinea)
- črne in rumene češpljeve grizlice (*H. flava, H. minuta*)
- malinov hroščec (*Byturus tometosus*)

Uporaba v sadjarstvu:

- minimalno 2 pasti/ha na posamezno sorto

Čas uporabe:

- 1 teden pred cvetenjem do 1 teden po cvetenju
- Kontrola pasti vsaj 1-krat tedensko!

REBELL: lepljive barvne plošče

REBELL ROSSO

proti **vrtnemu zavrtaču**

Uporaba: 8 do 12 vab na hektar za zatiranje

Varstvo in gnojenje jablane

Razvojni stadij	Odpiranje brstov	Mišje uho	Rdeči balon	Cvetenje	Odpadli venčni listi	Trebljenje plodov	Izobliko vani plodovi	Zorenje

Jablanov škrlup	Baker; Delan®; Scala® + Delan®; Sercadis® + Delan®; Delan® Pro; Stroby® + Delan®; Delan® Pro; Sercadis® + Delan®; Stroby® + Delan®; Scab; Vitisan
Jablanova pepelovka	Kumulus®/Pol-Sulphur® 800 SC
Rastni regulator	Regalis® Plus; Regalis® Plus
Pršice, uši Jabolčni zav.	NeemAzal®; Masai®; RAK® 3; Madex® Max
Močilo	Super Blisk; Break® thru
Gnojenje	Cuprovin (baker) Novatec® Agromaster®; Algovital® Plantonic; Nutribor® Rhizocell®; Basfoliar® aktiv Plantonic; Basfoliar® combi stipp Rhizocell®; Agroleaf® Power Kalcij Greenstim®; Cuprovin Hlevski gnoj peletiran
Stresne situacije	Epin; Cirkon; Epin; Cirkon; Cirkon
Herbicid	Stomp® Aqua; Shyfo (glifosat)

Izredna registracija

MOVENTO®

2XSYS

Uporaba in učinkovitost pri zatiranju problematičnih škodljivcev v sadjarstvu

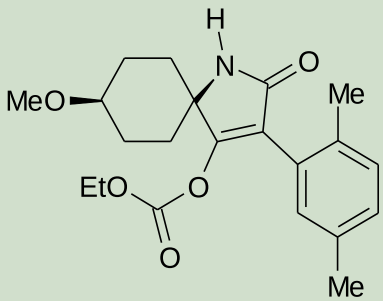
Maribor, 17.3. 2017

Gal Motore

Kaj je Movento®?

Movento je sistemični insekticid in akaricid za zatiranje škodljivcev v sadjarstvu, zelenjadarstvu in hmeljarstvu.

- Kemična skupina: Ketoenoli
- Aktivna snov: SPIROTETRAMAT
- Formulacija: SC
- Uporaba: Foliarno



MOVENTO

Izredna registracija 2017

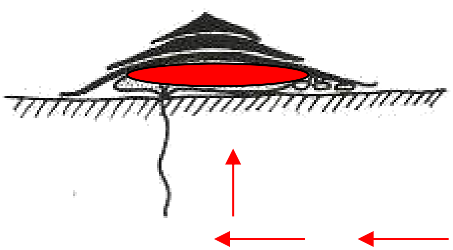
   

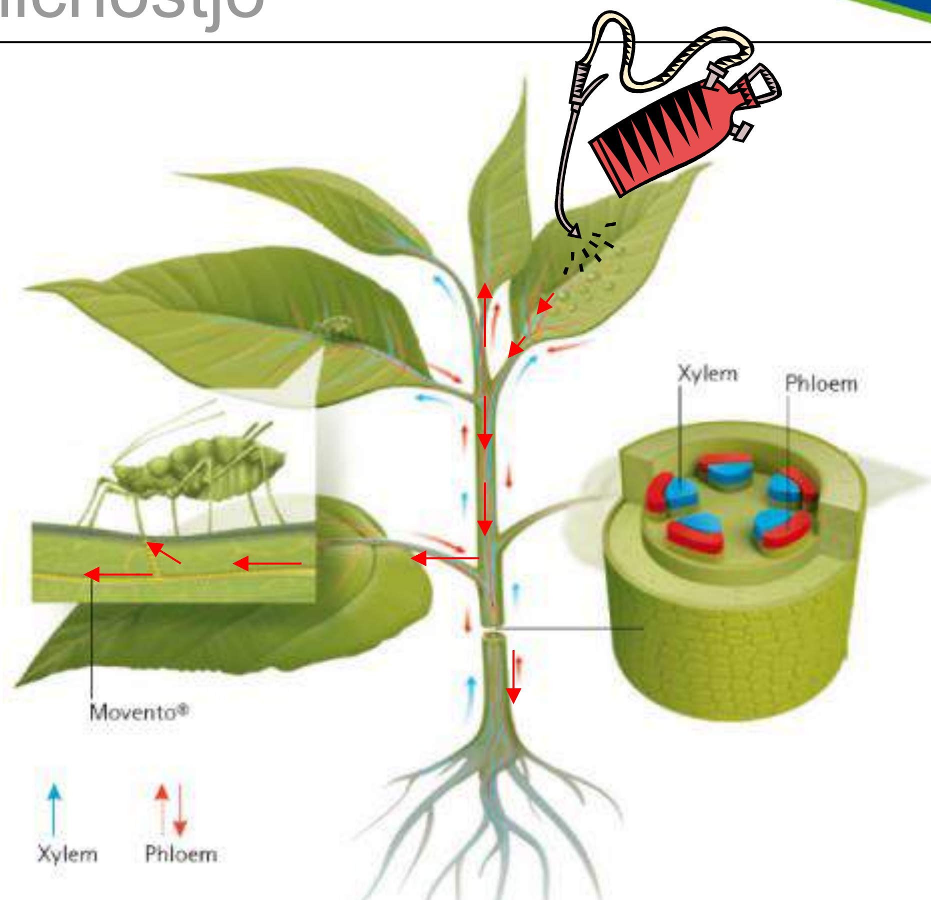
Kultura	**jablana**	**hruška**	**ameriške borovnice, kosmulje, bezeg**	**marelica, breskev, sliva, češnja in višnja**
Spekter	uši listna hržica, krvava uš ameriški kapar	uši listna hržica navadna hruševa bolšica kaparji	listne uši kaparji	listne uši Murvov kapar bolšice
Odmerek	1,5 L/ha 1,9 L/ha (2,25 L/ha)	1,5 L/ha 1,9 L/ha (2,25 L/ha)	0,75 L/ha	1,9 L/ha
Max. število tretiranj	2	2	2	2
Karenca (dni)	21	21		21

Edini insekticid z 2-smerno sistemičnostjo

2XSYS

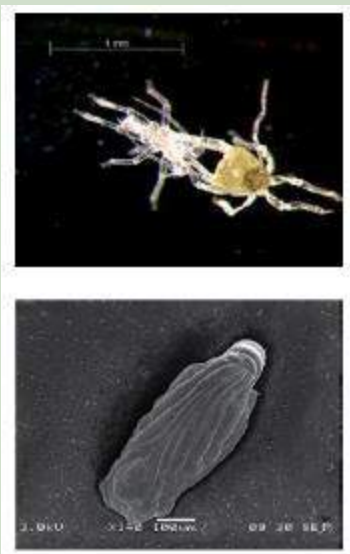
kapar





MOVENTO

Način zatiranja škodljivcev



- Sprejetje a.s.: oralno/s sesanjem.
- Inhibicija sinteze lipidov.
- Ovira proces preobrazbe in preprečuje razvoj odraslih oblik škodljivcev.
- Zmanjšuje plodnost ženskih osebkov.
- Movento ne deluje kontaktno - brez „knock down” efekta

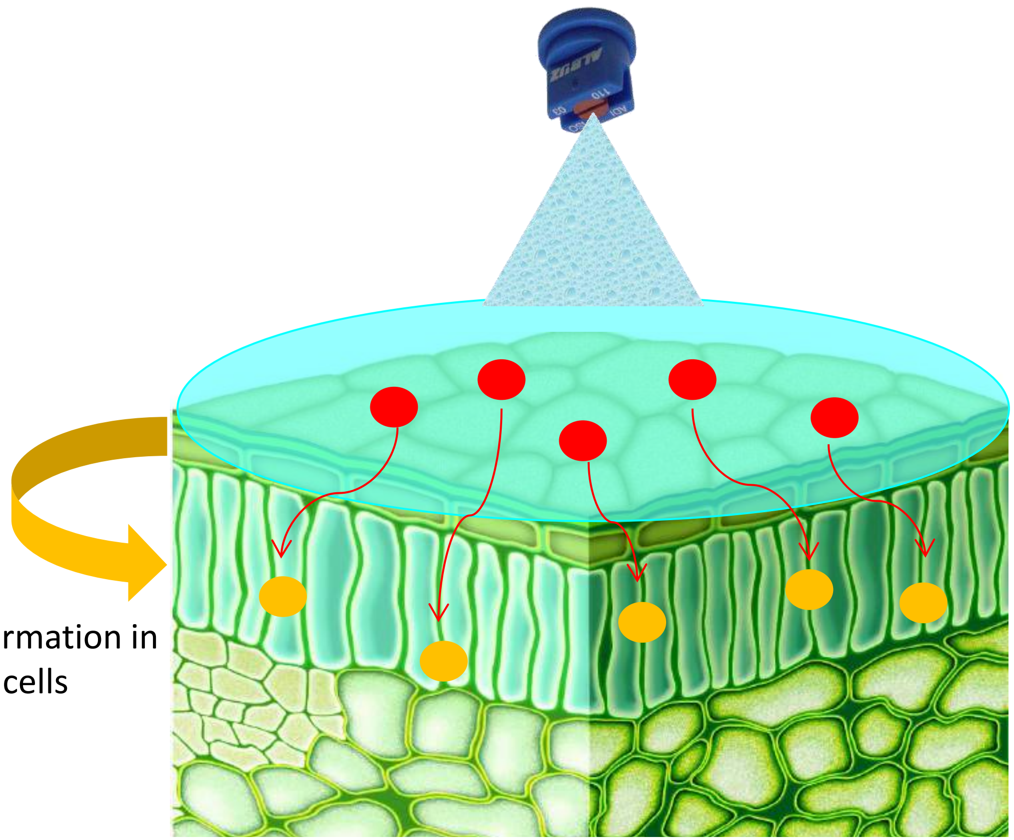
Integrirana pridelava

- Varen za plenilske žuželke in opraševalce.
- Odlična izbira, ko plenilci ne morejo imeti populacije škodljivcev pod nadzorom.

Kaj je pomembno pri uporabi Moventa?

- ✓ Odmerek
- ✓ Aplikacija
- ✓ Čas uporabe
- ✓ Intenzivnost vegetacije
- ✓ Uporaba močila
- ✓ SOLO uporaba

Aplikacija

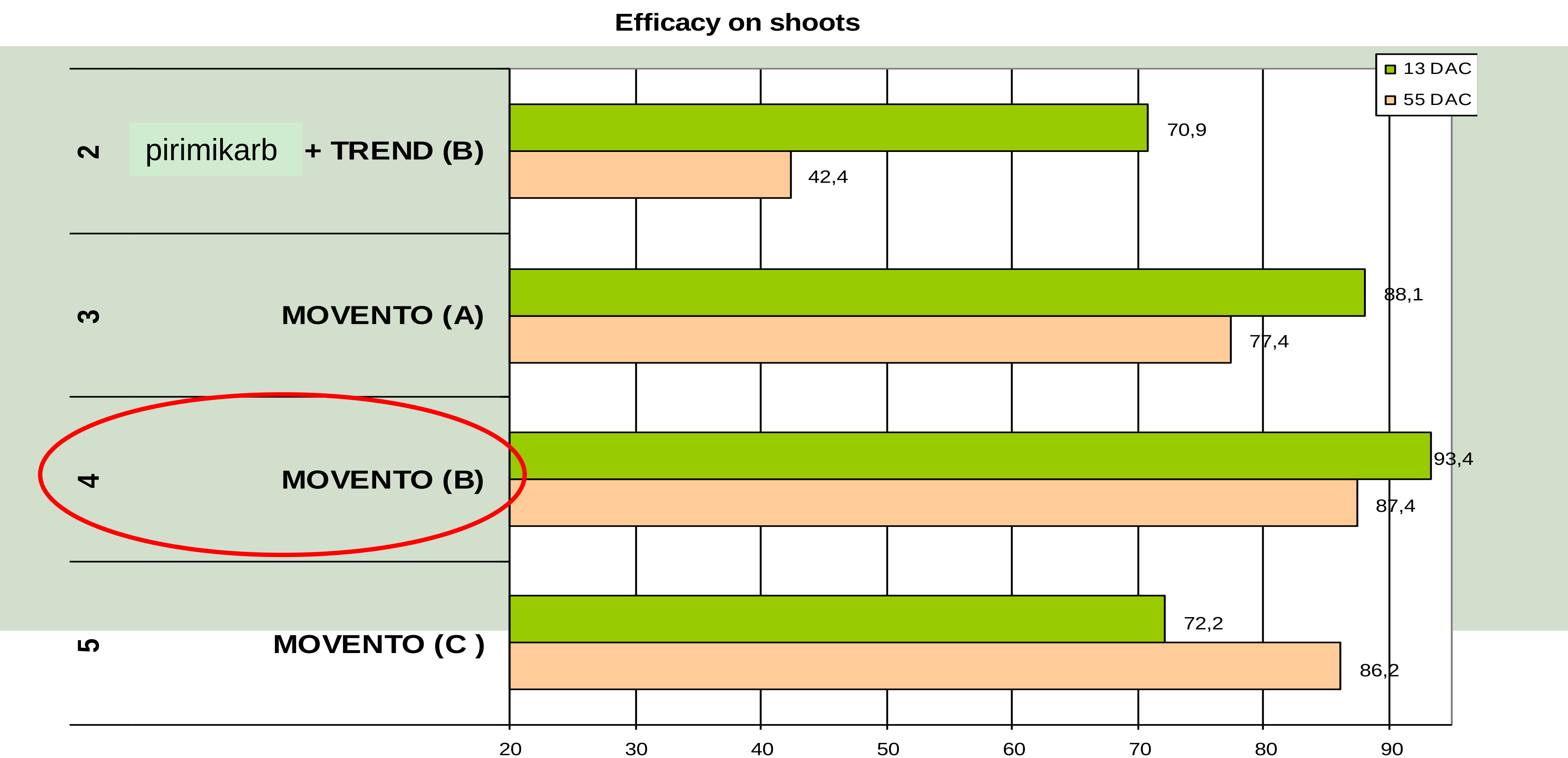


Enzymatic transformation in parenchymatous cells

Spirotetramat **<u>Neaktiven!</u>**

Spirotetramat-enol **<u>Aktiven !</u>**

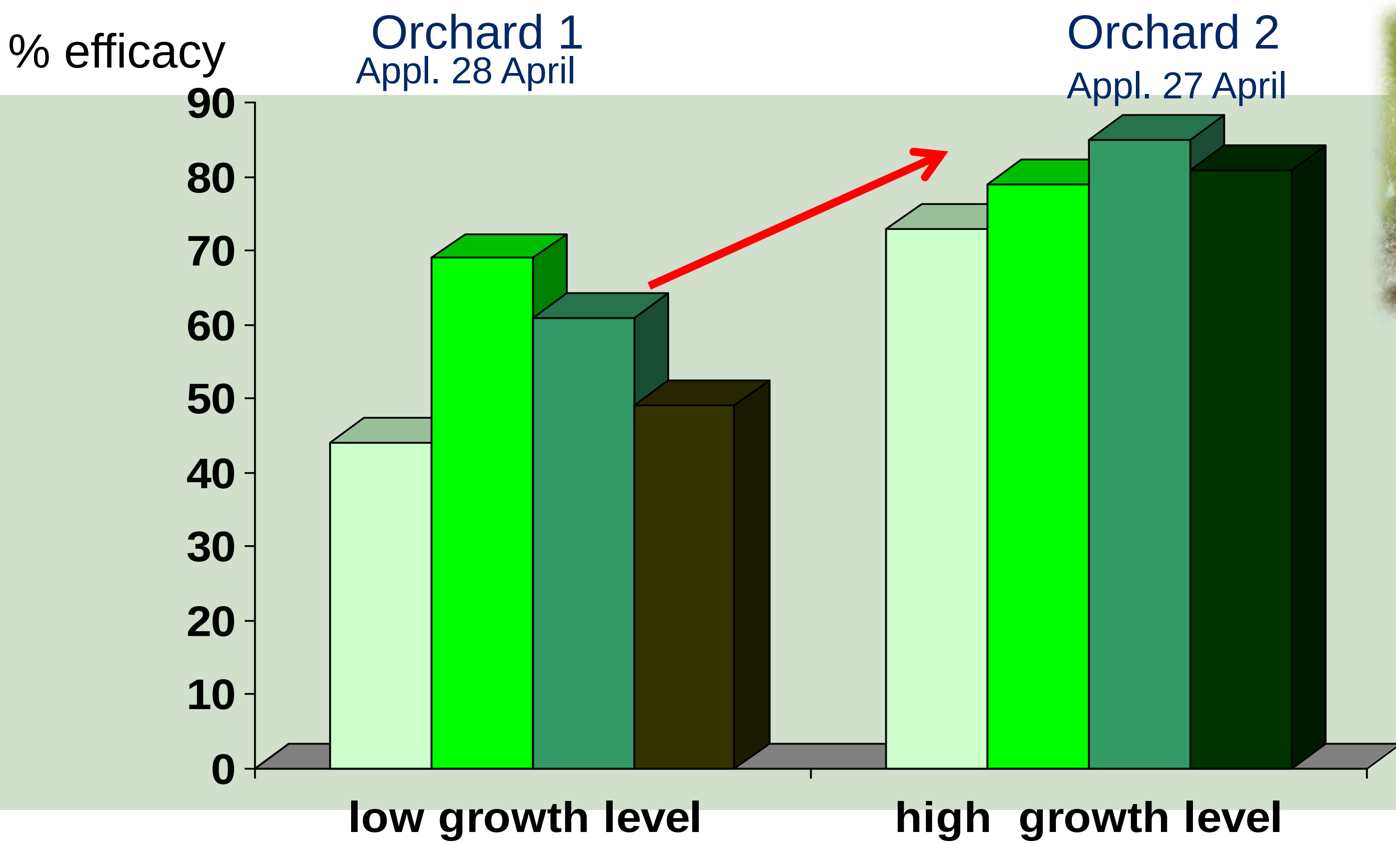
Efficacy: trial result – positioning ! (Eriosoma)



Untreated: 100/220 /236 kolonies on 20 shoots

Treatments A: 5-05 B: 9-05 C:21-05

Movento: key influencing
growth-flux (translocation)

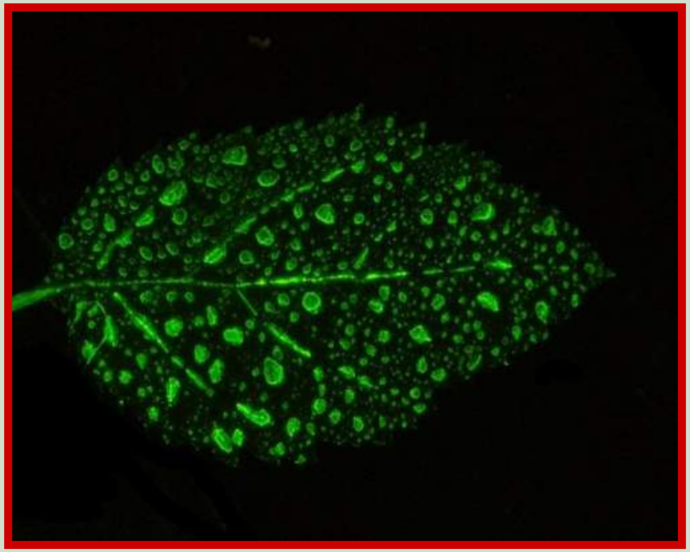


Untreated: Av. 5888-3719-5069-3093 aphids on 20 shoots **(15 cm)**

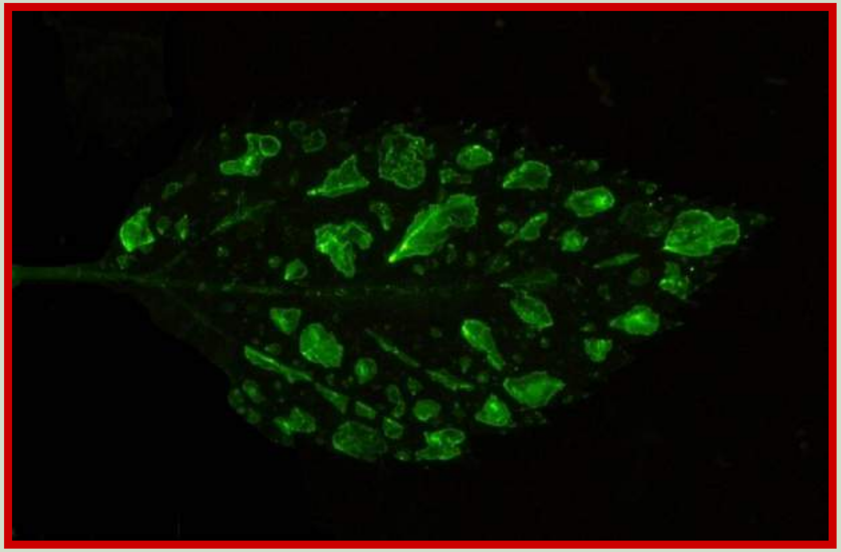
Untreated: Av. 411 - 1033 - 1485 - 3057 - 4535 - aphids on 20 shoots **(35 cm)**

Efficacy Movento on Eriosoma, depending on growth-flux (translocation)

Mešanje



Movento 100SC



Movento 100SC + kaptan + trifloksistrobin

6 dejavnikov za boljše delovanje

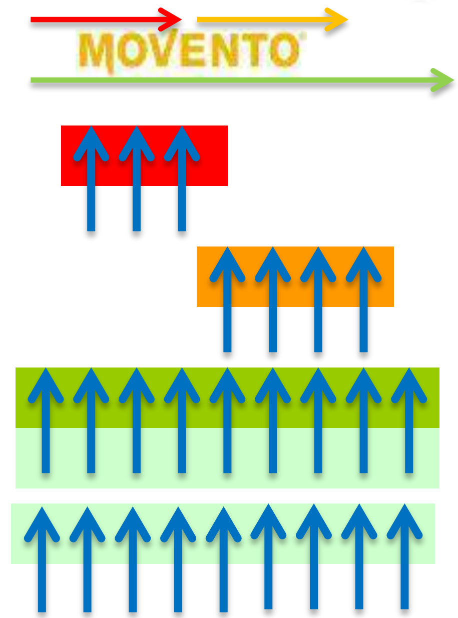
- ✓ Odmerek: krvava uš, hruševa bolšica – 2,25L/ha v blok tretiranju
- ✓ Aplikacija: krvava uš – poraba vode vsaj 800L/ha, ne v stresnih situacijah
- ✓ Čas uporabe: v sadjarstvu – po cvetenju
- ✓ Intenzivnost vegetacije: intenzivna vegetacija – hitrejše delovanje
- ✓ Močilo: mineralno olje ali Silwett
- ✓ Mešanje: SOLO uporaba

Smernice za uspešno delovanje in maksimalno učinkovitost

Jablana in hruška

Pozicioniranje: jablana

BBCH



Eriosoma lanigerum

Quadraspidiotus perniciosus

Aphis pomi
Dysaphis plantaginea

Dasineura spp.

Po cvetenju

Zatiranje krvave uši

Čas uporabe pripravka MOVENTO®

1. aplikacija pripravka MOVENTO® 2,25 L/ha v fazi BBCH 68–72, neposredno po cvetenju, pri prvi migraciji krvave uši na mlade zelene poganjke.

2. aplikacija pripravka MOVENTO® 2,25 L/ha 21 dni po prvi aplikaciji.

Zatiranje listnih uši

Čas uporabe pripravka MOVENTO®

Multi target pristop, če je strategija zatiranja usmerjena na krvavo uš ali ameriškega kaparja (zatiranje več vrst škodljivcev naenkrat) ...

ALI

1. aplikacija pripravka MOVENTO® 1,5L/Ha v fazi BBCH 69–75. Zatiranje uši, ki se pojavljajo po cvetenju.

2. aplikacija pripravka MOVENTO® 21 dni po prvi aplikaciji.

Pozicioniranje: hruška

31 55 61 65 69 72 74 75

BBCH

MOVENTO

Cacopsylla pyri

„MULTI TARGET"

Aphis pomi

Po cvetenju

Zatiranje hruševe bolšice

Čas uporabe pripravka MOVENTO®

1. aplikacija pripravka MOVENTO® 2,25 L/ha v fazi BBCH 72–73, po cvetenju, ob pojavu rumenih jajčec 2. generacije hruševe bolšice.

2. aplikacija pripravka MOVENTO® 2,25 L/ha 21 dni po prvi aplikaciji.

Prednosti pripravka MOVENTO®

- Širok spekter delovanja na sesajoče škodljivce v številnih kulturah.
- 2-smerna sistemičnost
- Dolgotrajna učinkovitost in istočasna uporaba proti različnim škodljivcem => „multi target”.
- Zaščita količine in kakovosti pridelka (MRL).
- Varen za koristne organizme.

BAYER

MOVENTO®

2XSYS

Hvala za pozornost!