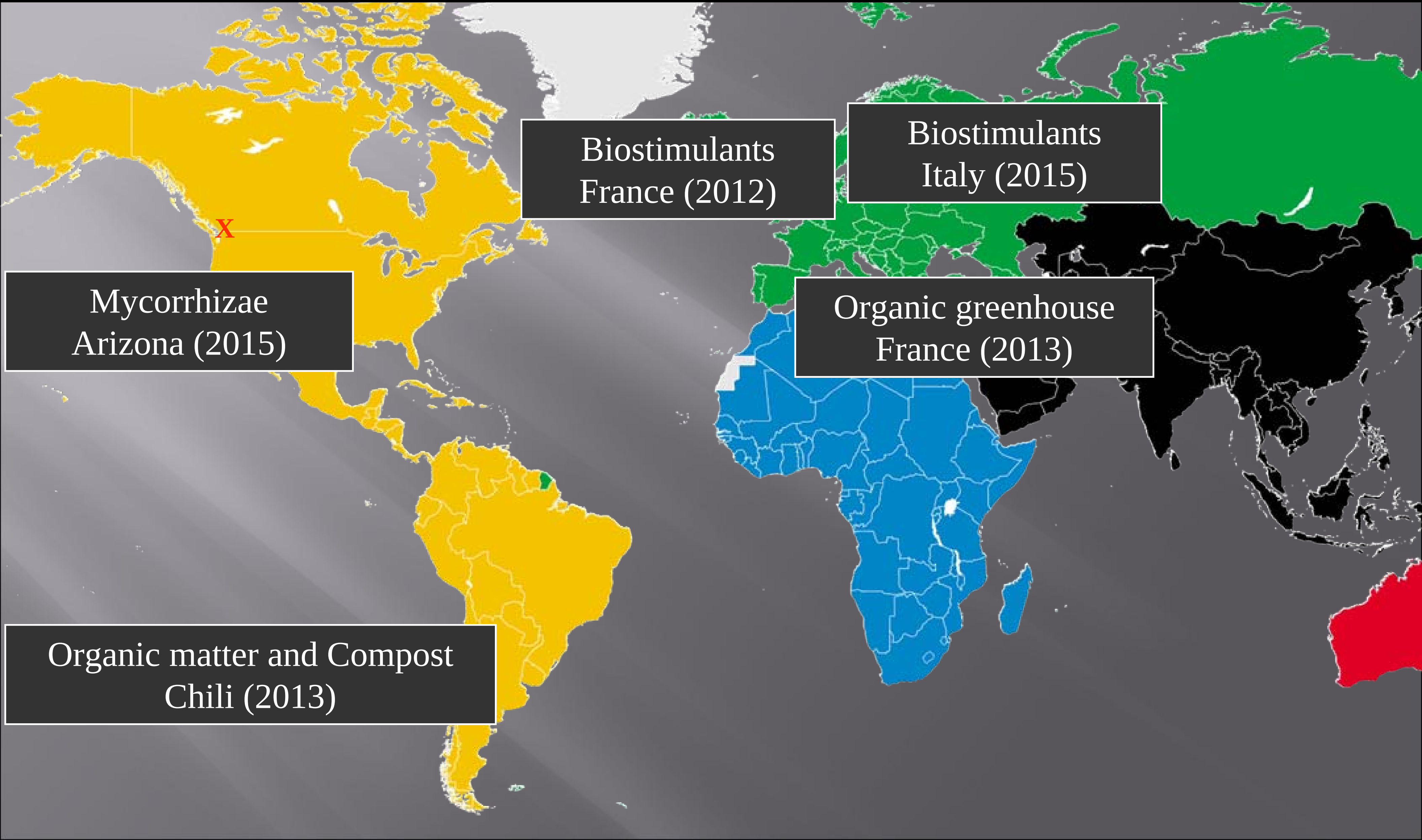
Organic Matter in Horticulture - A Report from Scientific Meetings

Mario Lanthier CropHealth Advising & Research
Kelowna B.C. 250-717-1898 www.crophealth.com

Scientific meetings are held every year …

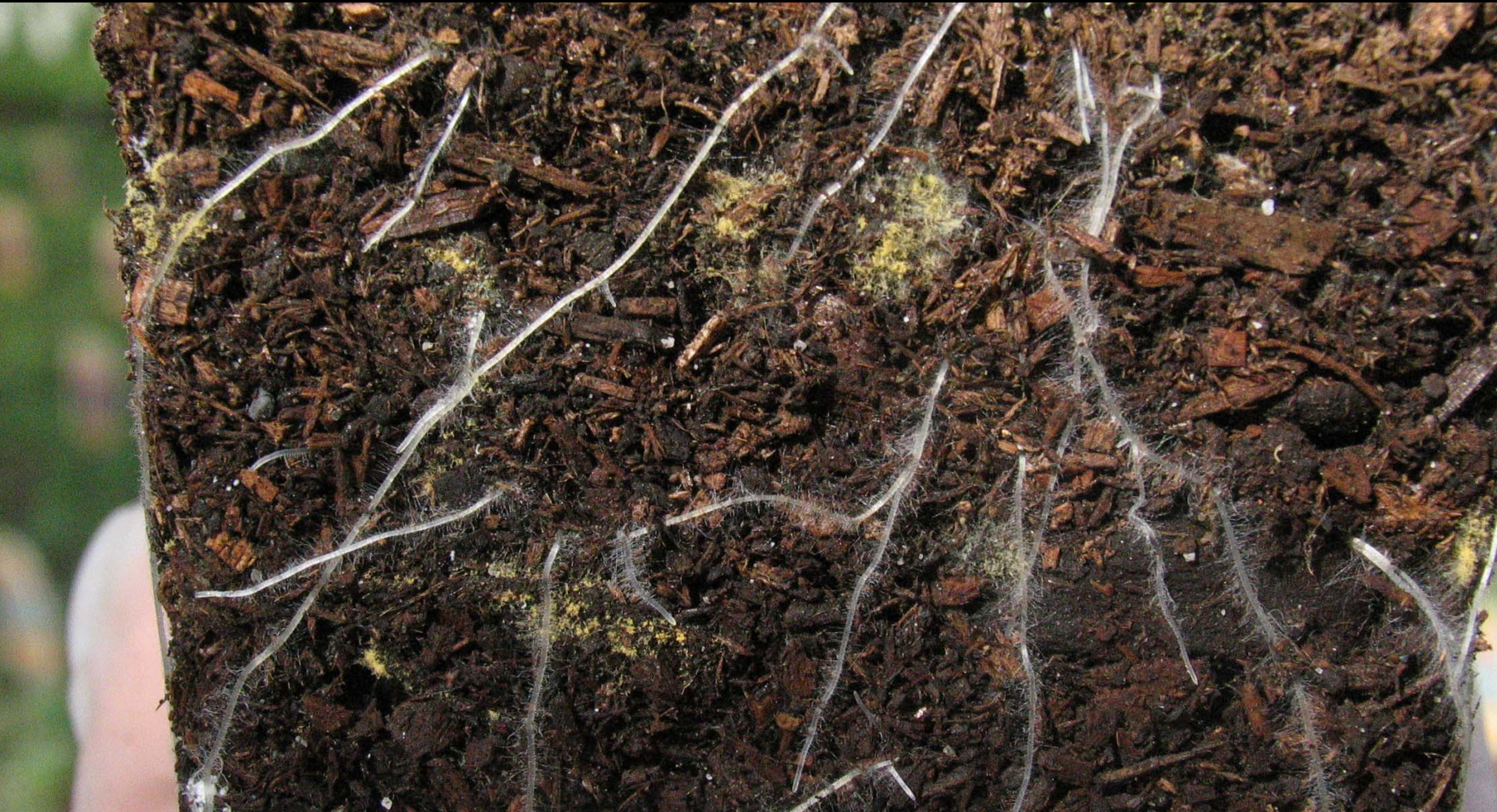
… often attached to a small trade show

Recent meetings attended by our company



Attendance: 120 persons from 18 countries

Compost is used to supply organic matter, to increase microbial activity and to revive the soil.



How much compost should be applied ?

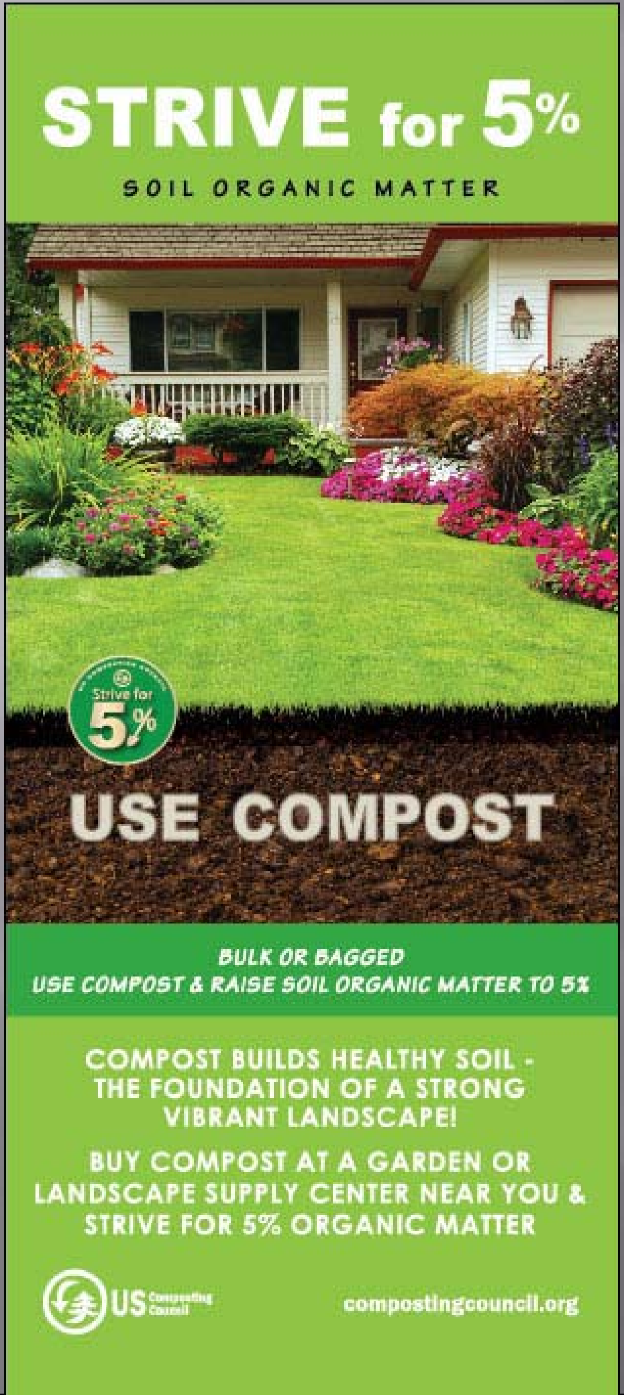
Animal manure compost

- Apply 2.5 cm deep
- Incorporate in top 10 cm
- Watch for salts (EC)

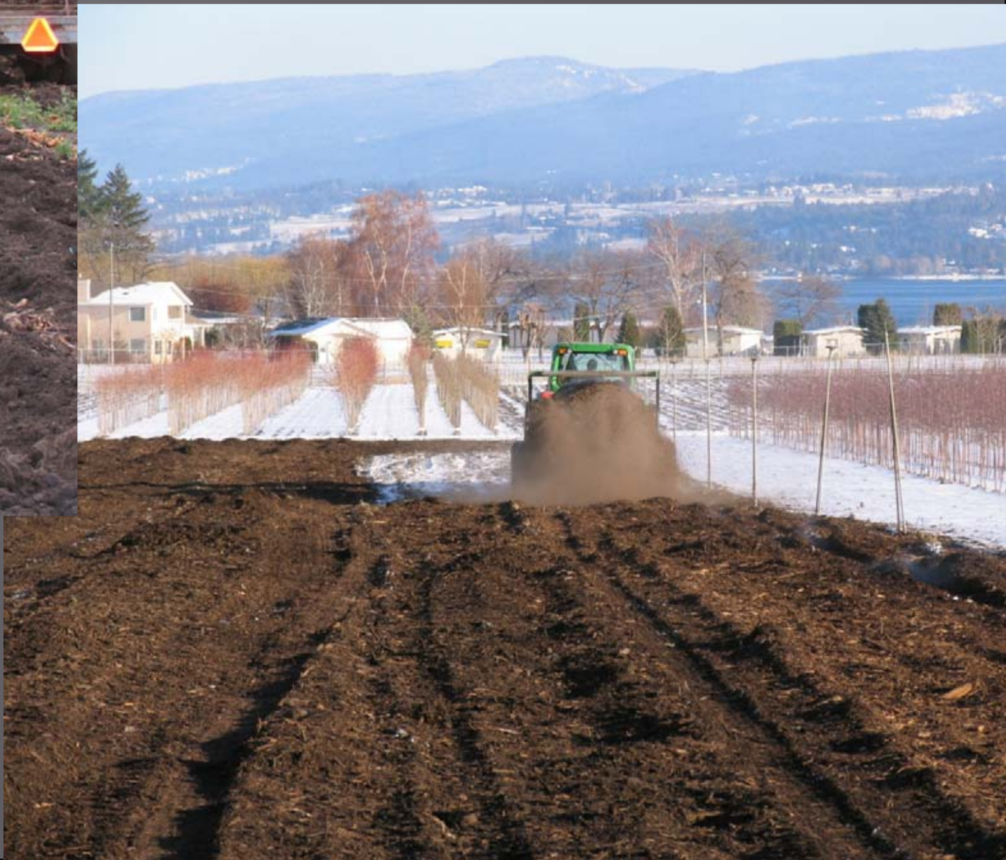
Plant residue compost

- Apply 2.5 to 15 cm deep
- Incorporate 5 to 25 tons / ha
- Top dress 10 to 30 tons / ha
- Or, 4 cubic metres / 100 m^2

How much organic matter should there be in our soils ?

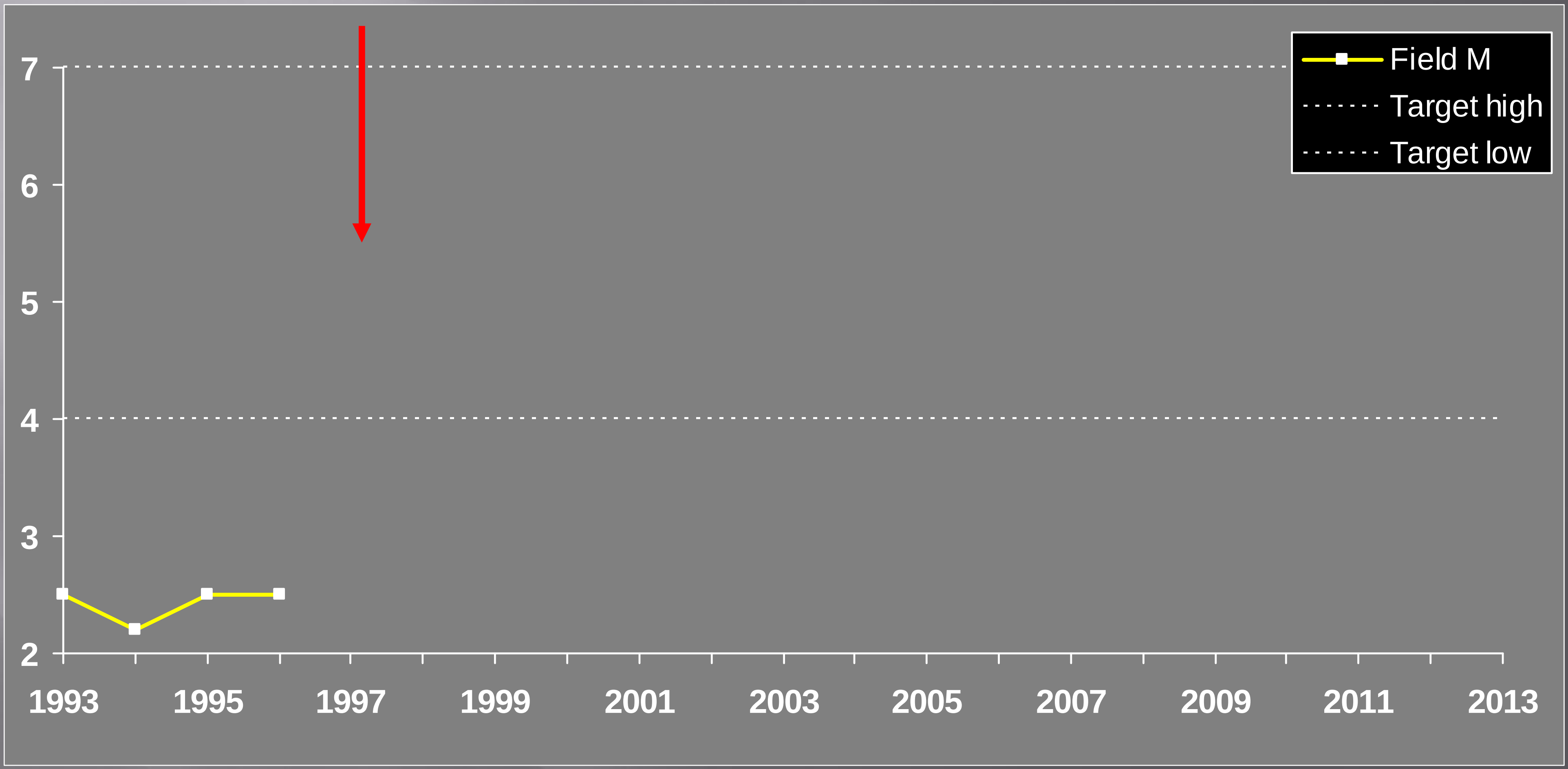


My contribution: Impact of long term use
Compost is applied in fall every 2 or 3 years



Soil organic matter (target is 4 to 7%)

Compost applied since 1997 at 250 to 500 m^3 / ha / 2 years



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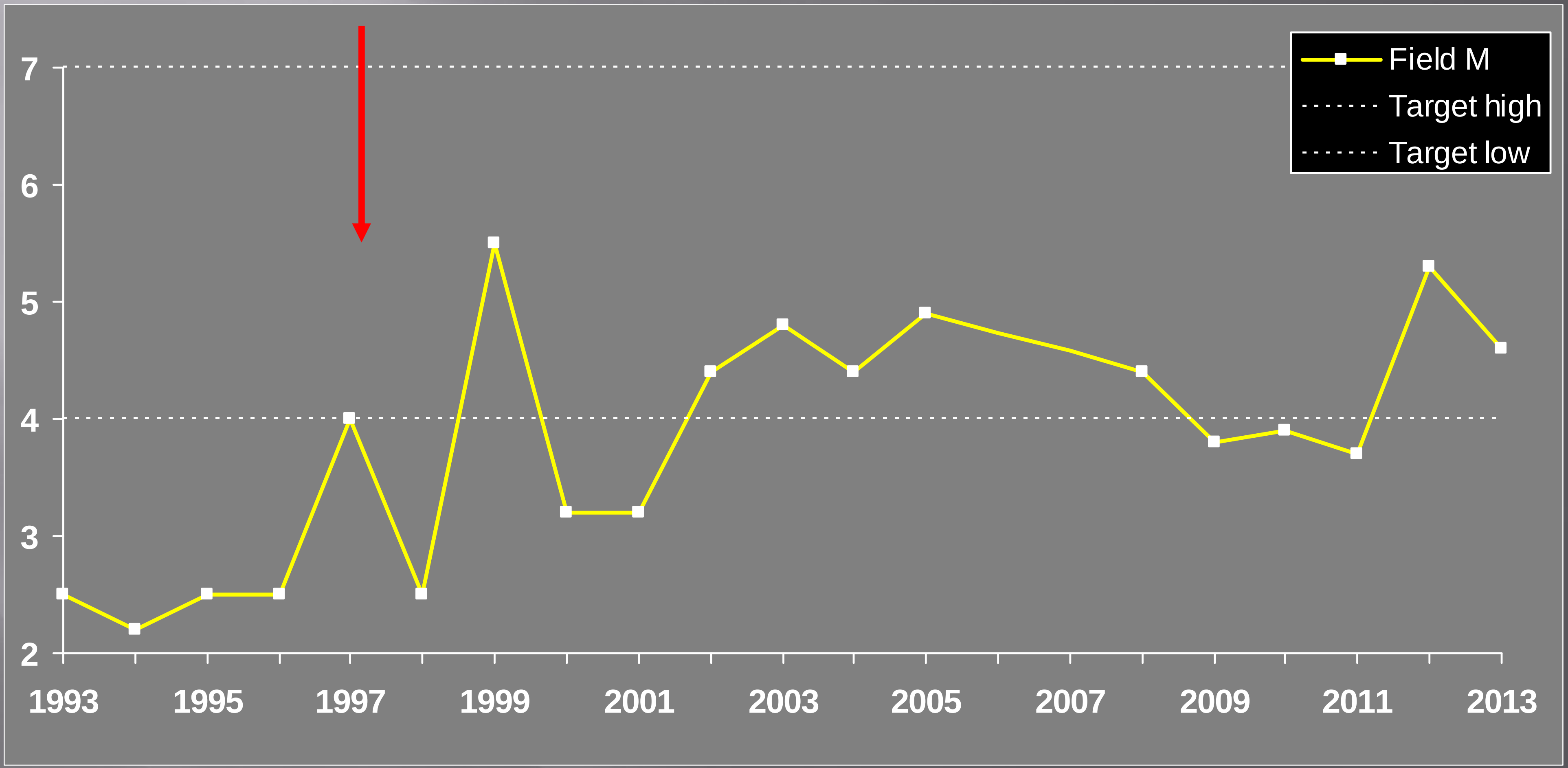
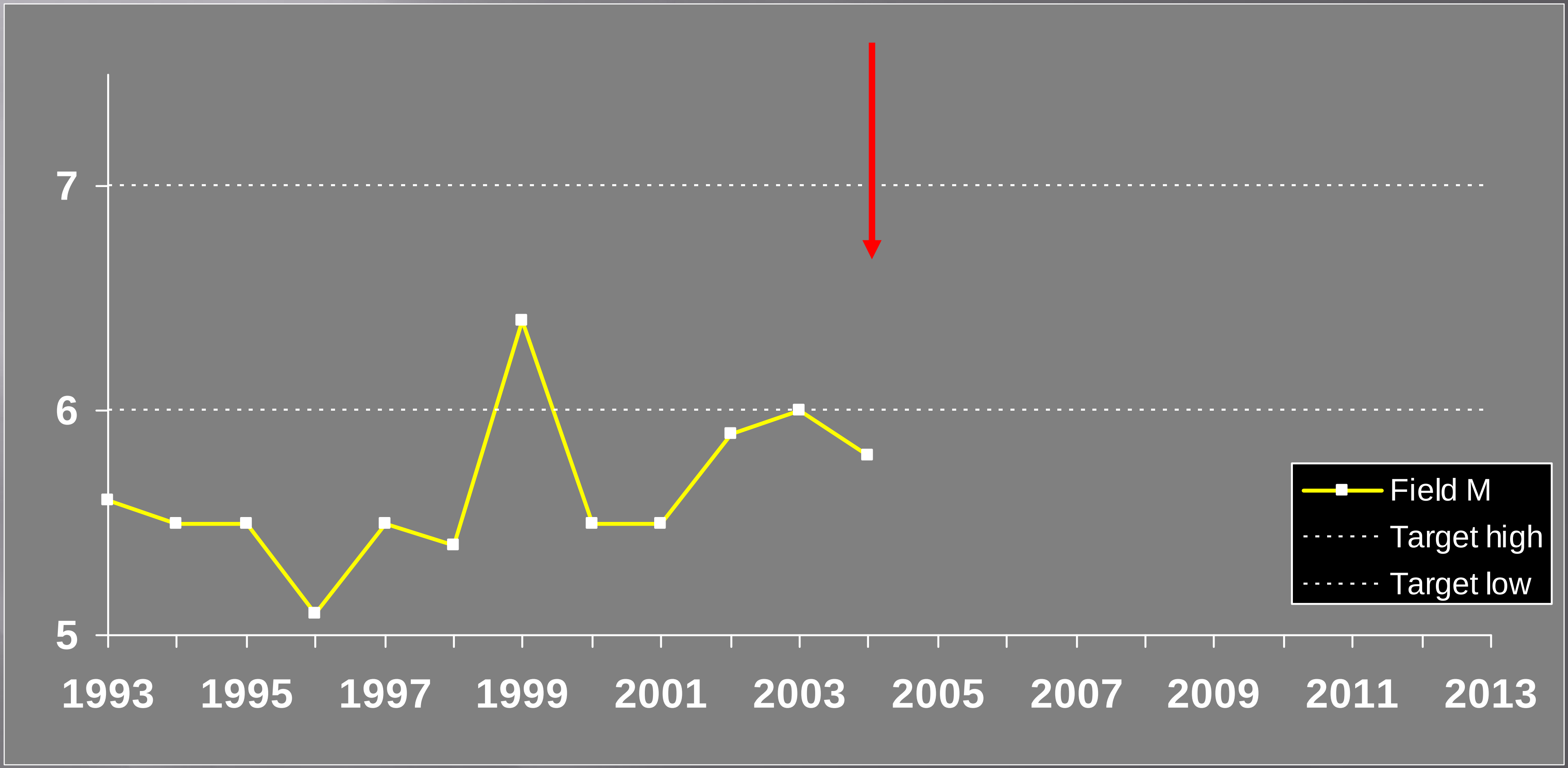


Soil pH (target is 6.0 to 7.0)

Dolomite lime annually until 2004 at 2.25 to 4.50 tonnes / ha



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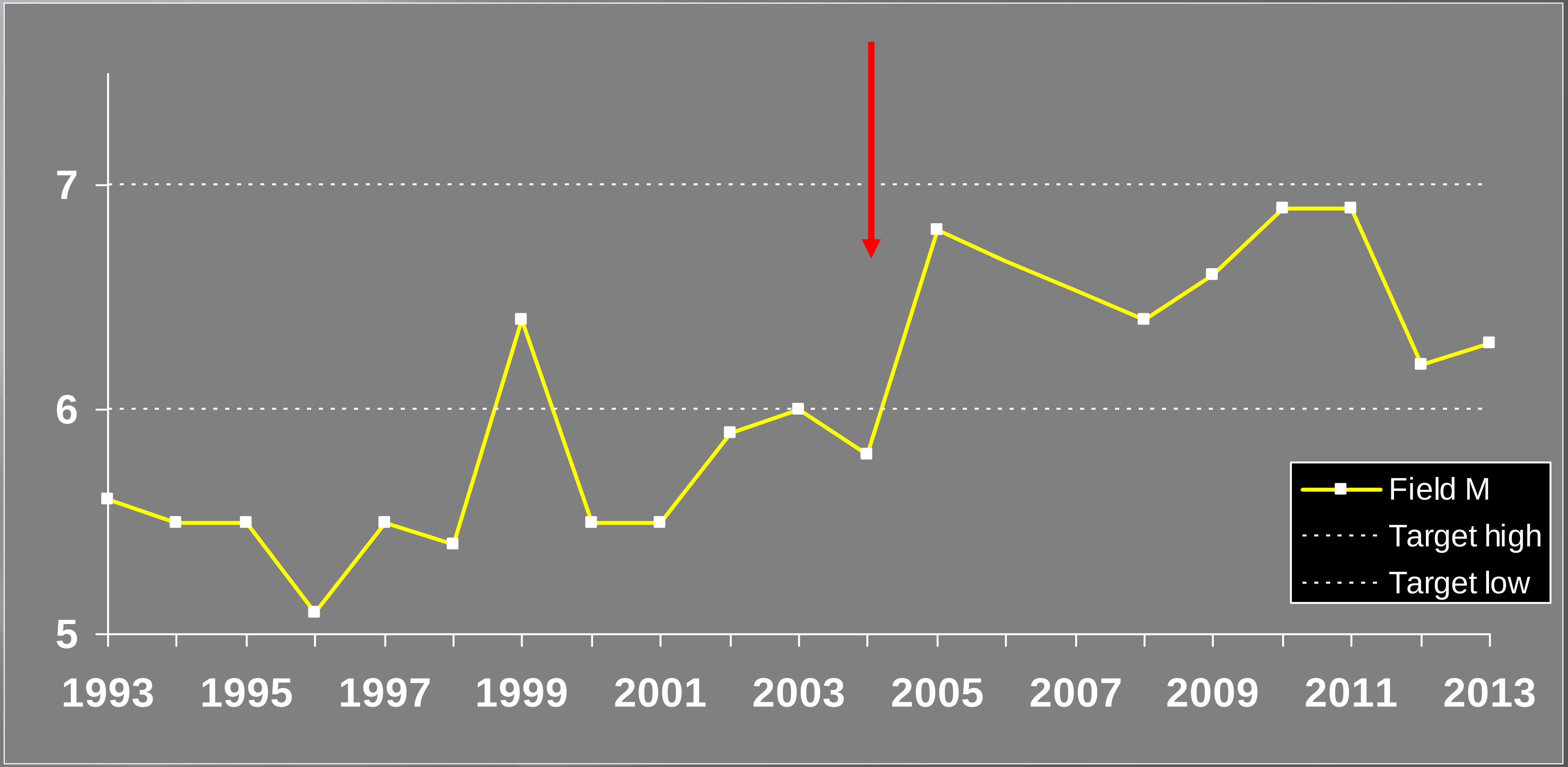
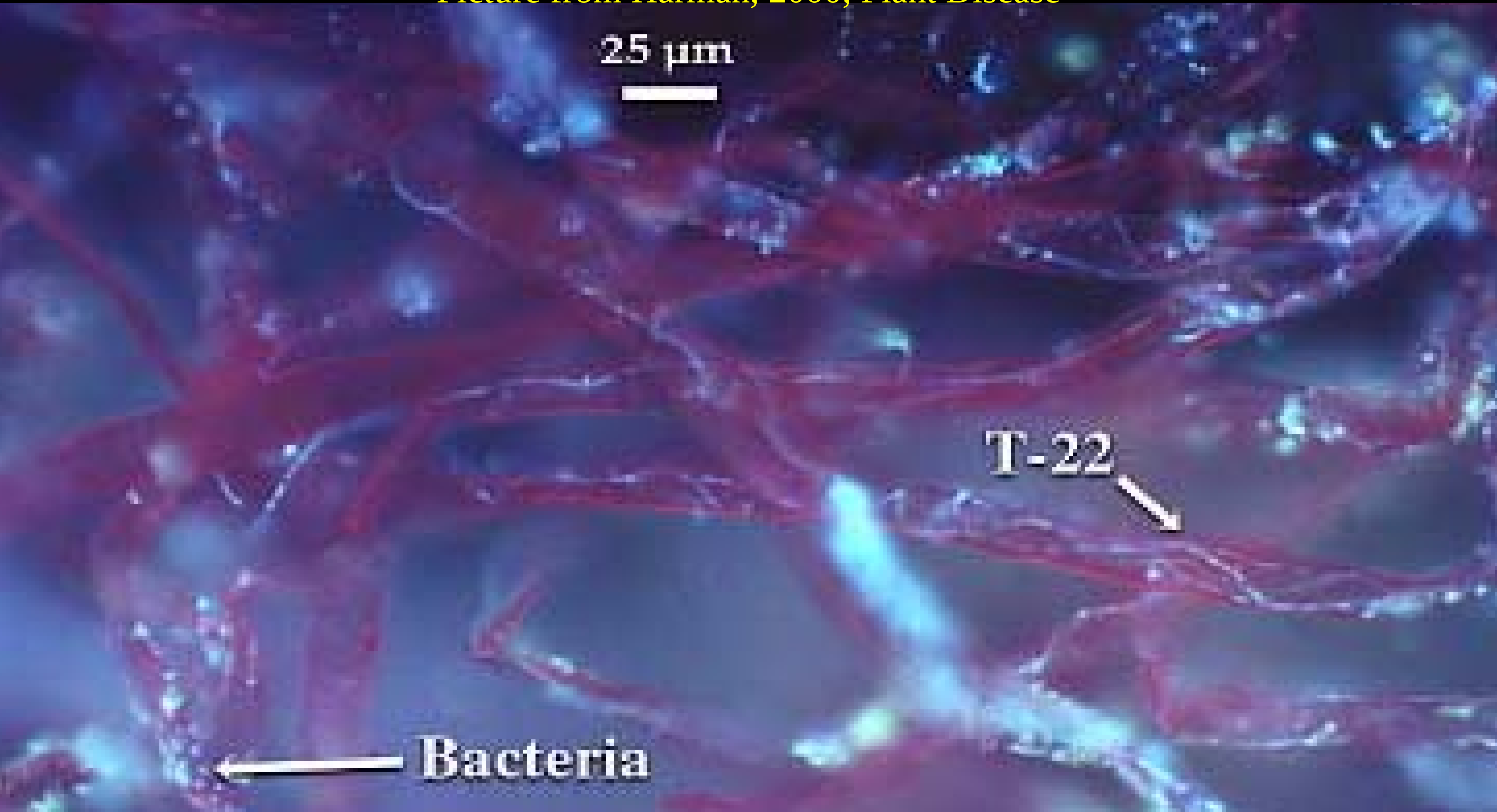
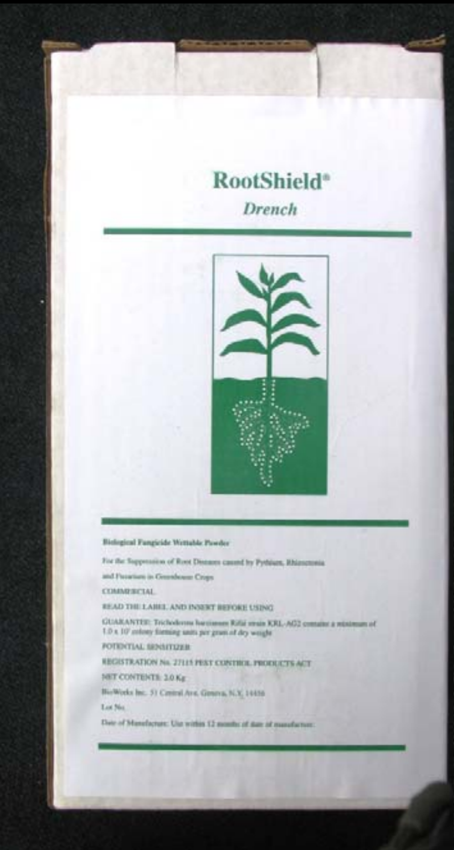


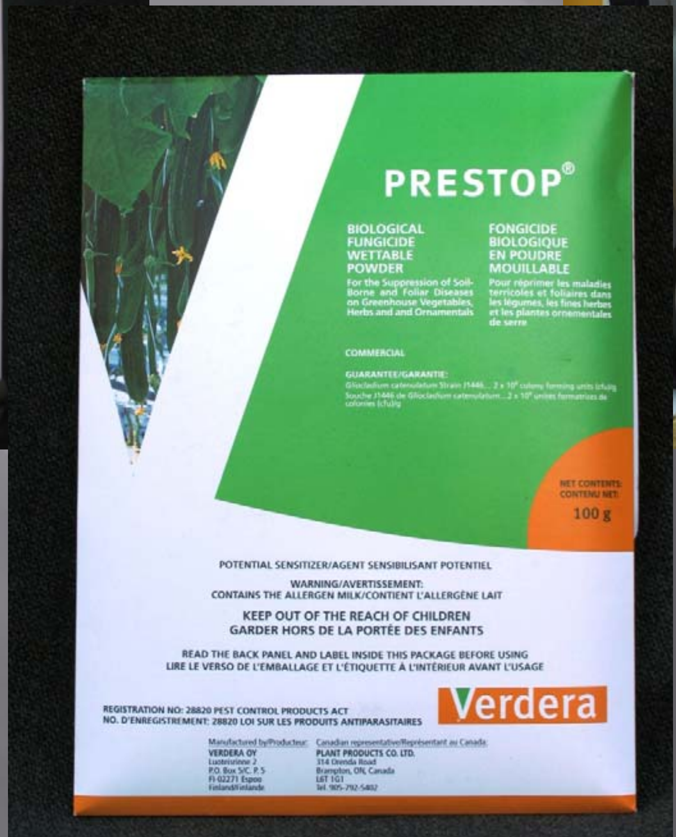
Beneficial microorganisms live on plant roots and protect against disease infection

Picture from Harman, 2000, Plant Disease



Many biological fungicides are registered in Canada





High variability in commercial compost.
Is there a need to “fortify” to get suppressive quality ?

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Soil Biology & Biochemistry 38 (2006) 2461–2477

Soil Biology & Biochemistry

www.elsevier.com/locate/soilbio

Suppressiveness of 18 composts against 7 pathosystems: Variability in pathogen response

A.J. Termorshuizen[a,*], E. van Rijn[a], D.J. van der Gaag[b], C. Alabouvette[c], Y. Chen[d], J. Lagerlöf[e], A.A. Malandrakis[f], E.J. Paplomatas[f], B. Rämert[e], J. Ryckeboer[g,1], C. Steinberg[c], S. Zmora-Nahum[d]

From the 120 bioassays involving 18 composts and 7 pathosystems,
significant disease suppression was found in 54% of the cases
while only 3% of the cases showed significant disease suppression enhancement.
Different pathogens were affected differently by the composts.

An example of a presentation at the event Decontamination of an ex-refinery site in Mexico

Using beneficial microbes found in certain composts

Brazilian Journal of Microbiology 44, 2, 595-605 (2013)
ISSN 1678-4405

Research Paper

In situ biosurfactant production and hydrocarbon removal by *Pseudomonas putida* CB-100 in bioaugmented and biostimulated oil-contaminated soil

Martínez-Toledo Ángeles[1,2], Rodríguez-Vázquez Refugio[2]

[1]Facultad de Ciencias Químicas, Universidad Autónoma de San Luis Potosí, San Luis Potosí, SLP, Mexico.
[2]Departamento de Biotecnología y Bioingeniería, Centro de Investigación y de Estudios Avanzados del IPN, Col. San Pedro Zacatenco, Mexico, D.F., Mexico

Submitted: June 29, 2011; Approved: June 05, 2012.

Abstract

In situ biosurfactant (rhamnolipid) production by *Pseudomonas putida* CB-100 was achieved during a bioaugmented and biostimulated treatment to remove hydrocarbons from aged contaminated soil from oil well drilling operations. Rhamnolipid production and contaminant removal were determined for several treatments of irradiated and non-irradiated soils: nutrient addition (nitrogen and phosphorus), *P. putida* addition, and addition of both (*P. putida* and nutrients). The results were compared against a control treatment that consisted of adding only sterilized water to the soils. In treatment with native microorganisms (non-irradiated soils) supplemented with *P. putida*, the removal of total petroleum hydrocarbons (TPH) was 40.6%, the rhamnolipid production was 1.54 mg/kg, and a surface tension of 64 mN/m was observed as well as a negative correlation ($R = -0.54$; $p < 0.019$) between TPH concentration (mg/kg) and surface tension (mN/m), When both bacteria and nutrients were involved, TPH levels were lowered to 33.7%, and biosurfactant production and surface tension were 2.03 mg/kg and 67.3 mN/m, respectively. In irradiated soil treated with *P. putida*, TPH removal was 24.5% with rhamnolipid generation of 1.79 mg/kg and 65.6 mN/m of surface tension, and a correlation between bacterial growth and biosurfactant production ($R = -0.64$; $p < 0.009$) was observed. When the nutrients and *P. putida* were added, TPH removal was 61.1%, 1.85 mg/kg of biosurfactants were produced, and the surface tension was 55.6 mN/m. In summary, in irradiated and non-irradiated soils, *in situ* rhamnolipid production by *P. putida* enhanced TPH decontamination of the soil.

Key words: bioremediation, irradiated soil, total petroleum hydrocarbons, rhamnolipids, *P. putida*.

Introduction

For such pollutants, the use of synthetic surface agents has been suggested. These agents enhance the pollutants solubility's (Volkering *et al.*, 1995), leading to their

Using beneficial microbes found in certain composts To fortify the compost used in the decomtamination

Research Paper

In situ biosurfactant production and hydrocarbon removal by *Pseudomonas putida* CB-100 in bioaugmented and biostimulated oil-contaminated soil

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Introduction

For such
agents has been
lutants solubility

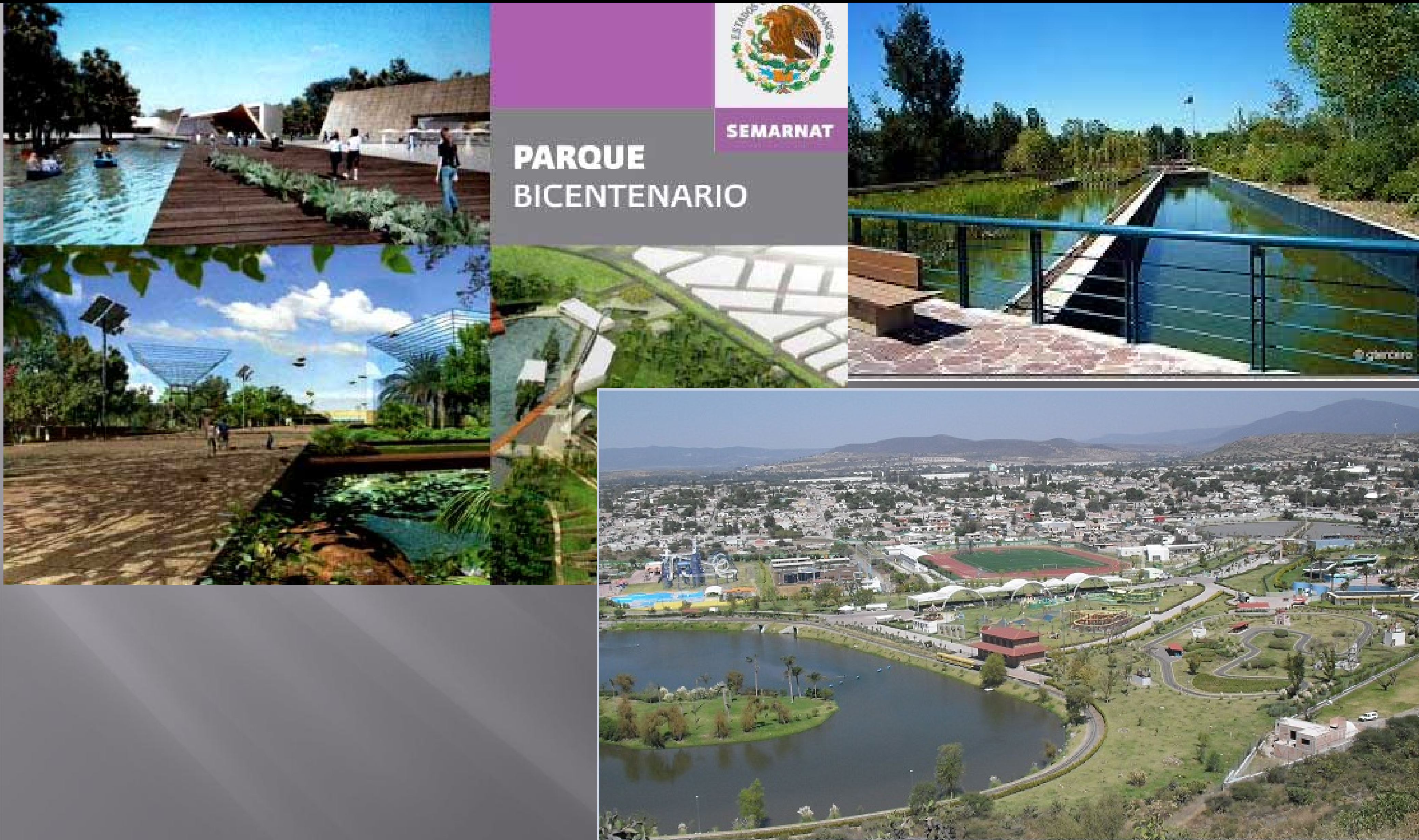
USE OF CRUDE COFFEE GRAIN FOR TREATMENT OF PETROLEUM HYDROCARBON-CONTAMINATED SOIL

G. A. Roldán-Martín, R. Rodríguez-Vázquez
Centro de Investigación y Estudios Avanzados del IPN (CINVESTAV) Av. Instituto Politécnico Nacional 2508 Col. San Pedro Zacatenco, 07360 Apartado postal 14-740, 07000 México, D.F.
aroldanm@iingen.unam.mx, rrodrig@mail.cinvestav.mx

ABSTRACT

The environmental pollution caused by toxic compounds is a global problem. In Mexico, a number of diverse technological options in biological processes have been tested for the restoration of sites contaminated with hydrocarbons. One of these processes is the addition of organic bulking agents to improve the characteristics of soil and to enhance the removal of the contaminant. The present research was designed to evaluate the crude coffee grain as a bulking agent in biopiles and to increase the biodegradation of petroleum hydrocarbons in contaminated soil. The first part of the work consisted in designing the biopile and the second, in the evaluation of the biopile. Sampling were done every week during the first month, every fifteen days during the second, and every month during the third stage. Along the treatment; humidity, pH,

Today the site is "Parque Bicentenario"



Attendance: 120 persons from 36 countries

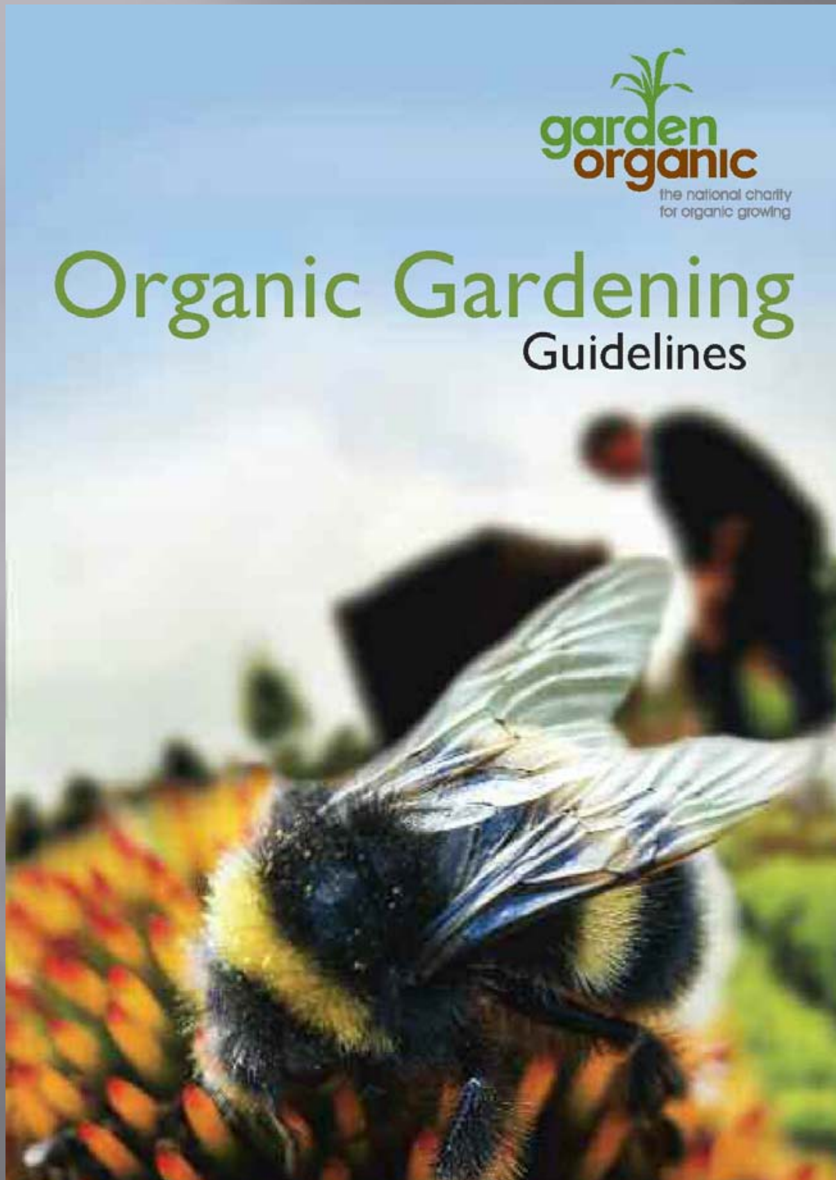
Discussion # 1

Greenhouse organic vegetable production is in real soil

Urban farming is not in real soil. Is it "organic" ?

Picture Ulrich Schmutz, Coventry University, UK

On the web: www.gardenorganic.org.uk



Growing media

An organic growing medium – seed, potting, or multipurpose compost – has, as its main ingredient, biologically active material, such as composted plant wastes. Seed compost should be low in nutrients. Other mixes should provide plants with nutrients for as long as possible, to limit the need for liquid feeding.

Best organic practice – the first choice

- Make your own growing media using home made garden compost and other bulky organic ingredients from those listed in the Soil Care section

Acceptable organic practice

- Loam from the garden as an ingredient in growing media, returned to the garden after use
- Organic fertilisers, including animal by-products, as ingredients of growing media
- Commercially available growing media, with an organic symbol, or wording, from an approved organic certification organisation
- Commercially available growing media containing materials listed in the Soil Care section of these guidelines

Acceptable, but not for regular use

- Coarse grade seaweed meal for moisture retention
- Sulphur chips to lower pH (increase acidity)
- Horticultural sand and grit
- Vermiculite and perlite
- Coir
- Bought in loam (topsoil)

Never acceptable in an organic garden

- Growing media containing materials not approved in these guidelines, including non-organic fertilisers and peat
- Peat, other than recycled/reclaimed peat

Garden Organic factsheets

- Make your own potting compost
- Hanging basket liners

Discussion # 2

Organic says: Manage the capacity of the soil

Accountant says: Maximize yield to recoup investment

Picture Frederic Rey,
Institut Technique de l'Agriculture Biologique
(ITAB), France

Fertilization is supplemented by liquid compost tea

Using compost tea in urban plantings

Since 1998 along highways in Texas: 1 million trees planted

Pictures Ethan Beeson,
Texas Department of Transportation, Houston

Using compost tea in urban plantings

On the web: “Sustainable Roadsides in the Houston District”

Technical Report Documentation Pag

1. Report No. FHWA/TX-07/0-5330-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle SYNTHESIS OF NEW METHODS FOR SUSTAINABLE ROADSIDE LANDSCAPES		5. Report Date November 2006 Published: August 2007
		6. Performing Organization Code
7. Author(s) Kim D. Jones, Beverly Storey, Debbie Jasek, and Joseph Sai		8. Performing Organization Report No. Report 0-5330-1
9. Performing Organization Name and Address South Texas Environmental Institute, MSC 213 Texas A&M University–Kingsville Kingsville, Texas 78363		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. Project 0-5330
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, Texas 78763-5080		13. Type of Report and Period Covered Technical Report: September 2005–August 2006
		14. Sponsoring Agency Code

15. Supplementary Notes
Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
Project Title: Synthesis of New Methods and Techniques for Developing Sustainable Roadside Landscapes
URL: http://tti.tamu.edu/reports/0-5330-1.pdf

16. Abstract
Several Texas Department of Transportation (TxDOT) districts have developed innovative landscape efforts specifically seeking to establish sustainable landscapes that require little if any supplemental water and utilize no chemical fertilizers. The concept behind this approach is that as land use intensifies, surface water runoff increases and the soil's ability to absorb runoff diminishes. TxDOT needs creative alternatives that can help soil retain moisture and recycle nutrients to reduce the energy expended in the maintenance of right-of-way landscape development. Techniques that utilize the environmental processes found in natural, self-sustaining, and self-sufficient plant communities have been clearly demonstrated to minimize and restore development impacts on soil, reduce peak storm flows, and increase infiltration. These techniques include major soil modifications as part of large-scale highway plantings. This project identifies many of the common non-chemical soil amendments and additives that can be used to create an environment that simulates a naturally occurring sustainable system found in undisturbed landscapes. Alternative management practices used by the public and private sectors were investigated for possible application to urban roadside landscapes for TxDOT and included cost and benefit evaluations, and the analysis of traditional and more sustainable landscaping comparisons of maintenance, water use, erosion control, and pollutant runoff mitigation. As these sustainable landscape development methods evolve, improved maintenance cost savings and public acceptance is anticipated.

17. Key Words Sustainable Landscape, Organic, Soil Amendments, Landscape, Water Quality, Soil Moisture Retention		18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service Springfield, Virginia 22161 http://www.ntis.gov	
19. Security Classif.(of this report) Unclassified	20. Security Classif.(of this page) Unclassified	21. No. of Pages 156	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Attendance: 705 persons from 50 countries

Attendance: Over 1000 persons from 50 countries

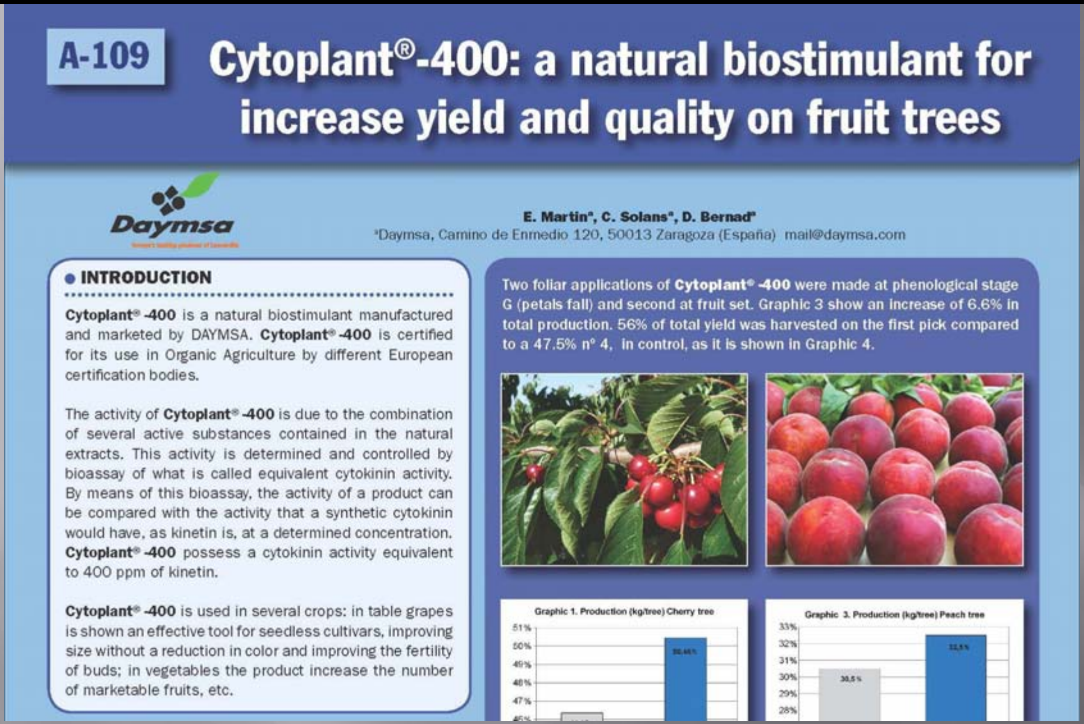
Attended by scientists, manufacturers, investors…

Humic acid, Kelp, Fish fertilizer, Amino acids are now called "biostimulants"

Seaweed extracts as biostimulants

Extensive research by B. Prithiviraj, Dalhousie University Nova Scotia

There are many, many commercial products in Europe


A-109

Cytoplant®-400: a natural biostimulant for increase yield and quality on fruit trees

Daymsa

E. Martin[a], C. Solans[a], D. Bernad[a]
[a]Daymsa, Camino de Enmedio 120, 50013 Zaragoza (España) mail@daymsa.com

INTRODUCTION

Cytoplant® -400 is a natural biostimulant manufactured and marketed by DAYMSA. Cytoplant® -400 is certified for its use in Organic Agriculture by different European certification bodies.

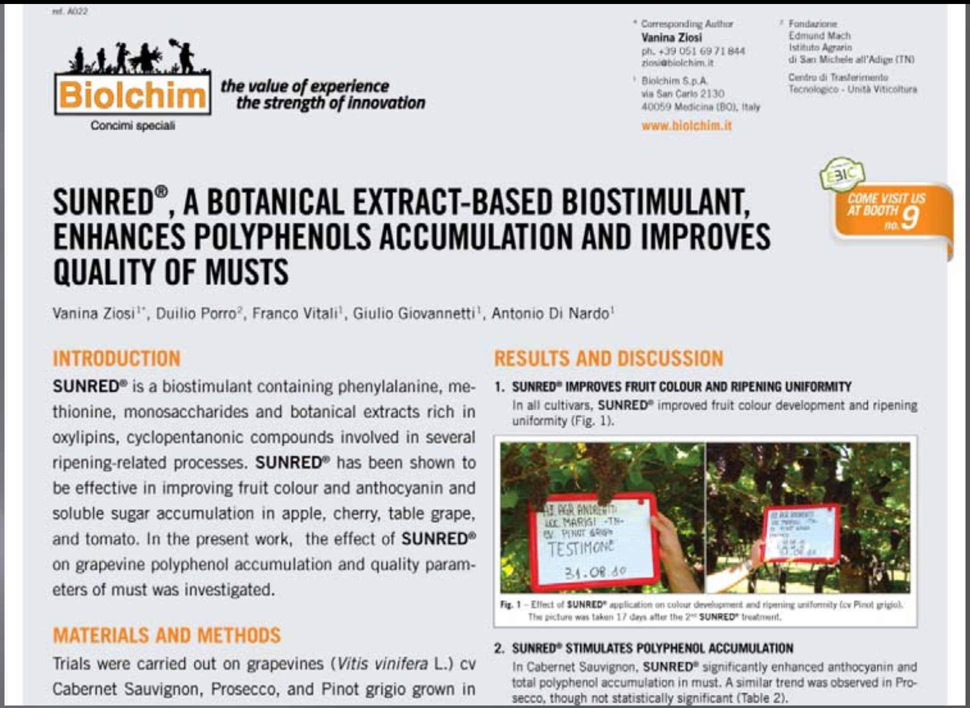
The activity of Cytoplant® -400 is due to the combination of several active substances contained in the natural extracts. This activity is determined and controlled by bioassay of what is called equivalent cytokinin activity. By means of this bioassay, the activity of a product can be compared with the activity that a synthetic cytokinin would have, as kinetin is, at a determined concentration. Cytoplant® -400 possess a cytokinin activity equivalent to 400 ppm of kinetin.

Cytoplant® -400 is used in several crops: in table grapes is shown an effective tool for seedless cultivars, improving size without a reduction in color and improving the fertility of buds; in vegetables the product increase the number of marketable fruits, etc.

Two foliar applications of Cytoplant® -400 were made at phenological stage G (petals fall) and second at fruit set. Graphic 3 show an increase of 6.6% in total production. 56% of total yield was harvested on the first pick compared to a 47.5% n° 4, in control, as it is shown in Graphic 4.

Graphic 1. Production (kg/tree) Cherry tree

Graphic 3. Production (kg/tree) Peach tree


ref. A022

Biolchim
Concimi speciali
the value of experience
the strength of innovation

* Corresponding Author
Vanina Ziosi
ph. +39 051 69 71 844
ziosi@biolchim.it

[1] Biolchim S.p.A.
via San Carlo 2130
40059 Medicina (BO), Italy
www.biolchim.it

[2] Fondazione Edmund Mach
Istituto Agrario di San Michele all'Adige (TN)
Centro di Trasferimento Tecnologico - Unità Viticoltura

COME VISIT US AT BOOTH no. 9

SUNRED®, A BOTANICAL EXTRACT-BASED BIOSTIMULANT, ENHANCES POLYPHENOLS ACCUMULATION AND IMPROVES QUALITY OF MUSTS

Vanina Ziosi[1*], Duilio Porro[2], Franco Vitali[1], Giulio Giovannetti[1], Antonio Di Nardo[1]

INTRODUCTION

SUNRED® is a biostimulant containing phenylalanine, methionine, monosaccharides and botanical extracts rich in oxylipins, cyclopentanonic compounds involved in several ripening-related processes. SUNRED® has been shown to be effective in improving fruit colour and anthocyanin and soluble sugar accumulation in apple, cherry, table grape, and tomato. In the present work, the effect of SUNRED® on grapevine polyphenol accumulation and quality parameters of must was investigated.

MATERIALS AND METHODS

Trials were carried out on grapevines (*Vitis vinifera* L.) cv Cabernet Sauvignon, Prosecco, and Pinot grigio grown in

RESULTS AND DISCUSSION

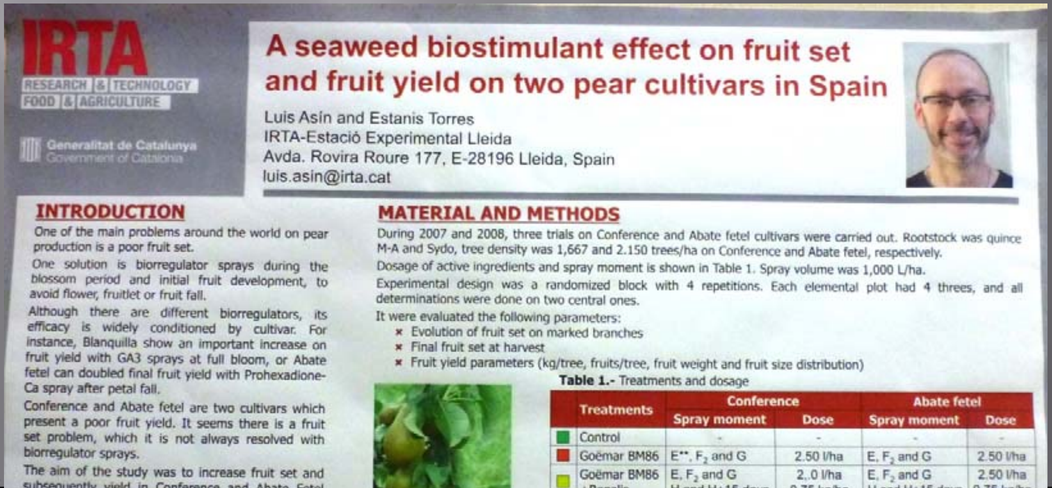
1. SUNRED® IMPROVES FRUIT COLOUR AND RIPENING UNIFORMITY

In all cultivars, SUNRED® improved fruit colour development and ripening uniformity (Fig. 1).

Fig. 1 – Effect of SUNRED® application on colour development and ripening uniformity (cv Pinot grigio). The picture was taken 17 days after the 2nd SUNRED® treatment.

2. SUNRED® STIMULATES POLYPHENOL ACCUMULATION

In Cabernet Sauvignon, SUNRED® significantly enhanced anthocyanin and total polyphenol accumulation in must. A similar trend was observed in Prosecco, though not statistically significant (Table 2).


IRTA
RESEARCH & TECHNOLOGY FOOD & AGRICULTURE
Generalitat de Catalunya
Government of Catalonia

A seaweed biostimulant effect on fruit set and fruit yield on two pear cultivars in Spain

Luis Asín and Estanis Torres
IRTA-Estació Experimental Lleida
Avda. Rovira Roure 177, E-28196 Lleida, Spain
luis.asin@irta.cat

INTRODUCTION

One of the main problems around the world on pear production is a poor fruit set.

One solution is biorregulator sprays during the blossom period and initial fruit development, to avoid flower, fruitlet or fruit fall.

Although there are different biorregulators, its efficacy is widely conditioned by cultivar. For instance, Blanquilla show an important increase on fruit yield with GA3 sprays at full bloom, or Abate fetel can doubled final fruit yield with Prohexadione-Ca spray after petal fall.

Conference and Abate fetel are two cultivars which present a poor fruit yield. It seems there is a fruit set problem, which it is not always resolved with biorregulator sprays.

The aim of the study was to increase fruit set and

MATERIAL AND METHODS

During 2007 and 2008, three trials on Conference and Abate fetel cultivars were carried out. Rootstock was quince M-A and Sydo, tree density was 1,667 and 2.150 trees/ha on Conference and Abate fetel, respectively.

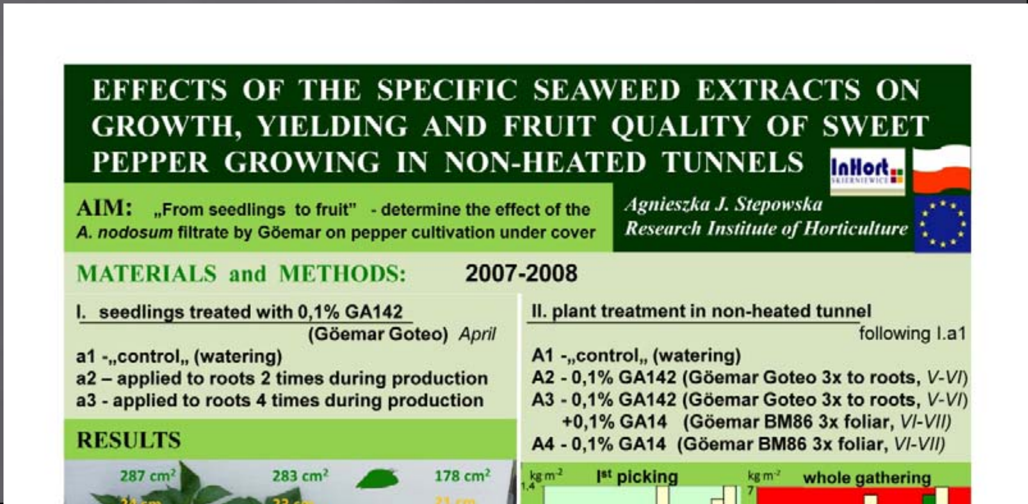
Dosage of active ingredients and spray moment is shown in Table 1. Spray volume was 1,000 L/ha.

Experimental design was a randomized block with 4 repetitions. Each elemental plot had 4 threes, and all determinations were done on two central ones.

It were evaluated the following parameters:
- Evolution of fruit set on marked branches
- Final fruit set at harvest
- Fruit yield parameters (kg/tree, fruits/tree, fruit weight and fruit size distribution)

Table 1.- Treatments and dosage

Treatments	Conference		Abate fetel	
	Spray moment	Dose	Spray moment	Dose
Control	-	-	-	-
Goëmar BM86	E**, F_2 and G	2.50 l/ha	E, F_2 and G	2.50 l/ha
Goëmar BM86	E, F_2 and G	2..0 l/ha	E, F_2 and G	2.50 l/ha


EFFECTS OF THE SPECIFIC SEAWEED EXTRACTS ON GROWTH, YIELDING AND FRUIT QUALITY OF SWEET PEPPER GROWING IN NON-HEATED TUNNELS

InHort

AIM: „From seedlings to fruit" - determine the effect of the *A. nodosum* filtrate by Göemar on pepper cultivation under cover

Agnieszka J. Stepowska
Research Institute of Horticulture

MATERIALS and METHODS: 2007-2008

I. seedlings treated with 0,1% GA142 (Göemar Goteo) *April*

a1 -„control„ (watering)
a2 – applied to roots 2 times during production
a3 - applied to roots 4 times during production

II. plant treatment in non-heated tunnel following I.a1

A1 -„control„ (watering)
A2 - 0,1% GA142 (Göemar Goteo 3x to roots, *V-VI*)
A3 - 0,1% GA142 (Göemar Goteo 3x to roots, *V-VI*) +0,1% GA14 (Göemar BM86 3x foliar, *VI-VII*)
A4 - 0,1% GA14 (Göemar BM86 3x foliar, *VI-VII*)

RESULTS

An example of a commercial biostimulant product

Biolchim

Concimi speciali

the value of experience
the strength of innovation

Vanina Ziosi
ph. +39 051 69 71 844
ziosi@biolchim.it
Biolchim S.p.A.
via San Carlo 2130
40059 Medicina (BO), Italy
www.biolchim.it

COME VISIT US AT BOOTH

NOV@®, A BOTANICAL EXTRACT-BASED BIOSTIMULANT F… ROOT DEVELOPM…

Vanina Ziosi*, Giulio Giovannet…

INTRODUCTION

NOV@® is a biostimulant contai… vitamins, chelated micronutrients, … in phytosaponins, polysaccharides … ine. Phytosaponins are naturally oc… they also have biological activity, … tion of root growth. Phytosaponin… and organic acids act synergistic… growth, nutrient uptake and soil … charides, amino acids, vitamins a… nutrients complete the action by … metabolism.

The aim of present work was to in… of **NOV@®** application on post-tra… velopment, plant growth and crop …

MATERIALS AND METHODS

NOV@® was applied on Alba, Can… dor strawberries. Alba and Cando… open field in Emilia Romagna and… respectively. Splendor was grown u… in Larache (Morocco).

In Alba, **NOV@®** treatments were … transplanting stage (27, 34, and 4… planting, dose: 20 L/ha; plot size: … ed at pre-flowering, petal fall, and… stages (dose: 15 L/ha; plot size: 1…

In Candonga, **NOV@®** (20 L/ha) w… 42, and 65 days after transplantin…

In Splendor, **NOV@®** (15 L/ha) was… ing and fruit enlargement (plot size…

CONCLUSION

INTRODUCTION

NOV@® is a biostimulant containing organic acids, vitamins, chelated micronutrients, plant extracts rich in phytosaponins, polysaccharides and glycine betaine. Phytosaponins are naturally occurring surfactants; they also have biological activity, including stimulation of root growth. Phytosaponins, glycine betaine, and organic acids act synergistically improving root growth, nutrient uptake and soil structure; polysac-

An excellent review on the science of biostimulants

Available on the web

2012 report, 32 pages | **2015 scientific paper, 12 pages**

The Science of Plant Biostimulants – A bibliographic analysis

Prof. Patrick du Jardin

CONTRACT 30-CE0455515/00-96, « AD HOC STUDY ON BIO-STIMULANTS PRODUCTS »

April 2012 – Final report

Scientia Horticulturae 196 (2015) 3–14

Contents lists available at ScienceDirect

Scientia Horticulturae

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

ELSEVIER

Review

Plant biostimulants: Definition, concept, main categories and regulation

Patrick du Jardin

Plant Biology Unit, Gembloux Agro-Bio Tech, University of Liège, Belgium, 2, Passage des Déportés, B-5030 Gembloux, Belgium

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.

Contents


The Science of Plant Biostimulants –
A bibliographic analysis
Prof. Patrick du Jardin

CONTRACT 30-CE0455515/00-96, « AD HOC STUDY ON BIO-STIMULANTS PRODUCTS »
April 2012 – Final report

Biostimulants are not fertilizers –
but they improve plant nutrition.

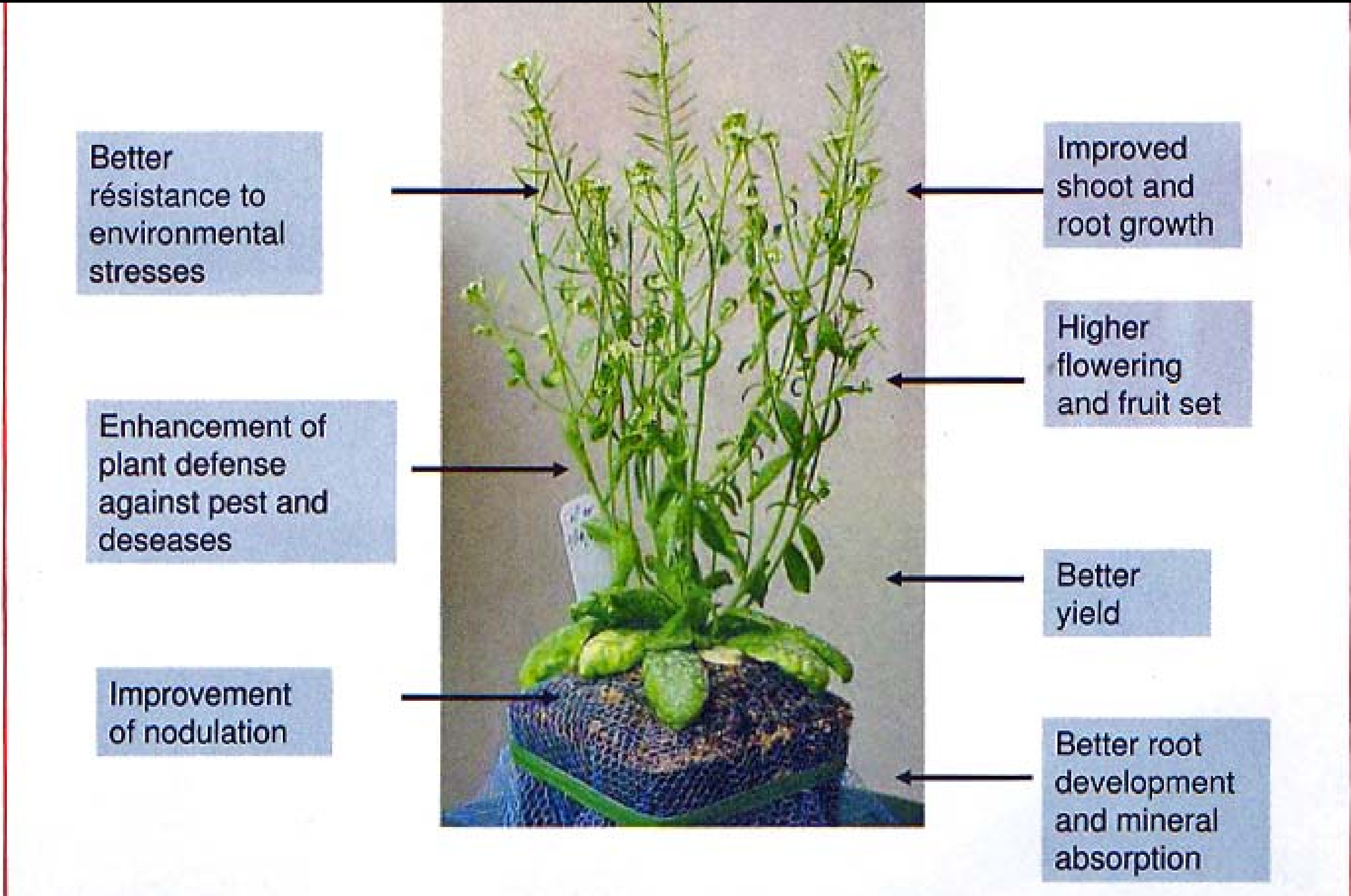
Biostimulants are not fungicides –
but they protect from disease infection.

They are not plant growth regulators –
but they stimulate plant growth.

“Biostimulants are defined by what they do more than by what they are, since the category includes a diversity of substances. They do more than stimulate growth. Stress tolerance is perhaps the most important benefit”.

Biostimulants help plants in different ways

Picture credit: J.F. Morot-Gaudry, INRA, Versailles France



One presentation at the biostimulant conference

INDUCED RESISTANCE AS A STRATEGY FOR VINEYARD PROTECTION

E. STEIMETZ[1], A. ECHAIRP[2], S. TROUVELOT[1], B. POINSSOT[1], A. CHILTZ[1], C. GUILLIER[1], E. BERNAUD[1], A. KLINGUER[1], M.C. HELOIR[1], X. DAIRE[1], M. ADRIAN[1]

[1] UMR 1347 Agroécologie AgroSup/INRA/uB - Pôle IPM - ERL CNRS 6300 - BP 86510 - 21065 Dijon cedex - France
[2] Wellence – Agroenvironnement – Parc technologique de la Toison d'OR, 28 rue L. de Broglie - BP66517 - 21065 Dijon cedex - France

State of the art

As plants possess an immune system to defend themselves against potentially pathogen microorganisms, disease is finally an exceptional outcome in plant-pathogen interactions.

Compounds called "elicitors" mimick pathogens and their perception by the plant triggers plant defence reactions [1], (Fig. 1). General elicitors belong to various biochemical classes: carbohydrates, lipids, (glyco)peptides and (glyco)proteins. They are active in different plant species and induce a protection against various pathogens. Most of them are secreted by the pathogen or derived from its cell wall during interaction with the plant and are called MAMPs (Microbe Associated Molecular Patterns) [2].

Our research is focused upon oligosaccharidic elicitors and both grapevine / *Plasmopara viticola* (downy mildew) and grapevine / *Botrytis cinerea* (gray mold) pathosystems.

Our objective is to understand the key mechanisms associated to induced resistance (IR) in order to develop the use of elicitors in strategies of crop protection.

Fig.1: Elicitor-induced cascade of events in plant cells.

Methods to screen and study elicitors

The use of cell suspensions is an easy way to screen elicitors and study their mode of action. We have developed methods to follow H_2O_2 and NO production, ion fluxes, MAPK activation, intracellular calcium variations, gene expression, and phytoalexin production in *Vitis vinifera* cv Gamay cell suspensions treated by elicitor such as EndoPG1 [3] and laminarin [4] (Fig. 2).

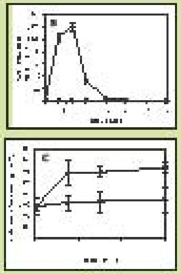


Fig.2: Analysis of AOS production, and calcium influx in Gamay cells treated by laminarin 1g/L.

However, cell suspensions are not suitable for compounds acting by priming. Moreover, they don't allow to check if elicitors induce resistance to pathogens.

We have therefore developed bioassays using leaf disks or plants grown in greenhouses to study the mode of action of elicitors (H_2O_2 production, callose deposition, phytoalexin production...) and IR (measured by the infected leaf area) [5] (Fig. 3).

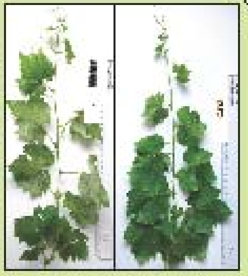


Fig.3: Plants treated by water (left) or an elicitor (right) and inoculated with P. viticola.

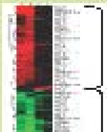
Understanding IR

MAMP recognition

It has been shown that plant perception of MAMPs is achieved by Pattern Recognition Receptors (PRRs) [6]. Using functional genomic approach we are presently looking for PRRs in grapevine.

Identification of IR markers

We are investigating which events associated to elicitor treatment are markers of IR. A transcriptomic approach has allowed us to identify a set



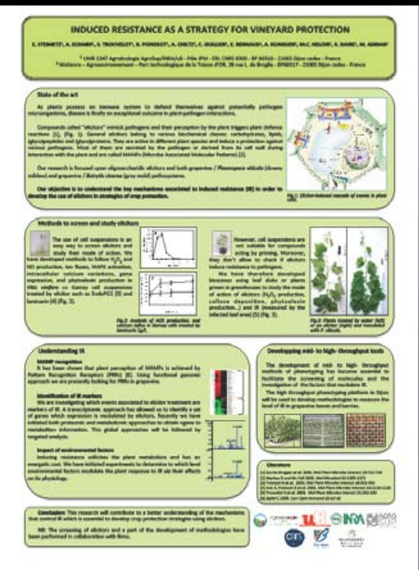
Developping mid- to high- throughput tools

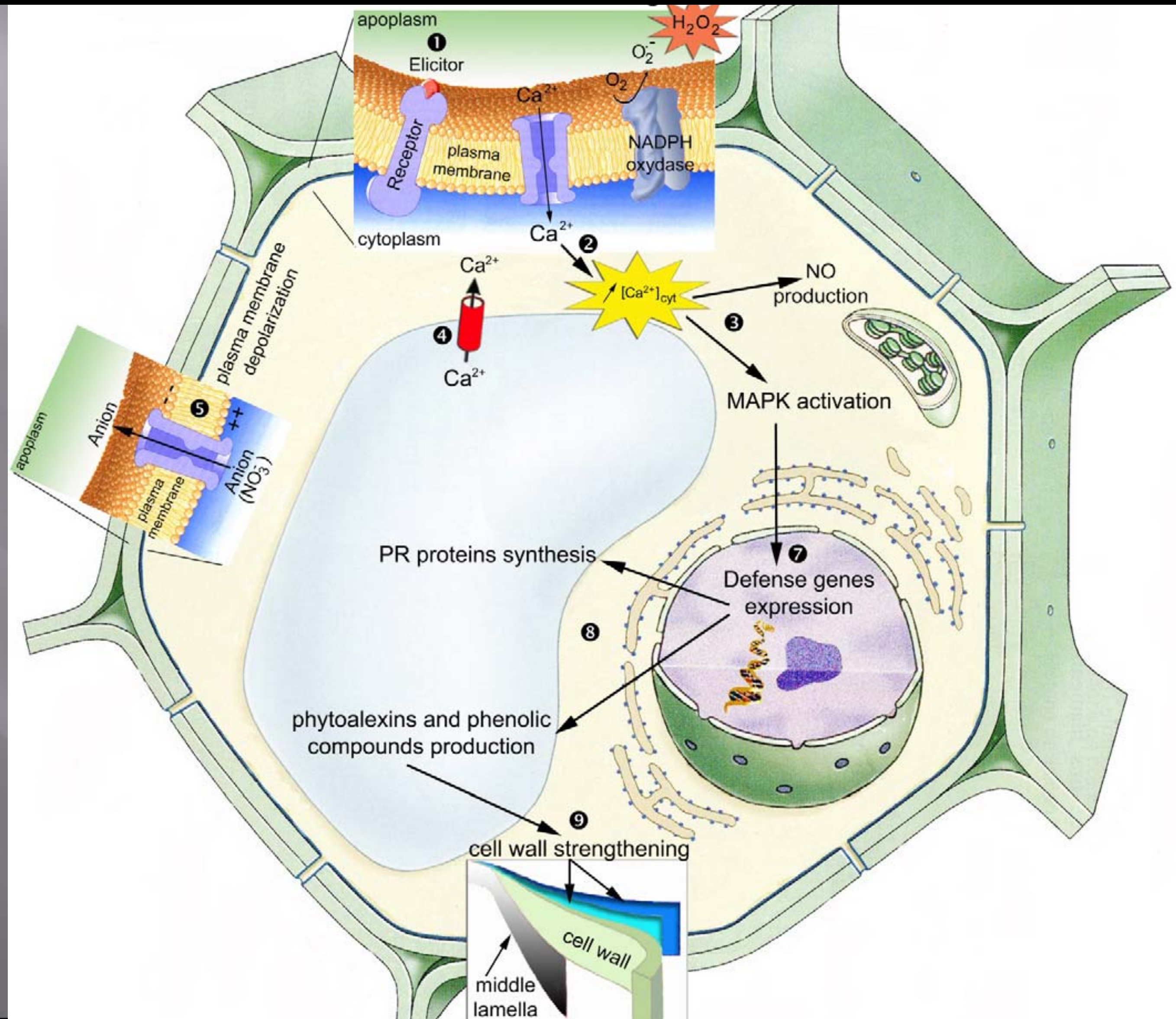
The development of mid- to high- throughput methods of phenotyping has become essential to facilitate the screening of molecules and the investigation of the factors that modulate IR.

The high throughput phenotyping platform in Dijon will be used to develop methodologies to measure the level of IR in grapevine leaves and berries.

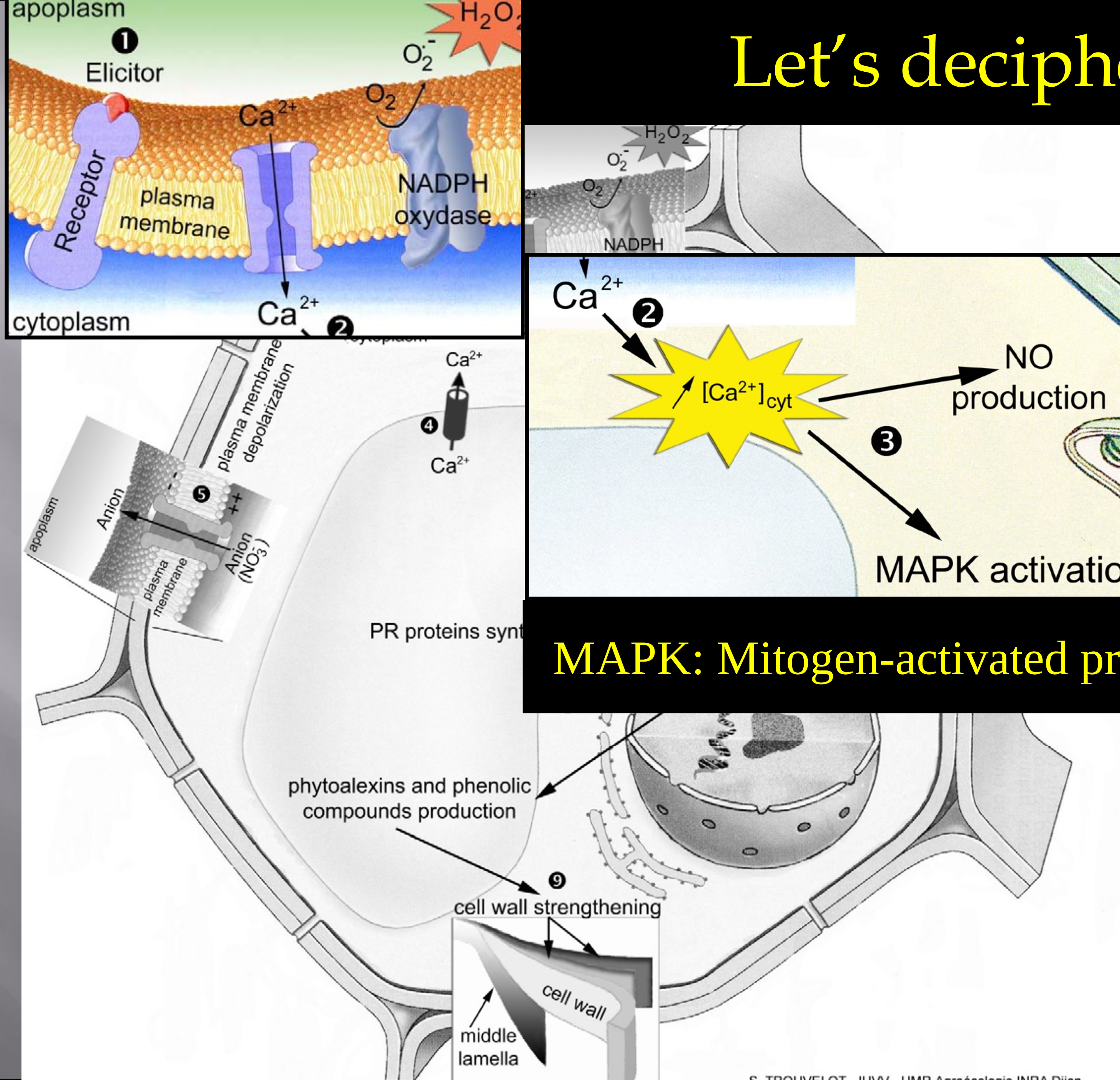
Pathways of biostimulants into the plant cell

Picture credit: S. Trouvelot, INRA Agroécologie, Dijon France





Let's decipher



MAPK: Mitogen-activated protein kinase

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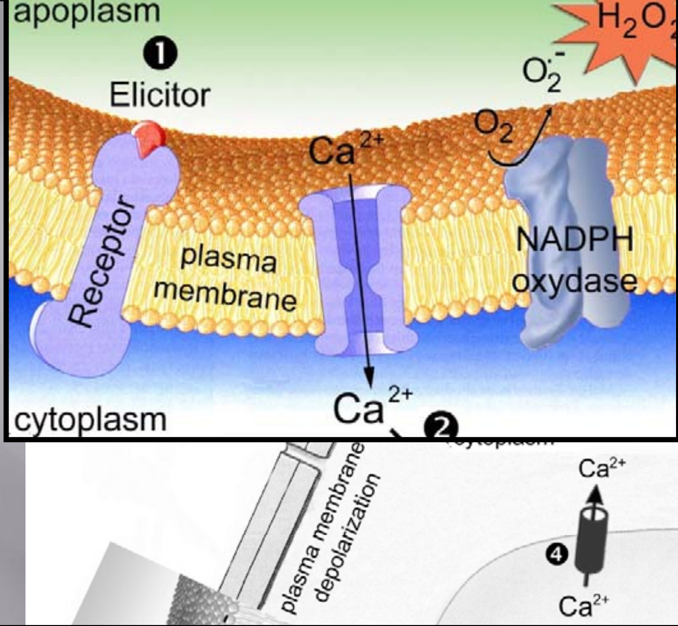
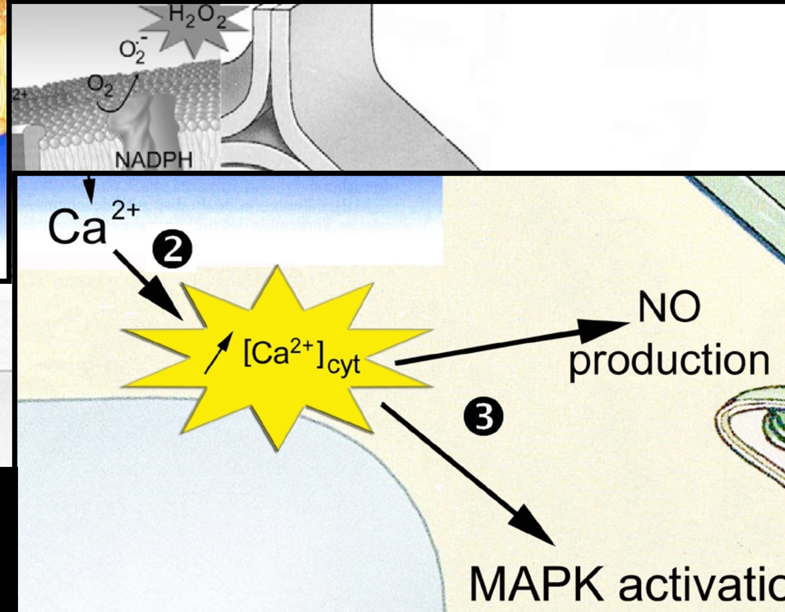
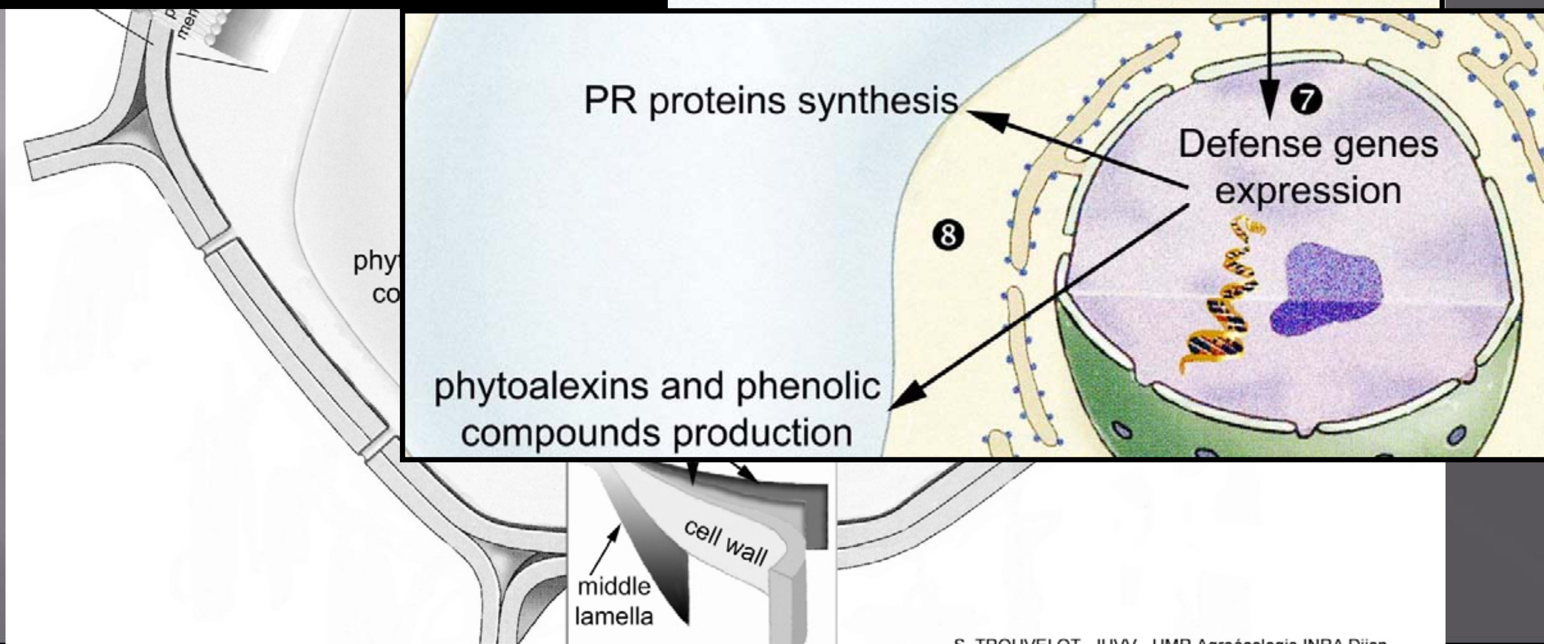




PR: Pathogenesis-related protein



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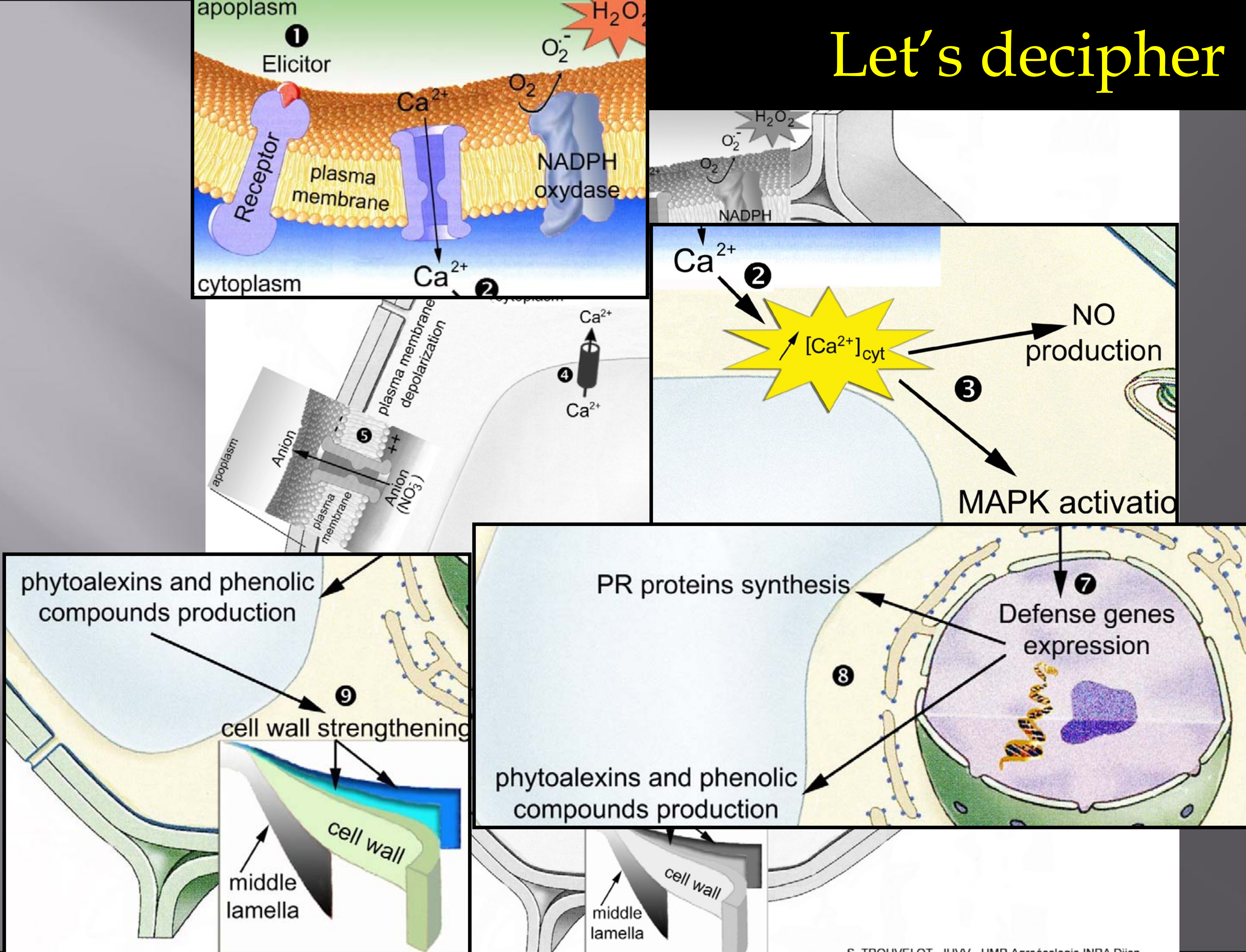

A “biostimulant” in the eyes of the user…

Thank you for joining us today !

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