

# Teaming with Nature : Replacing Iron with Roots

Sarah Singla  
French farmer  
January 15, 2014





# WE WANT YOU!





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nide  
iou



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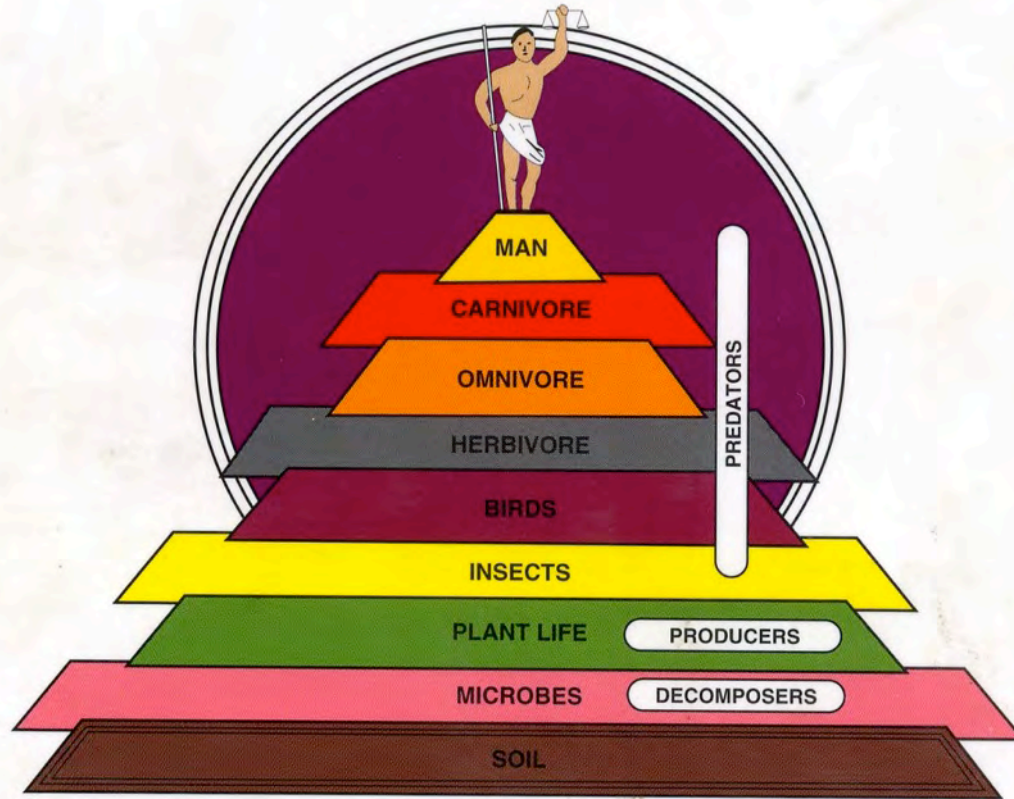


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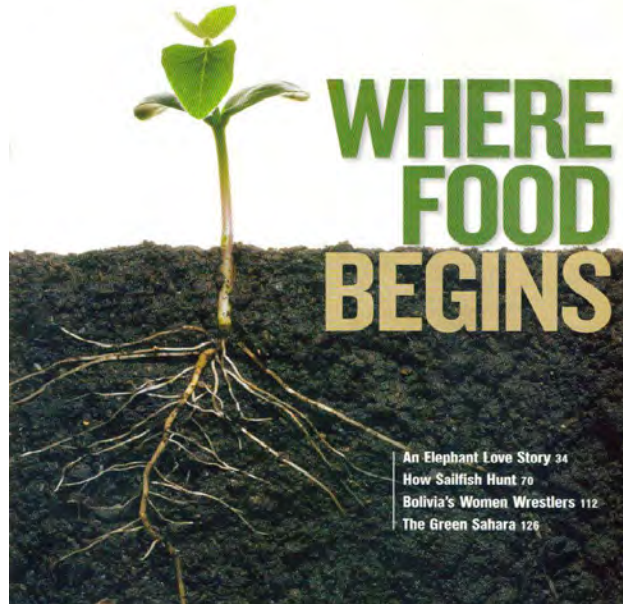


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# NATIONAL GEOGRAPHIC



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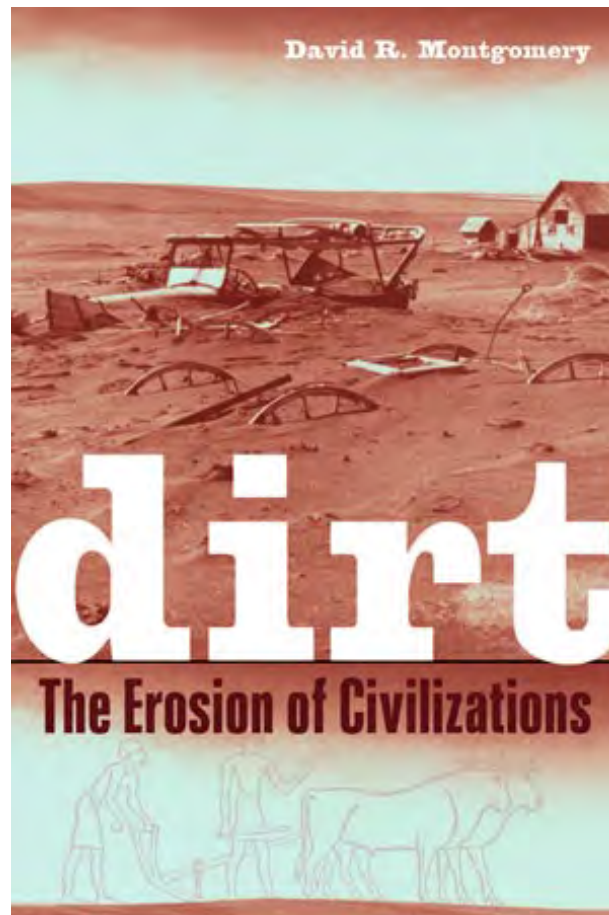


# Humus

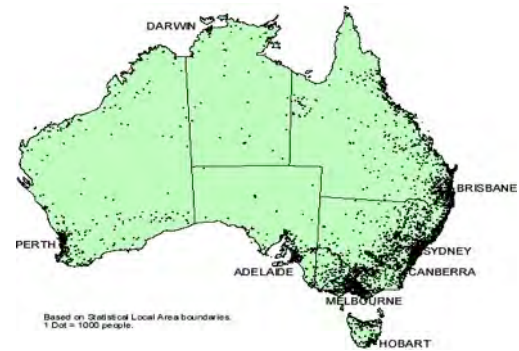
# Humility

# Humanity









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# *N°1 Public's ennemy*





# Where does the dirt come from ?







**Crédit Photo : Ray Archuleta (April 29, 2007)**  
**Flight from Greensboro NC to Minneapolis, MN**

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# Erosion in France



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# 1 inch of dirt is nothing....



...on 1 acre, it's 1,3 cu yd of soil that goes away





~ 1938



Source : Sturny

1980





# *How long will we keep on wasting money and destroying our main tool of production ?*



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**« If you want to make small changes,  
change how you DO things »**

**If you want to make BIG changes,  
Change how you SEE things**

**Don Campbell**





# « The best farmers are on the worst soils »

*Manoel Enrique Pereira*



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# « *The worst farmers are on the best soils* »



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*Back to school...*



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***If the corn roots go 3 feet deep, how deep should we till the soil and with which tool ?***



***...Et avec quel outil ?***



# Sold !!

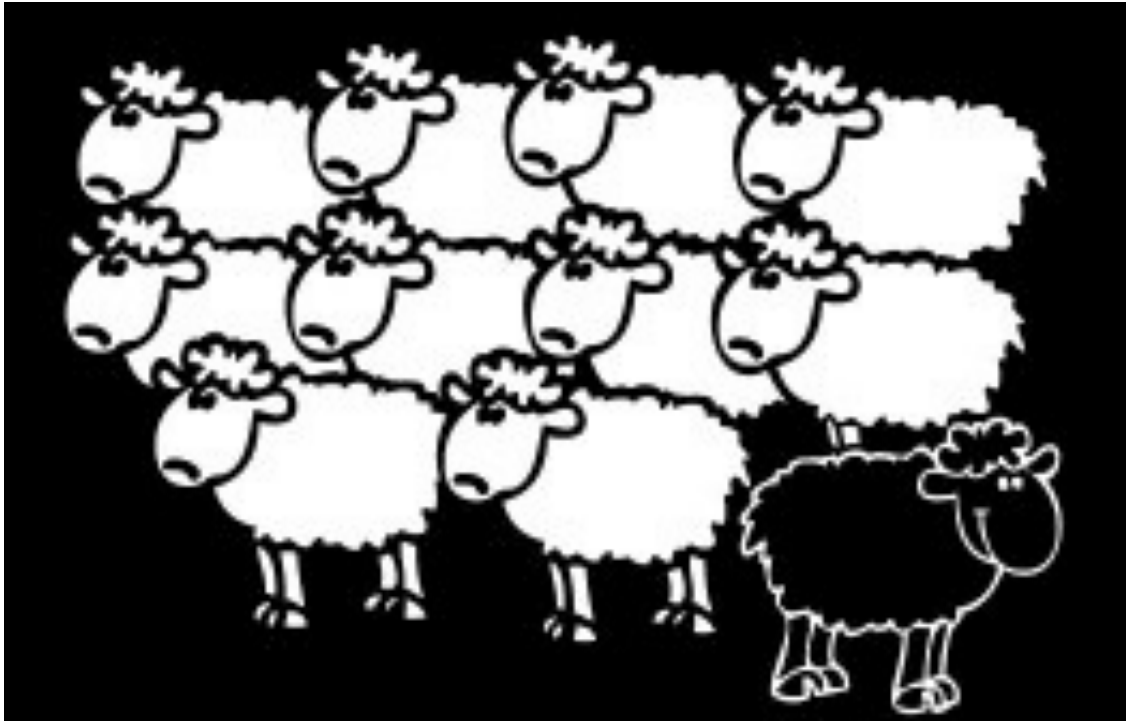


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***It's time to think different !!***





***“Insanity: doing the same thing over and over again and expecting different results”***

**Albert Einstein**



***“We can't solve problems by using the same kind of thinking we used when we created them”***

**Albert Einstein**





*What do you want  
your farm to be in  
100 years time ?*





**Yesterday**



**Today**



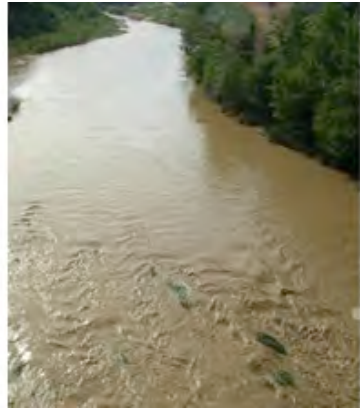
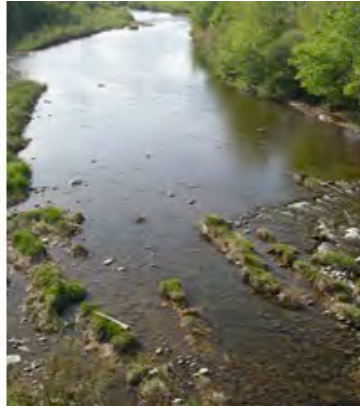


***Don't treat the symptoms***

***Address the cause***



# Erosion happens when the soil is naked





***“The best way to learn to be a good farmer  
is to observe someone that has been  
doing this successfully for a long time”***

**Dwayne Beck**



# What does Nature teach us ?







**In Nature, the soil is always covered, and nutrients are naturally recycled thanks to living root systems and living soil's organisms** (Prescott et al., 1985)



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***The new technology...***

***Biotechnology ?***



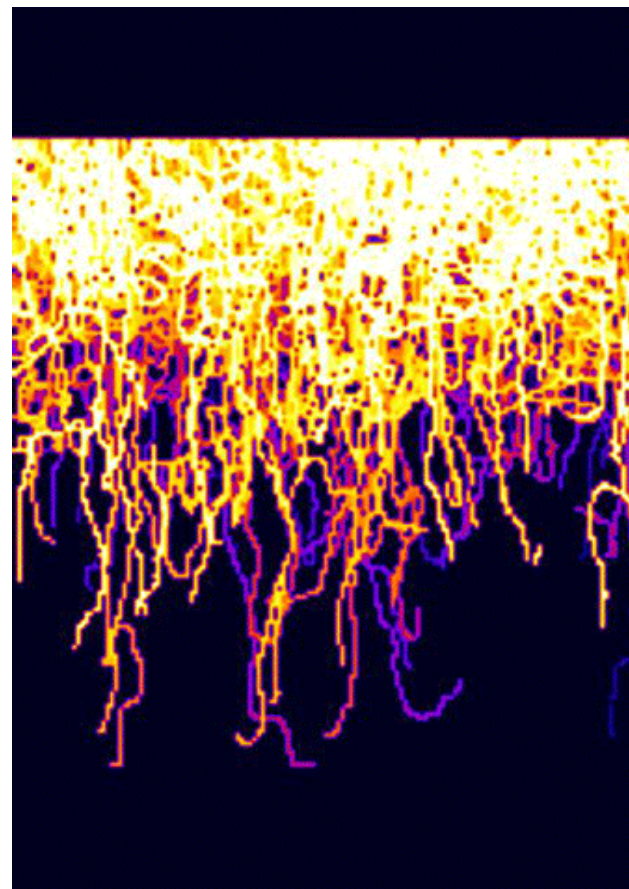




*Megascolides australis*



# Porosity's builders





Crédit photo : F.Thomas



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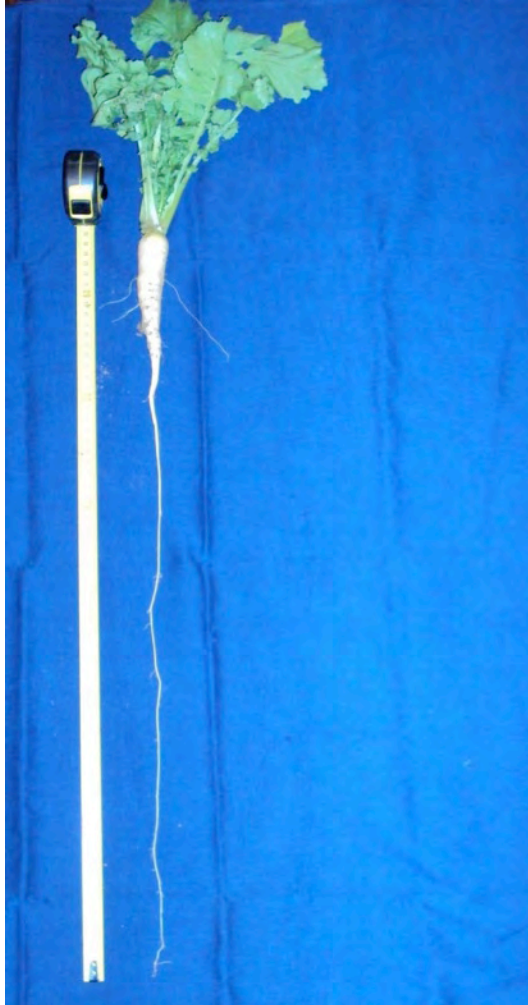


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Crédit photo : S.Singla



**25 inches...**





# Sunflower



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# Corn



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# Wheat



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# *Phacelia*







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# Persian clover



Source : J. Clapperton



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# Hairy vetch



Source : J. Clapperton

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Source : A. Gässler



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Sulla



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# The Key To Success

Diversified Rotations

No till

Cover Crops

Soil Health





**« *The difficulty lies, not in the new ideas,  
but in escaping from the old ones* »**

**John Maynard Keynes**



# Soil is habitat !!



The Furrow



# Soil is an habitat that doesn't like to be disturbed



Source : Jill Clapperton

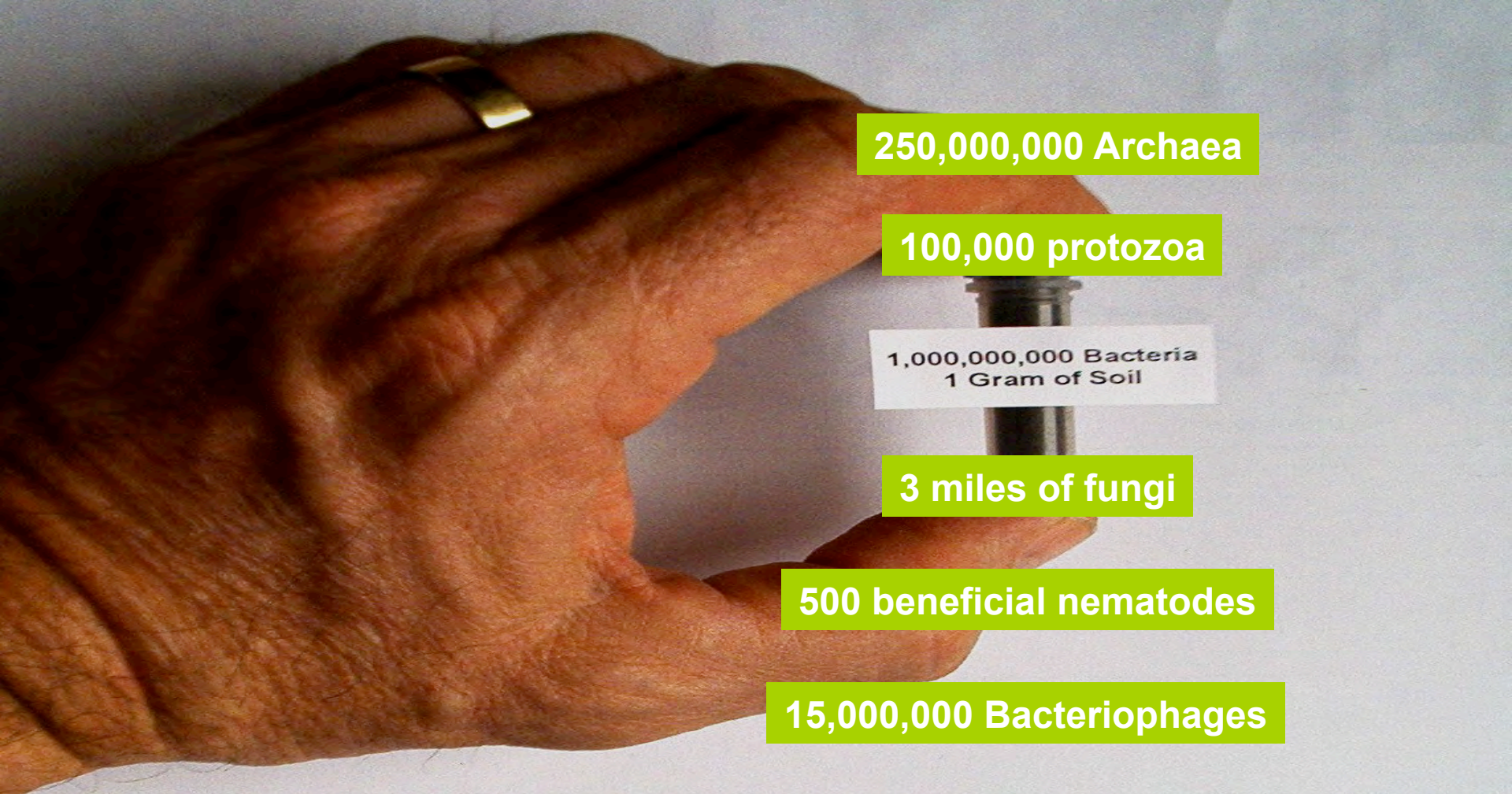


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250,000,000 Archaea

100,000 protozoa

1,000,000,000 Bacteria  
1 Gram of Soil

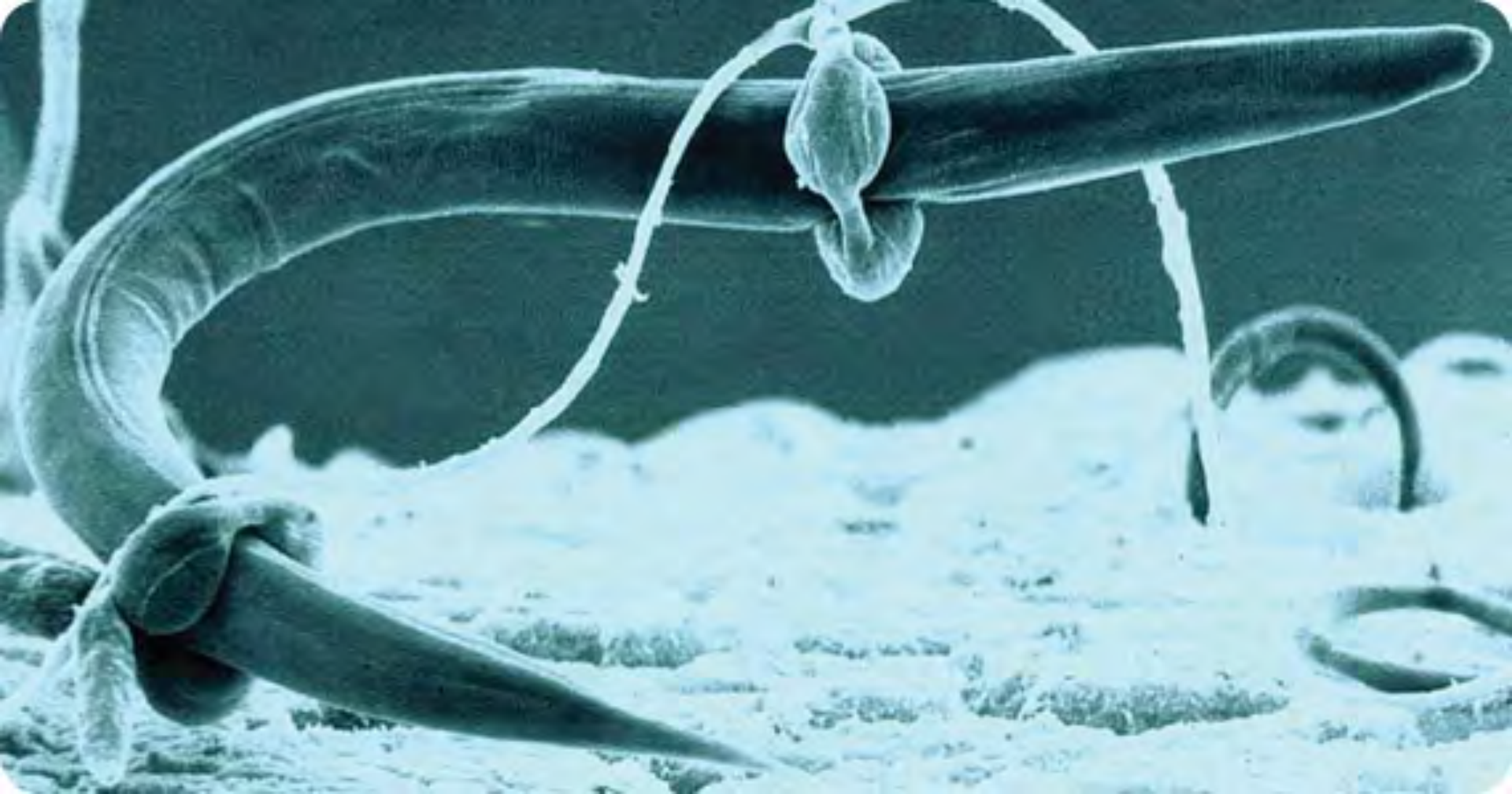
3 miles of fungi

500 beneficial nematodes

15,000,000 Bacteriophages







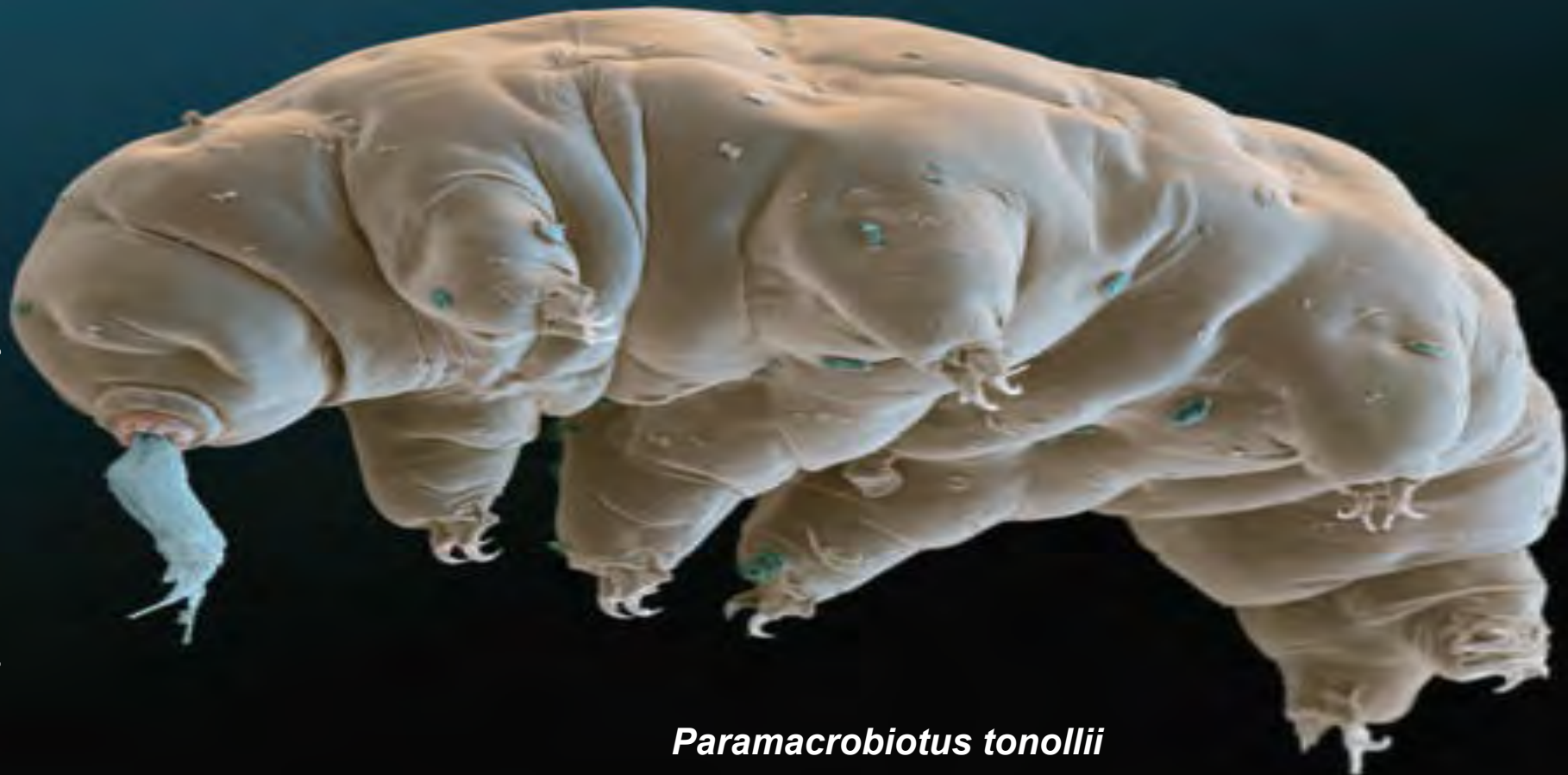
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Source : European Atlas of soil biodiversity



*Paramacrobiotus tonollii*



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*Echniscus granulatus*

Source : European Atlas of soil biodiversity




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# Bacteria on a fungal hyphae



Source: Europe Atlas of soil biodiversity

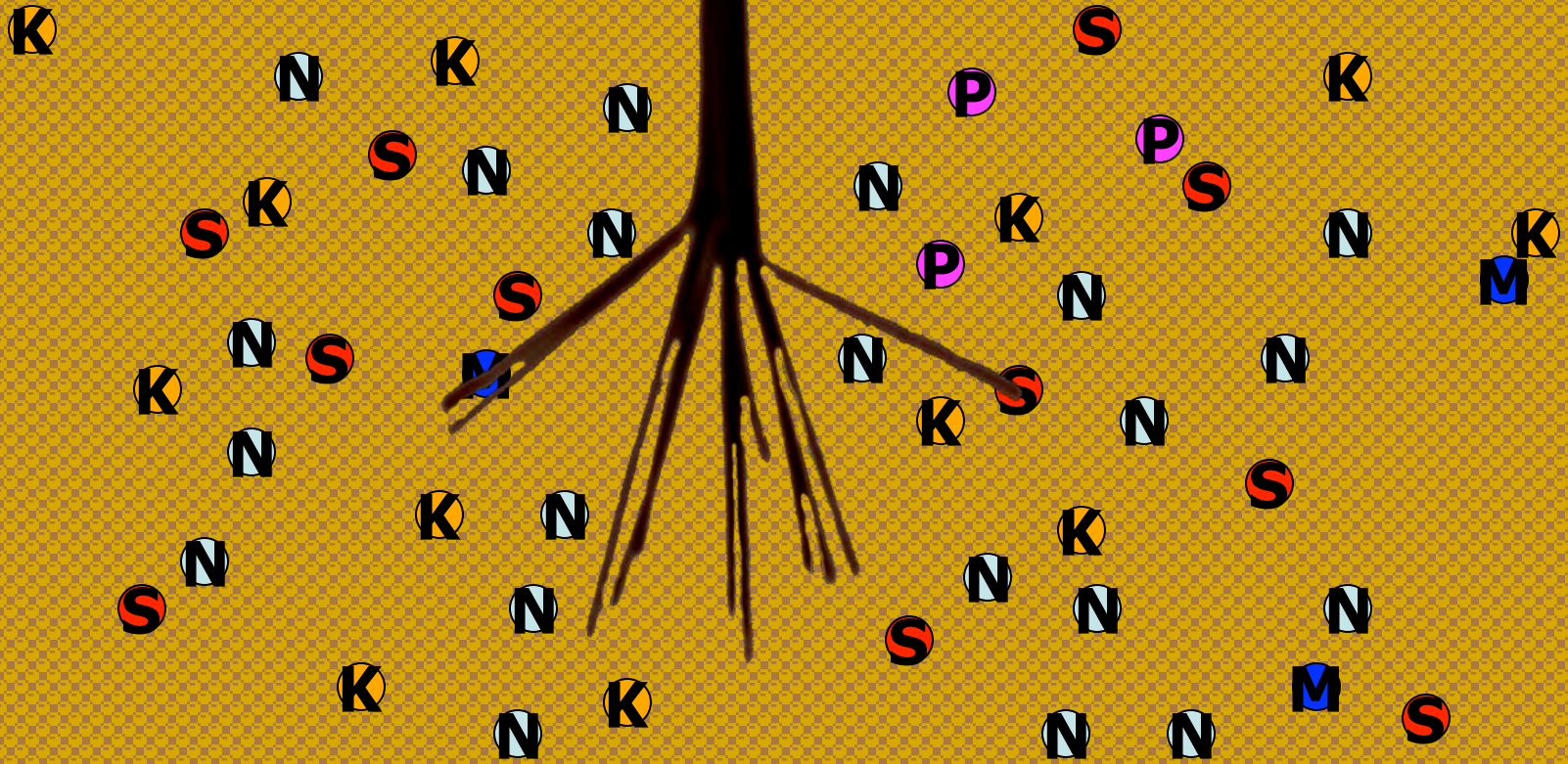


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Source : Kris Nichols

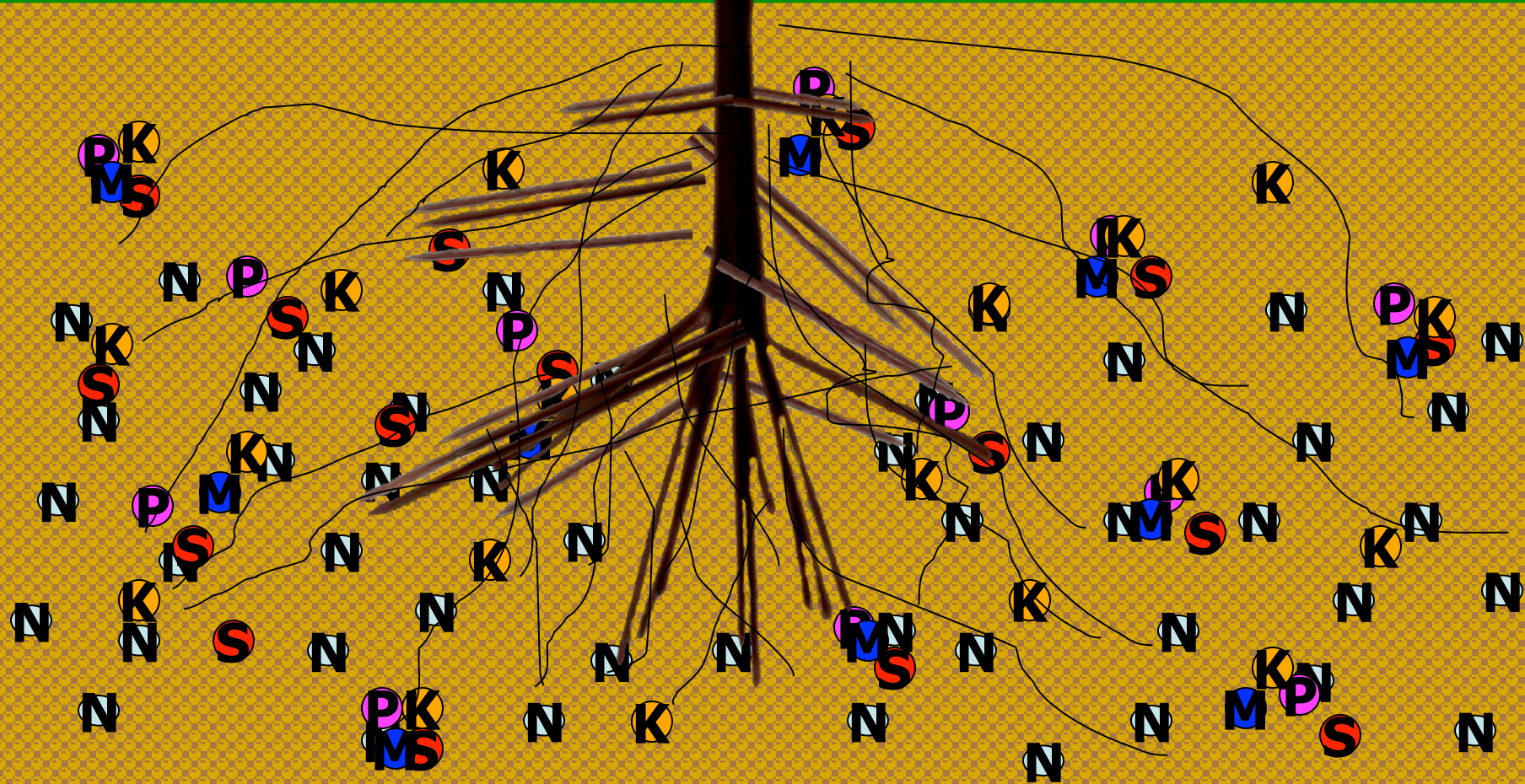


**What a plant can explore**





Source : Kris Nichols

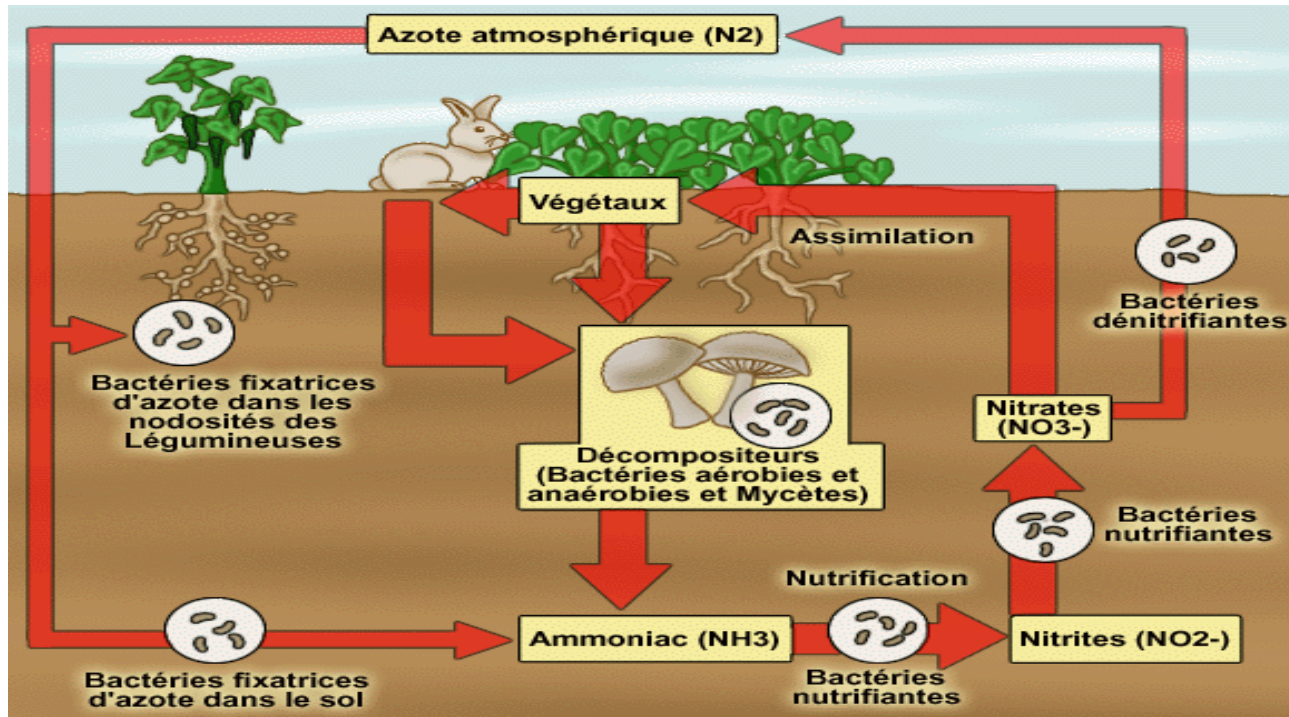


## Collaboration between roots and fungus





# Whatever the fertilizer, the biological processes will take place







5 x N  
7 x P  
11 x K

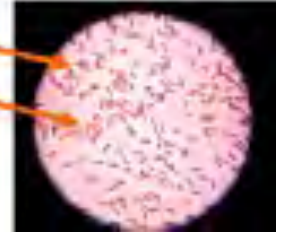
Source : Gassler

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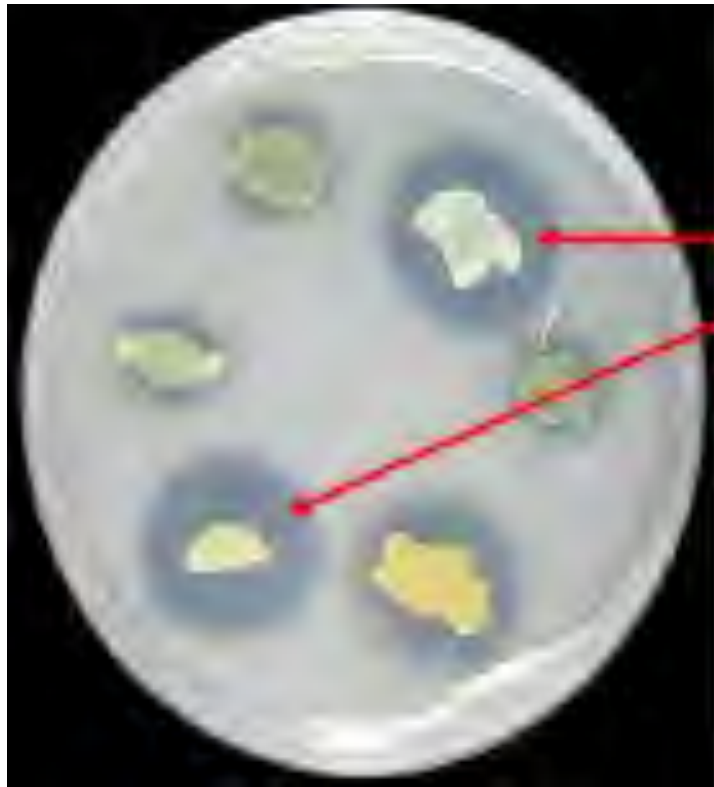




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Zones of clearing around bacteria growing on agar indicate P-solubilisation potential using a suite of enzymes.

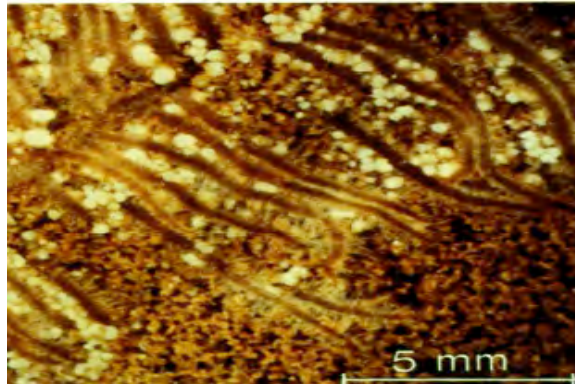
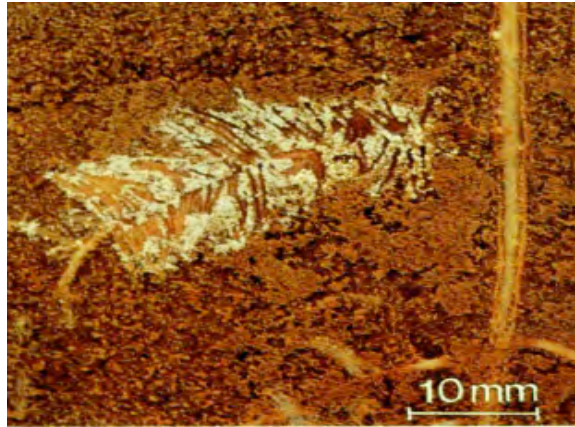


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Source : Ray Archuleta, NCGS  
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*Citrate exudation from a  
root of white lupine  
(d'après Dinkelaker et al,  
1989)*



*Every living thing  
needs energy*





# Root exsudates are sugars coming from the photosynthesis



dirceugassen.com



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***A set aside***

***A cultivated field***

***A living soil***

***Naked, thirsty, hungry soil***

Crédit photo : M. Archambeaud





# *Living plants*

*24h/24 7/7*





# CULTIVATEUR



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*“Van gogh already knew that to sleep well, the soil had to be covered*



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***We are farmers :***

***We harvest Sunlight all year long !!***







7 14:05

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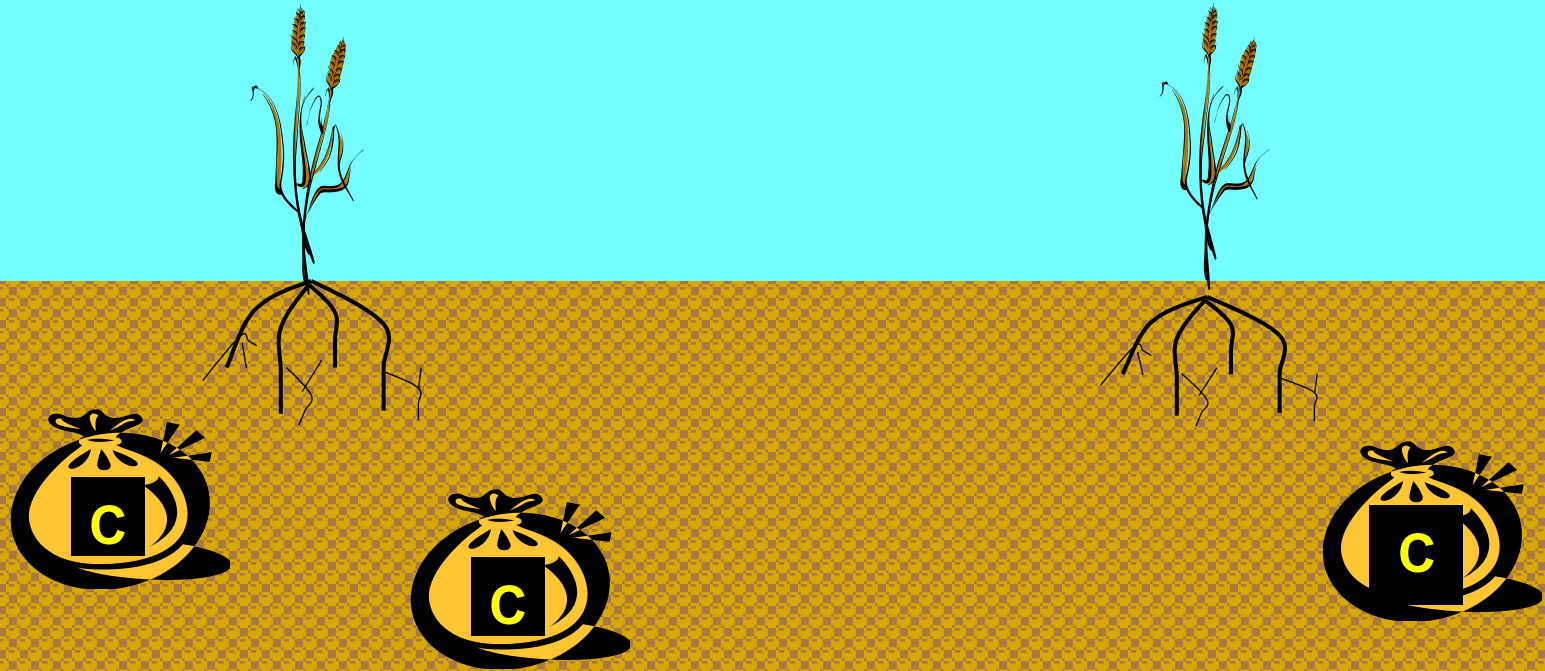
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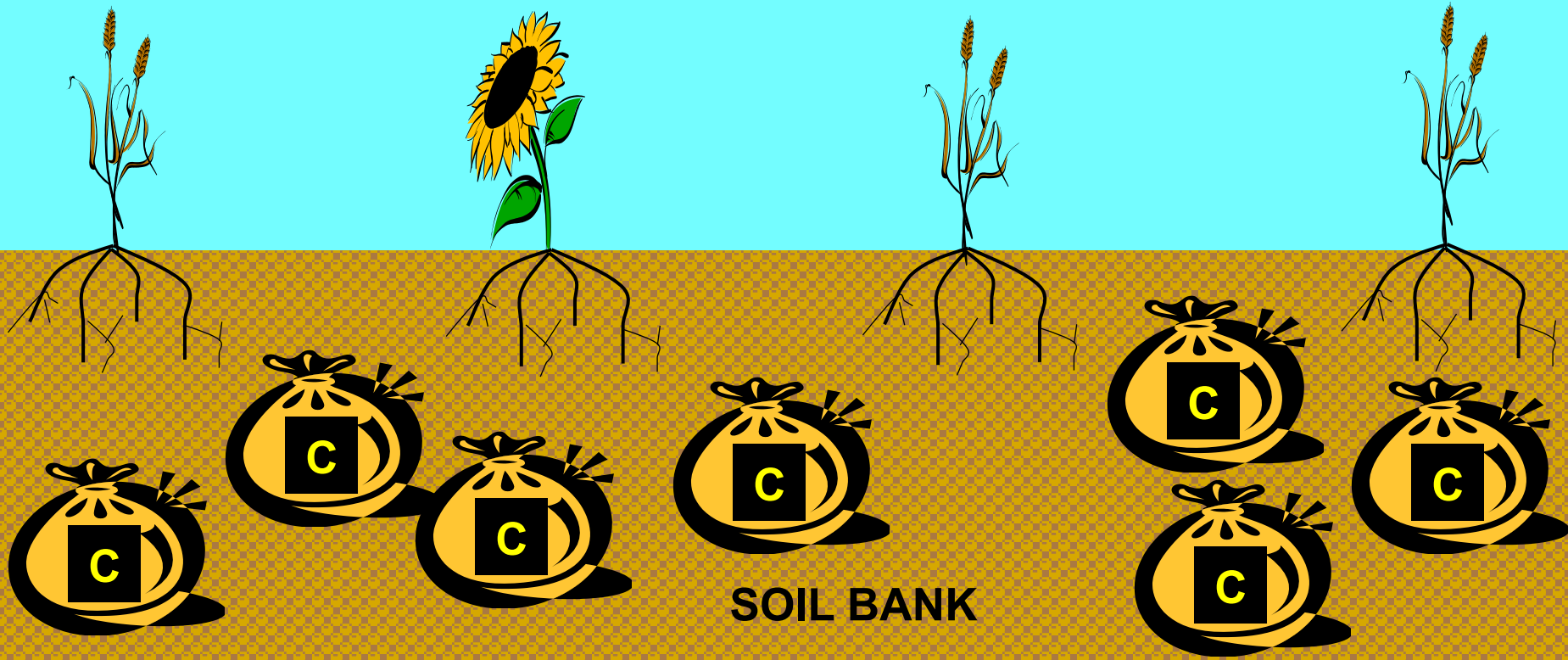


# Wheat on wheat without cover crops





# Minimum Diversity



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# Maximise diversity with the crops you grow





# Maximise diversity with cover crops





# The key to success : Look at the big picture

*Covered soil*



*No disturbance*

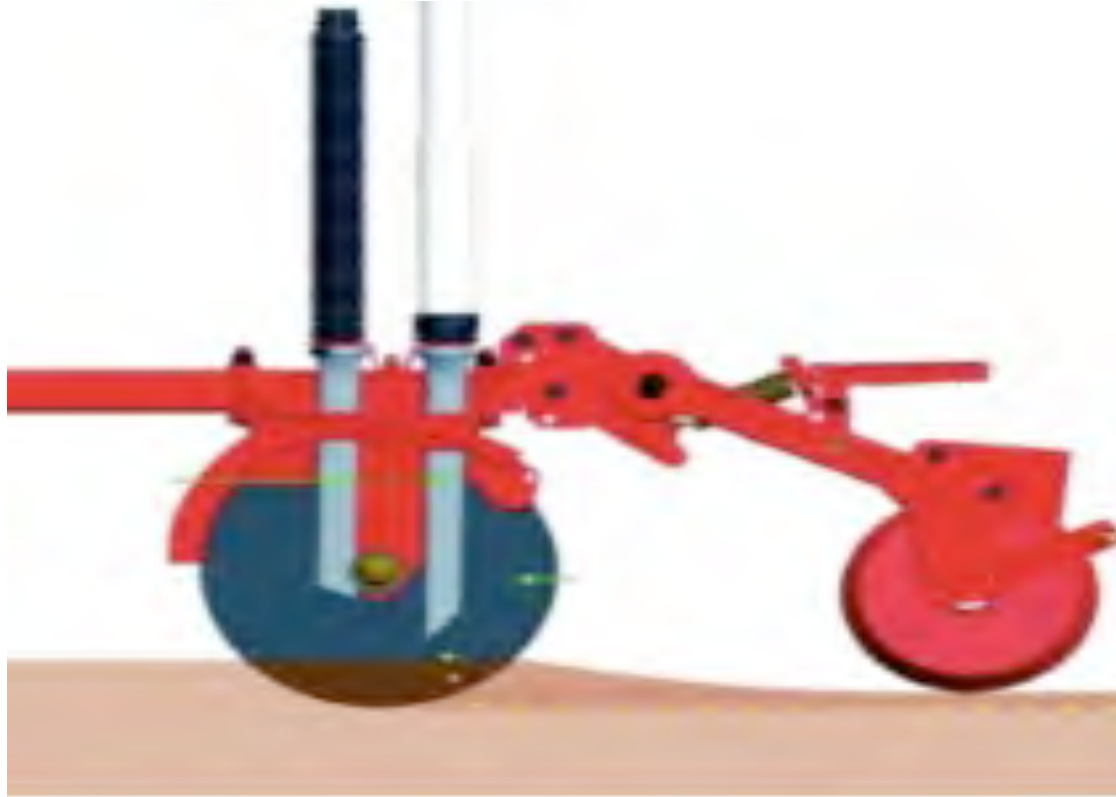


*Diversified Rotations*





# Surgery without scar



Source - Gassler - Semeato





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**No-Disturbance**



**Low disturbance**

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# The key to success : Look at the big picture

*Covered soil*



*No disturbance*



*Diversified Rotations*





***Don't provide the opportunity for the  
herbicide resistance to appear***

***Adopt a rotation !!***





# Diversity is not only introducing new crops



Triticale



Rape



Triticale



Peas



Triticale



Peas



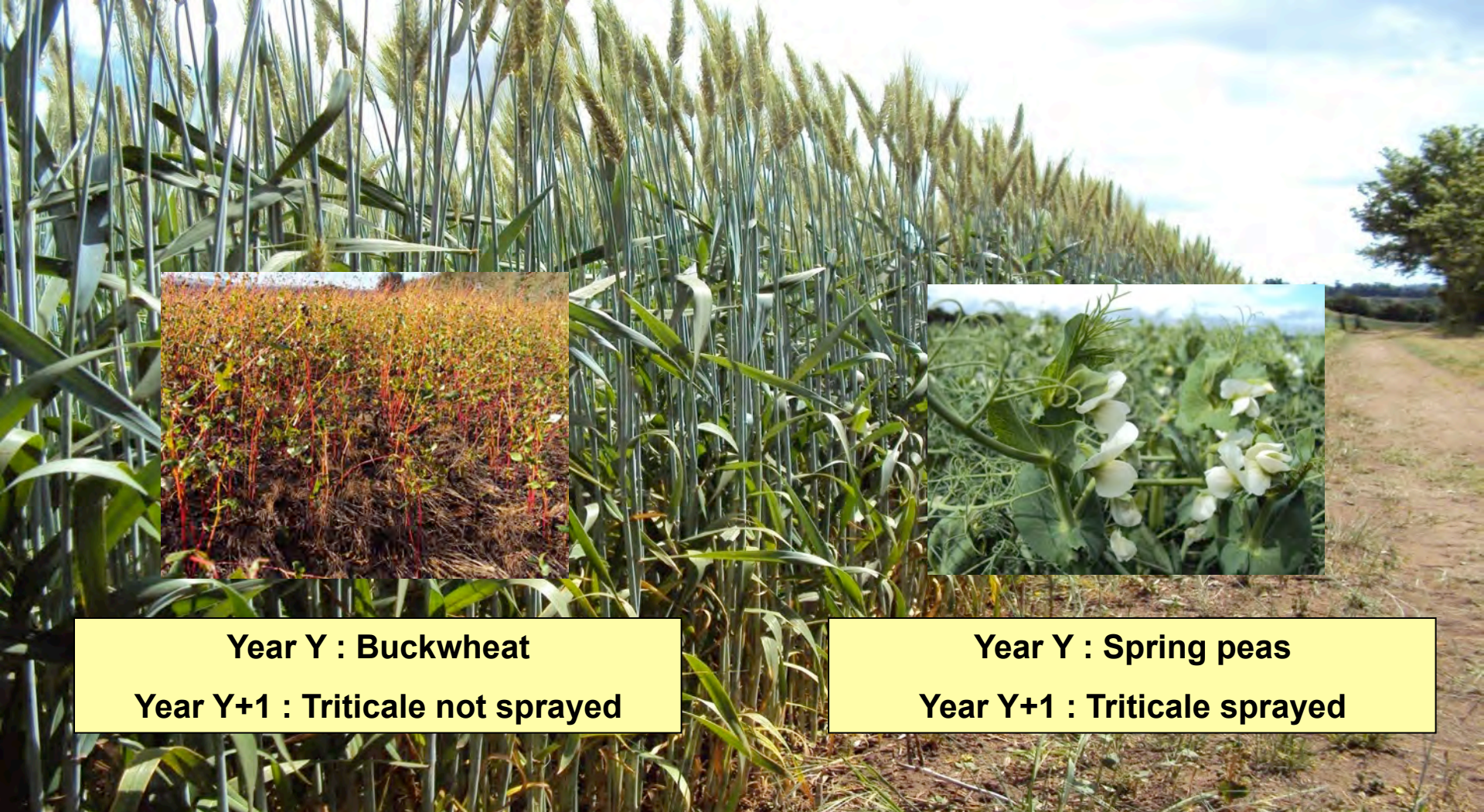
Rape



Triticale







**Year Y : Buckwheat**

**Year Y+1 : Triticale not sprayed**

**Year Y : Spring peas**

**Year Y+1 : Triticale sprayed**





# The key to success : Look at the big picture

*Covered soil*



*No disturbance*



*Diversified Rotations*



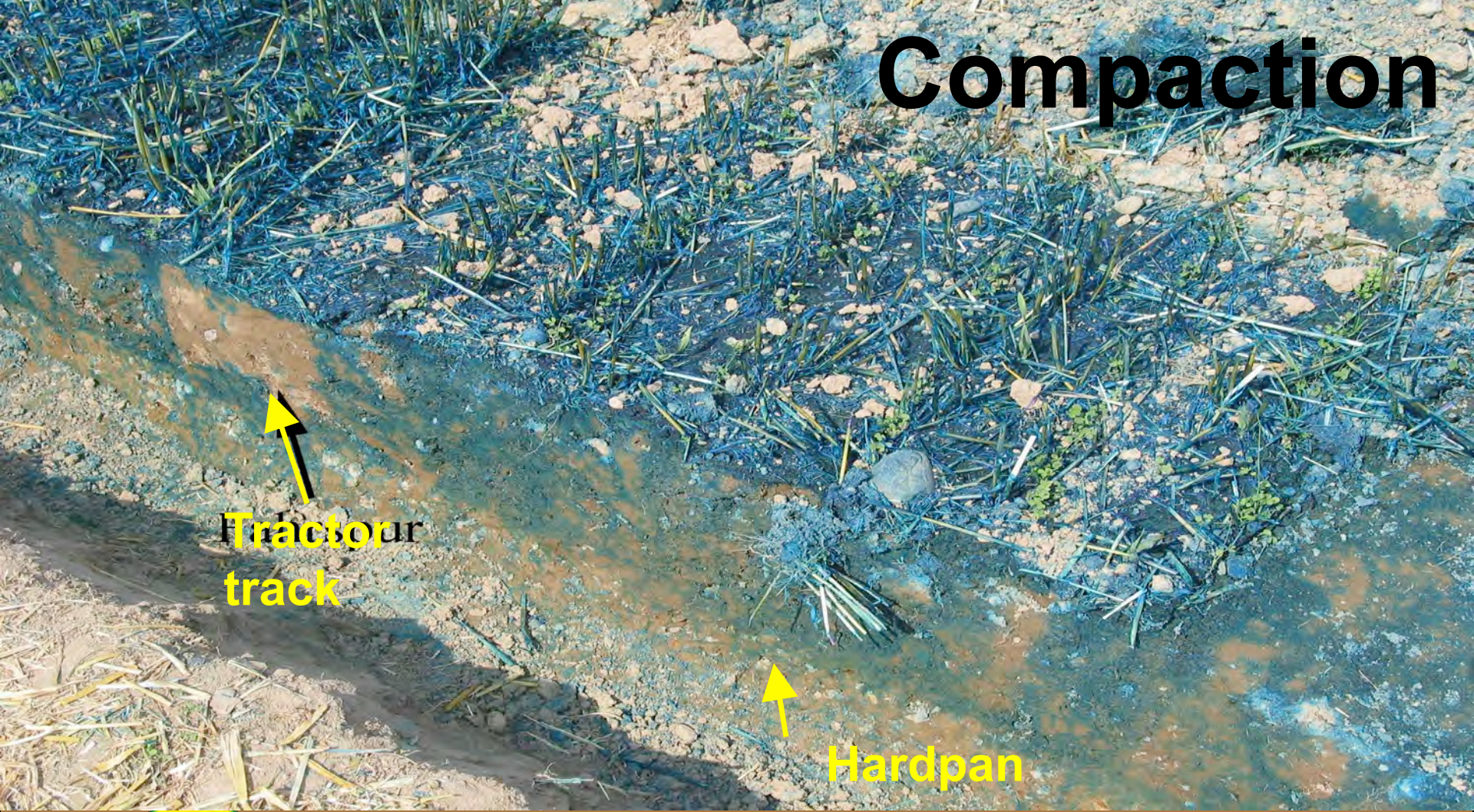


# *How to maximize your yields in corn ?*





# Compaction



Tractor track

Hardpan

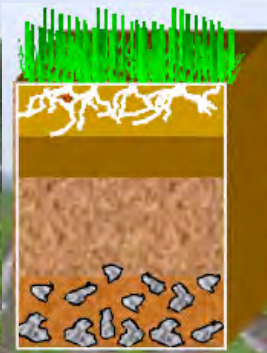


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**DIREKTTSAAT**  
semis direct  
*zero tillage*

**PFLUG**  
labour  
*plow*

Source : Sturny



(THOMAS, 2004)



# Too wet to sow?



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# Use cover crops...



Crédit photo : J. Barthes

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# Too cold?





# Use cover crops...



Credit Photo : S Singla







White color :

40°F

09/01/2011

15H00

Dark color :

43°F

09/01/2011 15H00







Source : M.Archambeaud

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# Too dry ?



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# Look under your feet...



Crédit photo : Thomas, Archaambeaud

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*How to maximize your yields in corn when it's too wet, too dry, too cold ?*

*Solve it with cover crops !!*





*The best investment you can do for  
now and for the future :  
Solar panels through living plants !!*

*...Be a farmer : Harvest as many  
sunlight as you can !!*

Credit Photo : S.Singla





Crédit photo : Barry Fisher, NRCS



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Crédit photo : Thomas, Archambeaud



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Le procédé n'est valable qu'avec de petites graines qui peuvent flotter.



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Source : Gassler



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**Clover sowed at harvest**



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# August 2013



Credit Photo : S.Singla

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# September 2013



Credit Photo : S.Singla



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Credit Photo : S. Singla



Sunflower Radish Corn Flax Nyger Clovers... Fababean Lupin Buckwheat Peas Phacelia



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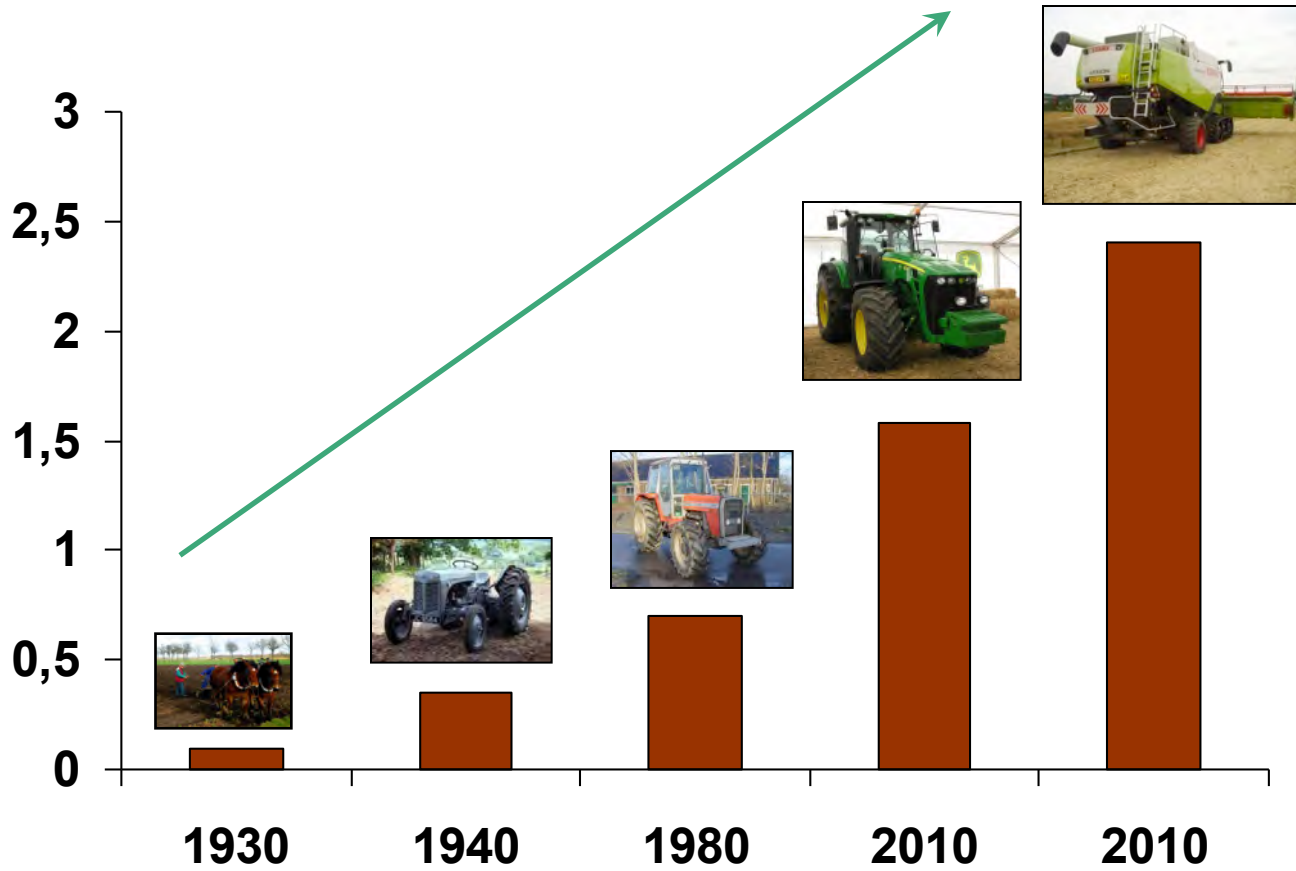


# *Some details*





Pressure  
at 16"



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**(1 bar  
is 14.5**







Picture provided by Michelin/Raben

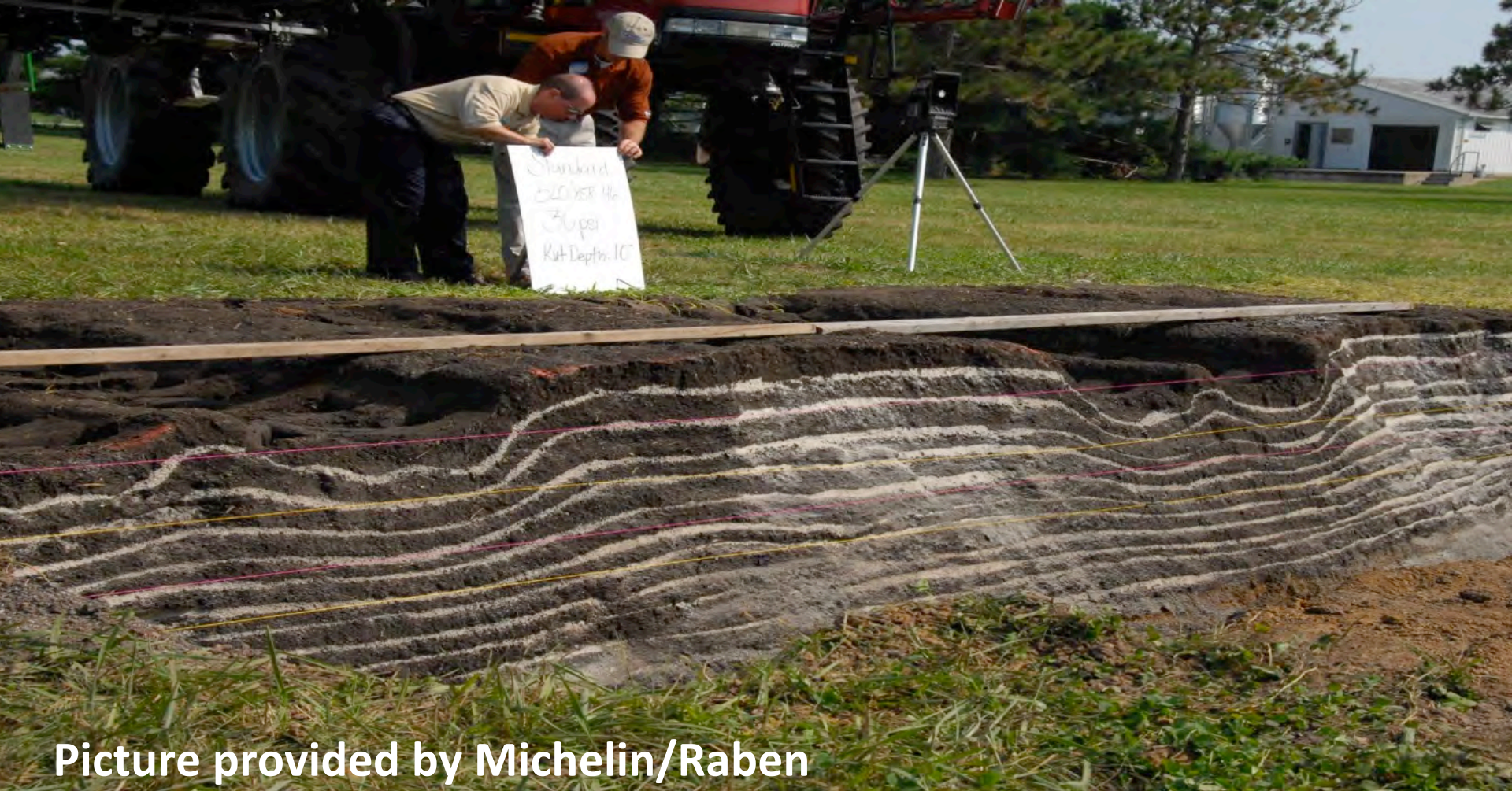


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Picture provided by Michelin/Raben

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The logo for the 22nd Annual National No-Tillage Conference. It features a stylized black and white flower-like symbol on the left. To the right, the text "22nd Annual National No-Tillage Conference" is written in green and black. Below this, it says "Spring 2011, June 15-18, 2011" and "An Honest No-Till Education".

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Spring 2011, June 15-18, 2011  
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Picture provided by Michelin/Raben





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# Spreading the residues



Photo : Phil Needham

The logo for the 22nd Annual National No-Tillage Conference. It features a stylized black and white sunburst or flower-like symbol on the left. To its right, the text "22nd Annual National No-Tillage Conference" is written in a bold, sans-serif font. Below this, it says "Springfield, Ill. • Jan. 15-18, 2014" and "An Honest No-Till Education". The entire logo is set against a yellow and green background.

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# Spreading the residues



Photo : Phil Needham

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Photo : Phil Needham





***Mixing crops :***  
***Don't improvise, Build it !!***





Credit Photo : Frédéric Thomas



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Credit Photo : S. Singla



Sunflower Radish Corn Flax Nyger Clovers... Fababean Lupin Buckwheat Peas Phacelia



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# ***Not only species, but varieties...***



Credit photo : Thomas, Archambeaud



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Source :  
[www.agriculturedeconservation.com](http://www.agriculturedeconservation.com)





*Not only species, but varieties...*



[www.agriculture-de-conservation.com](http://www.agriculture-de-conservation.com)



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# ***Not only species, but varieties...***

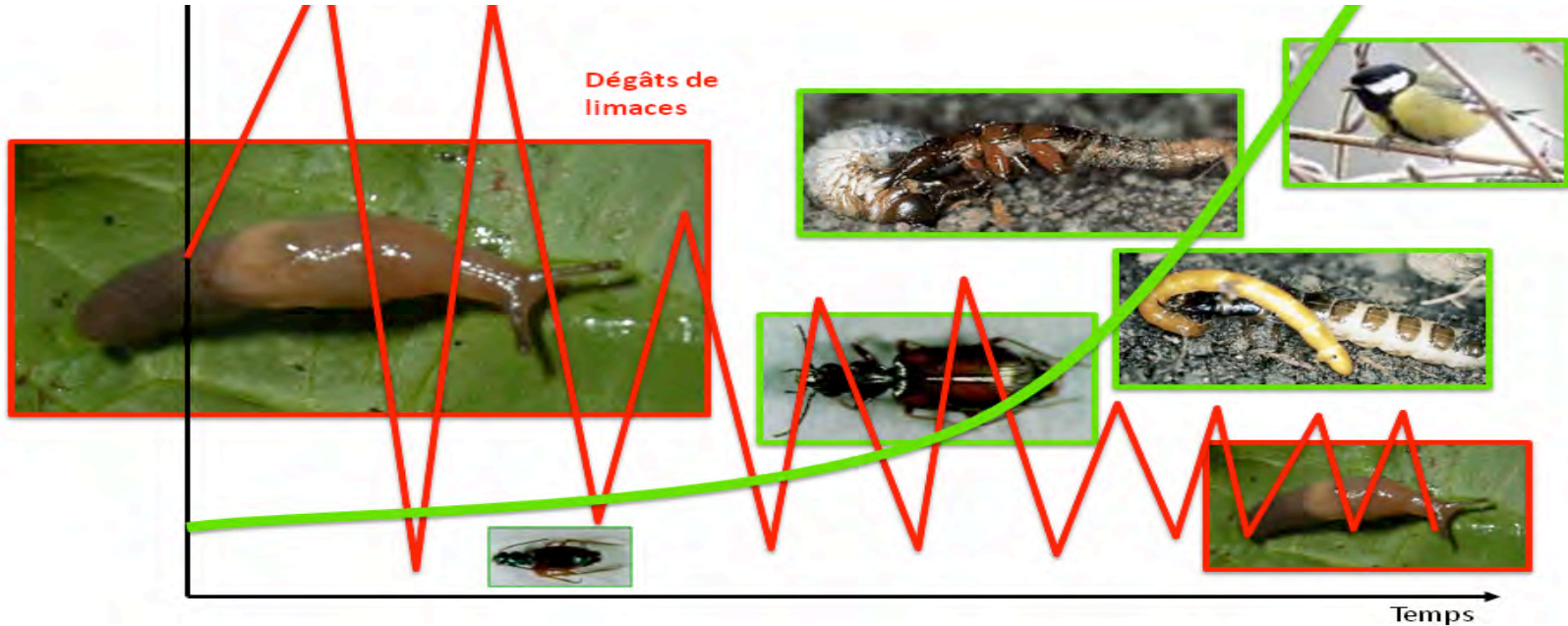


Credit Photo : M.Archambeaud





# Slugs : Is it about biodiversity ?



www.agriculture-de-conservation.com







Credit Photo : S.Singla



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*When the main crop is grown with  
other crops :*

*The companion cropping system !!*







CASSLER SARL  
TECHNIQUE DU SOL



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GÄSSLER, SARL  
TECHNIQUES DU SOL



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CÄSSLER SARL  
TECHNIQUES DU SOL



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The logo consists of a stylized sunflower head with black and white segments, set against a yellow circular background. Below the sunflower, the text "22nd Annual National No-Tillage Conference" is written in a bold, green font. Underneath that, "Springfield, Ill. • Jan. 15-18, 2014" and "An Honest No-Till Education" are written in a smaller, black font.





Tournesol avec culture associée



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August

Credit Photo : S.Singla



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October



Credit Photo : S.Singla



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# November



Credit Photo : S.Singla

The logo features a stylized sunburst or flower icon on the left, composed of black and white segments. To its right, the text "22nd Annual National No-Tillage Conference" is written in a bold, green, sans-serif font. Below this, in a smaller black font, is "Springfield, Ill. • Jan. 15-18, 2014" and "An Honest No-Till Education". The entire logo is set against a yellow and green background.

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# December



Credit Photo : S.Singla



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# February



Credit Photo : S Singla





# March



Credit Photo : S.Singla

The logo for the 22nd Annual National No-Tillage Conference. It features a stylized sun or flower icon with a central 'O' on a green and yellow background. The text reads: "22nd Annual National No-Tillage Conference", "Springfield, Ill. • Jan. 15-18, 2014", and "An Honest No-Till Education".

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April

Credit Photo : S.Singla







Credit Photo : S.Singla



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Mai 2012



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Credit Photo : S.Singla



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# Début Septembre 2012



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# September



Credit Photo : S.Singla



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# November



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The logo features a stylized sun or flower icon with a central 'O' on a yellow background. Below the icon, the text '22nd Annual National No-Tillage Conference' is written in green. At the bottom, it says 'Springfield, Ill. • Jan. 15-18, 2014' and 'An Honest No-Till Education'.



# August



Credit Photo : S.Singla

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Credit Photo : S.Singla



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# September



Credit Photo : S.Singla



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Credit Photo : S.Singla



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# October



Credit Photo : S.Singla



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# *The most important ?*





“Simplicity is the  
ultimate sophistication”

Leonard de Vinci





*« What would you do if you knew you could not fail ? » R.Schuller*

 *Just Do It...*



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*They didn't know it was impossible, so they did it !!*

*Thank you*

Credit Photo : S.Singla

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