



# Bio-Desolve Soil Carbon Program



# MTS ENVIRONMENTAL PRODUCTS

- ③ At MTS Environmental Products, we provide 100% natural solutions to agriculture, municipal, residential, recreational, and industrial organic waste and water environmental issues – with a radically different approach.
- ③ Nutrient contamination, odours, solid build-up, and soil borne diseases are not the problems – they are the symptoms of microbial and nutrient imbalance. This imbalance also makes crop plants more susceptible to disease and insect attack. Our products work to restore a natural balance of microbial life, activating the natural biodigestion system to eliminate the cause as well as the symptoms.

# BIOLOGICAL EDGE

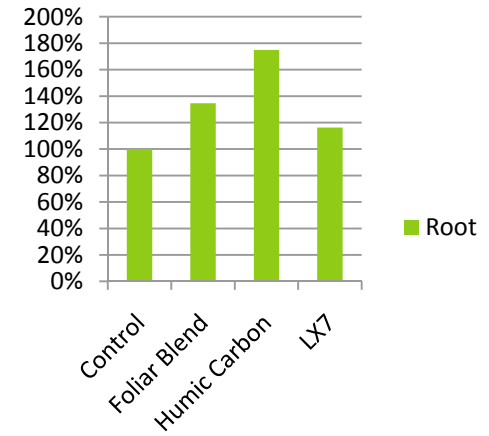
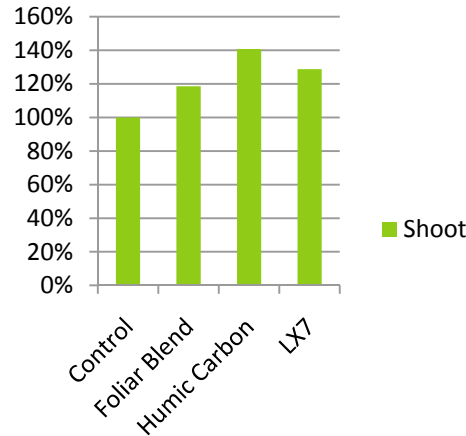
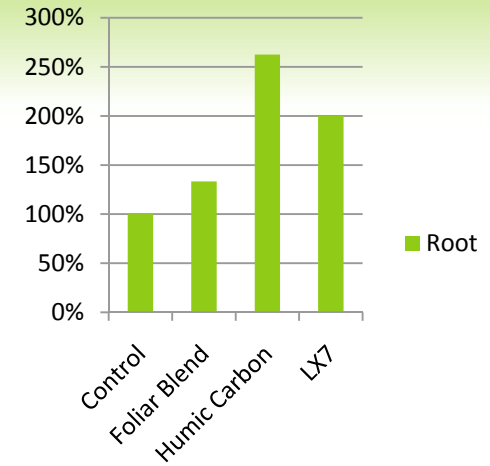
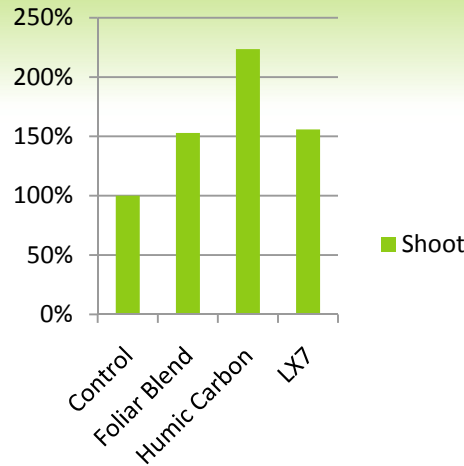


# GROWTH CHAMBER TESTS AT UNIVERSITY OF MANITOBA USING WHEAT PLANTS

## Wheat Trial by Halotec @ Univ of Manitoba

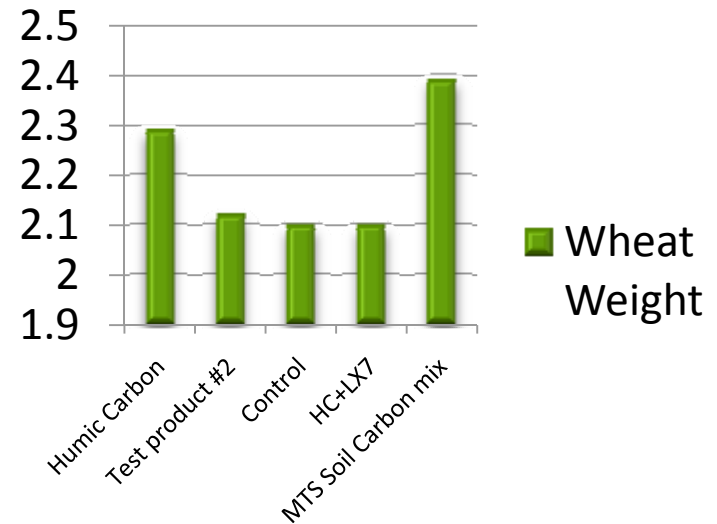
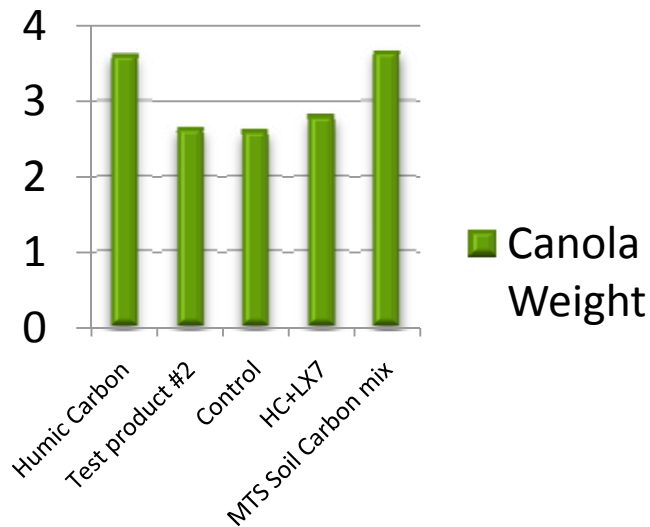
Growth Chamber test with soil-less mix

14 Days	Soil Applied	Shoot	Root
13-CTRL-2NA	Control	100%	100%
3-AG-2SL	Foliar Blend	153%	133%
4-HC-2SL	Humic Carbon	224%	263%
2-LX-2SL	LX7	156%	200%
21 Days	Soil Applied		
13-CTRL-2NA	Control	100%	100%
3-AG-2SL	Foliar Blend	119%	135%
4-HC-2SL	Humic Carbon	141%	175%
2-LX-2SL	LX7	129%	116%



# PRODUCT COMPARISON TEST SEEDING TO 28 DAYS

Mix of Silt loam (Carberry) and soilless mix			
	Alfalfa	Canola	Wheat
Treatment	Weight	Weight	Weight
Humic Carbon	0.37	3.62	2.29
Test product #2	0.29	2.64	2.12
Control	0.27	2.61	2.1
HC+LX7	0.32	2.81	2.1
MTS Soil Carbon mix	0.26	3.66	2.39





# BIO-DESOLVE PROGRAM

- ⊙ After research on various materials and compounds we are using
- ⊙ a combination of 2 different main types of products.
- ⊙ Bio-stimulants and Humates.
- ⊙ All elements play an integral part in the overall process.
- ⊙ MTS Environmental Products has developed
- ⊙ Bio-DeSolve Soil Carbon Program



# NATURAL BIO STIMULANT

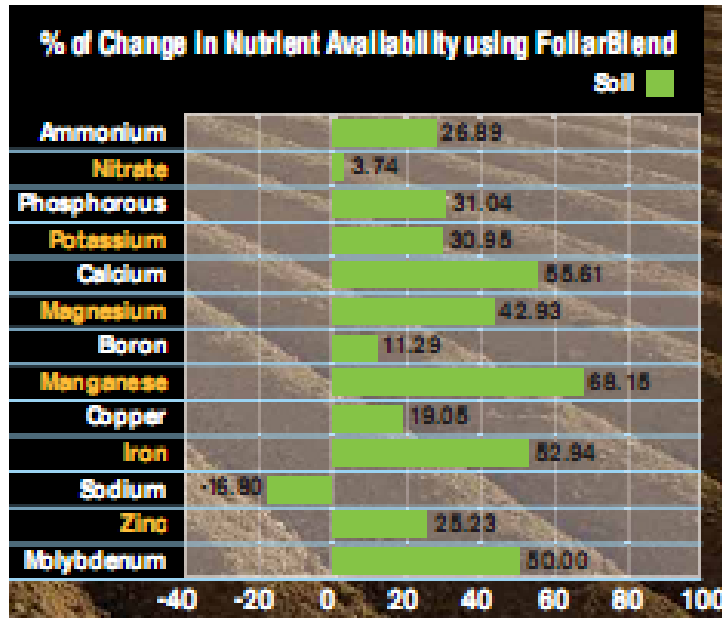
- ◎ One component is a natural bio-stimulant in a liquid concentrate form that has a significant impact on the plant-soil system.
- ◎ It contains;
  - Enzymes
  - micronutrients
  - amino acids
  - plant growth hormones
  - complex carbohydrates

# 3400% INCREASE IN MICROBIAL ACTIVITY

- ◎ *3400% Increase in Microbial Activity*
- ◎ The microbiology division of EMSL Analytical in New York, NY recently investigated the effects of this bio-stimulant when applied to soil media. The soil was tested for colony forming units (CFU) before treatment and then *24 hours later* after treatment. The CFU/gram of soil went from 5,500,000 to 187,500,000.
- ◎ That is over 34 times more colony forming units per gram than the untreated soil.”

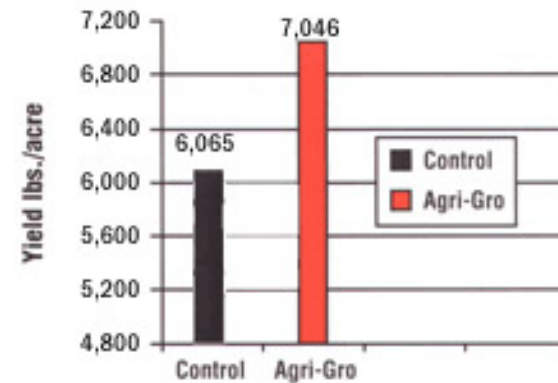
~ Foliar Blend website

# INCREASED MICROBIAL ACTIVITY



Percentage of Change in Nutrient Availability and Uptake

**Bring home more with Agri-Gro  
Higher Yields / Better Profits**



Yields of a Broccoli Crop in a Controlled Setting.

A 16% increase

# HUMIC CARBON

- ⊙ The other component of Soil Carbon Mix is
- ⊙ Humic Carbon
- ⊙ What is Humic carbon? Our brand of humic acid
  - ⊙ It is the most active part of organic matter
  - ⊙ It is an alkaline extract of organic matter, typically from lignite coal
  - ⊙ It is a dark brown or black liquid
  - ⊙ It is one of the compounds that makes topsoil dark



# HUMIC CARBON

- ① Is a natural element in a liquid concentrate form
- ① Provides both macro and micro plant nutrients, greatly increases root system organisms and improves trace element nutrition through chelation
- ① Affects the release of plant nutrients
- ① Promotes soil drainage
- ① Improves the capacity for water retention in the soil by as much as 95%

# THE ROLE OF HUMIC CARBONS

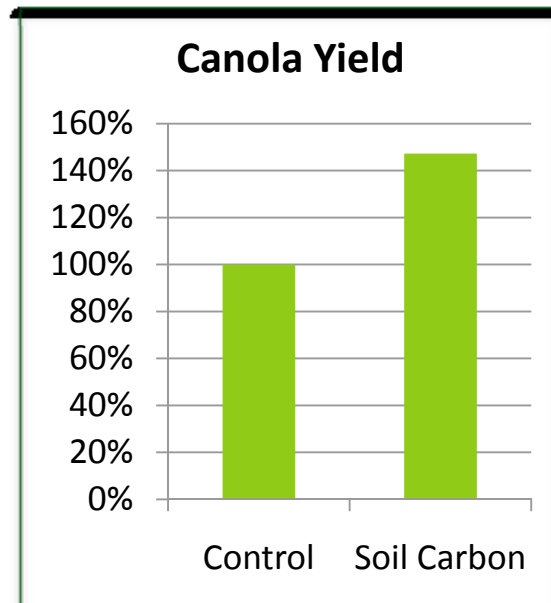
- ① Humus influences soil fertility through its effects on the water-holding capacity of the soil and microbial activity.
- ① It has been shown that plants are able to absorb the soluble forms of humus
- ① Humic substances promote the conversion of a number of elements into forms available to plants
- ① In the supply of trace elements and rare elements to plants, an important role is played by linking with humic substances in the form of chelates

# THE ACTION OF HUMIC SUBSTANCES

- ① Humic substances increase the germination capacity of seed and vitamin content of plants
- ① A positive effect of humic substances on the growth of various groups of microorganisms has also been observed
- ① Humic carbons act as specific sensitizing agents, increasing the permeability of the plasma membrane and resulting in an increased uptake of nutrients by the plants
- ① When humic carbons enter the plant at early stages of development, enzyme systems are intensified, cell division is accelerated, root systems show greater development and yield of dry matter increases

# GROWTH CHAMBER TEST AT HAPLOTECH CANOLA GROWN TO MATURITY

Canola Yield	
Control	100%
Soil Carbon Program	147%



# DID YOU KNOW THAT

- ◎ Soil microorganisms rebuild the soil, and play a major role in soil condition improvements seen due to practices such as crop rotation, mulching, and other conventional soil treatments.
- ◎ Most of these treatments are attempts to increase soil organic matter, or humus. The most active part of this organic matter are humates, specifically humic and fulvic acids.

# GROUPS OF SOIL ORGANISMS

Animals	earthworms, arthropods, rodents, nematodes..
Plants	grass, legumes, blue green algae
Bacteria	Rhizobium, Azobacter, Nitrosomonas, Nitrobacter...
Fungi	mushroom, molds, Penicillium
Actinomycetes	streptomyces spp...

# ONE ACRE OF HEALTHY SOIL MAY INCLUDE

- ◎ 900 pounds of earthworms,
- ◎ 2,500 pounds of fungi,
- ◎ 1,500 pounds of bacteria,
- ◎ 130 pounds of protozoa,
- ◎ 900 pounds of arthropods and algae, and
- ◎ in most cases, it even contains small mammals
- ◎ (Amaranthus et. al 1989).

# SOIL MICROBE GROWTH

Promote Growth	Inhibit Growth
•soil drainage & aeration	•pesticides
•compost	•soil erosion
•barnyard manures	•industrial sewage
•fertilizer	•monoculture
•balanced irrigation	•fertilizer
•erosion control	•compaction
•mulching	•excess tillage
•lime	•soil sterilization

# IMPROVE SOIL BIOLOGY AND SAVE NITROGEN

- ◎ It has been proven that increasing the number and activity of soil microorganisms is an essential means of saving on nitrogen use
- ◎ By returning organic material to the soil, the resident bacteria, fungi and other beneficial but unseen organisms will thrive – especially along root surfaces
- ◎ They feed on the organic carbon compounds and convert nutrients into available forms
- ◎ Many crops, especially corn, wheat, and canola require high levels of nitrogen for optimum growth. Legume crops are able to obtain most of their needs from the air through symbiotic nitrogen fixation. This nitrogen is free if there is a good supply of beneficial microbes in the soil

# IMPROVE SOIL BIOLOGY AND SAVE NITROGEN

## Ontario Test Results @A&L Labs

- ◎ Spring soil N tests, 2008 on wheat stubble
  - ◎ No soil carbon program, required 86 lb/ Acre N
  - ◎ seeded to Red Clover
- ◎ With Soil Carbon program required 41 lb/ Acre n
- ◎ no Red clover, no manure

# IMPROVE SOIL BIOLOGY AND SAVE NITROGEN

## Alberta Test Results @ Enviro-Test Laboratories Oct 28, 2009

### Soil carbon Program Applied Spring '09

#### Soil Test Nutrient levels

Field #35 canola 2009, 44 bu / Acre

Treated S		95 lb N	>102 lb P	>1020 lb K	>82 lb S
Untreated	44lb N	>102 lb.P	>1020 lb K	79 lb S	

Field 18 Canola 2009 20 bu / acre

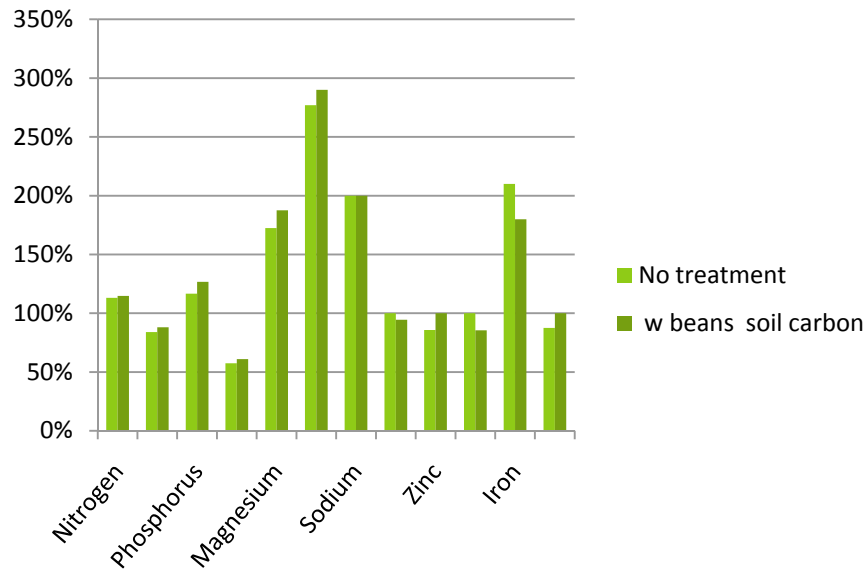
Treated		30 Lb N	>54 Lb P	>540 lb K	42 lb S
Untreated		22 lb N	>54 lb P	>540 lb K	>43 lb S

# MICROBES RECOVER PHOSPHOROUS IN SOIL

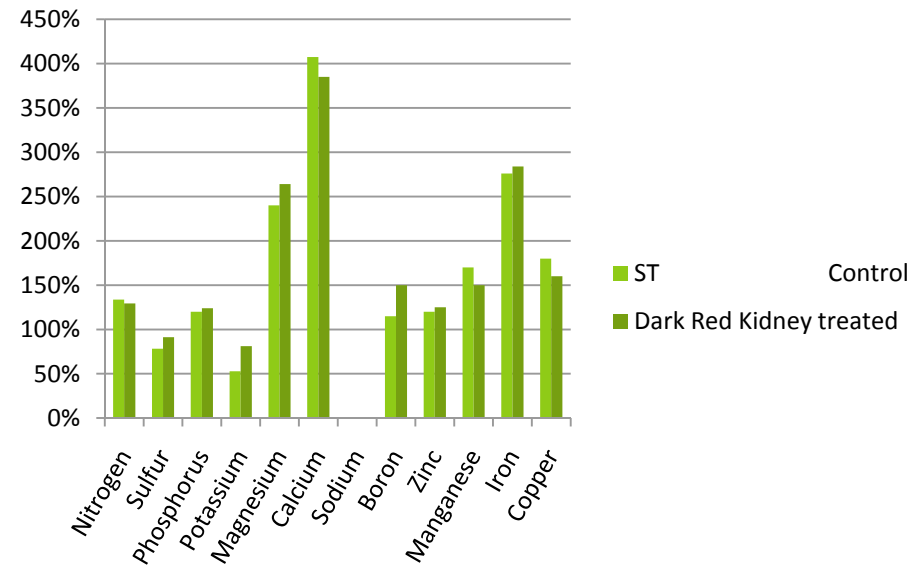
- ◎ To produce sugar, plants must have phosphate
- ◎ The mobility and availability of phosphate depends on microbiology – both during the living processes and decomposition
- ◎ The microbial life around the roots are devouring minerals as food, phosphorous being part of this. The minerals in the soil are in a polyphosphate form.
- ◎ In the process of the microbe eating the phosphate, they convert it into orthophosphate – a form that the plant can use
- ◎ When the soil is still cool in the spring, the polyphosphates are not available to the plant because the microbes are not yet active. Adding orthophosphate with spring planting allows the plant to have access to nutrients right away, instead of having to wait for the soil to “wake up”

# TWO FIELDS OF EDIBLE BEANS, SPRING APPLIED, FOLIAR TESTED IN AUGUST

**CB White beans with soil carbon**  
**% of sufficient**



**ST Dark Red Kidney treated**  
**% of sufficient**





# BIO-DESOLVE SOIL CARBON

- ③ The Bio-Desolve Soil Carbon program has been shown many times to speed the breakdown of crop residues.
- ③ Whatever the crop, applying Soil carbon mix to the crop residue, or having used it as an ongoing treatment at other times in the crop program will help in breaking down this residue, and recycle it to be used by the next crop

# CROP RESIDUE RECYCLING

- ⊙ Corn stover or straw all acts the same
- ⊙ Oat Field southwest of Winnipeg



- ⊙ Harvesting a large crop during the summer of 2009



# MARCH 2010



Field area that had been windrowed and windrows burned. The field had then been disked and harrowed



Area where the straw was chopped and spread, sprayed with Bio-DeSolve Soil Carbon Mix, disked and harrowed



# AFTER SEEDING APRIL 2010



Burned area after seeding



Treated area after seeding  
A lot more trash, but  
no problems planting  
into it.



# YIELD

- ① treated area.....51.9 bu / acre; this was the poorest half of the field
- ① control area.....50 bu / acre ;
- ① 1.9 bu @ \$10.00 / bu (\$440 per tonne)= \$19.00 / acre
- ① Product cost= 2 litres per acre @ \$4.95= \$ 9.90 / acre
- ① \$ 9.10 return
- ① The producer treated the poorest part and would normally have gotten 3 to 4 bu. less per acre.
- ① The treated part of the field also drained better, but normally would have been wetter.

# BIO DE SOLVE SOIL PROGRAM

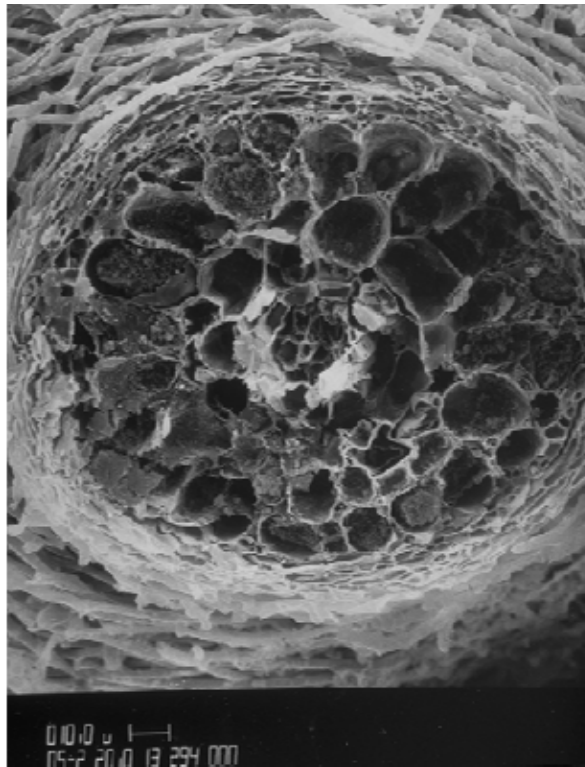
- ⦿ Benefits of Trichoderma
  - ⦿ fully colonizes on the roots of the crops
  - ⦿ the infection of outer root layers stimulate resistance to other pathogens
  - ⦿ suppresses soil borne diseases for an entire season
  - ⦿ enhances nutrient uptake and utilization
  - ⦿ increases stress tolerance in plants
  - ⦿ increases nitrogen efficiency
  - ⦿ increases yield with no-till farming through residue breakdown

# TRICHODERMA

- © Scientist S. Inch tested B. Trichoderma T22 on Fusarium head blight and at 28 days after inoculation, the perithecia were collapsed and removed. The hard chitin walls of the Fusarium spores were destroyed and eliminated the fusarium
- © After 13 days in wheat straw, the chitin cells had disappeared in contrast to the control straw
- © In addition to colonizing roots, Trichoderma attacks parasites, and feeds on harmful pathogens present in the soil, enhancing plant and root growth
- © By enhancing the growth of the plant, Trichoderma helps the plant become more tolerant to stress, absorb nutrients more freely (both micro and macro) and shuts down harmful pathogens around the root zone
- © Cereal Research Centre – based out of Winnipeg, Manitoba

# MYCORRHIZAL FUNGI

- ⊙ Mycorrhizal fungi can protect the roots from disease organisms, through simple spatial interference, by improving nutrient uptake, and by producing glomulin and other metabolites that inhibit disease.
- ⊙ The above photo shows an example of the spatial interference.)



- ⊙ Mycorrhizal fungi link root cells to soil particles to help protect the roots from disease.



- A microscopic photo of mycorrhizal fungi – note how it surrounds the root for protection

# BENEFITS OF CARBON PROGRAM

Our program can be applied as fall residue program, pre-plant, at planting, or foliar

- ⊙ aids in water penetration into the soil
- ⊙ accelerates germination that is free of pathogens
- ⊙ overall reduced stress increases crop yields
- ⊙ enhances the farm safety food program by minimizing toxins
- ⊙ breaks down years of no-till trash into useable nutrients
- ⊙ Researched by G.E. Harman of Cornell University

# COMPETITIVE EXCLUSION OF DISEASE

- ⊙ During wet seasons, it becomes evident that pathogen stem rot, clubroot rot, pythium and fusarium can curtail growth and maturity in a crop
- ⊙ Most chemicals are not effective when dealing with wet conditions
- ⊙ Powdery and downy mildew also spread quickly in damp, warm weather
- ⊙ Best results appear if the program is used before disease appears

# PYTHIUM



Pythium damage on a golf green

Pythium damage to bentgrass golf green. Courtesy Joseph Krausz, TAEX, 1996.

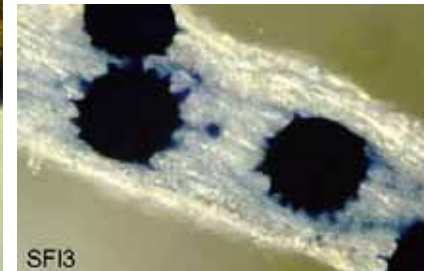


Pythium stalk rot – this damage prevents nutrients from travelling up the stalk

The picture on the left shows healthy white roots and the picture on the right depicts the beginning stages of pythium root rot



Close-up views of pythium spores and damage caused on the root



# FUSARIUM CHALLENGES ARE WIDESPREAD

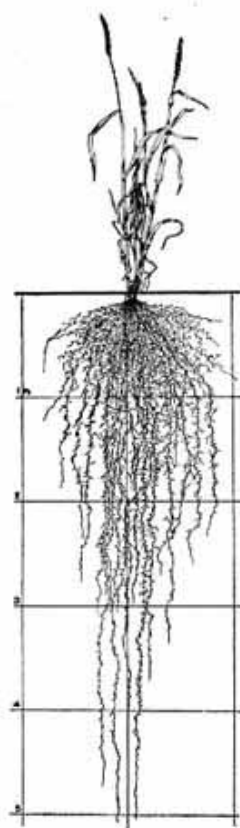
- ① The toll of the fusarium disease across Canada is now over \$1 billion per year
- ① This is due to the mycotoxins caused by fusarium head blight
- ① Mycotoxin residues on grains and grain products due to the frequently occurring fungal disease are spreading their reach to more growing regions
- ① Fusarium head blight disrupts the seed development, reduces yield and can make harvested grain unfit for both human and animal use
- ① High amounts of time and research dollars have been given to finding fusarium-resistant varieties of wheat, but this does not answer short term concerns

# FUSARIUM

Microscopic view of fusarium on a root system



How a healthy wheat root system should look



Damage caused by the presence of fusarium

Fusarium ear rot on field corn

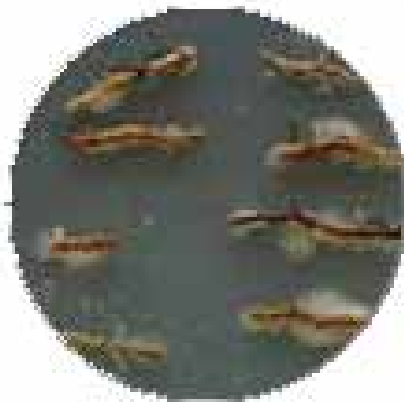


The complete destruction of a wheat root system when fusarium is present



# FUSARIUM COLONIES

## Fusarium Colonies on RR Soybean Roots



Check



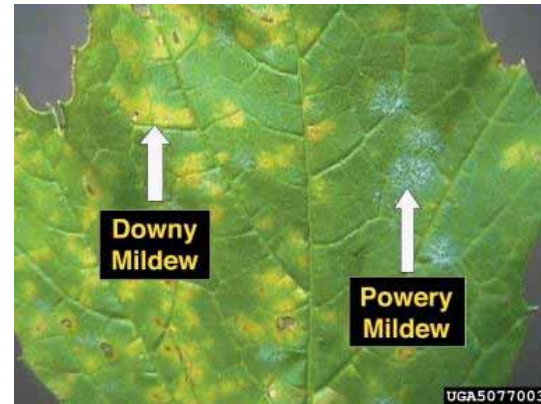
Glyphosate



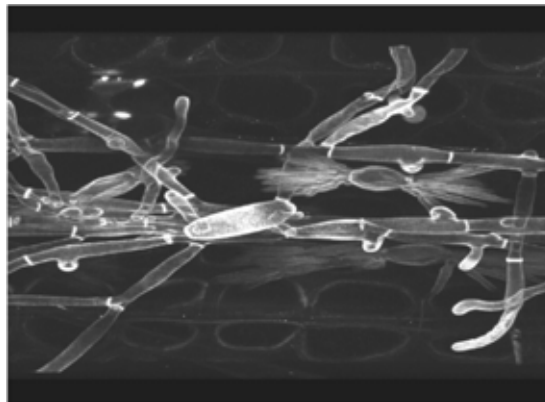
Glyphosate  
+ FoliarBlend

Research by USDA - ARS, Columbia, MO

# POWDERY AND DOWNY MILDEW

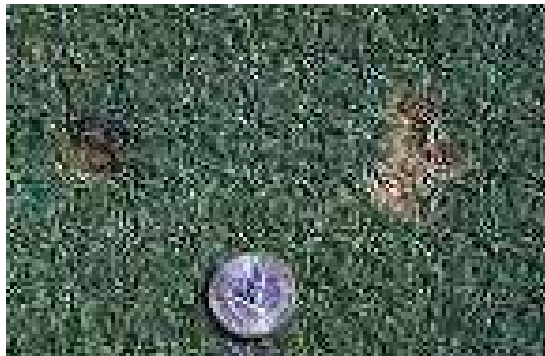


3-D imagery of the  
powdery mildew  
pathogen



# SCLEROTINIA

One species of sclerotinia causes dollar spot in turf.



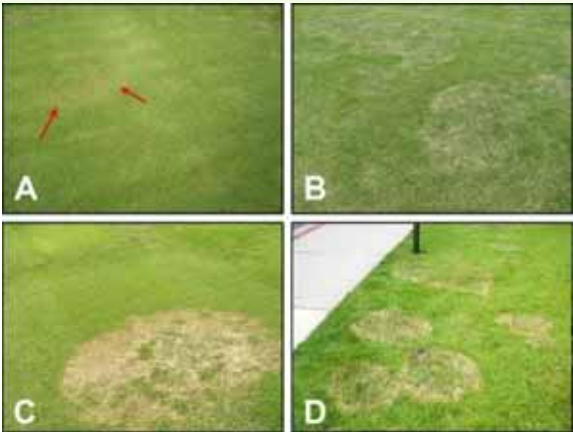
Sclerotinia (white rot) on the fruit of the crop



Sclerotinia stem rot

# RHIZOCTONIA

Evidence of rhizoctonia in grass samples

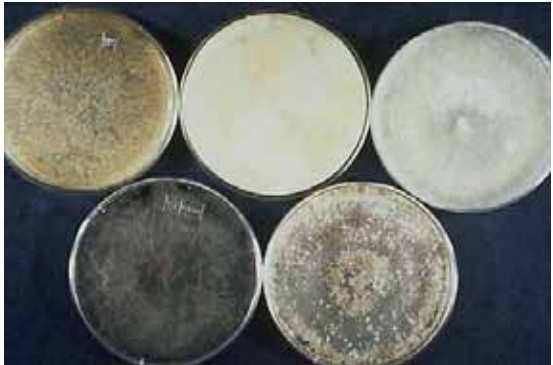


Rhizoctonia in a pea field



The start of rhizoctonia on a pea root (left) vs. a healthy pea root (right)

Rhizoctonia colonies



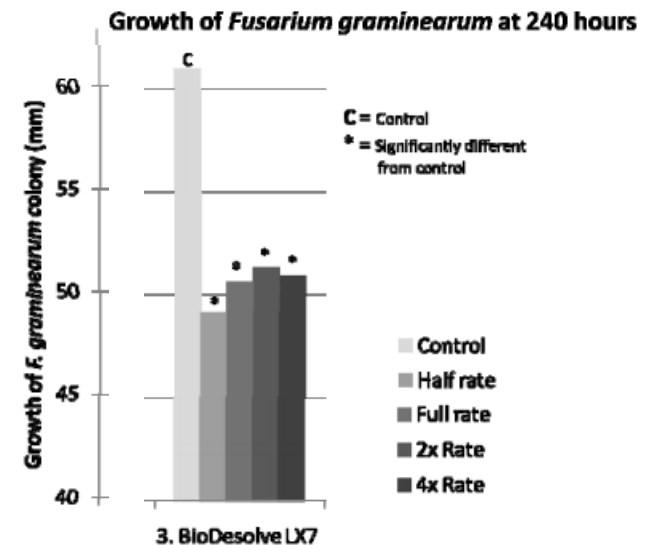
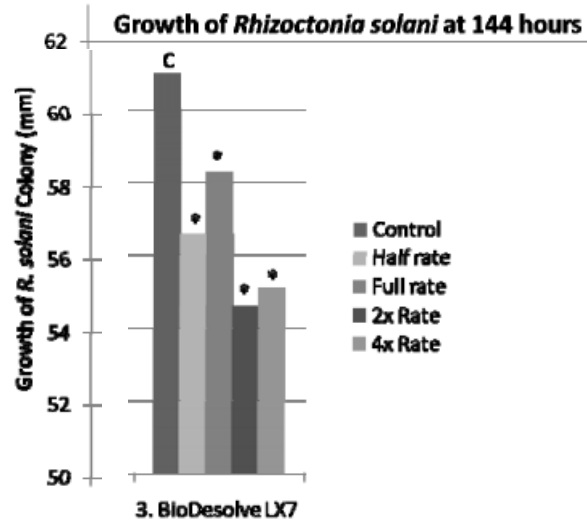
Rhizoctonia damage to the root system



# UNIVERSITY OF GUELPH TESTS, FEB. 2010



*Rhizoctonia solani*  
Treatment 4



# PHYTOPHTHORA



Zoospores being released from the tip of a sporangium during saturated soil conditions.



Phytophthora stem rot

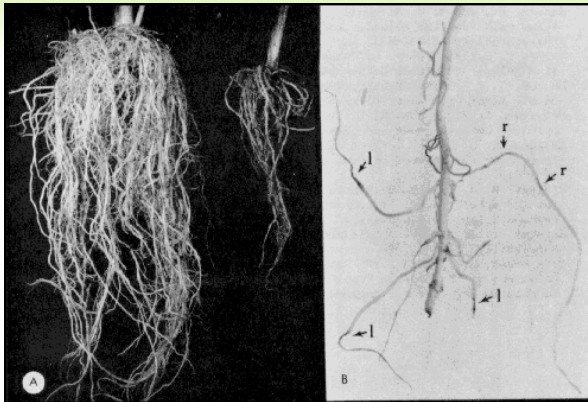


Phytophthora stem rot – causing cancer-like cankers



Phytophthora blight in a soy field

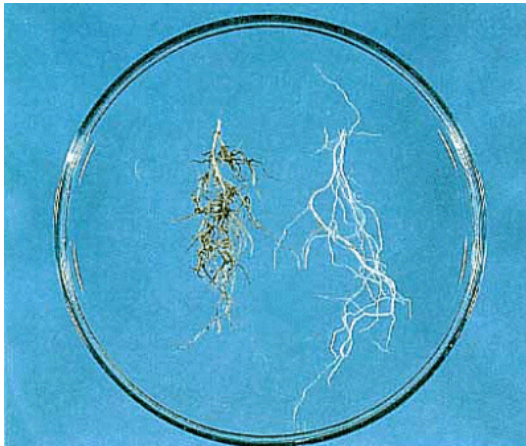
# HEALTHY VS. DISEASED ROOTS



Far left – healthy white root system. Right – fusarium damage.



Top right – rhizoctonia damage to the roots of corn causing plant distress vs. healthy corn from the same field.



Root knot nematode damage (left). Healthy root (right).



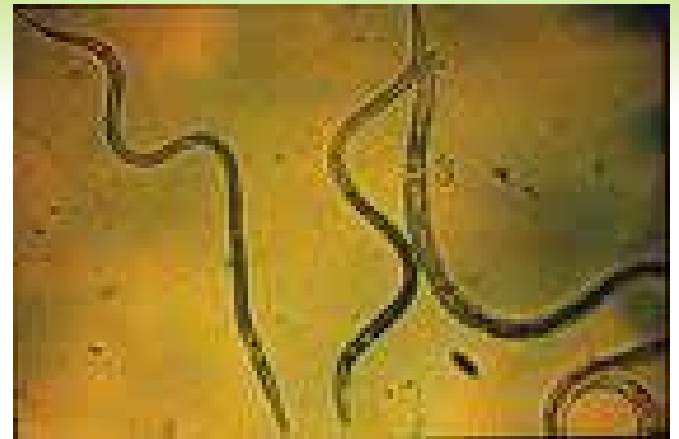
Left – mature healthy corn root system.

# DID YOU KNOW...

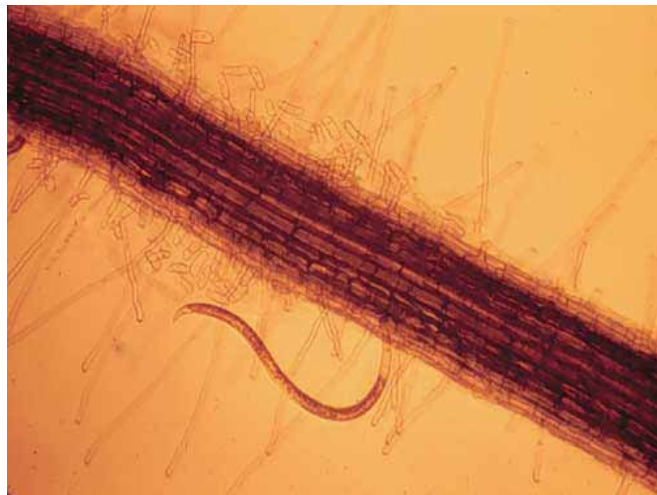
- © “With a base of actively alive and balanced soil, you can control insects naturally.”

Dr. William Jackson, Enviro Consultant / Service,  
Evergreen, Colorado

# NEMATODES



Stunt  
nematode on  
corn



# APHIDS

Microscopic view of an aphid



Aphid damage to an ear of corn



Aphid infestation



Aphids covering a soybean stalk





# THE BRIX SCALE

## HOW DOES THIS PERTAIN TO US?

- ⊙ Not only do Brix readings determine sucrose levels in plants – they also indicate soil fertility needs
- ⊙ A low Brix reading means there is quite likely to be bacteria, insect and fungal attacks, whereas a high Brix reading means general immunity to the aforementioned attacks
- ⊙ If soil nutrients are in the best balance and are made available by microbes upon demand by the plant, Brix readings will be higher
- ⊙ Carbon stimulates plant enzymes to produce sugars in the plant. Liquid carbon is possibly the most powerful chelating agent known to man
- ⊙ Plant nutrition starts with the soil. Balanced and healthy soil leads to balanced and healthy crops

# PLANT READINGS AND INSECT POPULATION

<b>BRIX</b>	<b>aphid count/ plant</b>
<b>9.5</b>	<b>0-10 aphids</b>
<b>8.0</b>	<b>50-100 aphids</b>
<b>7.2</b>	<b>200-500 aphids</b>
<b>5.8</b>	<b>2000- 3500 aphids</b>
<b>5.7</b>	<b>over 3500 aphids</b>

# BRIX READINGS

WINNIPEG AREA				Brix Readings
Oats	Treatment spring applied	60% higher sugar	8%	
	No treatment applied			5%
Soys	Treatment fall applied		9.60%	
	No Treatment			9.50%
Wheat	Spring treated Seed	Spring Wheat	10%	
	No treatment			10%
This was an excellent crop of wheat in this field				

# BRIX READING

PORTAGE LA PRAIRIE area		Brix Readings	
Spring Treated wheat was	15.3% higher	7.50%	
No Treatment			6.50%
Carrots treated (Top of root)	10.5% higher	10.50%	
Carrots no Treatment			9.50%
LETHBRIDGE area			
spring treated corn leaf was	20% higher	6%	
No Treatment			5%

# BRIX READNG

Granton area		Brix Readings	
Foliar Treated soybeans	18% higher	6.50%	
No Treatment			5.50%
The treated area was noticeably taller than untreated			
Hensall area			
Foliar treated soybeans	20% higher	6%	
No Treatment			5%



# HIGH YIELDS USING THE MTS SOIL CARBON PROGRAM

1. Microbes consume disease spores and residual herbicides
2. Microbes and carbon work together to release locked in nutrients for higher yields and an increased level in seed germination
3. Highly balanced soil with the addition of the Bio DeSolve Soil Carbon Program gives all crops higher yields in an optimal growing season
4. Digests polyphosphates into orthophosphates, which makes the nutrients more readily available to the plants – as this phosphate supply is critical during the first six weeks of growth.
5. Available orthophosphates become more water soluble, which encourages root growth to accelerate downwards to cope with droughts.

# GRAND BEND AREA SOYBEANS

2,488 ft long field, with 30' head

Treated with Soil Carbon Mix @ 4 litre / A at seeding, LX7  
@ 1 litre / A with herbicide application

Control	118 bu soys off 2.45 A = 48 bu / A
Treated	118 bu soys off 2.27 A = 51.9 bu / A

*an 8% increase*

Advantage of 3.9 bu / A @ 10.00= \$39.00

Cost Soil Carbon \$20.00

LX 7 \$ 9.75

\$9.25 / A in the first year.

# CREDITON AREA

2661 ft long x 20' head.  
2 rounds equals 4.89 A

Treated ½ the field with 1 L LX 7 with herbicide and 1 litre LX 7 at full flower

Other half, no treatment at seeding, Quilt at full flower

Control	232 bu. Off 4.89 A =	47.4 bu/A
Treated	245 bu off 4.89 A =	50.1 bu / A <i>a 5.5% increase</i>

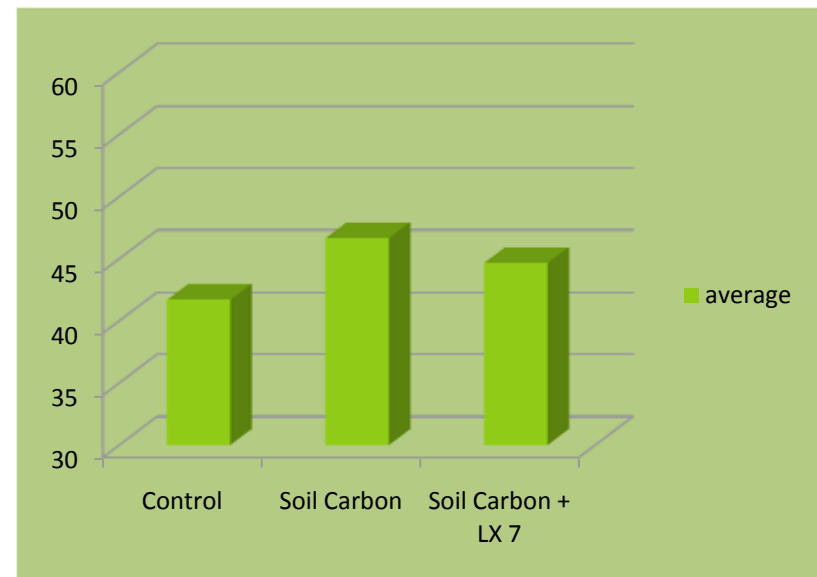
Advantage	2.7 bu/A @ 10.00 =	\$27.00
	Cost 2 L @ 9.75 = <u>\$19.50</u>	
		\$ 7.50

But the control side also had an application of Quilt at \$13.00 per acre that the “treated” side didn’t have.

# WHITE BEANS, CENTRALIA AREA

- ⊙ Average of three repetitions
- ⊙ Control 42 bu / A
- ⊙ Treated soil Carbon Mix 47 bu / A
- ⊙ Treated Soil carbon Mix + LX 7 45 bu / A
- ⊙ 5 bu = 300 lb @0.40/ lb = \$120.00 / A

*a 12% increase*



# A R CORN PLOT

A R Corn Plot		Oct 13, 2010				
<u>1 L Lx7 with herbicide, 1 L LX7 foliar</u>						
Hyland B38R	no treatment	16,930 lb @ 17.8%	355 g / 1/2L	201 bu dry		
Hyland B38R	treated	17930 lb @ 18.1%	355 g / 1/2L	212 bu dry		
	An advantage of 11 bu/A @ \$5.00=			\$55.00		
	2 L of LX7 at \$9.75			\$19.50		
				\$35.55 return / A		
						A 5.5% increase

# 3-YR STUDY

- ③ Three year study at Huron Research station of University of Guelph
- ③ Herbicide application was reduced by 25% from label rates on treated plots
- ③ 5 repetitions per treatment

Year	Crop	% Weed Control	Yield Difference
2006	Soybeans	-5.5%	Treated 50/50 untreated
2007	Winter Wheat	0%	73/71
2008	Corn	+1%	152/142

7% increase!

# YIELD TESTING

## Ailsa Craig Area – Dark Red Kidney Beans

2 x 30ft wide strips in each control and treated areas; width of farm equals 1.25 acres each

Control	1556 lb/acre	
MTS Soil Carbon treated	2093 lb/acre	34.5% increase

Weighed across legal for trade scale

## Parkhill Area - Soybeans

Side by side test strips of 22 ft x 759 ft

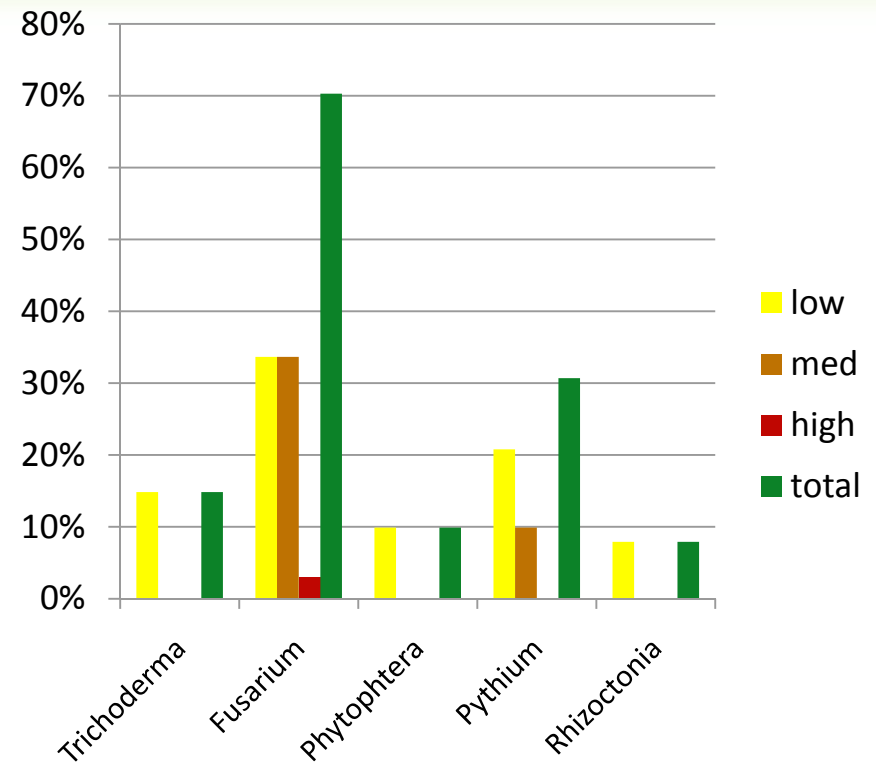
Control	39.3 bu/acre	
MTS Carbon treated	45.3 bu/acre	15% increase

Weighed by NK dealer with weigh wagon

# DNA MULTISCAN RESULTS

## FALL 2009

Large membrane tests	101			total
	low	med	high	
Trichoderma	15%			15%
Fusarium	34%	34%	3%	71%
Phytophthora	10%			10%
Pythium	21%	10%		31%
Rhizoctonia	8%			8%



# OMRI STATUS

- ◎ MTS Environmental Products has registered both Humic Carbon and Fulvic Carbon with OMRI, the world recognized registration body for organic input products.
- ◎ OMRI stands for Organic Materials Review Institute, and an OMRI Listed Seal assures the suitability of a product for certified organic production, handling and processing, under set guidelines



# CROP APPLICATION RATES

## Crops (application rates are per acre)

Year 1: 4 litres MTS Bio-DeSolve Soil Carbon Mix

All Following Years: 2 litres MTS Bio DeSolve Soil Carbon Mix

### Crops Included

Alfafa & Forages

Edible Beans

Canola

Soybeans

Cereal Grains

Spring & Winter Wheat

Corn