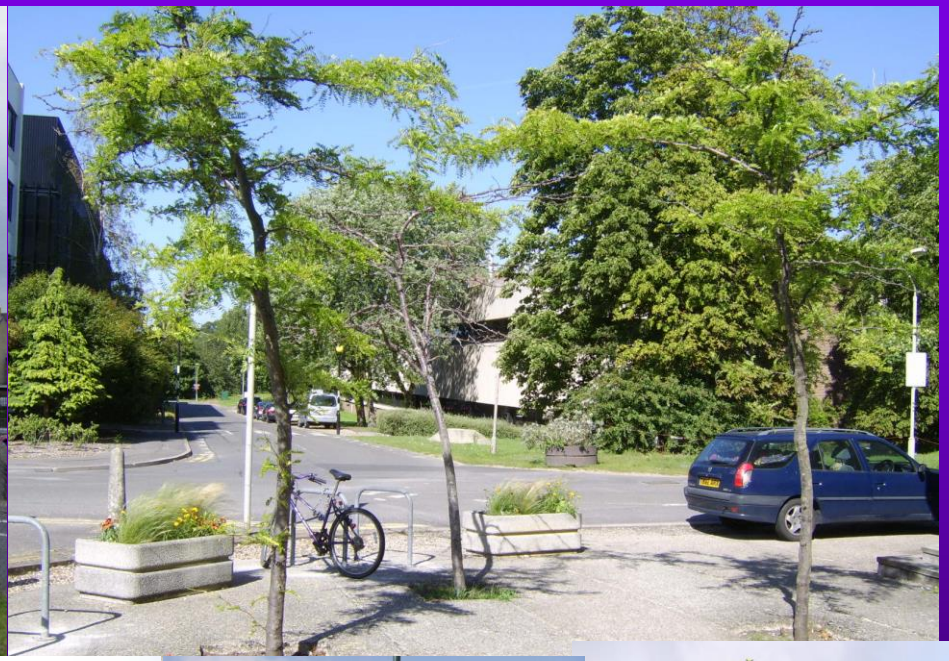
Planting Trees And Aftercare

- Dr G. Percival
- Bartlett Tree Research Laboratory
- Reading University, UK

The Extent of the Problem



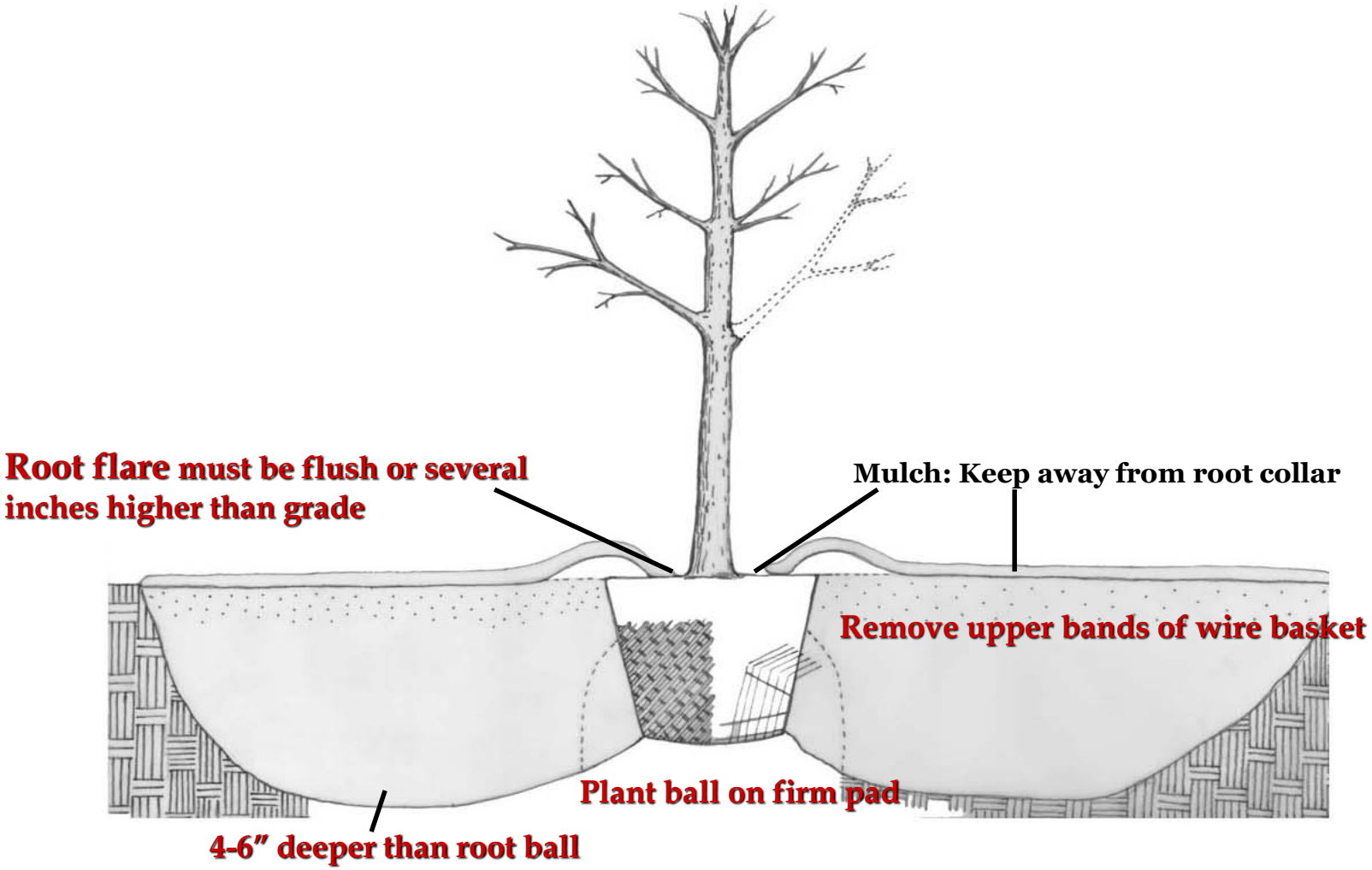
Planted Jan 2019: Assessed July 2019

pH	8.2	**Alkaline**
N	42.0	Low
P	88.0	High
K	464.0	High
Mg	402.3	Low
Compaction	1.80	High
Soil Respiration	0.2	V. Low
Leaf chlorophyll content	-	-
Photosynthetic efficiency	-	-
Mycorrhiza	-	-

Out of 220 trees planted 198 were dead?

Planting Project: London

Tree Planting Detail



Where's the root flair???

Roots too Deep in a B&B Root Ball

- Remove soil from on top of ball so you can see roots emerging from the trunk
- Cut roots that circle, those that are kinked, or those that cross over major roots

Depth in

Courtesy Dr. E. Gilman


Orient roots in a radial fashion


Soil soaked to avoid compaction

One year warranties: look better and grow more in 1st season if planted IMPROPERLY

Control

Disturbed


Husqvarna

Control: Right out of the 70 Litre Container, Planted Into the Ground


Control


Disturbed

Circulating root to root

Circulating root to stem

Root collar depth is a chronic problem

What lurks beneath?

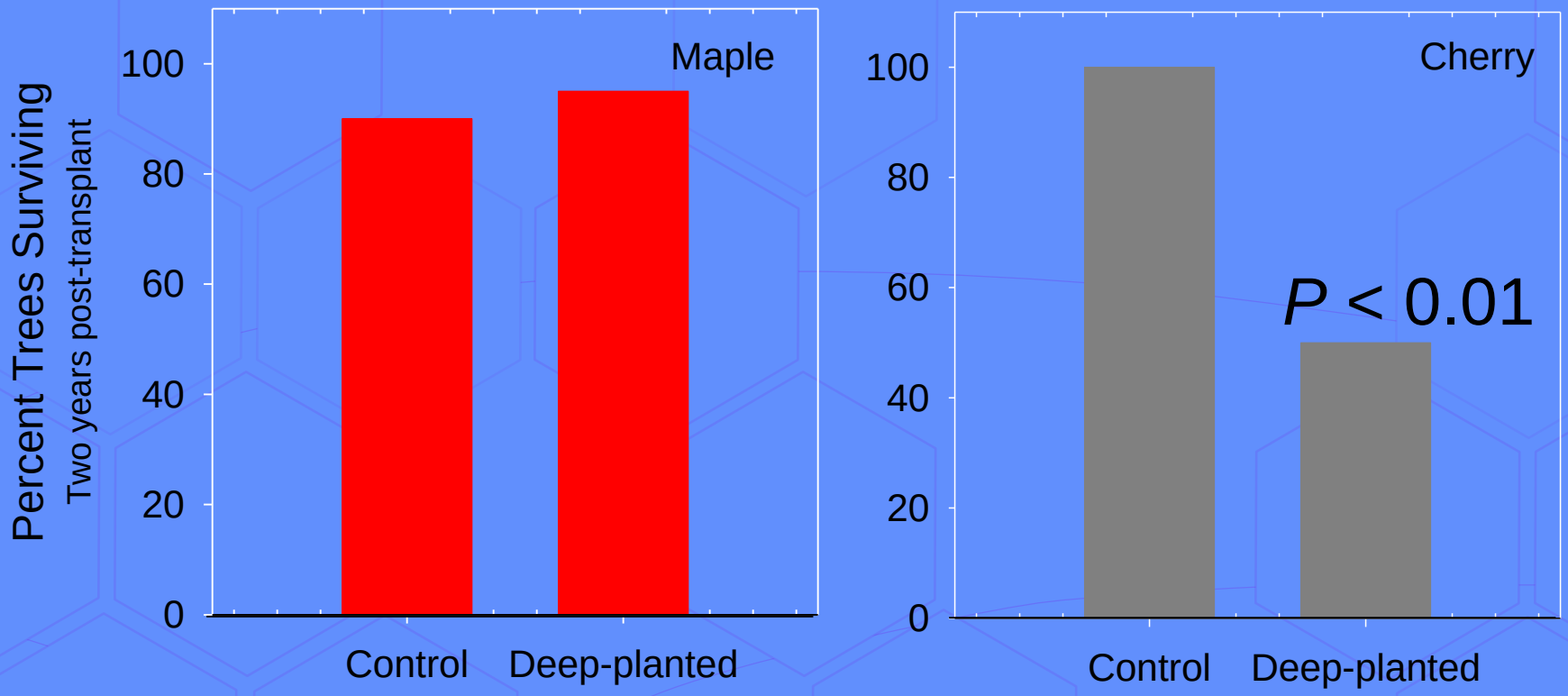
Root Collar Excavation

Root collar must be located at planting

Deep Planting Study

Cherries and Red maples, planted 2008, survival data from 2015

Tree survival after 2 seasons was less in deep-planted cherries



Aftercare: Mulching

One of the most simplest systems of promoting tree vitality and managing soil borne diseases.

Plant resource competition

Soil Nutrition

Soil temperature fluctuations

Soil Moisture Retention

Plant Disease

Soil Biota

Soil Compaction

Root Establishment

Impact of Soil Contaminants

Plant Performance

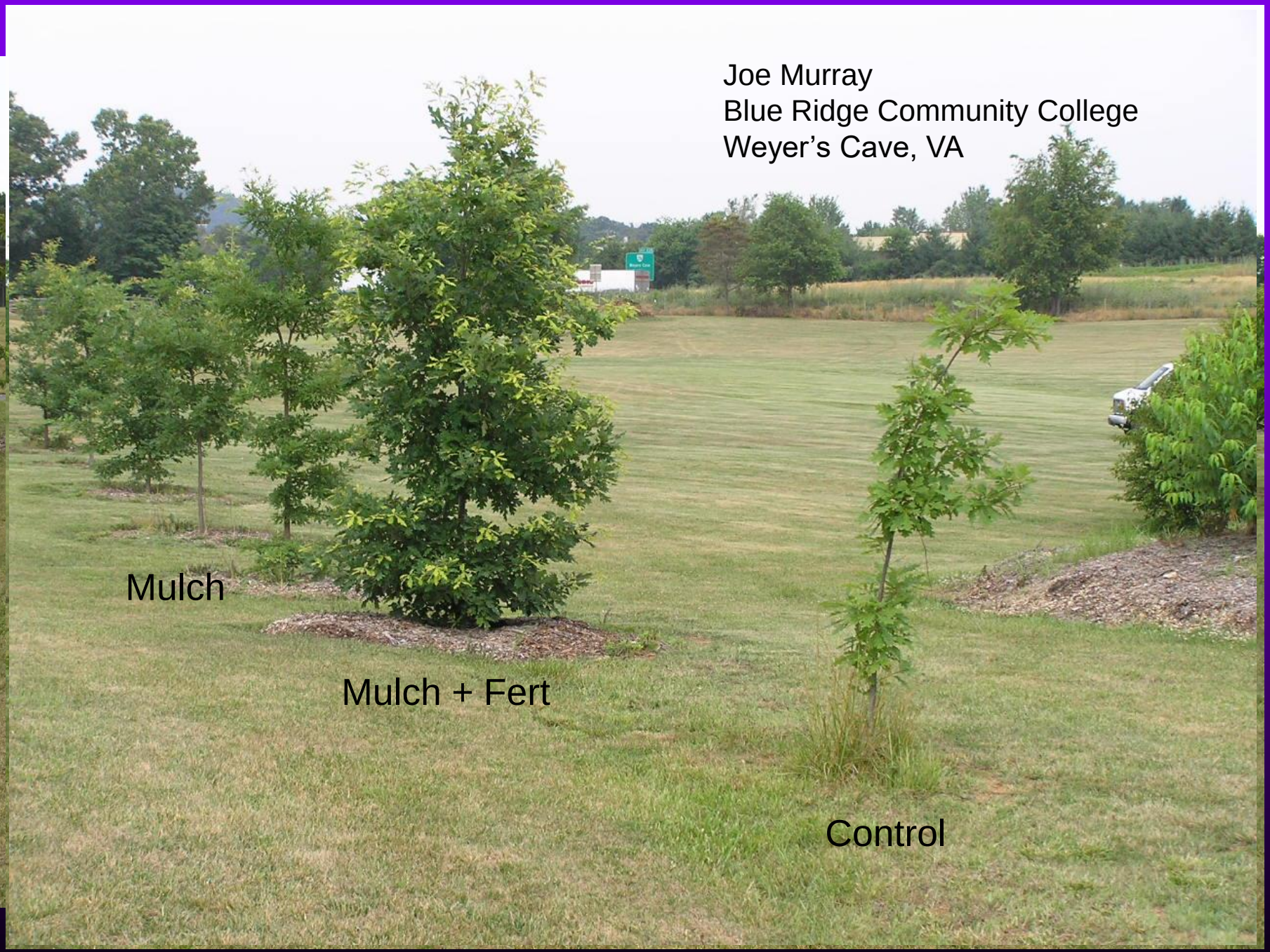
– ORGANIC MULCH +

(5-10 cm DEPTH)

Mulch

<u>One</u> of the Best treatment for any tree

- Apply to the dripline if possible
- 5 to 10cm of wood chips
- No fabric, no grass, no matting, no fine woods, no diseased chips (*Verticillium*, *Armillaria*)


Joe Murray
Blue Ridge Community College
Weyer's Cave, VA
Mulch
Mulch + Fert
Control

Trees (Ash) in with shared mulched areas grew more than twice as fast as trees with mulched rings

Mulch rings

Shared mulch areas

Two years after planting

Pure or Single Species Mulch

Mulch

Wood chip Smart Mulch Food Biomass Control

Dispelling myths

- **Mulches made from wood chips DO NOT acidify soils.**
- **Diseased mulches rarely transfer pathogens to healthy hosts.**
- **Mulches from deciduous trees do not need composting – fresh mulches are fine.**
- **Mulches "lock up" N and C. No scientific evidence to support this.**
- **However, wood chip buried into soil CAN lock up C and N….in the short term!**

Soil Amendments
Mycorrhizal Fungi

The roots of most trees growing in a woodland are generally infected by beneficial fungi known as mycorrhizal fungi. Benefits from this type of association include;

Striking growth responses of tree seedlings grown in poor soils or under drought conditions.

Increased root vigour.

Resistance to *Phytophthora* root rot.

Ability to grow on soils high in heavy metals.


Independent research on commercially available Mycorrhiza has found NO consistent positive benefits on nursery or newly transplanted trees. Maybe helpful on declining mature trees
Photo: Mark Brundrett

Trees and Mycorrhizal Inoculations

Appleton et al (2003) Journal of Aboricuture. 29(2) 107-111.

Carlson et al (2000) Proceedings SNA Research Conference. 45:405-406.

Gilman (2001)Journal of Aboricuture. 27:30-38.

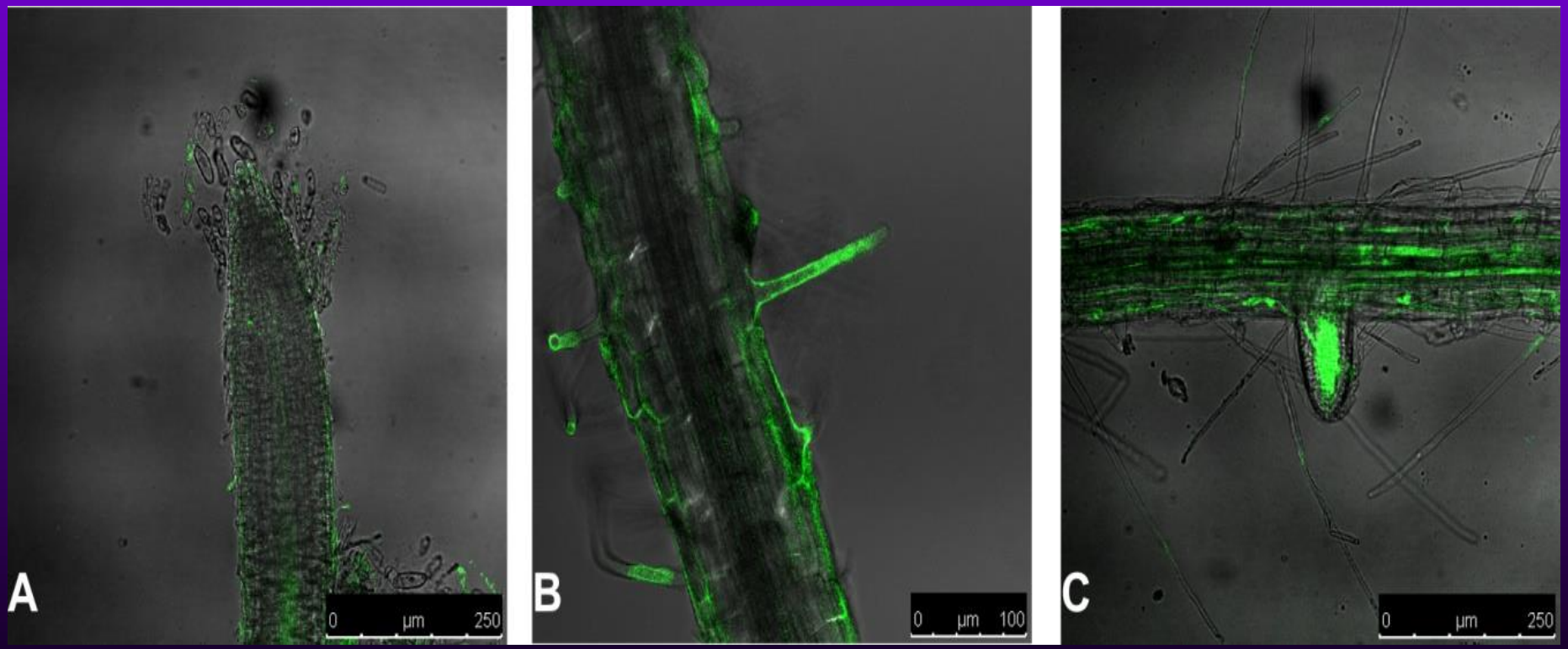
Support the conclusions that mycorrhiza have little effect on promoting transplant survival and growth of trees.

Mycorrhiza

Natural releases of sugar into soils by roots increased growth and mineralization by soil fungal mycorrhiza communities (DeBoois & Jansen, 1975).

Sugar/Mycorrhiza Interaction

- **Use of sugars (soil drench) and influence on mycorrhizal association**



Control Sucrose Glucose

Carbohydrate loading

Molasses based fertiliser

Sucrose

Granular carbohydrate fertiliser

2.5% solution	Root Sugar Concentration (g/100g DW)		
	English Oak	Poplar	Beech
Control	1.8	2.4	1.2
Molasses	2.8	3.2	1.9
Sucrose	2.5	3.8	2.1
Glucose	2.6	3.6	1.7
Fructose	2.9	3.6	1.5
Raffinose	3.0	3.5	1.9

Beech

Control

Sucrose

Beech

Control

Sucrose

English oak

- Percival G.C. and K Sacre (2014). The influence of soluble carbohydrates, slow-release nitrogen and a plant growth regulator on transplant survival of trees. *Arboricultural Journal*. DOI: 10.1080/03071375.2014.943559.

Control

Sucrose

FORMULATION OF BIOSTIMULANTS

"Eye of toad, ear of bat and that horrible lumpy bit in the bottom of a Pot noodle"

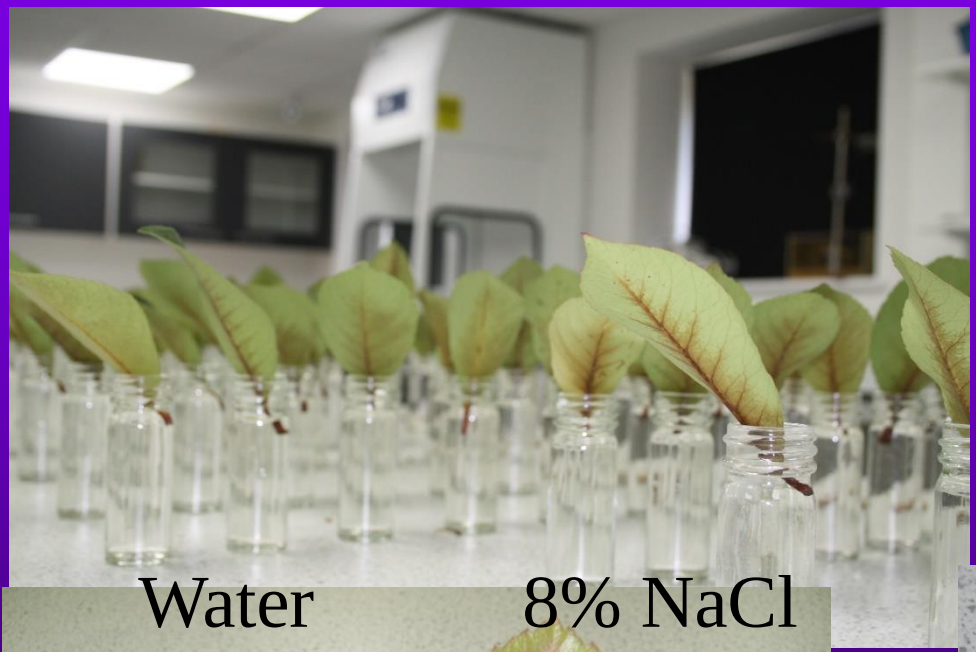
Biostimulants to enhance stress tolerance

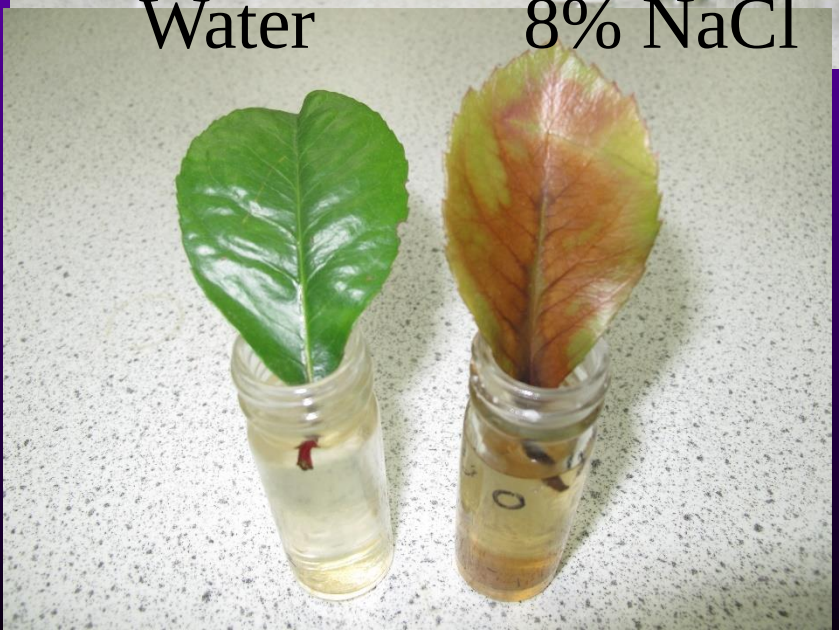
Sugar Cal: Sorbitol/Mannitol/Chelated Calcium Acetate
Horti-Kelp: Bioactives (Seaweed Extracts/Amino Acids/ Vitamins
IntraCell: Glycine Betaine
Topas: Penconazole
Phusion: Potassium Phosphite
Liquid Chitosan: Chitosan
Alpha Mat: Salicylic Acid + Surfactant

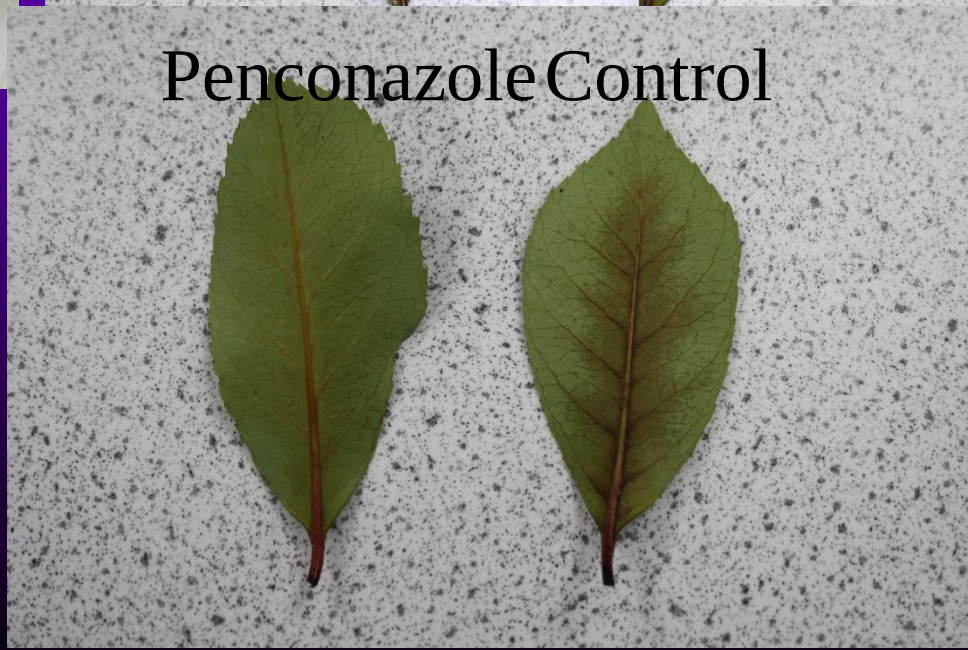
All products applied at MRR, generally 10ml litre. All applied as soil drench except Penconazole (foliar spray)

July 2018: One of the Hottest on Record

Salinity





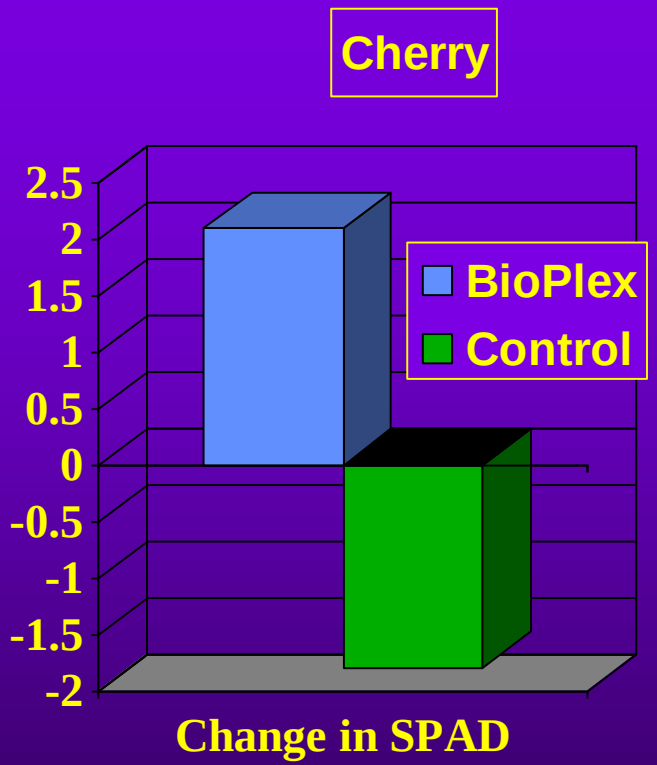


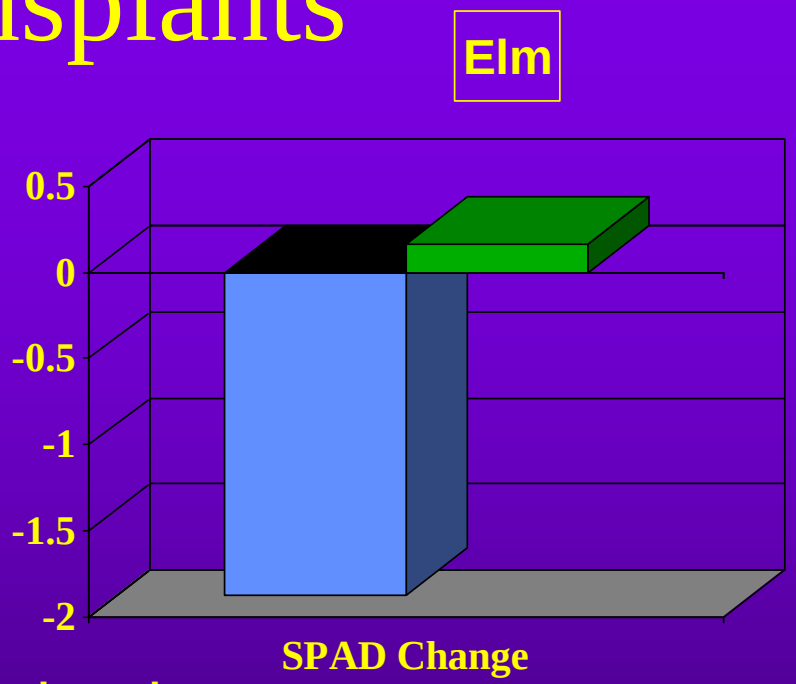
And the Winner was????

No “real” difference between controls and remaining treatments

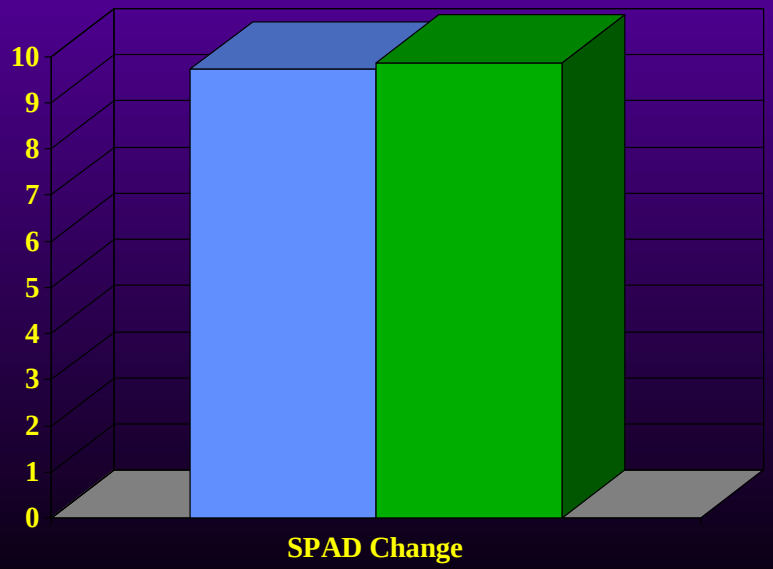
Alpha Mat **Control**

BioPlex on Transplants





Crab apple

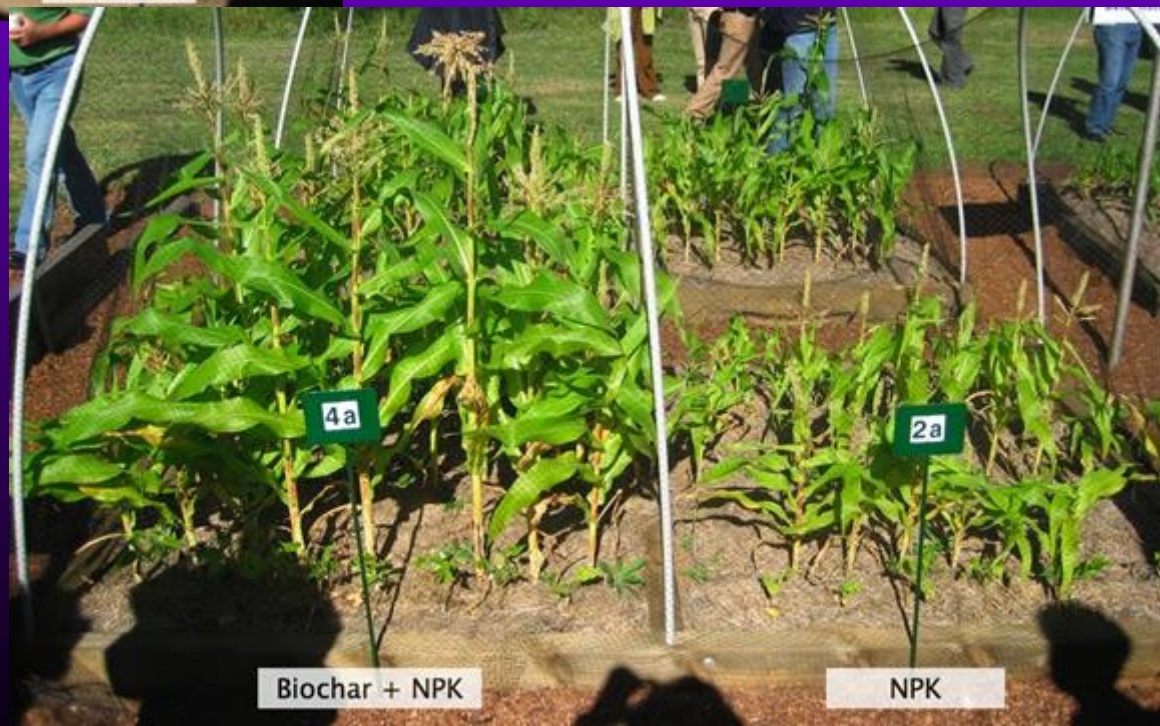


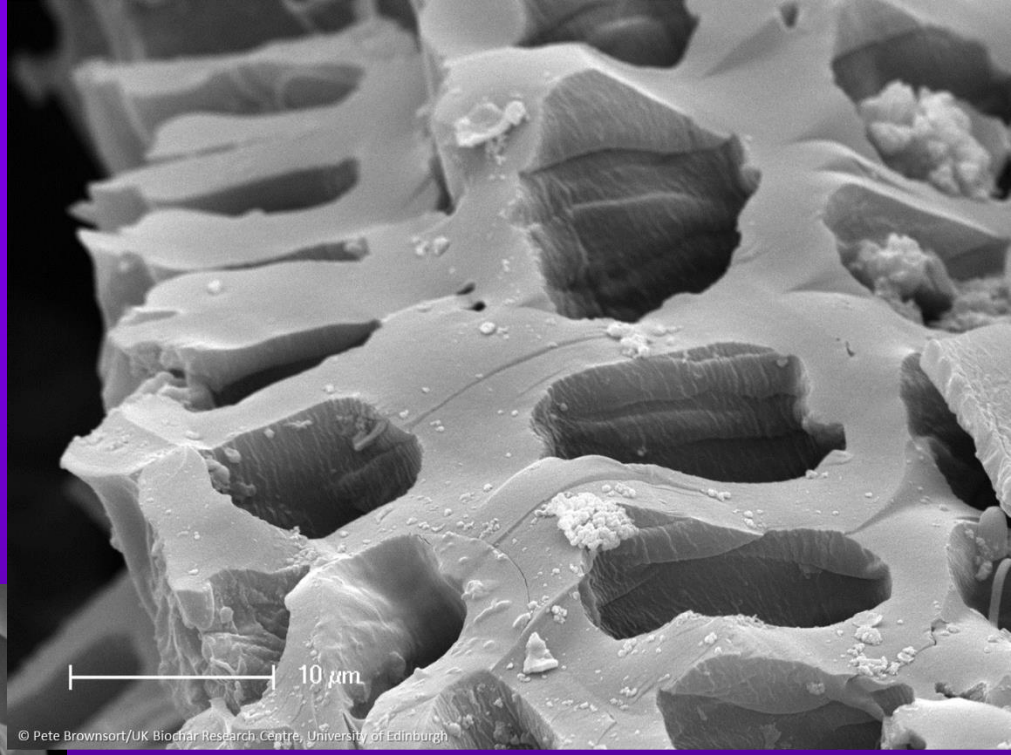
What is Biochar?

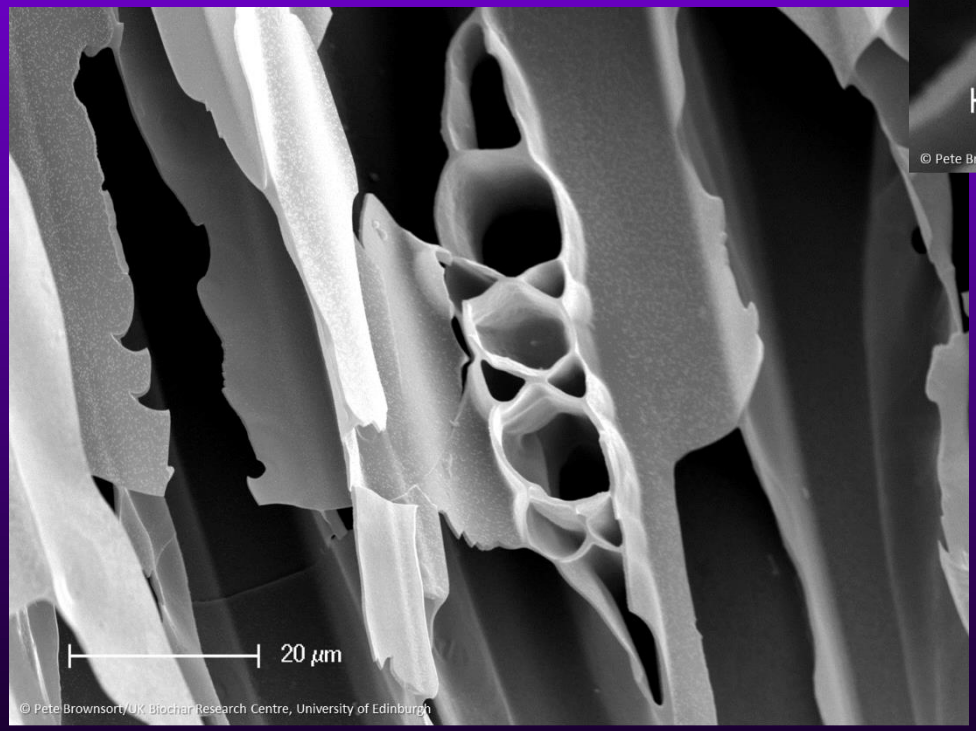
A purified form of charcoal.

- **When added to soil it:**
- Increases CEC
- Improves water retention
- Improves fertiliser effectiveness

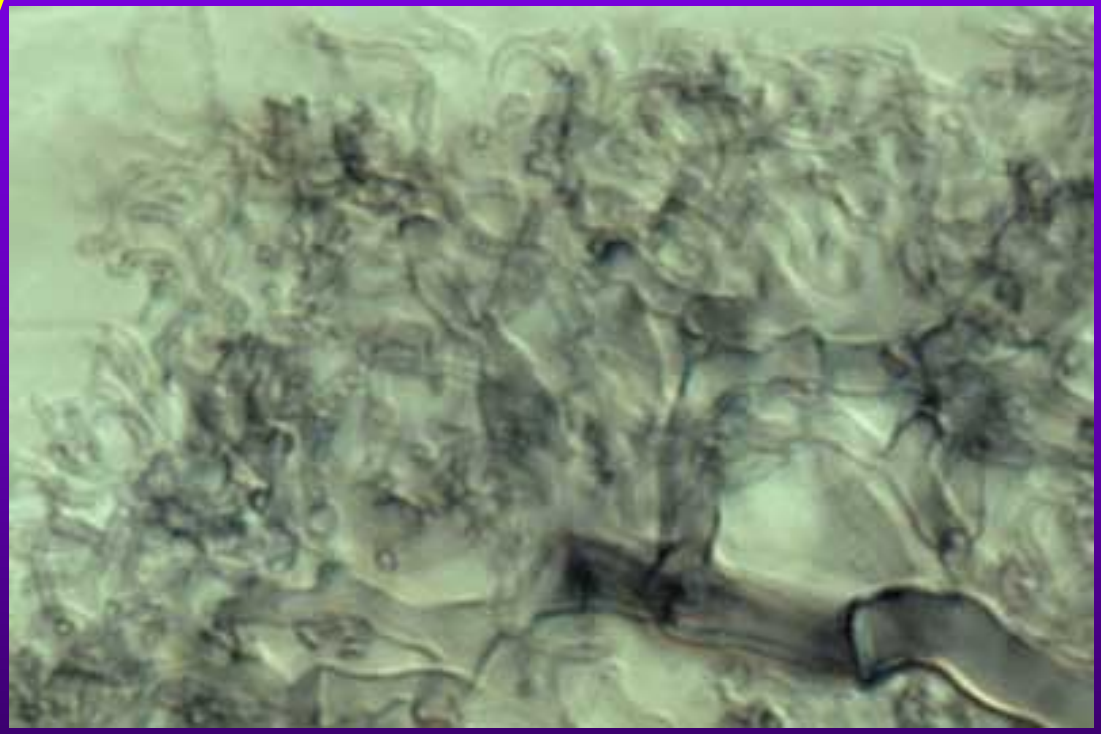
Benefits are now realised.



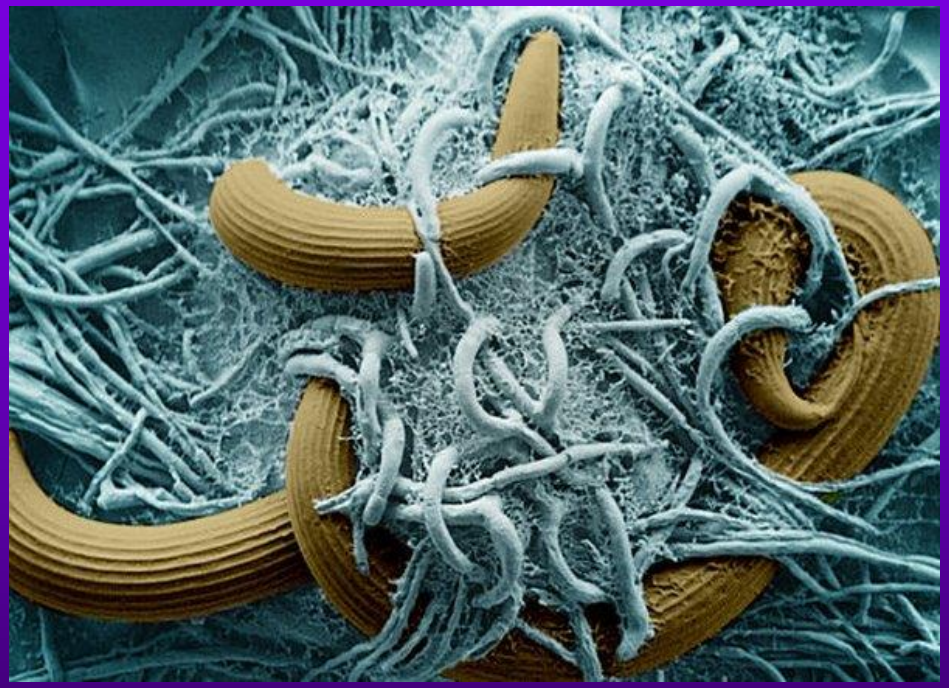


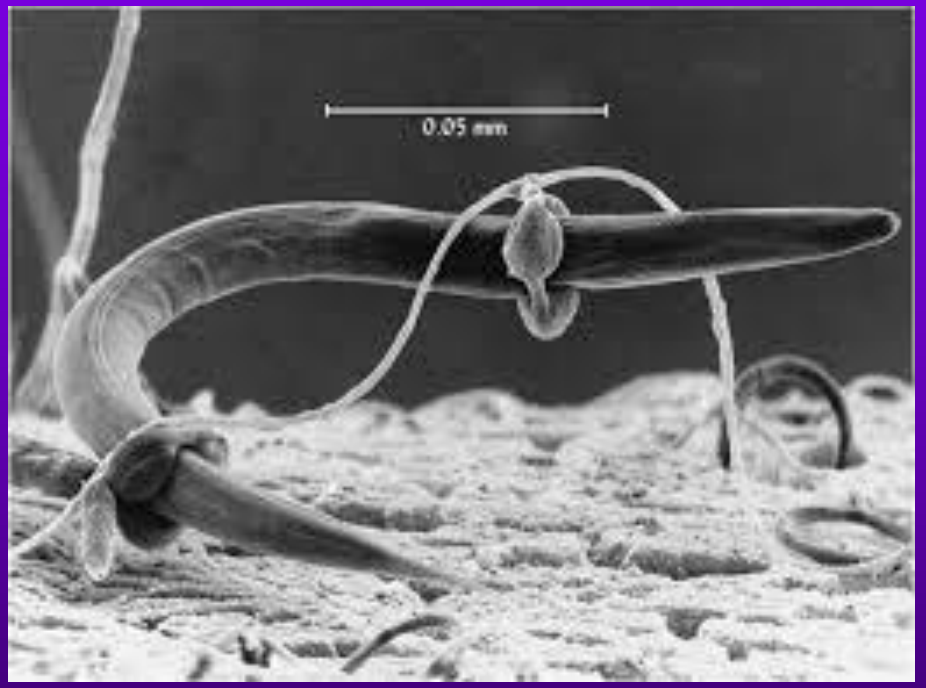


Acts as a haven for mycorrhiza



Slides courtesy of J MacPhail



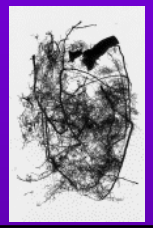
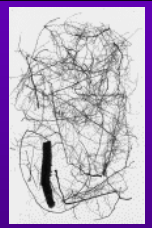
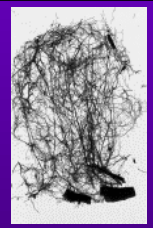


Mycorrhizae trapping nematodes with their filamentous hyphae

Slides courtesy of J MacPhail

Recent Research from the USA

[Scharenbroch, B.C., E. Meza, M. Catania, and K. Fite. 2013. Biochar and biosolids increase tree growth and improve soil quality for urban landscapes. Journal of Environmental Quality. doi:10.2134/jeq2013.04.0124]

Genus species (soil)	Water	Com-post tea	Wood chips	Com-post	NK fert	Bio-char	Bio-solids
Acer saccharum (silt loam)							
Acer saccharum (compact clay)							
Acer saccharum (sand)							

Root scans from *Acer saccharum* in sand, silt loam, and compact clay

Cherry Drought Trial

- Irrigation was removed from *Prunus avium* to monitor their drought response
- Above: Control with no soil amendment
- Below: Treated with enriched biochar


BTRL trial: simulated planting pits of approx. 4.0 cu metre. – oak, maple


CAT
320C L

MGB ‘Regal Prince’ oak ‘Pattern Perfect’ maple

Biochar Gravel Mulch Biochar Gravel Mulch

Month 18 after treatment

Control (first growing season) Biochar

Biochar HW

Control

Biochar SW

Biochar + N:P:K

Control

Biochar HW

SOIL AMENDMENTS (5% by Volume)

1. Biochar (soft/hard wood, rice)

2. Coir: waste product (coconut husks)

3. Hydroleca: Pulverised clay product

4. Terracottam (CRF/Polymer/Volcanic Rock)

With and without mulch

Biochar

Treatments:

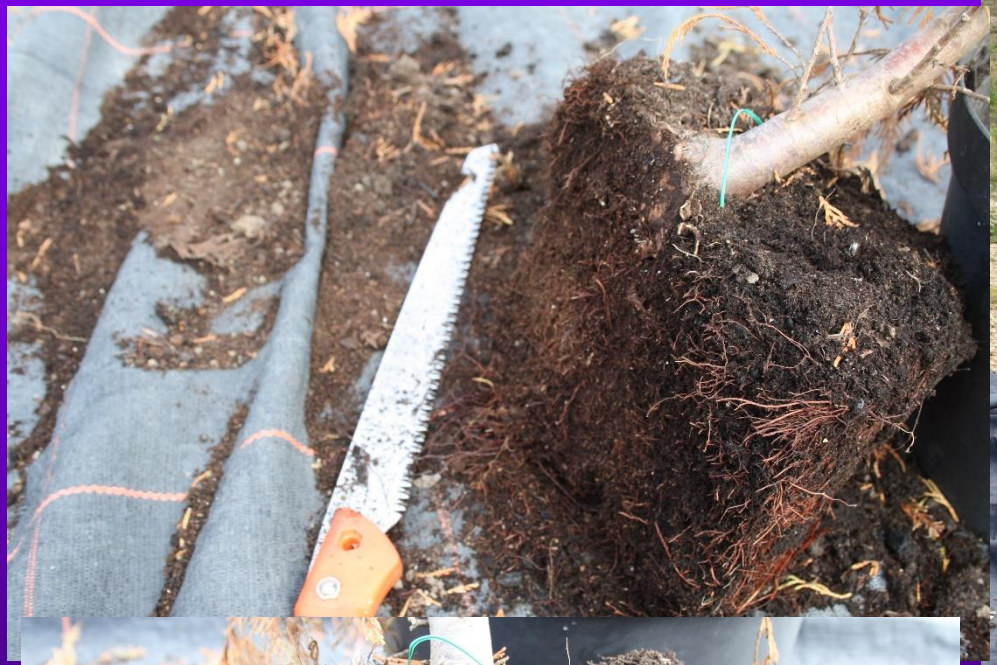
Biochar (softwood)
Biochar (hardwood)
Biochar (rice)
Control (no biochar)

Each biochar was then “marinated” for 24 hours in either

Water
Potassium phosphite (10 ml per litre)
Molasses (10 ml per litre)
Liquid BOOST (10 ml per litre)

i.e. Biochar (softwood) + Water
Biochar (softwood) + Potassium phosphite
Biochar (softwood) + Molasses
Biochar (softwood) + Liquid BOOST

Trees then had 50% of their root system removed



Trees then had 50% of their root system removed

SOIL AMENDMENTS (YEAR 1)

Biochar + Mulch

SOIL AMENDMENTS (YEAR 3)

Biochar + Mulch

SOIL AMENDMENTS (YEAR 2)

Biochar

Control

Root growth 12 months later at 45, 90 and 135 cm away from cut roots (Conifer)

Biochar	Treatment	45 cm	90 cm	135 cm
		Root growth g/cm^3		
Control	Water	0.01783	0.00782	0.00153
Control	Phosphite	0.02372	0.00858	0.00211
Control	Molasses	0.03607	0.01194	0.00299
Control	BOOST	0.03189	0.0117	0.0029
Softwood	Water	0.03416	0.01367	0.00339
Softwood	Phosphite	0.03617	0.01237	0.00313
Softwood	Molasses	0.04833	0.02085	0.00452
Softwood	BOOST	0.04676	0.01866	0.00458
Hardwood	Water	0.0351	0.01424	0.00415
Hardwood	Phosphite	0.04448	0.01682	0.00406
Hardwood	Molasses	0.06273	0.02186	0.00544
Hardwood	BOOST	0.06529	0.02301	0.00444
Rice	Water	0.02808	0.01033	0.00238
Rice	Phosphite	0.04105	0.01508	0.00406
Rice	Molasses	0.04833	0.01961	0.0052
Rice	BOOST	0.04596	0.02086	0.00538

Influence of biochar treatments on tree vitality (Cherry)

Biochar	Treatment	Crown Volume	SPAD	PI
Control	Water	0.86	34.5	2.4
Control	Phosphite	1.00	37.8	3.0
Control	Molasses	1.28	36.8	3.0
Control	BOOST	1.40	41.9	4.5
Softwood	Water	1.18	39.0	3.3
Softwood	Phosphite	1.25	44.1	3.4
Softwood	Molasses	1.45	44.8	3.9
Softwood	BOOST	1.56	52.4	5.6
Hardwood	Water	1.25	42.3	3.7
Hardwood	Phosphite	1.26	42.0	3.6
Hardwood	Molasses	1.59	44.5	4.6
Hardwood	BOOST	1.66	53.1	6.2
Rice	Water	1.14	41.1	3.3
Rice	Phosphite	1.12	43.7	3.5
Rice	Molasses	1.39	45.0	3.9
Rice	BOOST	1.47	48.8	5.5

Decling tree

Soil Conditioning – air spading of the soil

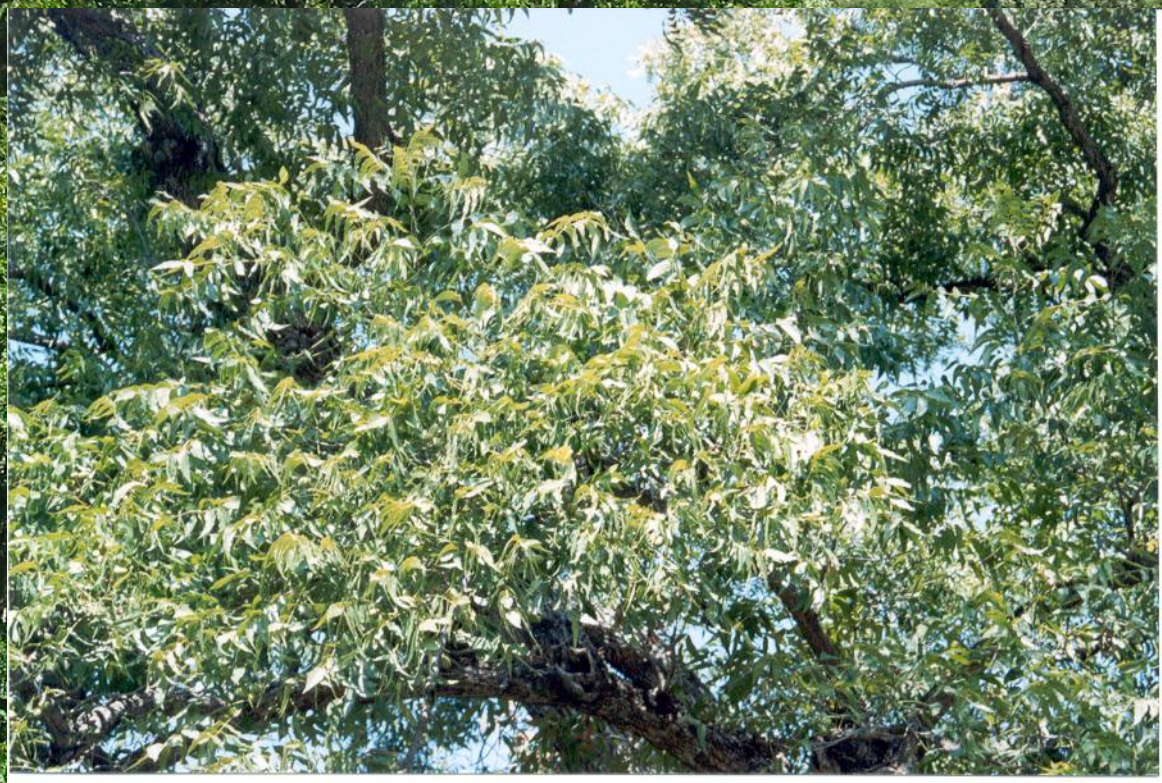
Working in organic matter,

Fertilizer and Mycorrhiza

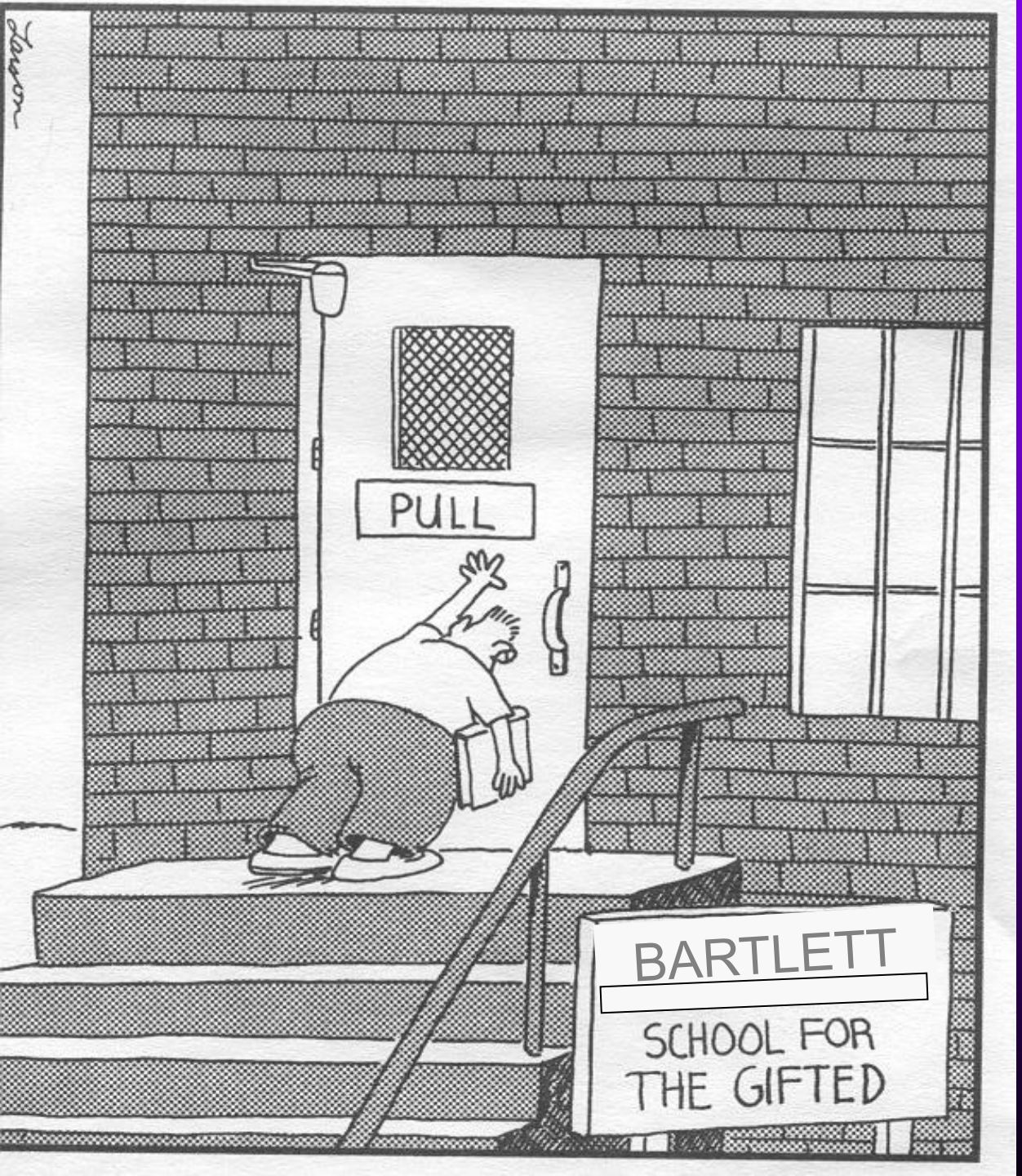
One Year into Recovery

Two years after treatment

3 years after treatment




Yr 4



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