Impact of mulches and disks in nursery container production

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European Weed Research Society "Physical and cultural weed control" Working Group
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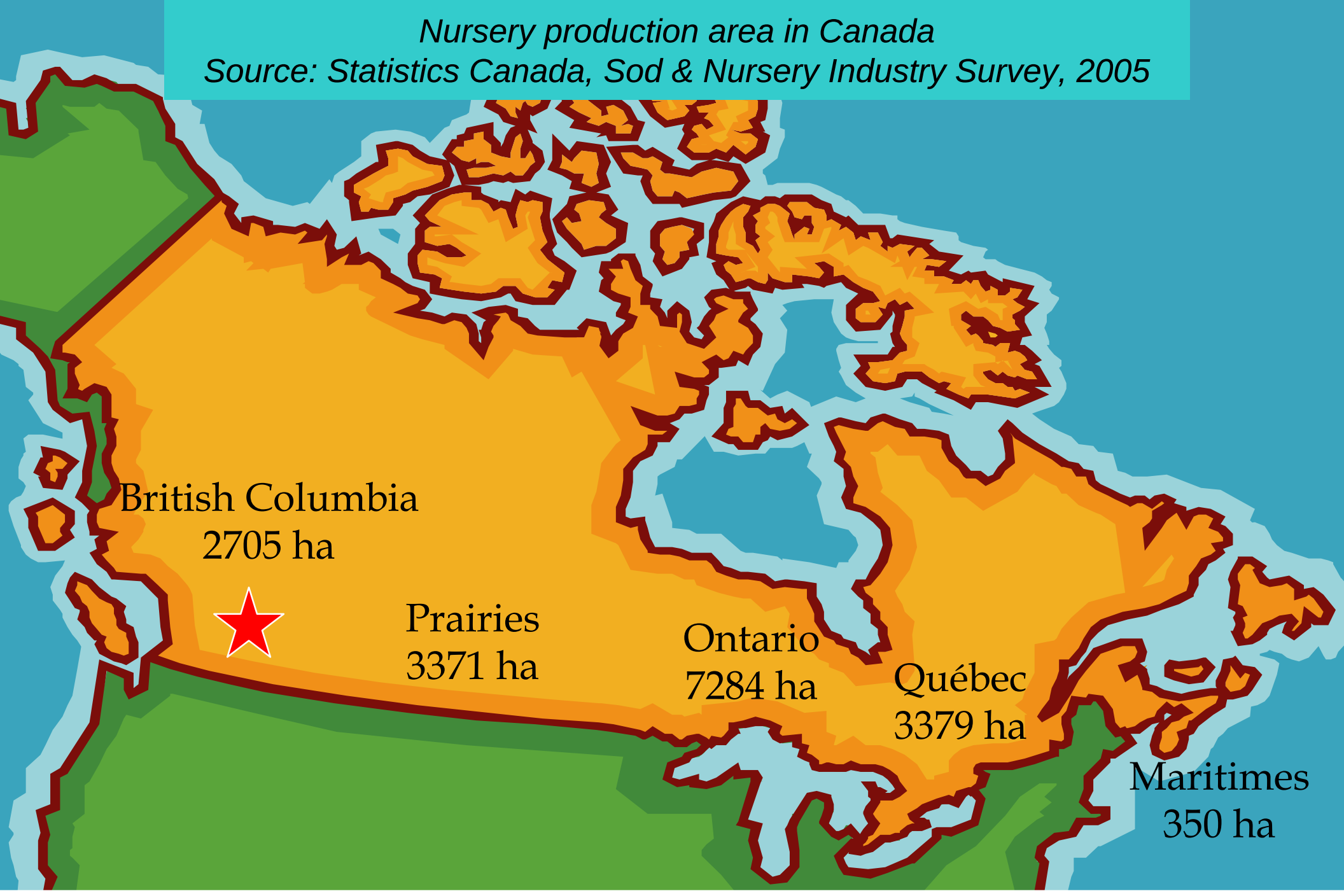

Nursery production area in Canada
Source: Statistics Canada, Sod & Nursery Industry Survey, 2005
British Columbia
2705 ha
Prairies
3371 ha
Ontario
7284 ha
Québec
3379 ha
Maritimes
350 ha

Trials conducted in British Columbia

Mulch for weed control in a container

Mulch for weed control in the landscape

Field trials with mulches and disks conducted in British Columbia

2003 - 2004 Impact on weed control
Costs for commercial use

2005 - 2006 Impact on irrigation
Impact on plant nutrition

2007 - 2008 Impact on plant growth
Impact on slow-release fertilisers

2003 - 2004: Products tested

Moulded plastic lid (1 disk)

Woven coco-fiber (1 disk)

Sawdust (1.25 cm thick)

Crumb rubber (1.25 cm thick)

BioTop (1.25 cm thick)

Corn gluten (10kg / 100 m^2)

Measuring plant growth in 2003

2003 trial: Selected results

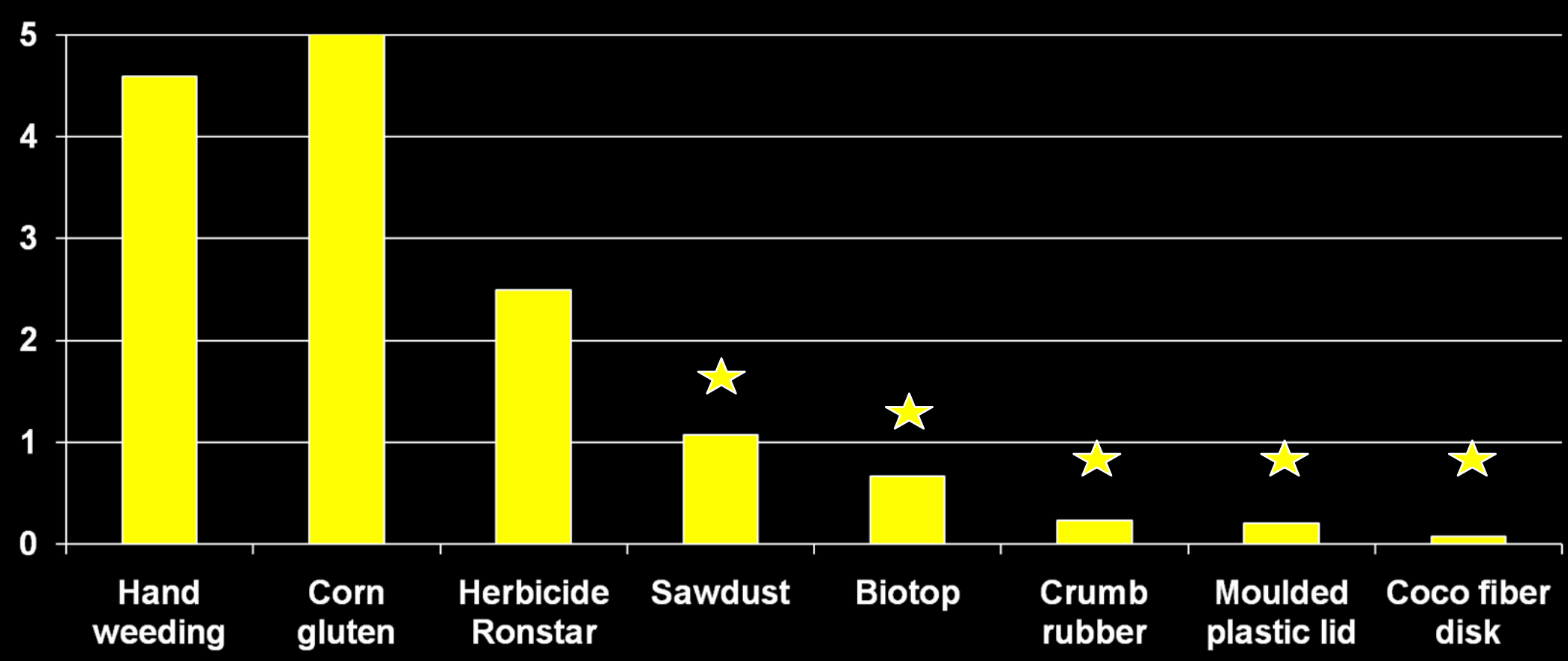
Each value is the mean of 30 measures

Treatment	Weeds (over 1 year)	Height (increase, cm)	Weight (top dry, g)
Hand weeding (control)	4.60	11.02	20.1
Herbicide Ronstar	2.50	10.93	22.8 *
Sawdust	1.07 **	11.62 **	20.5
Biotop	0.67 **	10.77	20.6
Crumb rubber	0.23 **	10.10	19.7
Corn gluten	5.10	10.15	22.5 *
Plastic lid	0.20 **	10.92	22.6 *
Coco fiber disk	0.07 **	12.28 **	23.1 *

Number followed by asterix is statistically different than control at ** p=0.01, * p=0.05, ANOVA

2003 - 2004 trial: Impact on weed control

Mean number of weeds removed per container between July 2003 and May 2004
Each bar is the mean of 30 measures



★ Treatment with a star is statistically different than hand weeding at p=0.01, ANOVA

Weed growth with disk or without

Weed growth in the opening of the disk

Cost of mulches and disks for containers

Product	Amount per 4.5 L container	Cost of product per container
Hand weeding	2 times per year	labour $ 0.10 to $ 0.25
Herbicide Ronstar	label rate	under $ 0.01
Sawdust	240 ml	under $ 0.01
Biotop	90 ml	$ 0.04
Crumb rubber	240 ml	$ 0.08
Moulded plastic lid	1 lid	$ 0.09
Coco fiber disk	1 disk	$ 0.14 to $ 0.17

Source: James Atland, Oregon State University, The Digger Magazine, March 2004

Quality of coco fiber disk over time

Commercial use in greenhouse crop

Best use: on slow growing plants

Commercial use in a wet climate

Field trials with mulches and disks

2003- 2004 Impact on weed control
Costs for commercial use

2005 - 2006 Impact on irrigation practices

Impact on plant nutrition

2007 - 2008 Impact on plant growth
Impact on slow-release fertilisers

What is the impact on fertilization?

Is mulch preventing fertilizer release?

2005 – 2006 Treatments

Fertiliser Osmocote 19-5-6
placed *under* or *over*

Sawdust

BioTop

Crumb rubber

Plastic lid

Coco fiber disk

Control:
no mulch, on media

Fertilizer placed over or under the mulch

Same procedure for sawdust mulch

Same procedure for coco fiber disk

Results were published in 2007

Influence of Container Mulches on Irrigation and Nutrient Management[1]

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Abstract

An experiment was conducted in 2005 and repeated in 2006 to determine the influence of mulch products and controlled release fertilizer (CRF) placement on irrigation and nutrition requirements of container-grown crops. Hydrangea (*Hydrangea macrophylla* 'Fasan' and 'Endless Summer') were grown in 2.7 liter (#1) containers with CRF placed above or below the mulch. Non-mulched controls were also maintained. Mulch products included geotextile discs, coco discs, plastic discs, hazelnut shells, sawdust, Biotop, and crumb rubber. Hydrangea growth, plant quality, foliar color, and foliar nutrition were measured, as well as water loss from containers. Controlled release fertilizer placed below mulch resulted in larger plants with higher quality ratings and foliar N levels compared to CRF placed above the mulch, and similar or superior size, quality and foliar N compared to non-mulched containers. After correcting for differences in plant size, there were few and minor differences in water loss from hydrangea between mulched and non-mulched containers.

Index words: alternative weed control, non-chemical weed control, disc, controlled release fertilizer, fertilizer placement.

Significance to the Nursery Industry

Preemergence herbicides are the primary tools used for weed control in container production. However, preemergence herbicides cannot be used in every production situation, most notably on herbicide-sensitive species or in enclosed production areas where herbicides are not labeled. There are several commonly used alternatives to preemergence herbicides including discs and mulches made from a wide variety of natural and synthetic materials. Covering the container surface with any material may require changes in some aspects of the production and maintenance of container nursery crops, in particular fertilization and irrigation practices. Data herein demonstrated that controlled release fertilizer (CRF) placement below the mulch product produced plants with similar or greater size, plant quality, and foliar nutrition compared to non-mulched plants. Placement of CRF above the mulch product reduced plant size and quality compared to placement below mulch or non-mulched crops. Mulch products caused few or minor differences in water loss from hydrangea compared to non-mulched controls.

Products used or with potential for use in the Pacific Northwest (PNW) region of the United States and Canada include; geotextile discs, coco discs, plastic discs, hazelnut (*Corylus avellana*) shells, Biotop, sawdust, and crumb rubber. Geotextile discs are a non-woven polypropylene fabric coated on one side with cupric hydroxide. Coco-discs are a byproduct of coconut (*Cocos nucifera*) processing where longer fibers are extracted from the coconut fruit pith and used for making weed discs among many other products (brooms, door mats, etc.). Coco discs are approximately 0.6 cm (0.25 in) thick. Hazelnut shells are a byproduct of processing nuts from that tree and crushed to a particle size <0.6 cm (0.25 in). Plastic weed discs have been manufactured with several designs, but most are composed of a thin but rigid plastic material that covers the container surface, with preformed holes for air and water infiltration. Biotop is mulch composed of starch and plant fibers used throughout Oregon, Washington, and British Columbia. Sawdust in the PNW is primarily from Douglas fir (*Pseudotsuga menziesii*) trees and can be obtained in a variety of particle sizes. Crumb rubber is produced by mechanically removing the steel radials from tires, then shred-

Atland and Lanthier
2007
Journal of Environmental Horticulture
25(4): 234-238

2005 trial: Impact on irrigation water

Least-squared means of water loss (liters) in 24 hours, adjusted for plant size
Each value is the mean of 16 measures

Treatment	4 weeks after potting	16 weeks after potting
Hand weeding (control)	0.17	0.29
Sawdust	0.16	0.30
Biotop	0.15	0.27
Crumb rubber	0.14 *	0.29
Plastic lid	0.14 *	0.26
Coco fiber disk	0.16	0.27

Number followed by asterix is statistically different than control at p=0.05, Dunnett-Hsu

2005 trial: Measures of plant growth

25 weeks after potting. Each value is the mean of 20 measures.

Mulch	Fertiliser	Dry weight (g)	Flowers	Chlorosis
None (control)	Surface			
Sawdust	Above			
Sawdust	Under			
Biotop	Above			
Biotop	Under			
Crumb rubber	Above			
Crumb rubber	Under			
Plastic lid	Above			
Plastic lid	Under			
Cocofiber disk	Above			
Cocofiber disk	Under			

2005 trial: Measures of plant growth

25 weeks after potting. Each value is the mean of 20 measures.

Mulch	Fertiliser	Dry weight (g)	Flowers	Chlorosis
None (control)	Surface	20.3	4.8	2.0
Sawdust	Above	24.2	5.5	3.0 **
Sawdust	Under	22.4	5.4	2.8 *
Biotop	Above	16.6	5.1	2.9 *
Biotop	Under	21.3	4.5	2.7 **
Crumb rubber	Above	21.9	4.9	2.1
Crumb rubber	Under	36.1 **	5.7	1.9
Plastic lid	Above	30.0 **	5.6	2.0
Plastic lid	Under	30.3 **	5.8	1.9
Cocofiber disk	Above	29.0 **	5.3	1.3
Cocofiber disk	Under	30.0 **	5.5	1.3

Number followed by asterix is statistically different than control at *p=0.05, ** p=0.01, Tuckey's LSD

2005 trial: Growing media

25 weeks after potting. Each value is the mean of 5 measures.

Mulch	Fertiliser	pH	EC	Nitrate	K	Mg	Fe
None (control)	Surface						
Sawdust	Above						
Sawdust	Under						
Biotop	Above						
Biotop	Under						
Crumb rubber	Above						
Crumb rubber	Under						
Plastic lid	Above						
Plastic lid	Under						
Cocofiber disk	Above						
Cocofiber disk	Under						

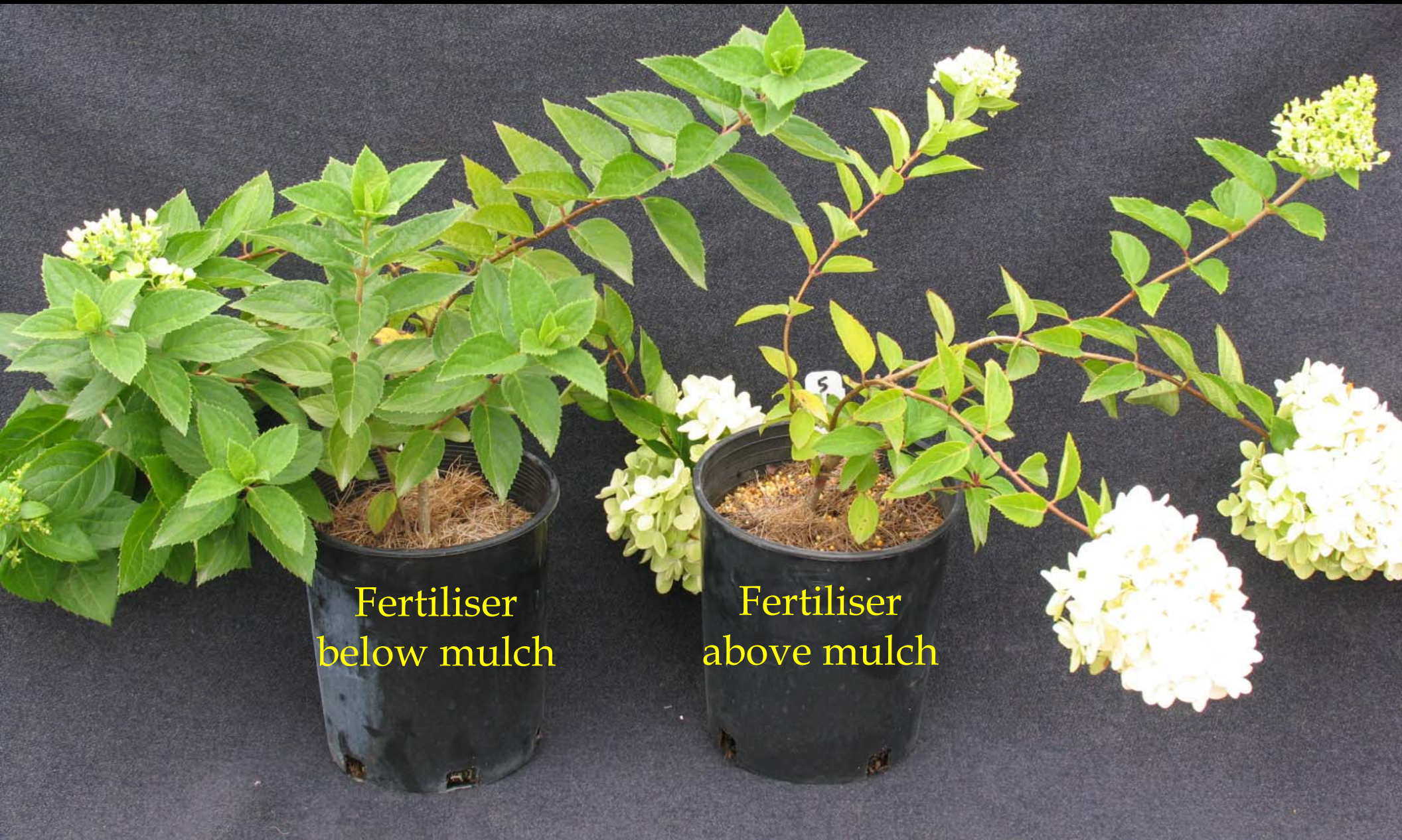
2005 trial: Growing media

25 weeks after potting. Each value is the mean of 5 measures.

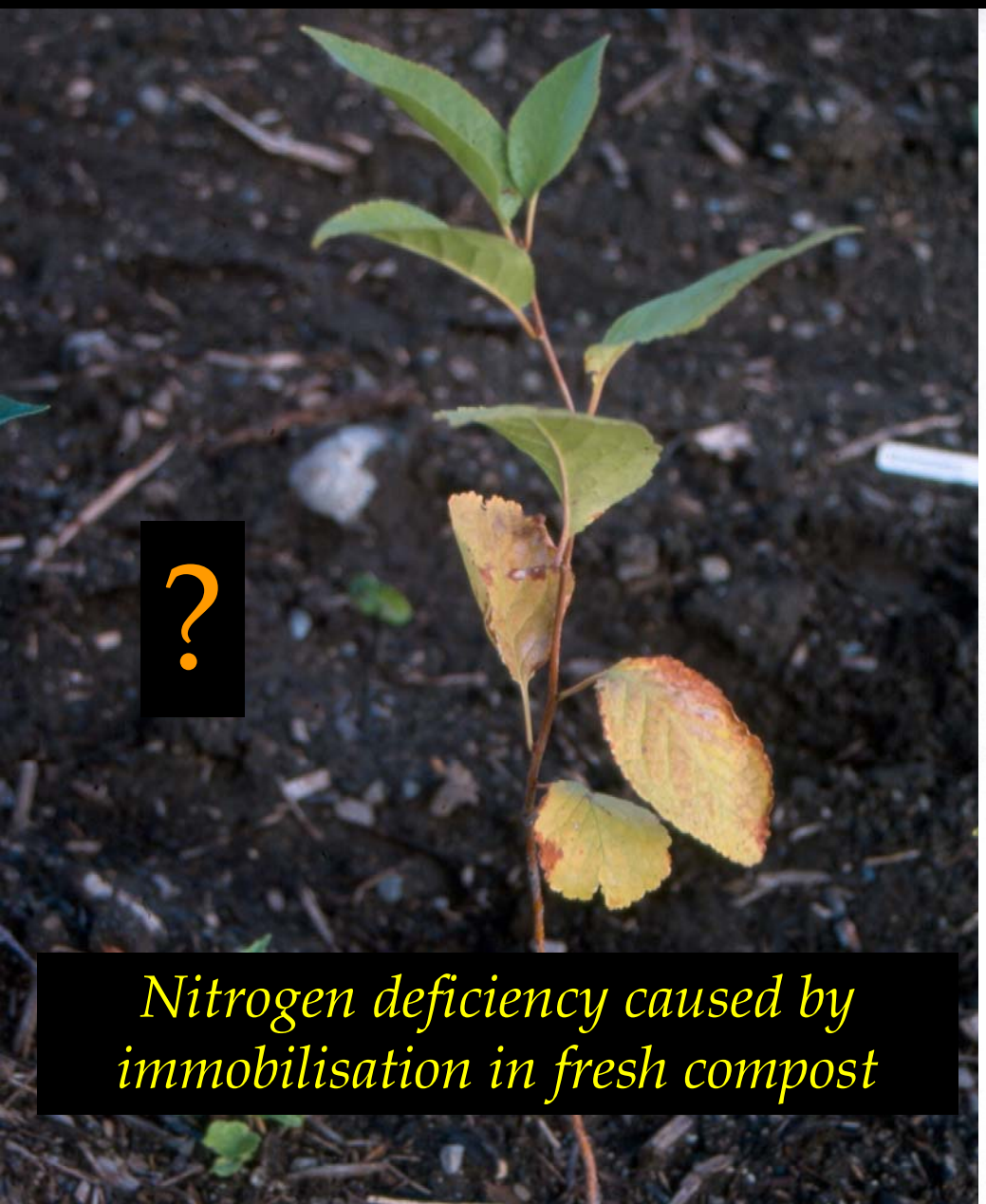
Mulch	Fertiliser	pH	EC	Nitrate	K	Mg	Fe
None (control)	Surface	6.8	136	0.5	14.8	7.3	0.9
Sawdust	Above	6.5	163	06	17.8	7.6	1.1
Sawdust	Under	6.4*	169	0.5	8.9	7.8	0.9
Biotop	Above	6.7	150	0.5	23.9*	6.6	0.8
Biotop	Under	6.6	163	0.4	16.7	8.6	0.7
Crumb rubber	Above	6.9	145	0.6	18.1	6.5	0.8
Crumb rubber	Under	6.5	199 *	0.6	12.7	10.2*	0.8
Plastic lid	Above	7.0	191	0.5	20.6	9.2	0.8
Plastic lid	Under	6.6	245 *	2.2	15.4	14.0*	0.8
Cocofiber disk	Above	6.7	157	0.5	14.2	6.9	0.7
Cocofiber disk	Under	6.8	197	0.4	15.0	11.4	0.5

Number followed by asterix is statistically different than control at p=0.05, Tuckey's LSD

Less fertilizer released above the mulch



Is it immobilisation? Lack of moisture?



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Nitrogen deficiency caused by immobilisation in fresh compost

Plantacote® Pluss

PLANT NUTRIENT

Plantacote Pluss coated NPK fertilizer with magnesium and micronutrients is a controlled-release fertilizer that ensures an even supply of macro and micronutrients over a period of up to 12 months, depending on formulation.

PROBLEMS CONTROLLED: For controlled release feeding to prevent nutrient deficiencies in a wide range of ornamental plants.

CROPS: Plantacote Pluss 4M is recommended as part of a complete nutritional program for stock of substrates for a wide range of uses includ bedding plants, potted plants, container-gr production and perennials.

Plantacote Pluss 6M is recommended for s of substrates with a wide range of planters, potted plants, cut flowers and container gro k.

Plantacote Pluss 12M is recommended for on of substrates for container-grown berry shrubs, fruit and tree nurseries, and applications to ornamental plants, container-grown nursery stock and trees in high-profile landscape areas.

RATE: Use Plantacote Pluss at recommended rates as determined by the nutrient needs of the plant. Rates range from 1.5-7.0 kg/m³ or 1.5-7.0 g/L of substrate depending on formulation. For fruit-growing trees and shrubs along with fertilization of amenity area plants, apply at a rate of 20-50 g/plant. Top-dressing rates of ornamental shrubs, bushes and trees range from 20-100 g/plant. For park roads and avenue trees, work in 2 kg/m³ of excavated soil. Consult labels for recommended rates for specific plants or consult a horticultural fertility specialist.

WATER VOLUME: N/A.

TANK MIXES: If fertilized substrates are used, reduce rates of Plantacote Pluss accordingly.

TIMING: Use as a substrate treatment before planting or after transplanting. Plantacote Pluss 12M can also be used as a top dressing for ornamental shrubs, roses, bushes and trees.

CAUTION: Declared release times refer to an average soil temperature of 21° C (70° F). Higher temperatures accelerate the nutrient release while lower temperatures slow it down. The release time is unaffected by substrate type, pH, micro-organisms, or level of irrigation.

RAINFAST: Controlled release is unaffected by rainfall or irrigation.

PREHARVEST INTERVAL: N/A.

RE-ENTRY TIME: N/A.

PACKAGE SIZE: 25 kg.

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"Controlled release is unaffected by rainfall or irrigation"

QUICK SHEET

Field trials with mulches and disks

2003 - 2004 Impact on weed control
Costs for commercial use

2005 - 2006 Impact on irrigation
Impact on plant nutrition

2007 - 2008 Impact on plant growth

Impact on slow-release fertilisers

2007 - 2008 trial: Treatments

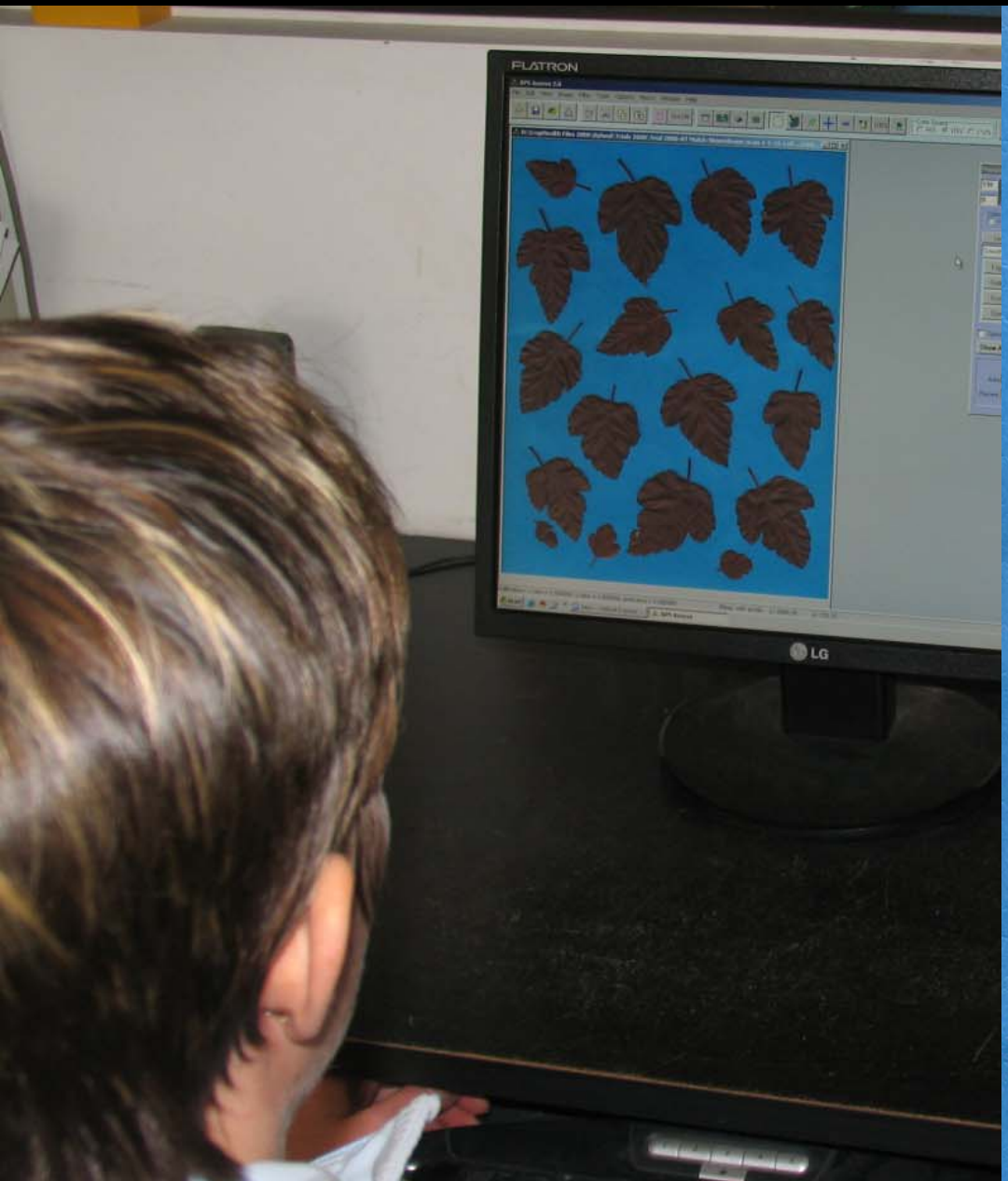
	Mulch	Fertiliser	Fertiliser placement
1	None		
2	Coco fiber disk		
3	Coco fiber disk		
4	None		
5	Coco fiber disk		
6	Coco fiber disk		
7	None		
8	Coco fiber disk		
9	Coco fiber disk		
10	Crumb rubber		
11	Crumb rubber		

2007 - 2008 trial: Treatments

	Mulch	Fertiliser	Fertiliser placement
1	None	Nutricote 18-6-8	On media surface
2	Coco fiber disk	Nutricote 18-6-8	Under disk
3	Coco fiber disk	Nutricote 18-6-8	Over disk
4	None	Plantacote 14-9-15	On media surface
5	Coco fiber disk	Plantacote 14-9-15	Under disk
6	Coco fiber disk	Plantacote 14-9-15	Over disk
7	None	Osmocote 19-6-12	On media surface
8	Coco fiber disk	Osmocote 19-6-12	Under disk
9	Coco fiber disk	Osmocote 19-6-12	Over disk
10	Crumb rubber	Osmocote 19-6-12	Under mulch
11	Crumb rubber	Osmocote 19-6-12	Over mulch

Measures of chlorophyll content

Leaf size measured with digitally



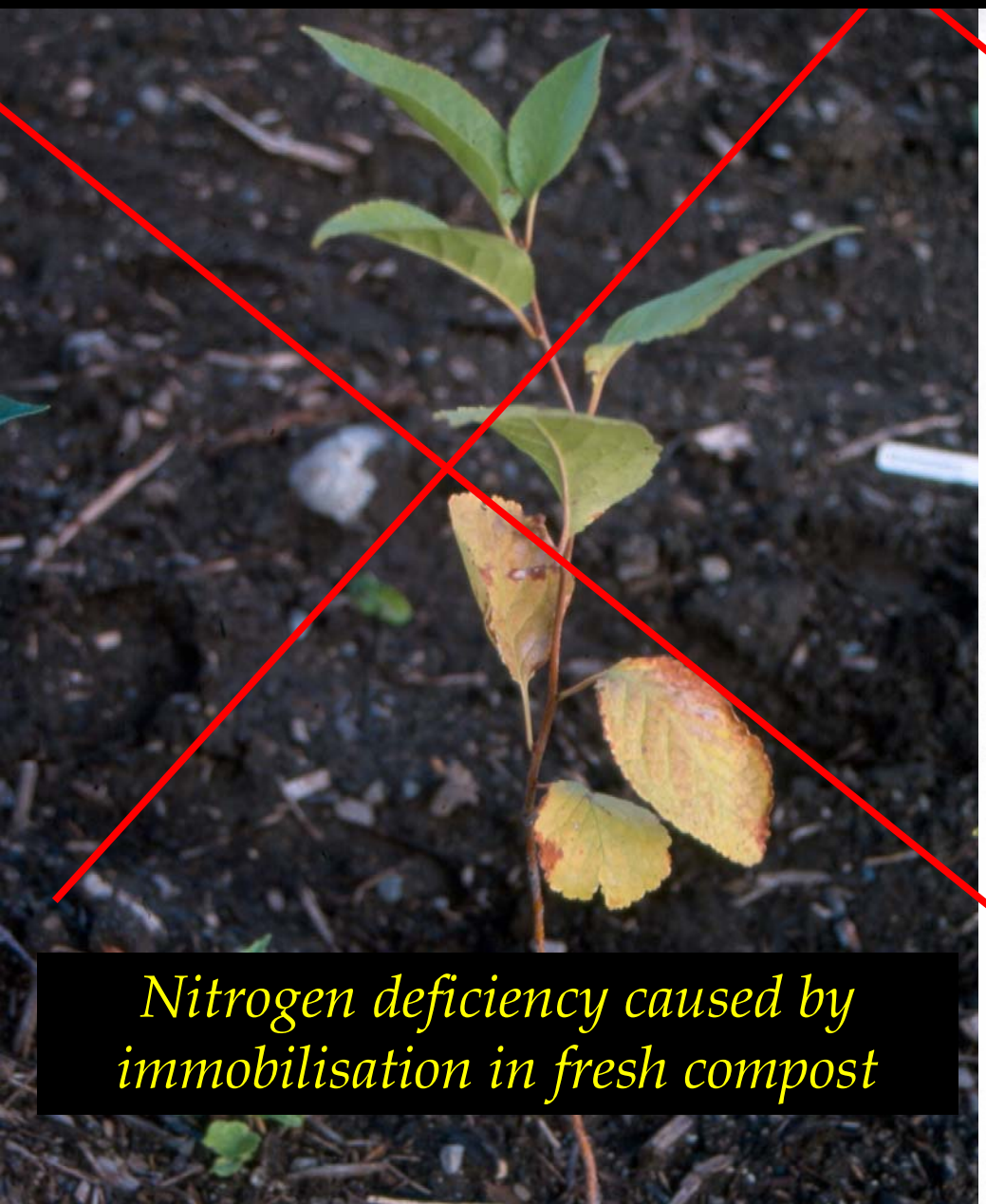
2008 trial: Impact of fertiliser placement

Measure	Leaf N (July 31)	Chlorophyll (SPAD Jul 31)	Leaf area (Access Oct 31)	Top weight (dry Oct 31)
Mulch treatment (none, coco fiber, crumb rubber)				
Fertiliser product (nutricote, osmocote, plantacote)				
Fertiliser placement (on media, above mulch, under mulch)				

2008 trial: Impact of fertiliser placement

Measure	Leaf N (July 31)	Chlorophyll (SPAD Jul 31)	Leaf area (Access Oct 31)	Top weight (dry Oct 31)
Mulch treatment (none, coco fiber, crumb rubber)	Not sig.	Not sig.	Not sig.	Not sig.
Fertiliser product (nutricote, osmocote, plantacote)	Not sig.	Not sig.	Not sig.	Not sig.
Fertiliser placement (on media, above mulch, under mulch)	Significant	Not sig.	Not sig.	Not sig.

Impact is not immobilisation but irrigation



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RE-ENTRY TIME: N/A.

PACKAGE SIZE: 25 kg.

"Controlled release is unaffected by rainfall or irrigation"

QUICK SHEET

Water is required to release from prills

Fertilizer prills were removed

Prills were analysed for residual fertilizer

Comments

1) Mulches and disks provide effective weed control
in nursery container production.

2) The method is cost effective
for greenhouse production of high value plants, or
outdoor production of single-stem slow growing plants.

3) Fertiliser placement *on top* of the mulch or disk
results in less plant fertilisation compared to placement *under*.

4) The difference in plant fertilisation
is not from binding of nutrients in the mulch or disk
but likely from reduced nutrient release from the dryer surface.