

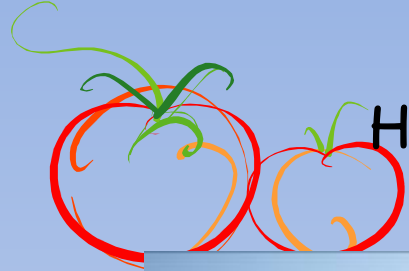


Managing tomatoes and peppers in high tunnels

ACORN- November 2015



Christine Villeneuve, agr.
MAPAQ Ste-Martine



High tunnels in this presentation refer to those structures

Seasonal caterpillar tunnel



Cold greenhouse and tunnel



Seasonal multibay high tunnel



CHOOSING A TOMATO CULTIVAR , YOU MAY CONSIDER



- Adapted to the climate and the structure (determinate vs indeterminate) with high yield potential
- Tolerant to major diseases ex: leaf mold. Few are available for indeterminate and none for determinate.
- Offer tomatoes for a long period: choosing early and mid-season
- Adapted to your customers



Tomatoes trials for traditional Red round tomato cultivars -2013/2014



Merci à toute l'équipe qui a rendu ce projet possible !

Semences SeminoVA- César Chléla, Hélène Valois
Semences Norseco – Claudine Beauchemin, Christine Ruckstuhl
Semences Enza Zaden – Dominic Bouchard

17 producteurs(trices) répartis dans 8 régions
10 conseillers(ères) horticoles du MAPAQ
Conseillère Dura Club, Pleine Terre

Programme P~~A~~D~~A~~A~~R~~ régionaux du MAPAQ

Variety Evaluation

50 % agronomic performance

50 % fruit (25 % taste and texture + 25 % internal + external look)

Isogenic indeterminate tomatoes have higher sugars than determinate tomatoes.

*John Jay W. Scott
Univ. Florida*

High sugars correlate with small fruit size

↑ Sugar → ↑ Aroma intensity

(Baldwin et al., 1998; Malundo et al., 1995)

Site (type of soil, irrigation, sunlight, night and day temperature ...) can make a big difference on the taste for the **same cultivar**



**CATERPILLAR TUNNELS HAVE USUALLY 3 ROWS ,
WITH 2 DIFFERENT CULTURAL HEIGHT POTENTIAL**



Semi-determinate (sold as a determinate) for Caterpillar-

Home ✦ Vegetables ✦ Tomatoes ✦ Defiant PhR



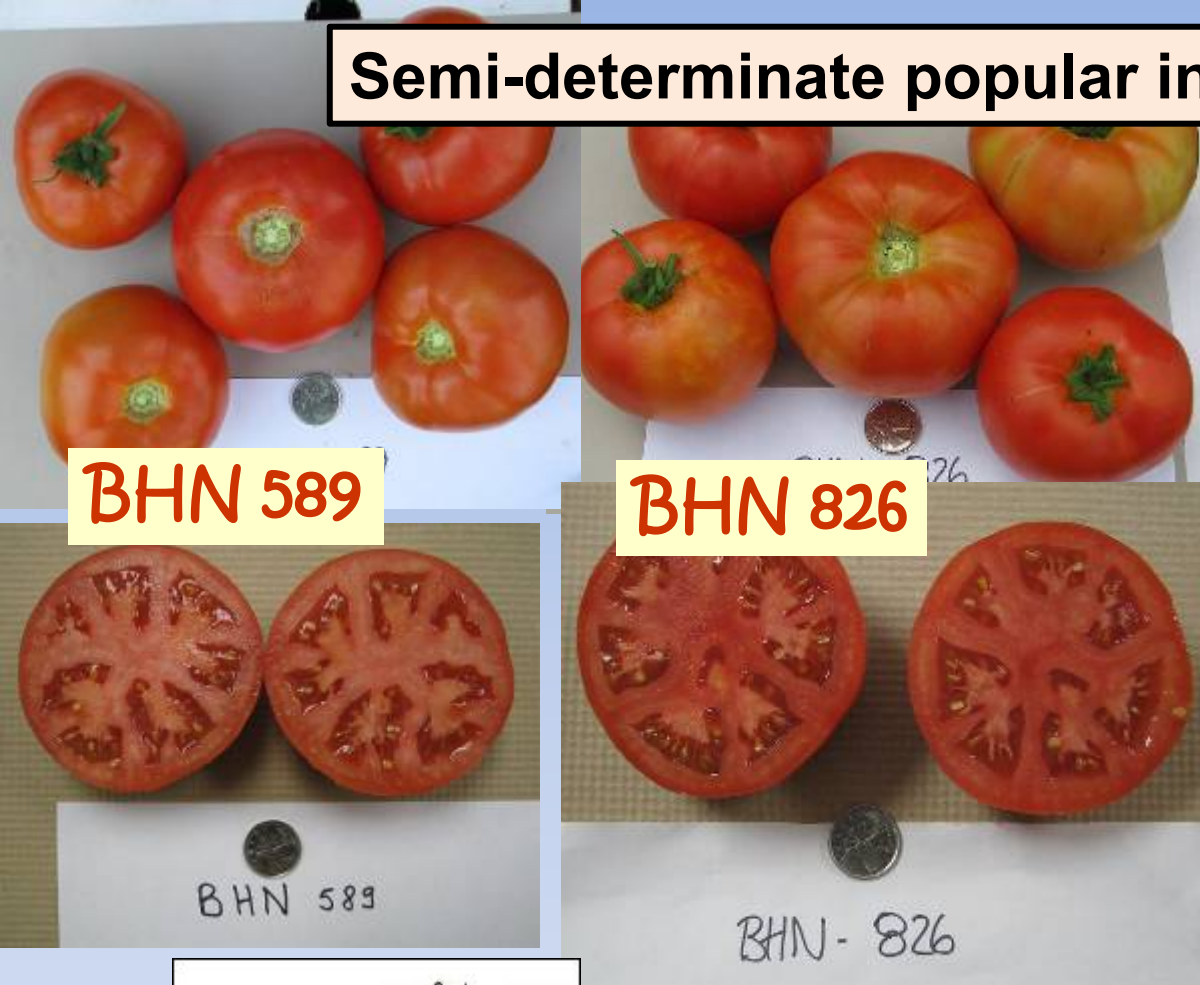
DEFIANT (f1) Early . Nice medium fruit 200g. Taste is medium to good. Plant 2,5- 3 feet high.



CELEBRITY (f1) and **MONTAIN SPRING MID-SEASON** . Bigger fruit 225 g and higher plant 3,5 feet . Excellent post harvest for Mountain Spring which is a popular field tomato well adapted to caterpillar tunnels.



Semi-determinate popular in USA in high tunnels



Variety adapted to
your customers



Tolerant to leaf mold

Big – 250 g Mid-Season : 75 jrs. Good but the texture isn't there for the Quebec consumers. They are « meaty, not very juicy with no acidity »

Tasti – Lee™ : strong determinate popular in USA

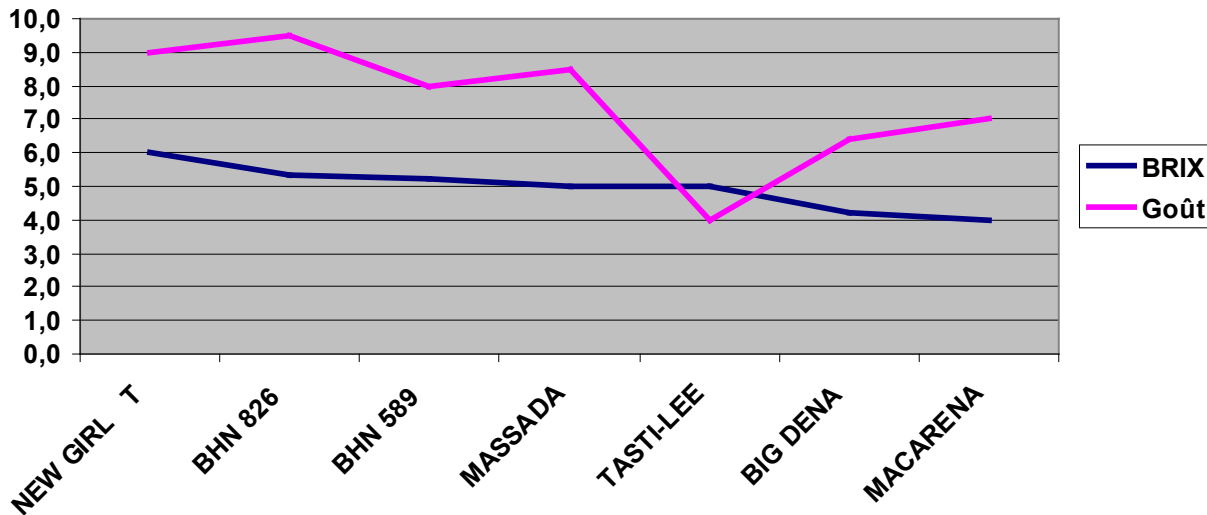


Released in 2006 to compete with the commercial standard of Florida tomato field. Get the high lycopene crimson gene : a nice internal red color . Interesting for tomato slicer in restauration.

In Quebec :Taste 5 on 10
 Sugar taste with low aroma intensity



Relation entre le Brix et la saveur pour 7 variétés de tomate ronde



Tasti-Lee Other Variety



Indeterminate

MACARENA



Beef tomato 250-300 g, excellent yield, good taste adapted to minimum heated greenhouse or hoop house mid-season. Perform in northern and southern part of Quebec



syngenta®



Sold as tolerant to leaf mold but some resistant strains observed in Quebec



Fiorentino



Indeterminate

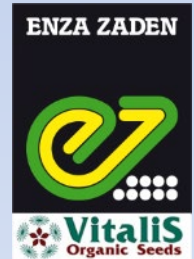
FIorentINO



Beef 250g , juicy and good , excellent yield and quality on a long term. Mid-season. Perform in northern and southern part of Quebec. Good conservation on the plant.



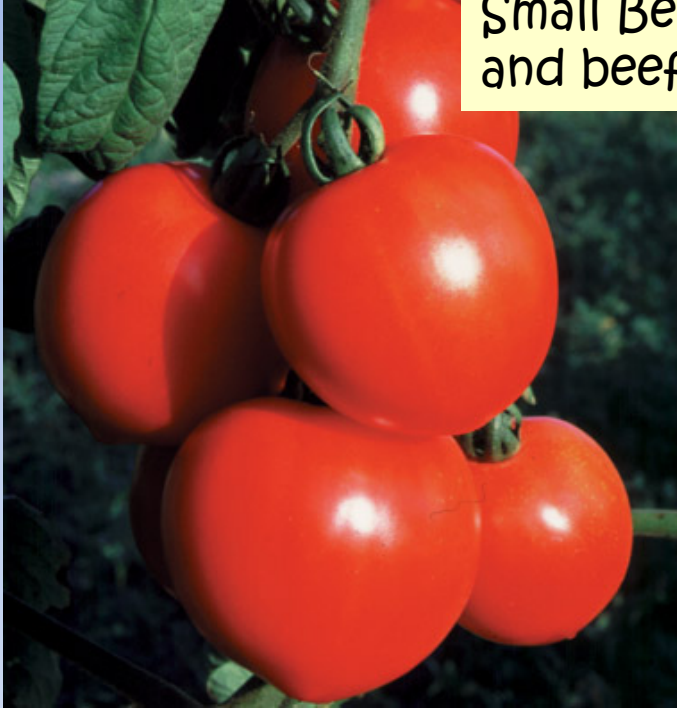
Has some tolerance to leaf mold but not sold like that.



Indeterminate

NEW GIRL

Small Beef : 170 g (between cluster and beef), special shape



 **Johnny's**
Selected Seeds
An employee-owned company

EARLY, excellent yield and quality on a long term, excellent taste. Popular in caterpillar tunnels. Fruit has a good conservation on the plant.

Éliot Coleman variety- Maine



Not tolerant to leaf mold

Beef to try- if you are concerned with leaf mold

CAÏMAN CAÏMAN

Indeterminate



CAÏMAN



Tolerant to leaf mold



Beef tomato 250g , good taste , less productive than Fiorentino and Macarena. Fruit size and shape are irregular. Mid season.



**Indeterminate popular in USA in high tunnels
Tolerant to leaf mold**

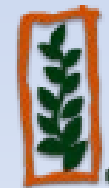


Beef ribbed tomato 270g ,
excellent yield. Mid season
Meaty and not tasty



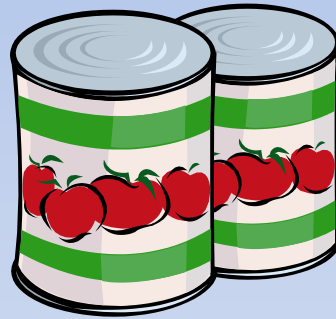
Tolerant to leaf mold

MONSANTO



De Ruiter™
Sharing your passion.
Seeding your success.

Italians



Indeterminate Italian



Big italian 130 g. good ,
excellent yield, nice fruit and
high quality on a long term,
Perform in northern and
southern part of Quebec.
Good conservation on the
plant. Mid-Season

GRANADERO



**Little tolerance to
leaf mold if the site
isn't badly infected.**



It's not a secret that High Tunnel is **THE SOLUTION** against bacterial diseases of **FIELD GROWN** tomato

Bacterial speck



Bacterial canker



Leaf mold is the most frequent fungus observed in HT

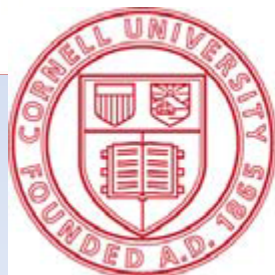
Leaf Mold - early symptoms



Early leaf mold symptoms: yellow spots on surface of leaf.



Typical early leaf mold lesions: yellow on top of leaf, brown and sporulating on underside



Cornell University
Cooperative Extension

Leaf mold *Fulvia fulva* rarely a problem in multibay high tunnel and field.



Well ventilated



Choosing a good site for multibay tunnels with a natural air circulation is a MUST. A little slope will help

This site was too much exposed to heavy winds.
The structure collapsed last spring



Leaf mold *Fulvia fulva*
Thrives well when
Relative Humidity RH > 85 %



Carterpillar tunnels are not high, can be long, narrow and the ends are closed. The lateral ventilation has to be optimal.



Picture: Claude Berthélemé

To improve lateral ventilation
altern hooks 6 feet, 4 - 5 feet.



Leaf mold and permanent structures

Conidia of the fungus can survive in the soil for 1 year without a host plant (tomato is a obligatory host).



In minimal heated or cold greenhouse, the leaf mold could be a real problem year after year after year. Rarely, will natural air circulation be sufficient to lower the RH below 85% which cause condensation and disease problems.

- Air circulation : - convention tube
 - Horizontal air flow system HAF
- Air exchange : - exhaust fan with a good rate of air exchange



Control Leaf mold

- Fungicide sprays, including copper, have not proven effective in stopping the spread. Sporulation occurs on the underside of the leaves making it difficult to achieve adequate spray coverage.
- At the end of the season, take off diseased plants, burn them or put them far enough – min 100 m.



- **Control Leaf mold**

Geotextile should be washed with high water pressure in order to eliminate contaminated crop material. Caterpillar tunnels provides rotation and sanitation of the site. Don't bring inoculum on the new site.



Control Leaf mold- Cultivars selection

Indeterminated limited, no determinate, no heirloom

Some varieties resistant to Leaf Mold

Sources are included for grower reference, no endorsement is expressed or implied for these seed companies.

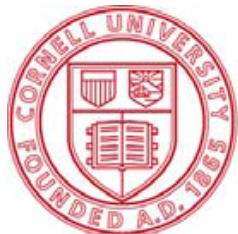
Key to abbreviations: **EZ**-Enza Zaden, **H**-Harris, **J**-Johnny's, **Sa**-Sakata, **Se**-Seminis

Cherry/Grape Type

Favorita (J)
Golden Sweet (J)
Pareso (J)
Picus (determinate, Roma) (Se)
Sakura (J)
Sunpeach (pink) (J)
Sweet Chelsea (Sa)
Sweet Elite (grape) (Sa)
Sweet Gold (yellow) (Sa)
Sweet Hearts (Sa)
Sweet Treats (pink) (Sa)
Viva Italia (determinate, pear) (Se)

Salad/Slicers

Bellini (Sa)
Beorange (orange) (J)
Caramba (Se)
Clermon (truss type) (J)
Rebelski (J)
Geronimo (J)
Panzer (H)
Pink Cupcake (Sa)
Pink Wonder (J)
Primo Red (determinate) (H)
Poseiden (pink) (Se)
Rally (determinate) (EZ)
Rebelski (J)
Red Deuce (H)
Rossini (Sa)
Tomimaru Muchoo (pink) (J)
Truss (J)



Cornell University
Cooperative Extension

Some popular varieties that are susceptible to leaf mold

(this is a partial list, not comprehensive)

Arbason
Big Beef
Brandywine and heirlooms

Fact sheet 2014

<http://www.hort.cornell.edu/hightunnel/crops/pdfs/Leaf%20Mold%20on%20Tomatoes%20-%20final.pdf>

MACARENA

High Resistance:Ff: 1-5 /

Indeterminate tolerant varieties are not a silver bullet.
The pathogen continues to mutate into new races.

12 races of leaf mold have been identified until now.





Why grow colored pepper in tunnels ?

Is it worth the investment ?

Some commercial varieties offer good resistance to 3 races of *Xanthomonas campestris* – Bacterial spot



Structures most of the time opened



Structures that optimise solar energy



Impact of "High Tunnels" on red pepper yield and earliness

	Plantation	1rst harvest	¹ Estimation of earliness vs field grown	² kg/m ²
Field grown	End of May beginning of June. No plantation in northern areas.	End of August, beginning of		2,8
Structures most of the time opened (<i>caterpillar, Multibay High tunel</i>)	End of May , beginning of June	Sept.	0 -10 days	5,2
Structures that optimise solar energy (<i>greenhouse, tunnel, some Multibay High Tunnel</i>)	Mid to end of May	End of July , begining of August	10- 20 days	7,3

2014

¹ Discussion with various growers in Quebec

² Datas from different Quebec projects

Mobile Caterpillar opened most of the time

Late colored pepper and good yield



Plantation: 22 May
Late harvest: 21- 28 of August = field
No stake, saving 0,50 \$/m²
Yield **5 kg /m² = 1,7 kg/plt** = staked pepper in other caterpillar (no rain lost)
Field mecanisation (bed formation, plastic, plantation)

No Rain lost



Permanent tunnel 14'x 44' x 8,5 ' high

- Keep the heat = 1 crop
- **Best yield 12 kg/m² = 2 kg/plant 2014**
- **6 kg/m² = 1,2 kg /plant 2015**
- **EARLINESS:** Planting: June 2
Harvest: Aug. 9
- Big transplants seeded 72 cells, transplants in 18
- Excellent management of irrigation, fertilisation, and environnement control



Colored pepper

The season as the agronomic practices can make a big difference

IRRIGATION



WEIGHT PROPORTION OF WATER IN TOMATO FRUIT IS BETWEEN 90 AND 95 % AND FOR PEPPER FRUIT IS AROUND 90 %. FRUIT ARE MOSTLY WATER !



Bad irrigation management

It's easier to see quality fruit losses than yield not harvest !

It's not because a plant can withstand drought that there are no yield lost !



Penn State Extension

Ten Reasons Not To Grow Tomatoes in High Tunnels

Posted: January 31, 2014

Every good reason to grow tomatoes and other high return vegetables and small fruits in high tunnels has a compelling argument to counter it. These potential pitfalls of tunnel culture are seldom mentioned in the rush to put a high tunnel on every farm.

While there are many excellent reasons to grow tomatoes and other high dollar return vegetables and small fruit in high tunnels, there are some very compelling arguments against them too. These are seldom mentioned in the rush to put a tunnel on every farm. These are some of the more important negative aspects of tunnel culture.

Return on investment

Simply put, input costs are substantially higher in a tunnel versus the field. After amortizing the costs of the structure, the plastic film and other specialized equipment that are required to effectively produce in a tunnel, the field planting has much lower input costs. Yes, increased yield, quality or market window can justify the increased costs of tunnels. However, we have observed in some situations poorly managed tunnels yield equal or less than field plantings. Consider carefully what every square foot of production space is worth and manage with the goal of justifying the increased input costs.

Increased risk

Greenhouses and High Tunnels are typically engineered carefully to balance the environment versus the need to keep material costs low. Metal tube structures do fail as do crops. Between your investment in the tunnel itself, the costs incurred in producing a crop and your anticipated return on investment, growing in protected culture requires a greater attention to details and pest management in order to realize economic goals.

Increased pressure from insects and arthropods

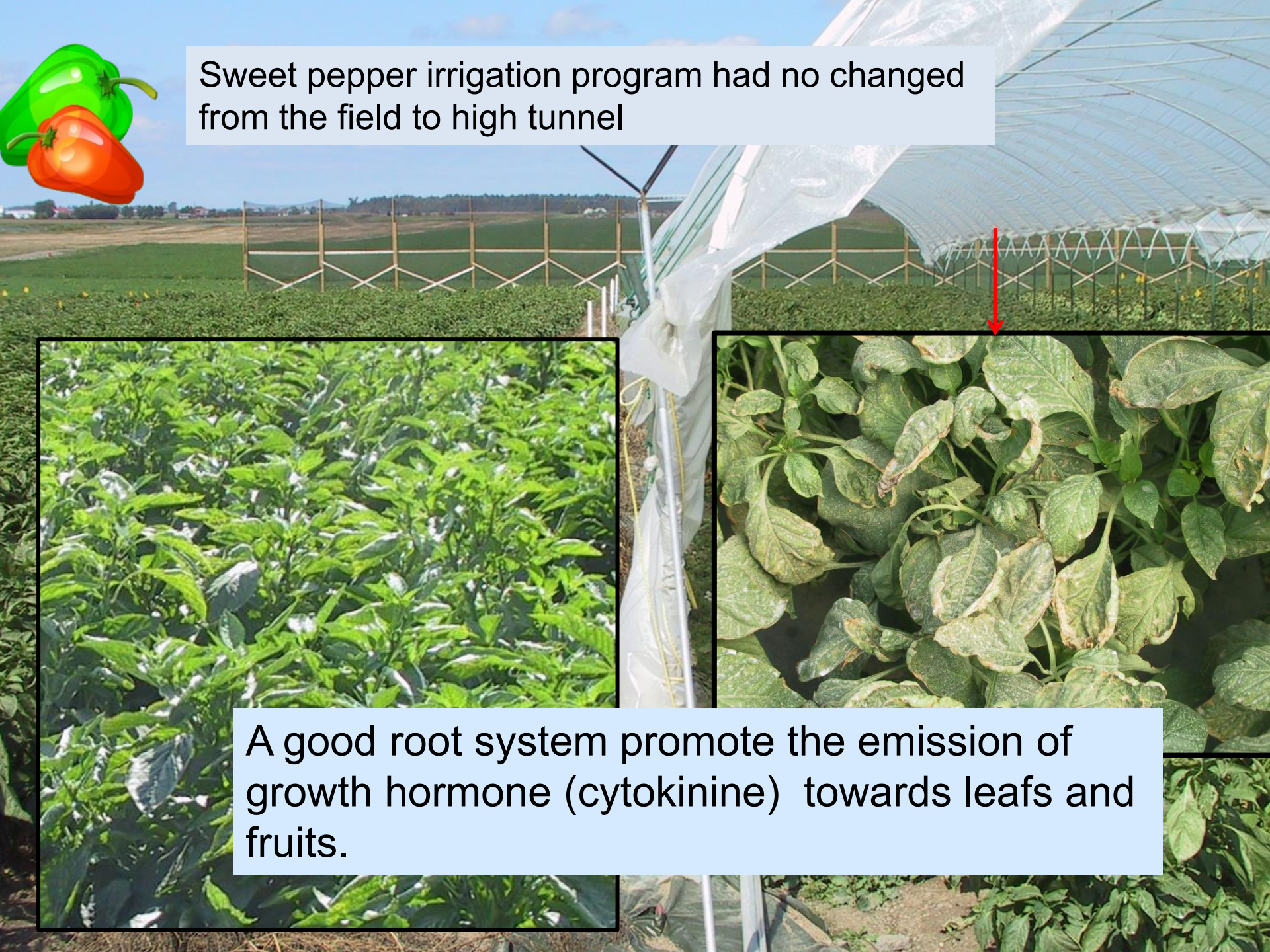
While tunnel culture brings with it the opportunity for higher crop quality, Aphids, Whiteflies, Western Flower Thrips, Spider mites and Broad mites all thrive under tunnel conditions. The dry foliage, stems and fruit grown under intense irrigation and fertigation are ideal environments for these pests to flourish. Scout regularly for pests and consider a proactive pest management that includes banker plants such as Black Pearl and Purple Flash peppers hosting Minute pirate bugs (Orius). Every crop reacts differently under tunnel conditions versus field grown. With no rainfall, Spider mites can increase populations incredibly rapidly unless carefully managed.

Irrigation management requires greater care vs. field grown

Irrigation :
4th reason out
of 10



Sweet pepper irrigation program had no changed from the field to high tunnel

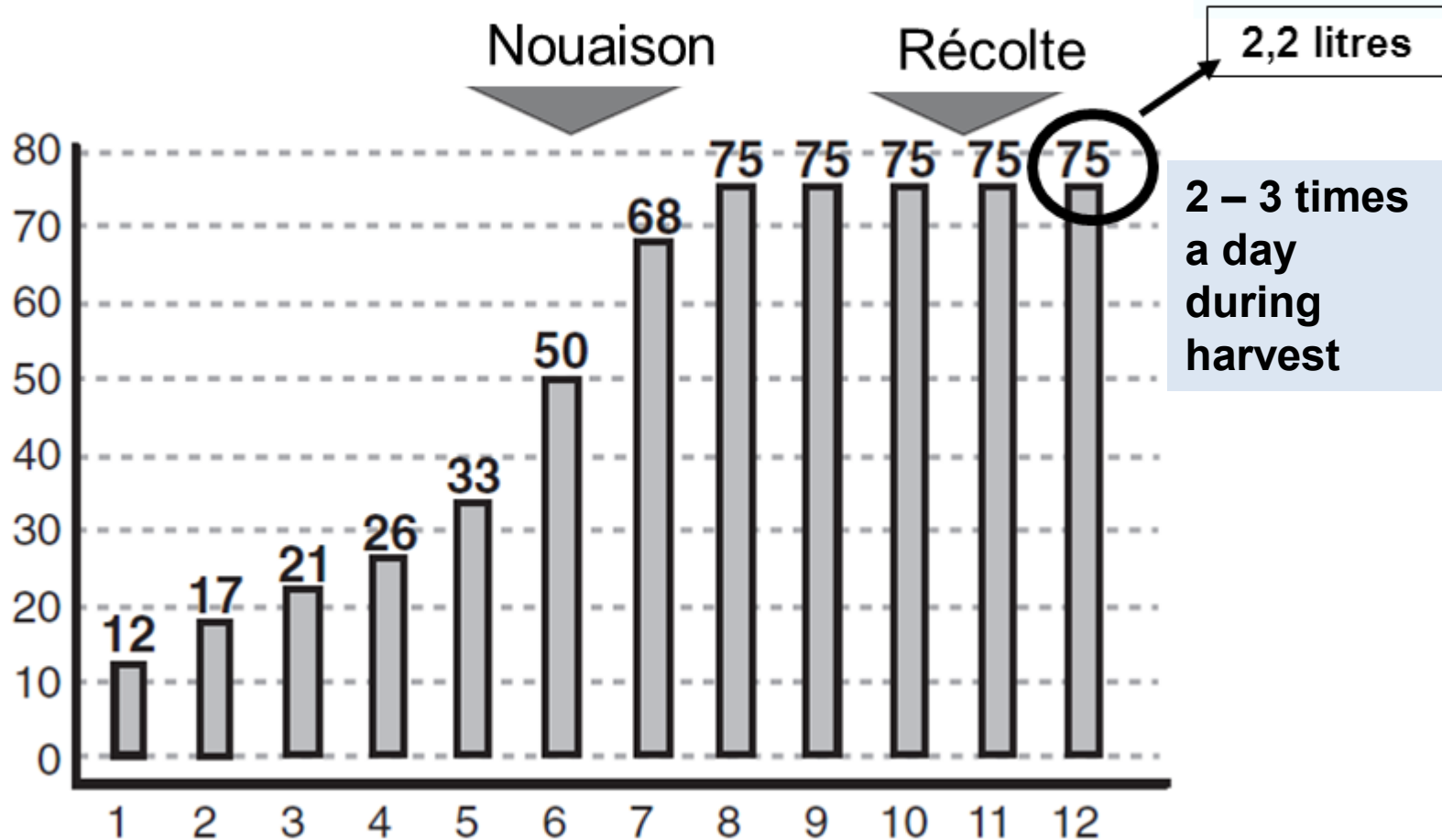


A good root system promote the emission of growth hormone (cytokinine) towards leafs and fruits.

Evolution des besoins en eau tomates en tunnels au Missouri



Besoin en eau
(onces/plant/jour)



10 fl.oz = 295 ml

Semaines après plantation

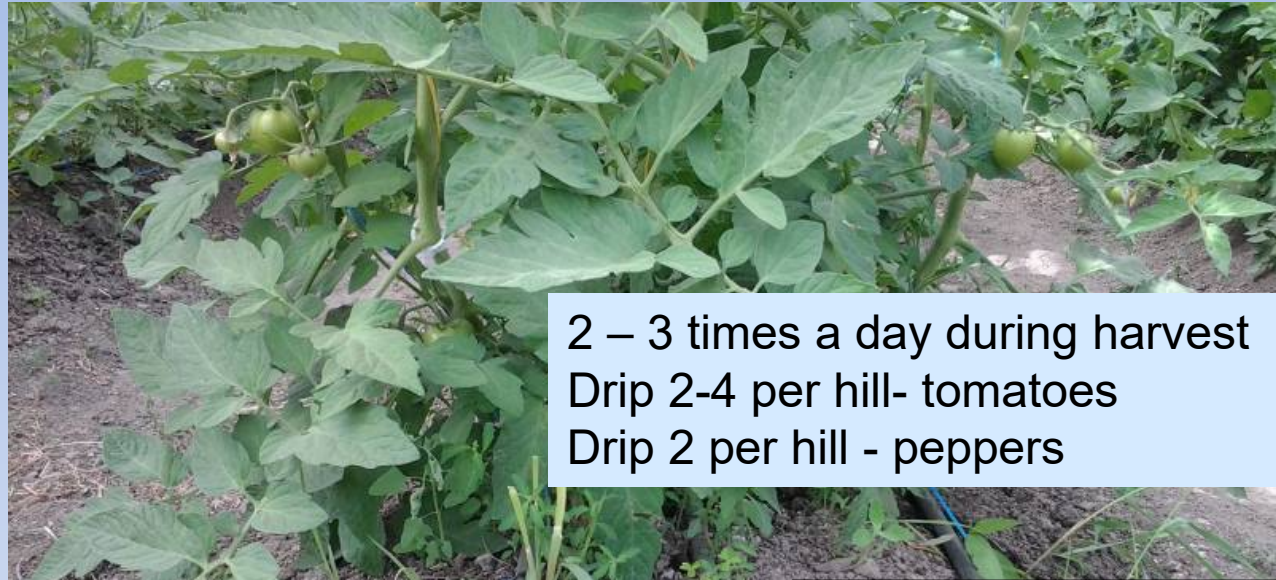
Source: W. Jett 2006

Merci à Daniel Bergeron,
MAPAQ

Two tensiometers:

First tensiometer (when to start watering): 3-4 inches depth

Second tensiometer (when to stop watering): 7-8 inches (match the compaction zone)



2 – 3 times a day during harvest
Drip 2-4 per hill- tomatoes
Drip 2 per hill - peppers



Very few watering after plantation :350 ml/plant/day
Depending of weather : wait a few days before
irrigating again

Harvest:2,2 l/plant/jr

Have a look at roots and soil moisture
2 – 3 hours after and irrigation



Pepper doesn't have the same capacity than tomato to recuperate after a drought stress.



More drip for more food especially in organic production

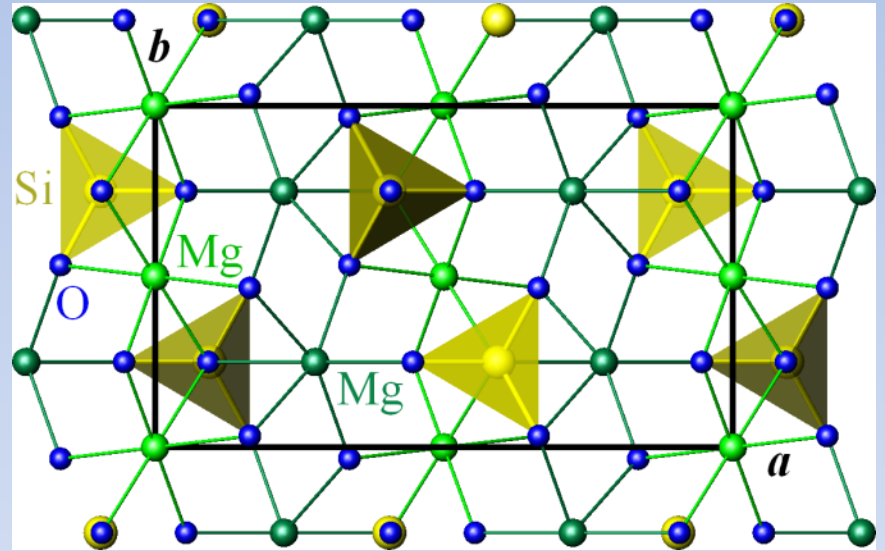
Roots must be well developed on the entire width of hill.
Actisol (dry hen manure) is applied on the entire width
Water is not provided on the hill width

Merci À Daniel Bergeron
Josée Bonneville, MAPAQ

Same fertilisation for peppers grown in caterpillar tunnels
2 drip lines per bed everywhere but outside rows received rain water by capilarity, N became more available to the roots.



A FEW THINGS ABOUT FERTILISATION



THE FIRST PLANT TO FERTILISE IS YOUR TRANSPLANT , IS YOUR FUTURE

Good start, for a possible early and heavier yield



Some organic growers seed in 72 cells ,
transplants in 18 cells at 8 - 10 weeks old.
May not need to harden transplants for HT as
you do for field production.

Example of a soilless media for
transplantation : Fafard Agromix
bio 02 or 06 : 2/3 + Compost bio
de Fafard (Biosol or Biofor) 1/3 +
Actisol (5-3-2) Dry hen manure



Quebec : New fertilisation guide for 2016

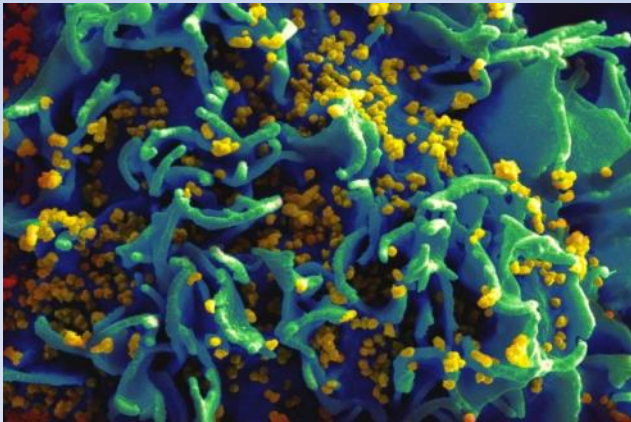
New guidelines

140 à 200 unités de N/ha poivron, indetermined tomato

140 à 170 unités de N/ha determined tomato.

In organic production, the answers are not that clear. Green and animal manures , compost are more common than in conventionnal agriculture. Soil life could be more active and more complex. Testing soil have their limits. Limited knowledge about the soil's biological activity.

Secret life of the soils



EFFECT OF DIFFERENT AMOUNT OF NITROGEN ON PEPPER YIELD

Traitements (kg N/ha)	Total Yield (kg/m ²)	Marketable yield(kg/m ²)
	Farm 1 : new site 3 years operation	
135	3,4a	2,4a
165	4,0	3,3b
195	4,5b	4,4c
	Farm 2 : 15 years-long history of green, animal manure, compost	
135	7,4	5,9
165	6,6	5,2
195	7,1	5,7

SPRINTER RED PEPPER 2014 : POWER OF WATER, FERTILITY AND PLANTING GOOD TRANSPLANTS

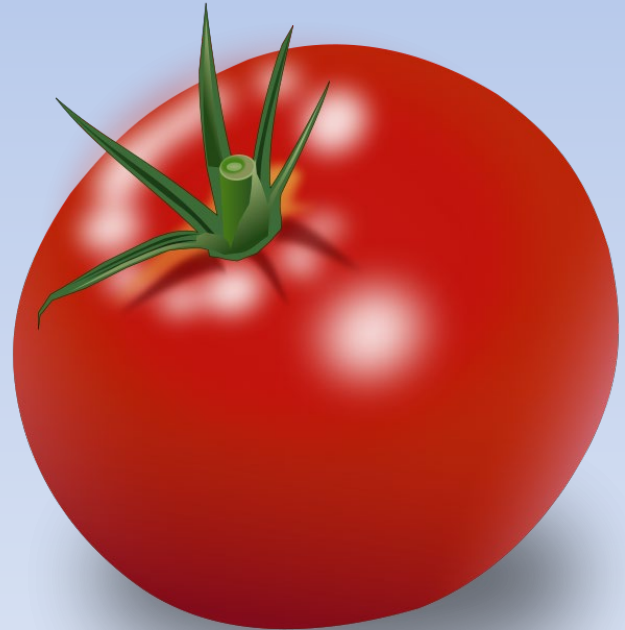
2 farms were deficient
1,2 kg/plant or 4,6 kg/m²

4 farms optimised
1,7 kg/plant ou 6,6 kg/m²

43 % yield



WHICH INTERSPACING IS THE BEST FOR TOMATO PRODUCTION ?



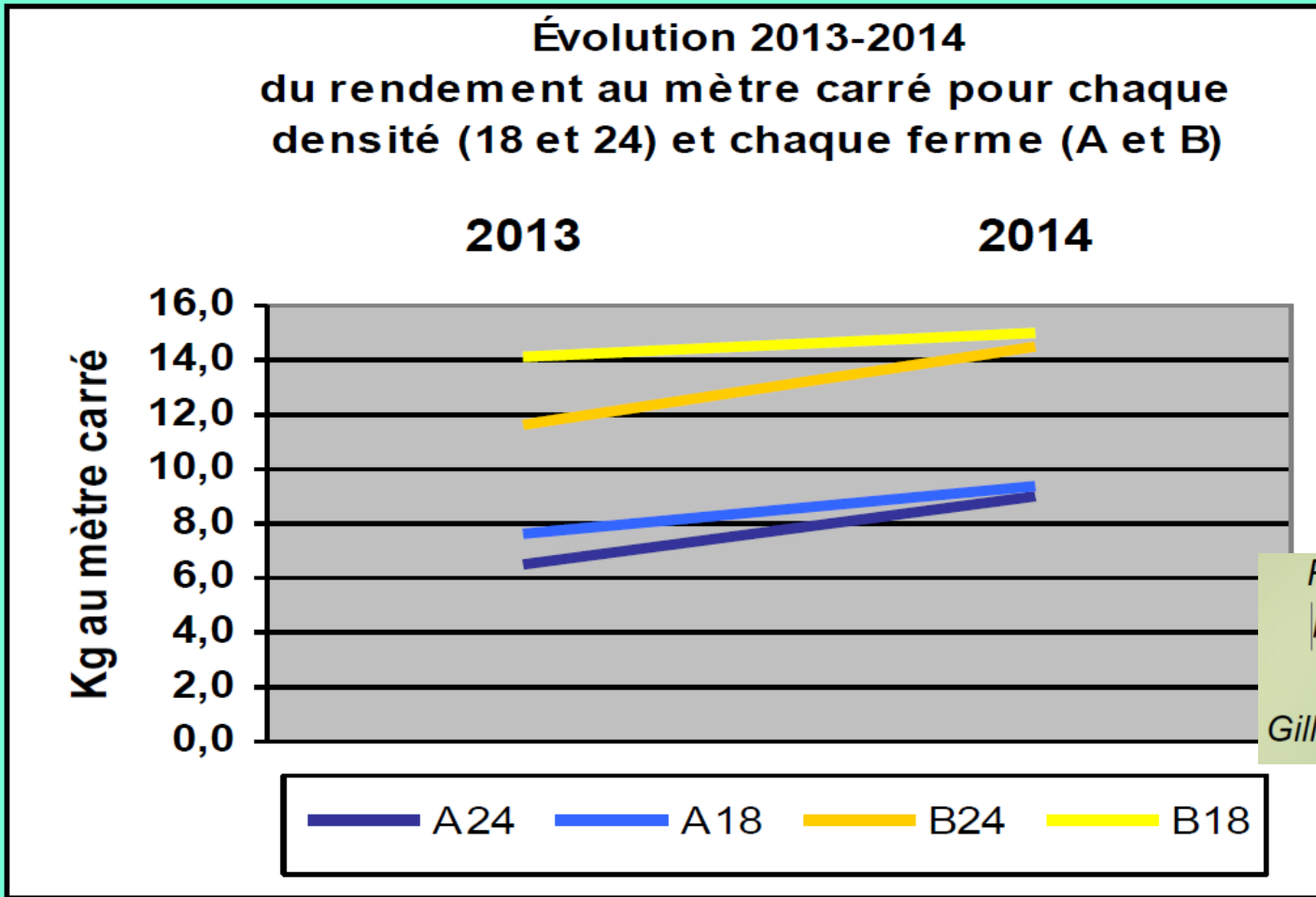
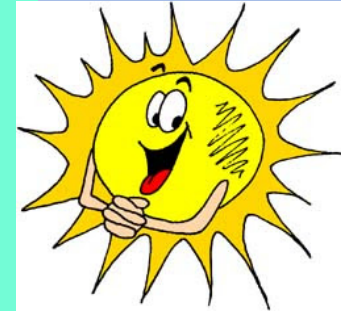
Interspacing 18 vs 24 inches

**Indeterminate Big Beef (non grafted)
and Rebelski (grafted) grown on 2 heads**

Photo :Christiane Cossette

*Merci à Gilles Turcotte, Fermes Val au vent et Vert Mouton
Fermes A et B du Bas St-Laurent
Projet INNOVBIO -02-inno1-03*

Indeterminate tomato : different answer depending on weather season



Producteur maraîcher
Ferme Val-aux-Vents
Gilles Turcotte, agr., M. Sc.

2013 : weather cool, high density a lot better and net revenue higher
2014 : optimal weather, high density a little better and net revenue equal
or a bit inferior at one farm

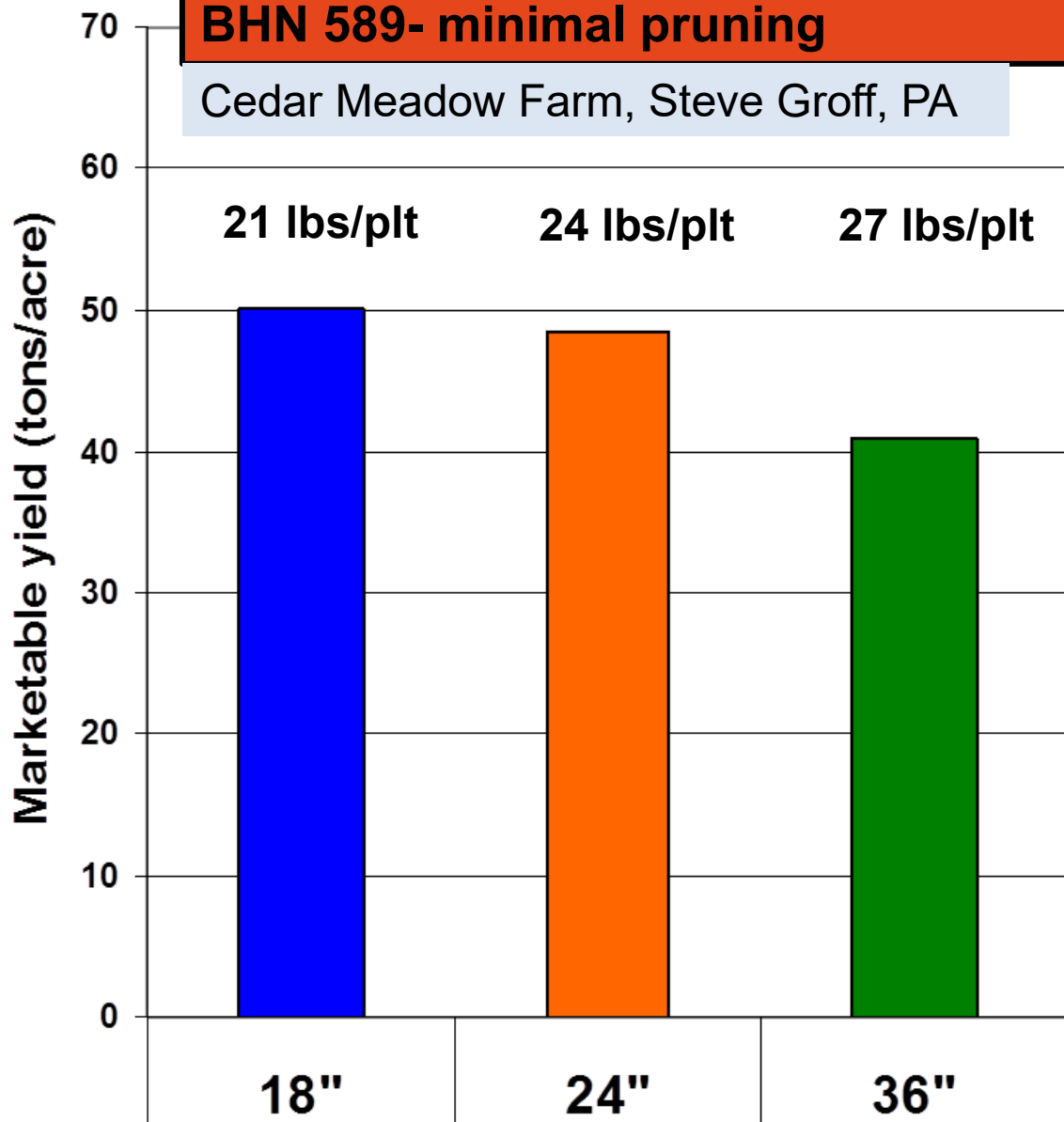
Interspacing 18 inches vs 24 vs 36

BHN 589 :strong determinate variety with minimal pruning : keeping the strong sucker under the 1st flower cluster. A lot more foliage than growing them on 2 heads (indeterminate)



Marketable fruit weight BHN 589- minimal pruning

Cedar Meadow Farm, Steve Groff, PA



WHICH INTERSPACING IS THE BEST FOR TOMATO ?



Nobodody can predict the weather for the summer. Choosing between 18 and 24 inches is a good choice

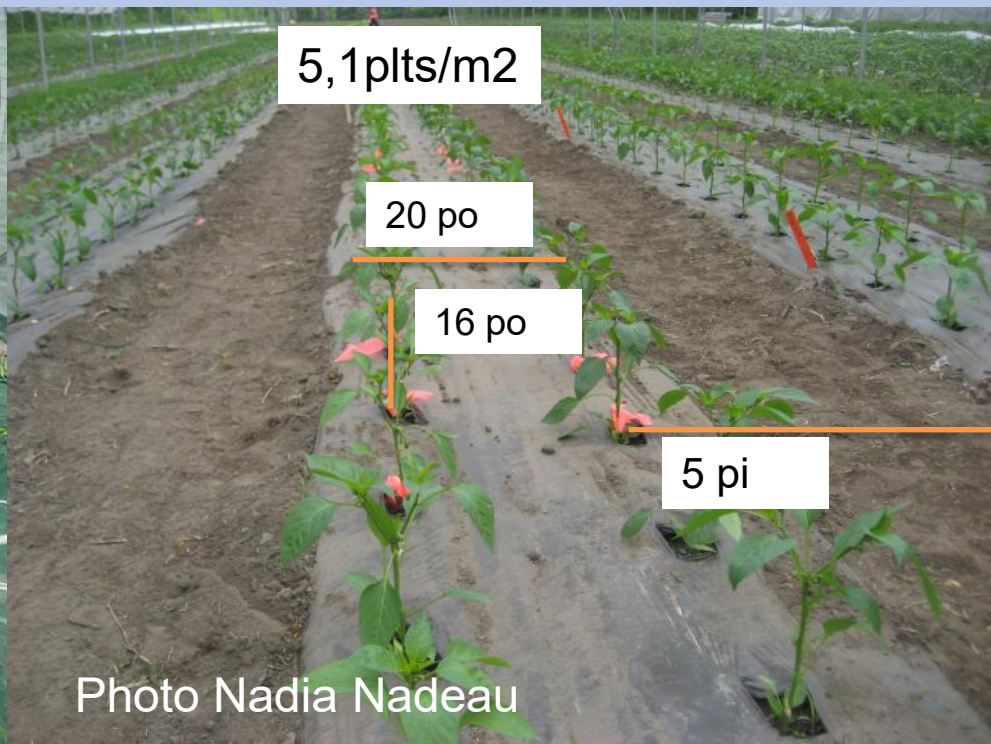
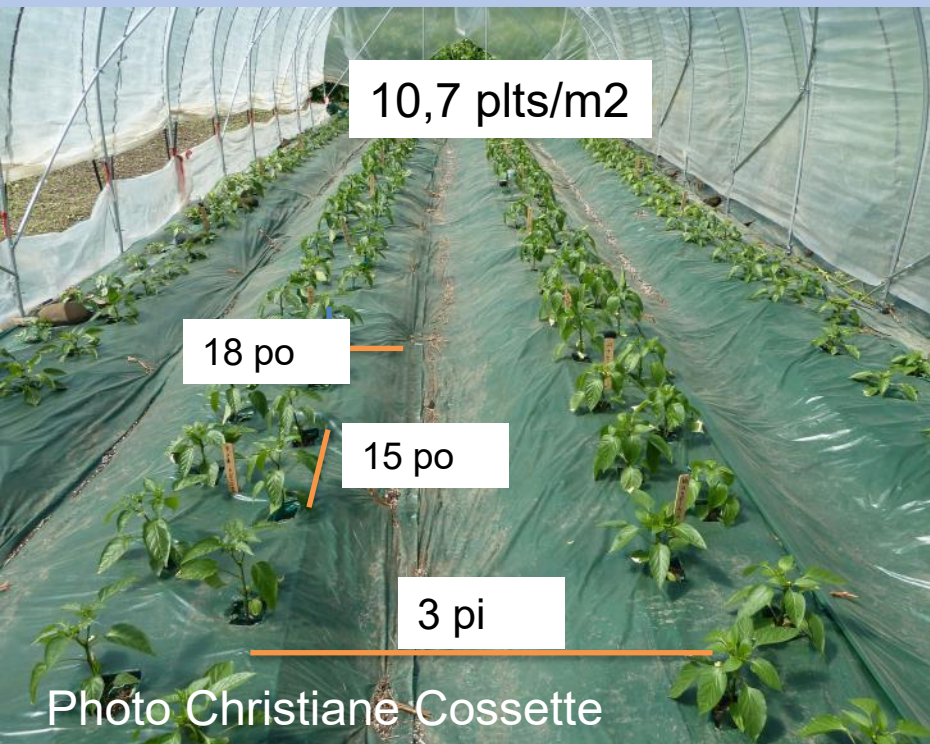
Quebec growers interspacing are : 18, 20 and 24 inches

Maybe 20 inches is a good compromise for all: for indeterminated, strong determinated cultivars, grafted, ungrafted, multihead or 2 heads plants.

WHICH INTERSPACING IS THE
BEST FOR PEPPER?



Sprinter red pepper 2014			
Structure	Interrows	kg/plt	kg/m2
Fixed tunnel	you choose	1,9	10,7
Multibay high tunnel	mecanised , same as field	1,7	5,1

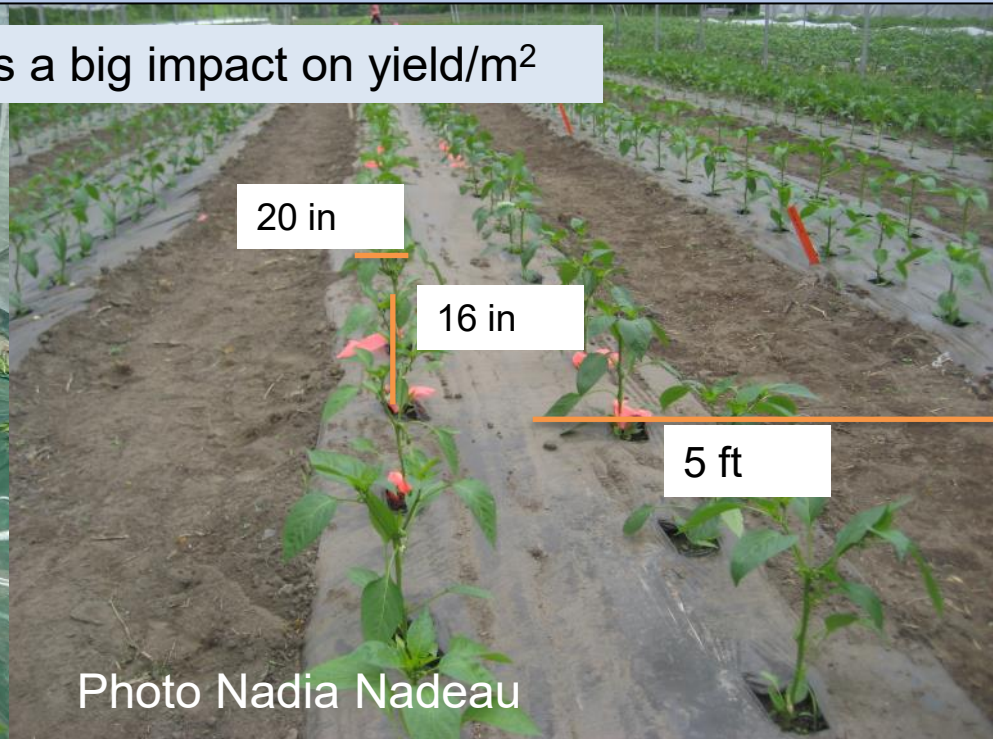


2014 Observations / 2015 Density Trials: 12 in. to 17 in.

15 in. (38 cm) to 17 in. (43 cm) seems to be the ideal spacing for the majority of the farms based on the season, practices and varieties.

- < 15 in. : For one farm it was not interesting because of the cost of the transplant and for the other farm it did ok
- > 17 in : could potentially lower the yield per m²

The row spacing has a big impact on yield/m²



WHICH INTERSPACING IS THE BEST FOR PEPPER?



The weather has more influence on yield than spacing
2014 favorable: average 1,7 kg/plant
2015 less favorable : average 1,3 kg/plant



15-17 inches is a good spacing that fits a lot of situations.
Better to improve irrigation, fertilisation and good soil structure.

Impact of "High Tunnels" on red pepper yield and earliness

	Plantation	1rst harvest	¹ Estimation of earliness vs field grown	² kg/m2
Field grown	End of May beginning of June. No plantation in northern areas.	End of August, beginning of Sept.		2,8
Structures most of the time opened (<i>caterpillar, Multibay High tunel</i>)	End of May , beginning of June	End of August, beginning of Sept.	0 -10 days	5,2
Structures that optimise solar energy (<i>greenhouse, tunnel, some Multibay High Tunnel</i>)	Mid to end of May	End of July , begining of August	10- 20 days	7,3

2014

¹ Discussion with various growers in Quebec

² Datas from different Quebec projects

Pruning and training tomatoes

Indeterminate

Continuous growth:
6-7 leaves + 1st cluster
Each 3 leaves = a cluster

Strong determinate

After 3rd or 4th cluster, lost of vigor



Pruning and training tomatoes

Pruning suckers

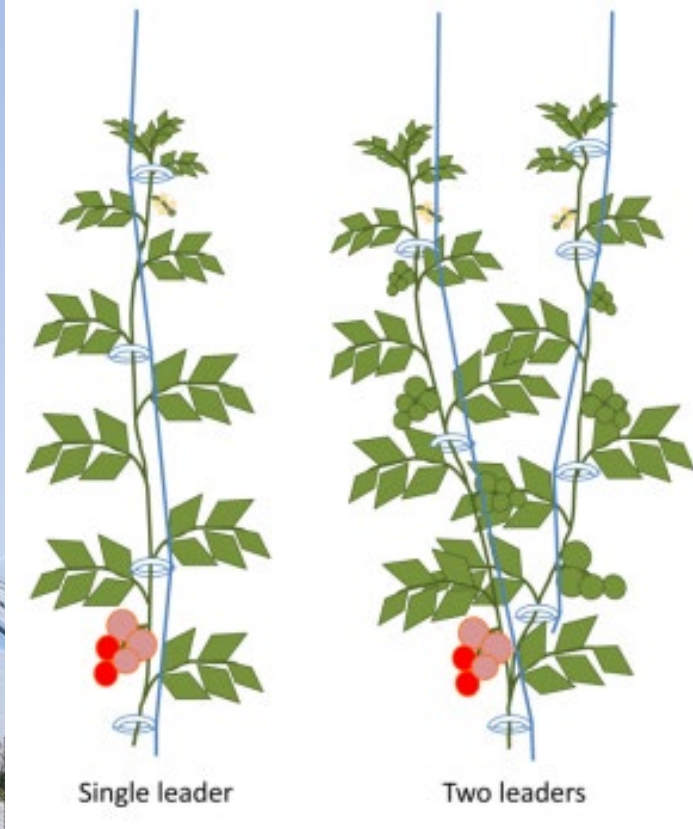
- For greenhouse during winter months essential because of the low luminosity, it helps giving light in the plants.
- Earliness, specially with grafted plants
- Bigger fruit and more consistant size
- It can help ventilation and has a certain control on disease



rustica.fr

The bigger the leaf / fruit ratio is, the best taste you get- cherry tomato
Extra pruning lower that ratio and can negatively affect taste

Pruning, training indeterminate tomatoes and type of structure



Pruning, training indeterminate tomatoes and type of structure

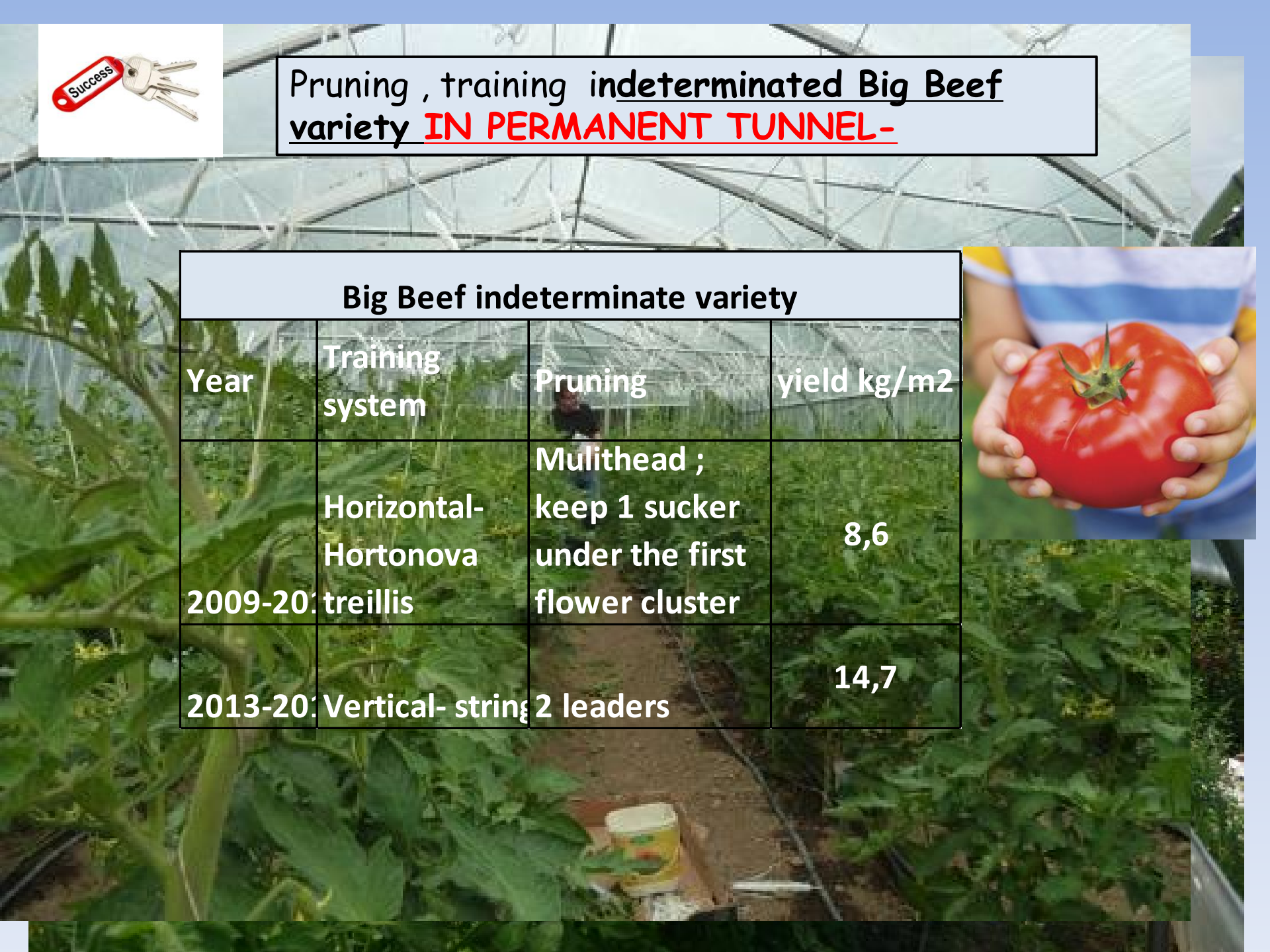
Multihead indeterminate plant : keep 1 to 3 suckers under the first flower cluster





Pruning , training indeterminated Big Beef variety **IN PERMANENT TUNNEL-**

Big Beef indeterminate variety			
Year	Training system	Pruning	yield kg/m2
2009-20	Horizontal- Hortonova treillis	Multhead ; keep 1 sucker under the first flower cluster	8,6
2013-20	Vertical- string	2 leaders	14,7



*Producteur maraîcher
Ferme Val-aux-Vents*

Gilles Turcotte, agr., M. Sc.

Report 2014

Flowering resumes

**Aborption of flower
clusters**

**Big load of fruits
= nice year**





Pruning , training indeterminated Fiorentino, Granadero, grafted on Maxifort **IN**
MULTIBAY TUNNEL

2014 : Big yield with 2 leaders on 2 twines but harder to manage in structures that do not have adequate support of the twines



2015 : horizontal weaving with minimal pruning but harvested 1 week later (less work and labour)

2016 : **will keep** horizontal weaving (less work) **but** will train grafted plants on 2 heads (with a vigorous scion variety).



Pruning and training strong determinate and indeterminate tomatoes **IN CATERPILLAR TUNNELS-**



Philosophy: not put too much time on tomatoes when you have to take care of a lot of other vegetables

Caterpillar: Minimal pruning, 1 sucker left under the 1st flower cluster, no grafting, excellent results

Varieties : New Girl, Granadero, Cobra, Caïman etc...

Minimal Pruning for some indeterminated tomatoes

Yield notation **4/10**

yellow shoulders



NEW GIRL

7 sites (2012-2013)

New Girl doesn't like
to be growened on 1 or 2 heads = yellow
shoulders



Minimal Pruning for some indeterminated tomatoes



Yield notation

9 /10

New Girl is early, has heavy yields of good quality and has good taste with low pruning

Keep 1 sucker under the 1st flower cluster

2013 = 15,7 kg /m²

New Girl



New Girl



Minimal Pruning for some indeterminate Heirloom in the field - Green Zebra

Multihead : 3 suckers left under the 1st flower cluster



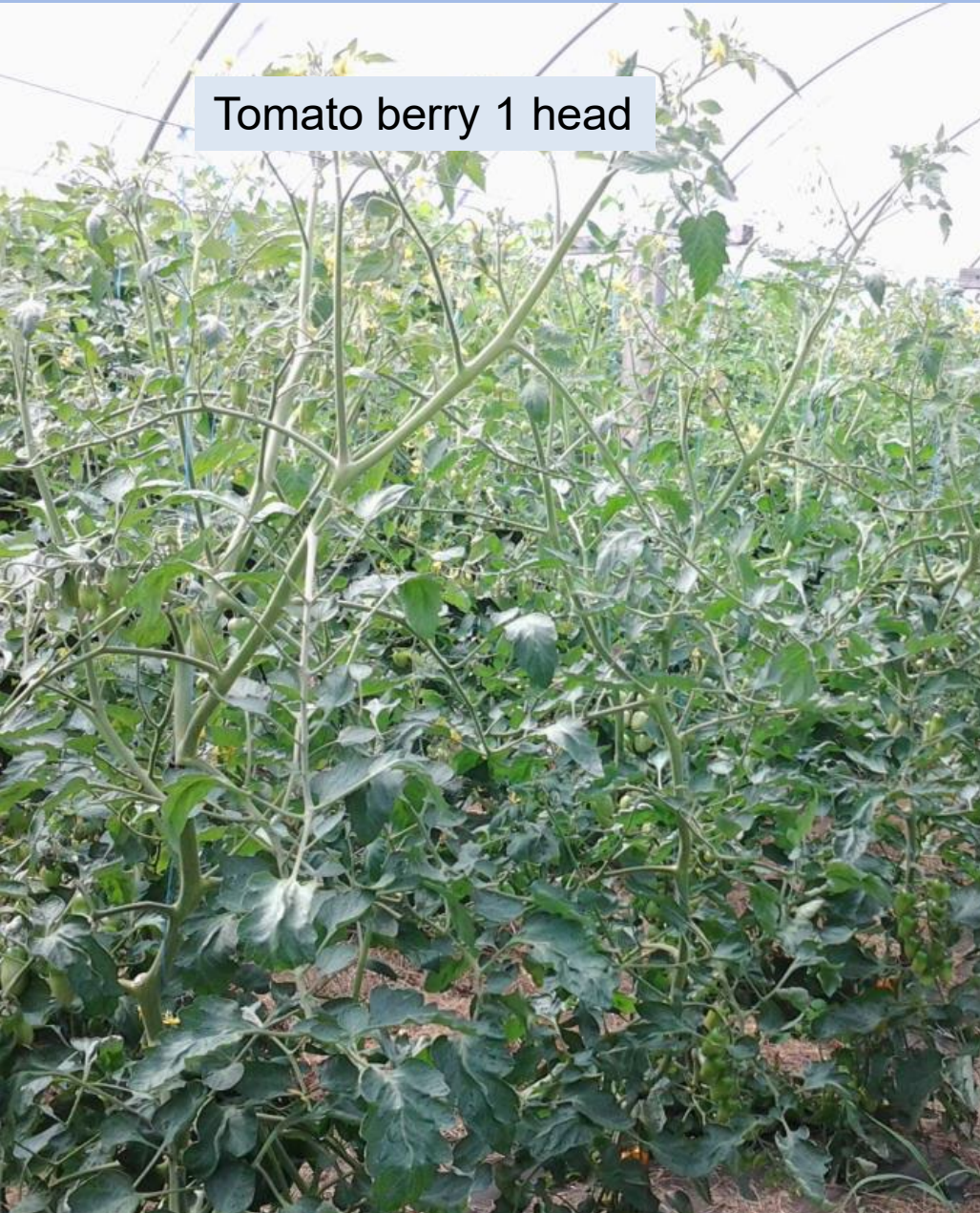
Taille de Green Zebra 2011			
	kg/m2	kg/plant	poids fruit (g)
multitête	8,1	5,8	70
2 têtes	5,5	3,9	90
3 têtes	7	5	90

Field tomato with high bacterial diseases pressure

18 po x 5 pi Photo Isabelle Couture



Cherry tomatoes have a higher yield potential when trained on 3- 4 heads



Influence of different types of pruning on cherry tomato fruit production and quality

José L. Franco, Manuel Díaz, Fernando Díez and Francisco Camacho*

"Plant Yield in Mediterranean Crop Systems" Research group, University of Almeria, Spain. *e-mail: fcamacho@ual.es

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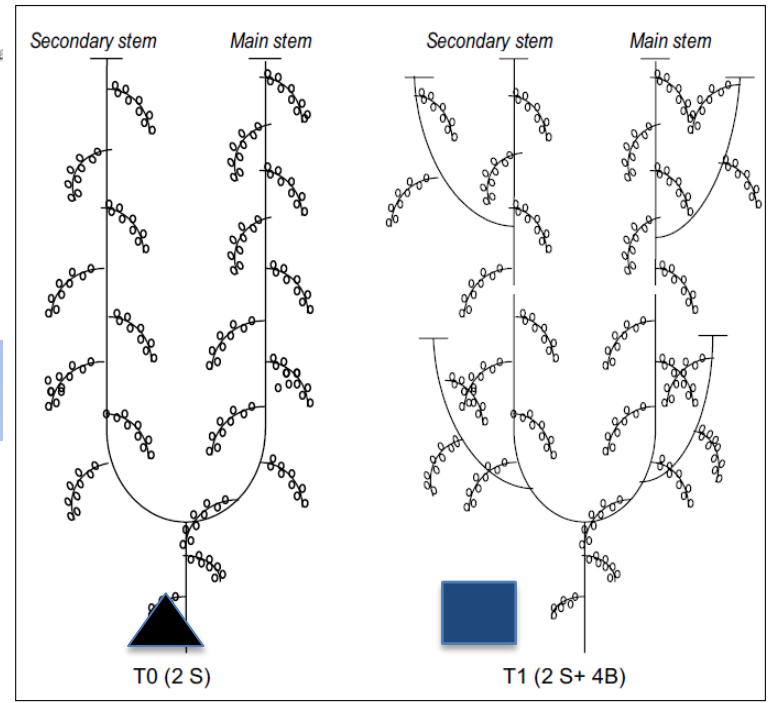
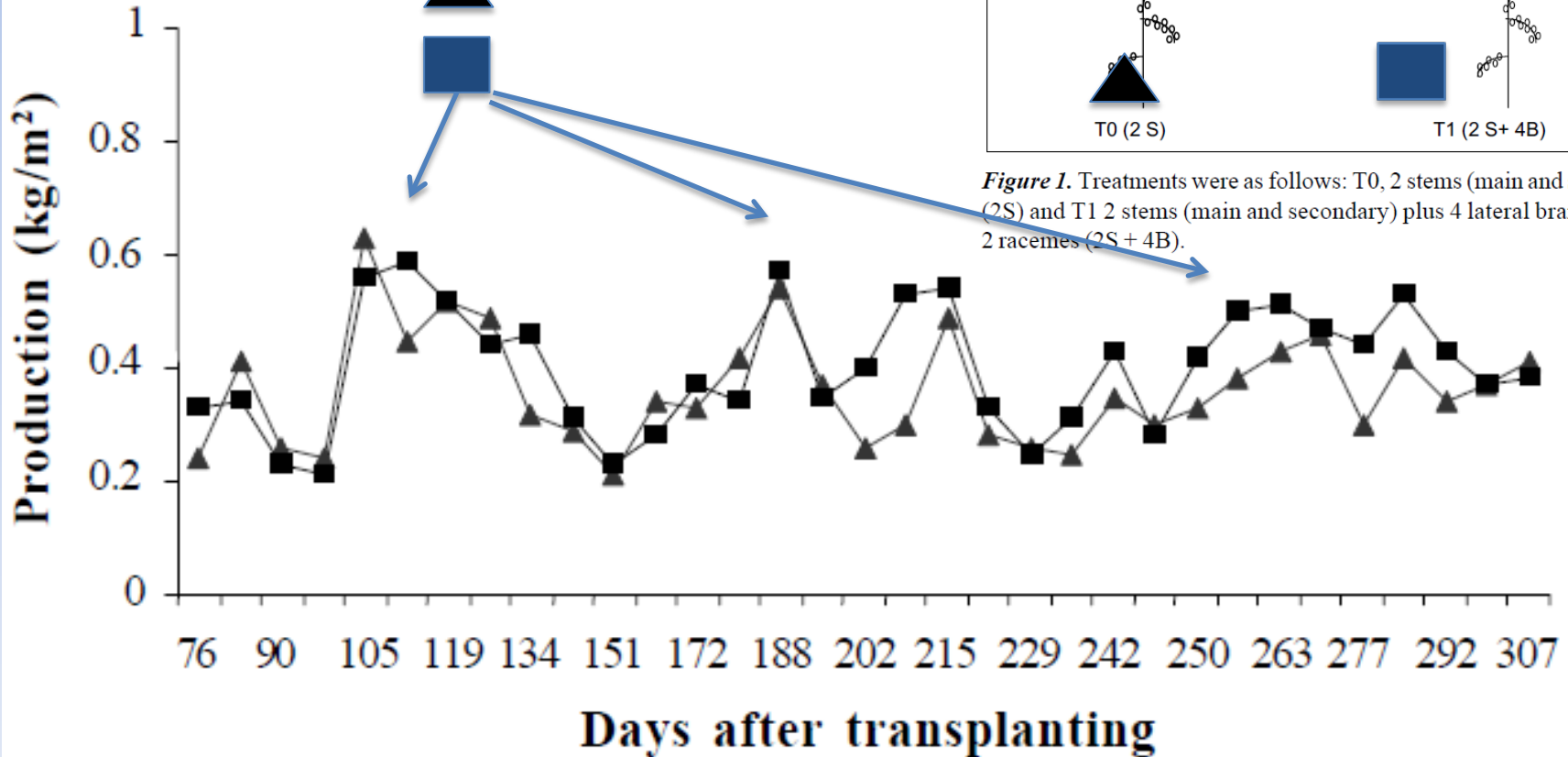


Figure 1. Treatments were as follows: T0, 2 stems (main and secondary) (2S) and T1 2 stems (main and secondary) plus 4 lateral branches with 2 racemes (2S + 4B).



Pruning and training tomatoes



Indeterminate

1 or 2 leaders:

- Hybrid « high tech » varieties
- Grafted plants delays harvest, pruning help balance
- Earliest harvest, bigger fruits
- Greenhouse type growers

3-5 leaders

- Cherry tomatoes

Do your own trials with multihead (keep 1 to 0 sucker under the 1st flower cluster

- Some heirloom
- Some less genetic worked varieties ex : New Girl
- Try if you want to spend less time in tomato tunnels but be aware that harvest can be delayed (7-14 days)

Strong determinate

Keep 1 to 3 suckers under 1st flower cluster





Optimise the structure -
Moveable caterpillar



- **Seedings of radish, green onion, spinach, kale, carrot, onion...
begining of April on the site that was cultivated
In tomatoes and peppers last year**
- **Put the plastic few days later depending on the weather**

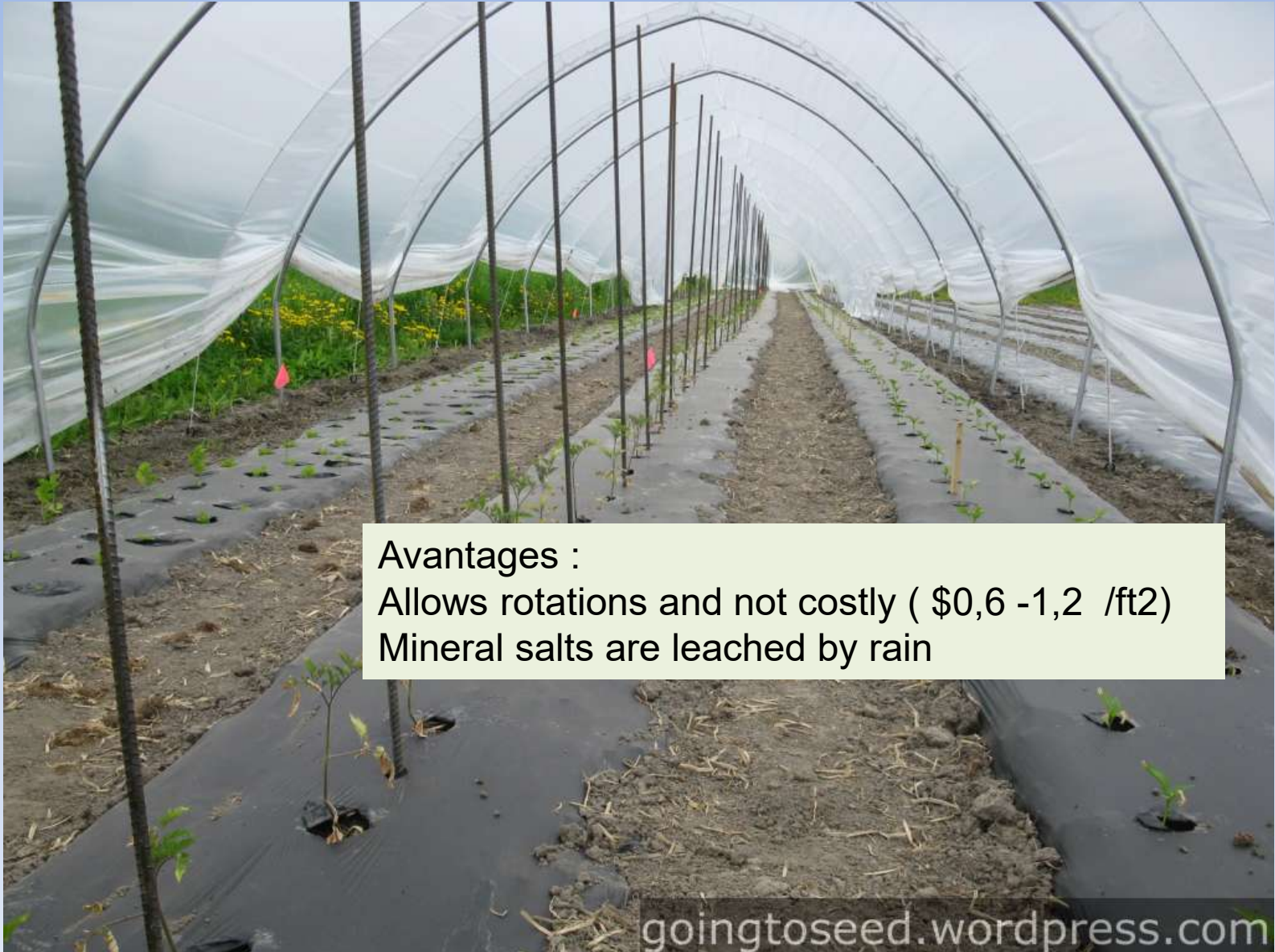


Before winter time, plastic is rolled at the base of the structure.

First week of May - The caterpillar tunnel is installed



Plantation mid May
14 ' x 7-8 ' height



Avantages :

Allows rotations and not costly (\$0,6 -1,2 /ft2)

Mineral salts are leached by rain

Optimise the structure-Cold greenhouse, high tunnel

May 13th

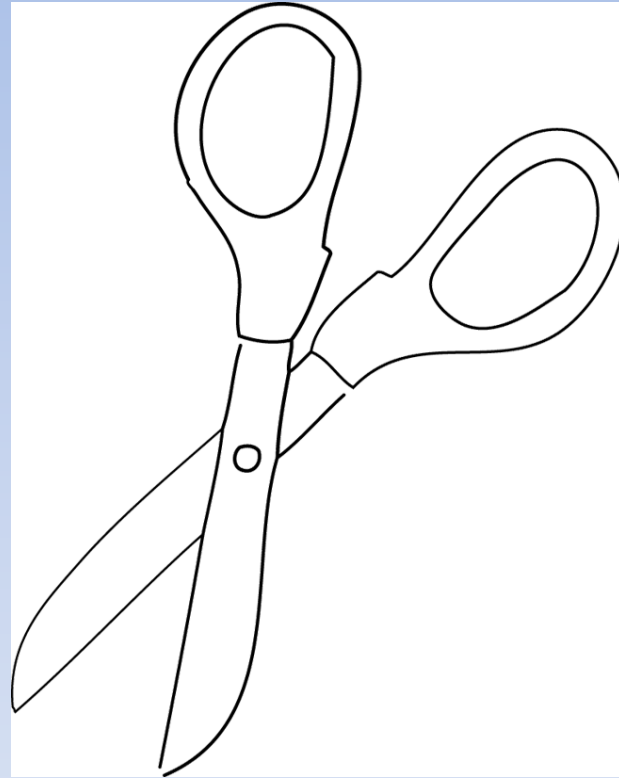


Optimise the structure-Cold greenhouse, high tunnel

June 2nd

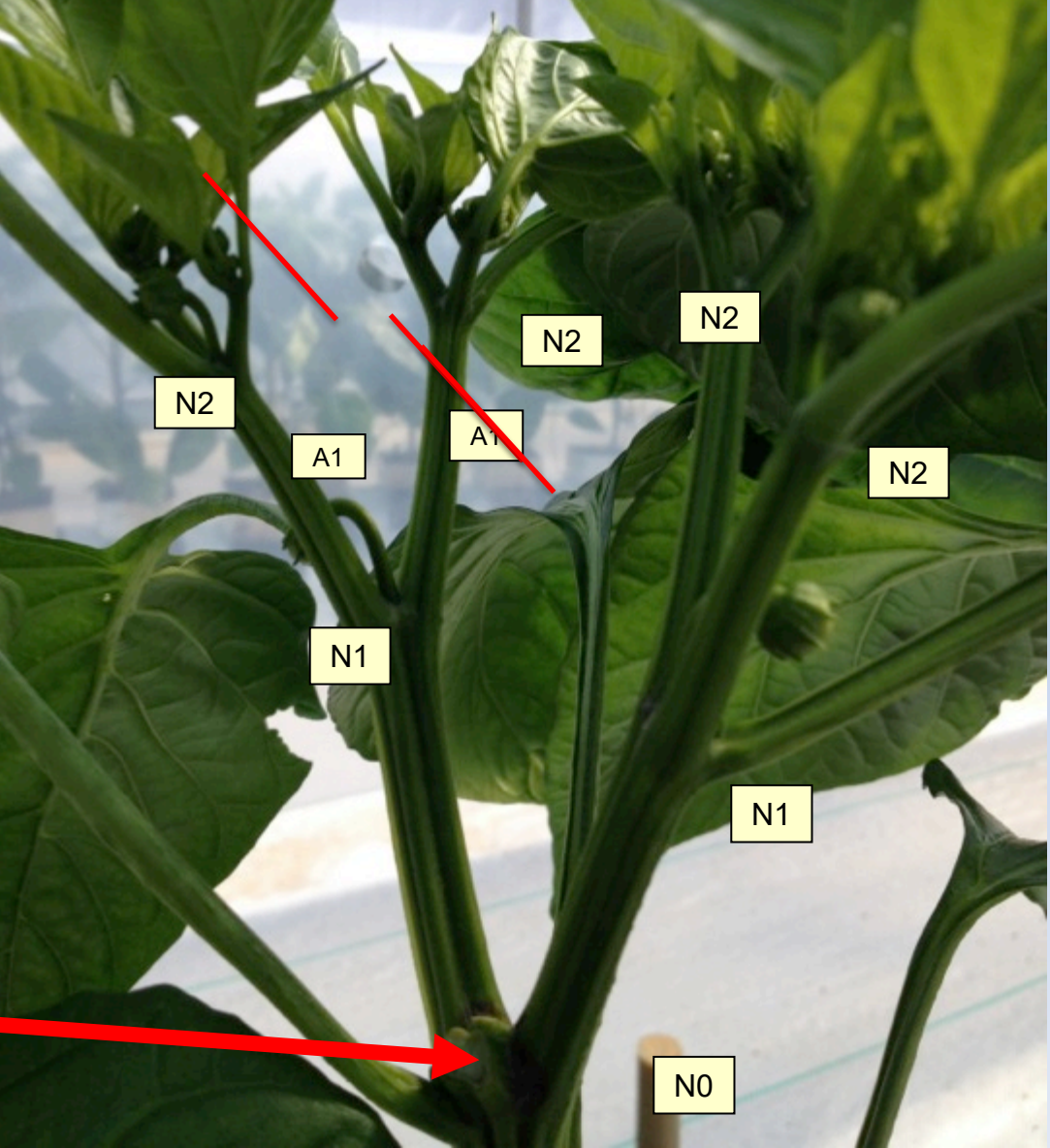


Pruning pepper or not ?



2014 Pruning project:
Horizontal trellising

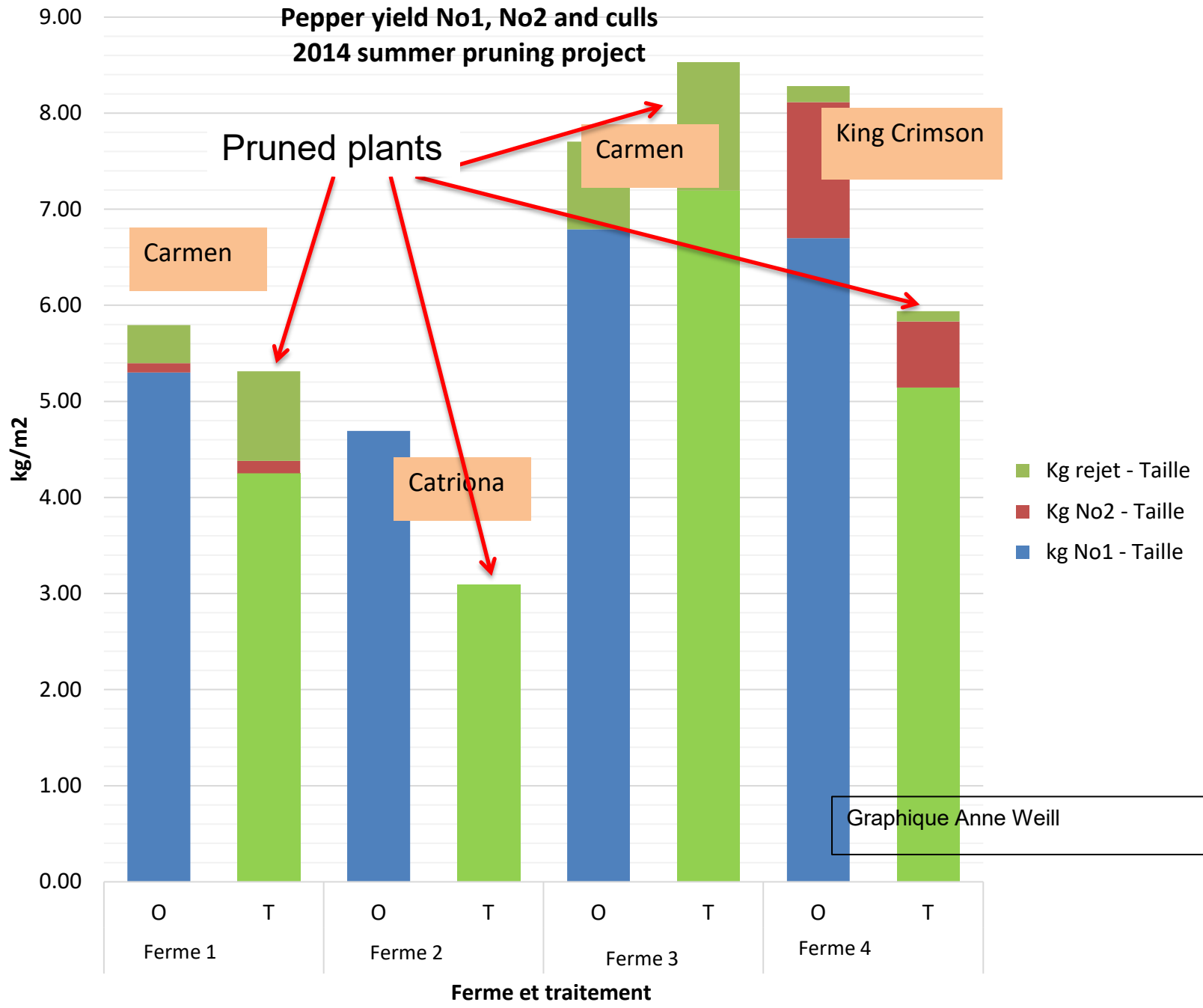
Pepper produce fruits by flushes. Project was elaborated with some greenhouse guys .3 lateral stems were pruned.
Main objective :Get a more consistant production over time



Take off fruit at the fork

Photo: Gilles Turcotte

**Pepper yield No1, No2 and culls
2014 summer pruning project**



SCREENING AGAINST INSECTS



Different products, different mesh size (mesh- g/m², mm x mm)
against different insects width

1 mm x 1,9 mm
Porosity : 95 %

0,3 mmx 0,8 mm
Porosity : 50 %

Dubois
Agrinovation

ProtekNet
Standard 60gr

HARNOIS
1-888-HARNOIS • www.harnois.com

#6J150

Filet pare-insectes / Insects screen

FARM 1 :WHY SCREENINIG?

: Proteknet 80 g 0,6 x1 ,0 mm porosity 80 %

> 1,1 mm

: Proteknet 25 g 0,35 x0,35 mm porosity 62 %

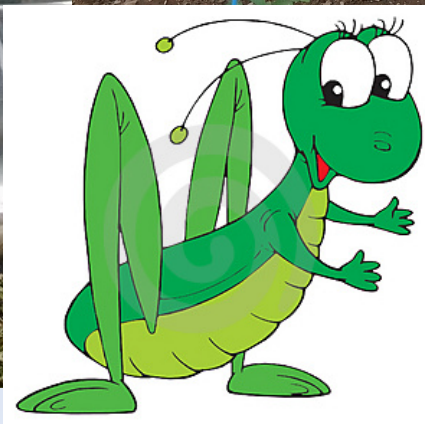
Priority Big Insects

- Stripped cucumber beetle
- Flea beetle

Secondary insects

- Tarnished plant bug
- European corn borer
- Swede midge

Farm 1 : Screening against swede midge, was too hot . Bio control with the *parasitic wasp* *Aphidius colemani* against green peach aphid with banker plants was a failure because of the mortality of the cereal and the cereal aphid.: *Rhopalosiphum padi*.



Farm 2 : Cold greenhouse
Main insect : Stripped cucumber beetle



1,35 mm et +

FARM 2 : GET A TIGHT HOUSE
INSECT SCREENING OPENING: 1,43
MM X 1,8 MM



Get a tight insect screening

Before



After



Don't choose a screening to prevent small insects like mites and green peach aphids when there are other biological control options : beneficial insects : Amblyseus, Aphidius, aphidoletes.

Bank crop system with cereal aphid
Parasited by *Aphidius colemani*



Tableau 1 : Largeur maximale des insectes (forme adulte) les plus problématiques en productions maraîchères

	Largeur (mm) ¹	Microns	Mesh ²	Exemple de filets recommandés ³
Tétranyque à deux points	0,25 à 0,50	250 à 500	60 à 35	<ul style="list-style-type: none"> ▶ Proteknet 52g - 25g ▶ Plastitech 52g - 25g ▶ Emis TP7 - TP8 ▶ Harnois Ginegar-Meteor ▶ AF4040 (pour cécido seulement)
Cécidomyies	0,2 à 1,2	200 à 1200	70 à 16	

Tableau 2 : Caractéristiques des filets anti-insectes

Produit commercial	Grosueur de maille (mm)	Poids g/m2	Porosité approximative	Luminosité approximative	Durée de vie	Distributeur
▶ Proteknet 25g	0,35 x 0,35	25	62%	90%	1 à 3 ans	Dubois Agrinovation
▶ Plastitech 25g						Plastitech
▶ Emis TP8	0,22 x 0,77	135	32%	62%	5 ans	Serres Guy Tessier
▶ Proteknet 52g	0,25 x 0,73	52	80%	93%	5 ans	Dubois Agrinovation
▶ Plastitech 52g						Plastitech
▶ Emis TP7	0,27 x 0,77	130	34%	64%	5 ans	Serres Guy Tessier
▶ Harnois 50 mesh	0,28 x 0,81	130	50%	80%	5 ans	Industries Harnois
▶ Harnois Econet 90% (pliable en accordéon pour courants de toit)	0,40 x 0,45	73	70%	90%	3 ans	Industries Harnois



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