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# Green manure and biofumigation for RLN and Verticillium wilt management in strawberry production

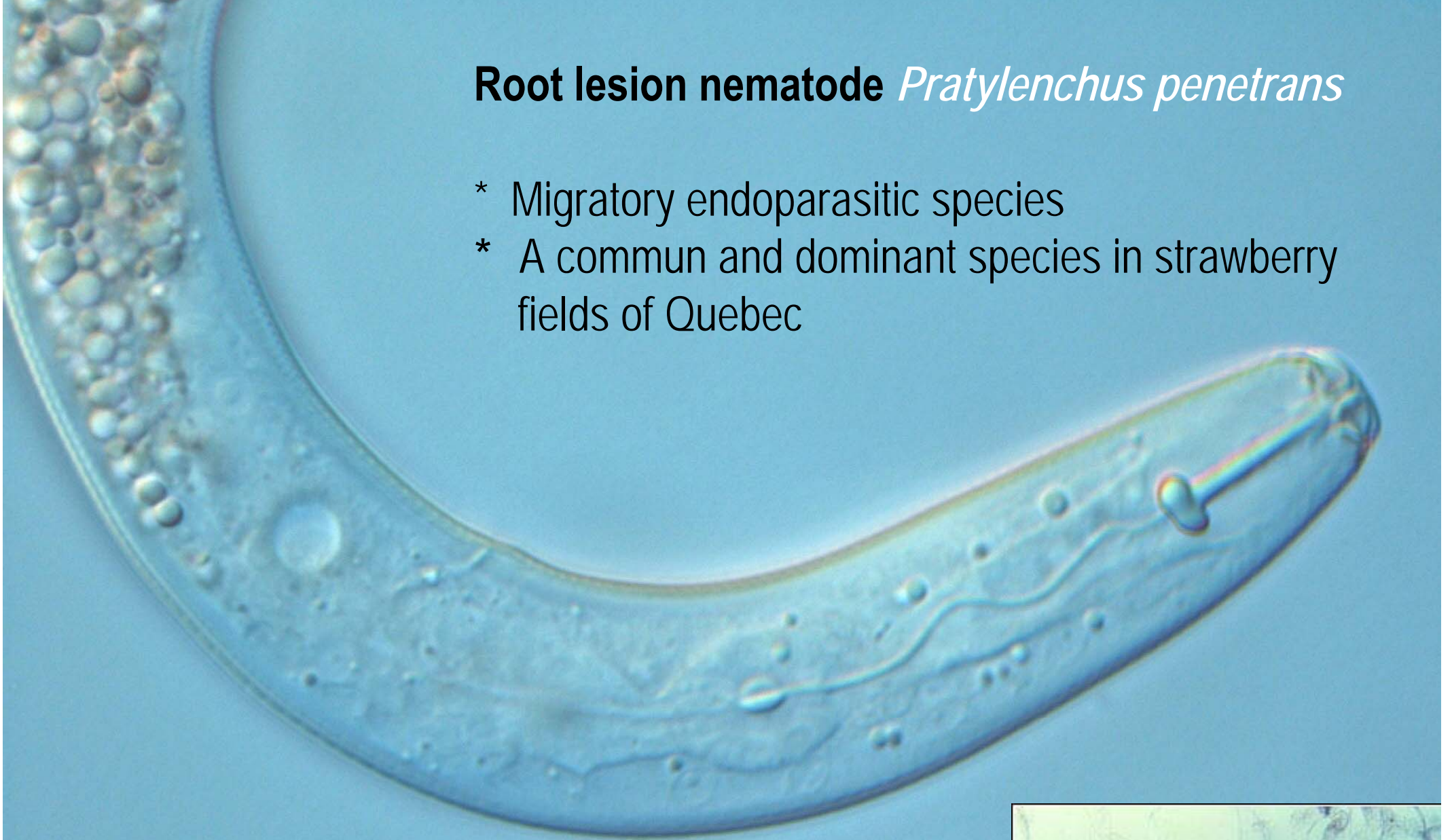
Guy Bélair and Jean Coulombe

AAFC, HRDC, St-Jean-sur-Richelieu, Québec

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## Root lesion nematode *Pratylenchus penetrans*

- \* Migratory endoparasitic species
- \* A common and dominant species in strawberry fields of Quebec



## Root lesion nematode *Pratylenchus penetrans*

- ✓ **Damage threshold**  
**≈ 1000 / kg sol (alone)**
- ✓ **On Île d'Orléans (near Quebec city), a severe incidence of verticillium wilt *Verticillium dahliae***
- ✓ **Monoculture of potato for many years on the island**
- ✓ **A good reservoir of *V. dahliae* in those soils**

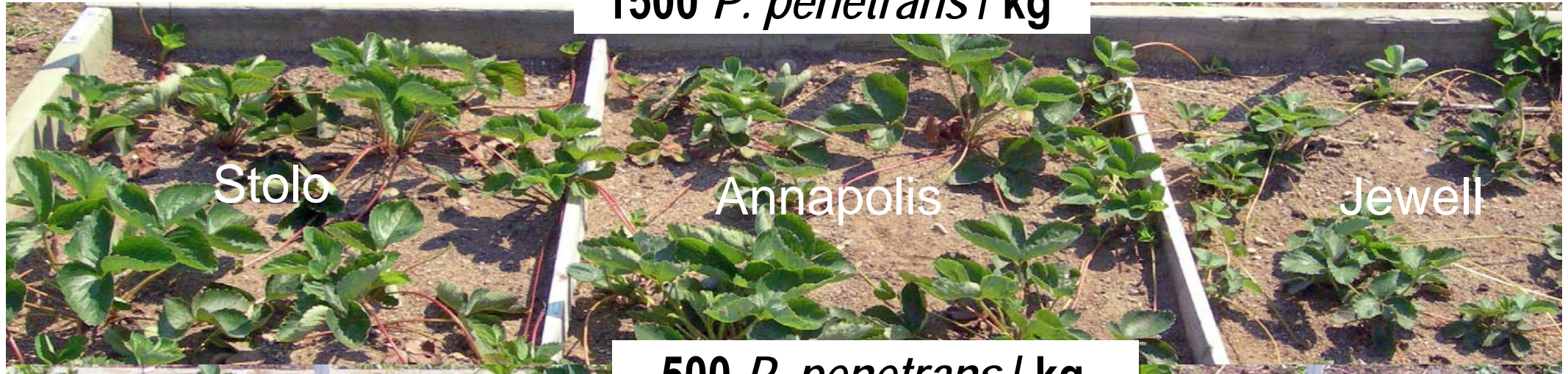


Annapolis

Stolo

Jewell

**1500 *P. penetrans* / kg**

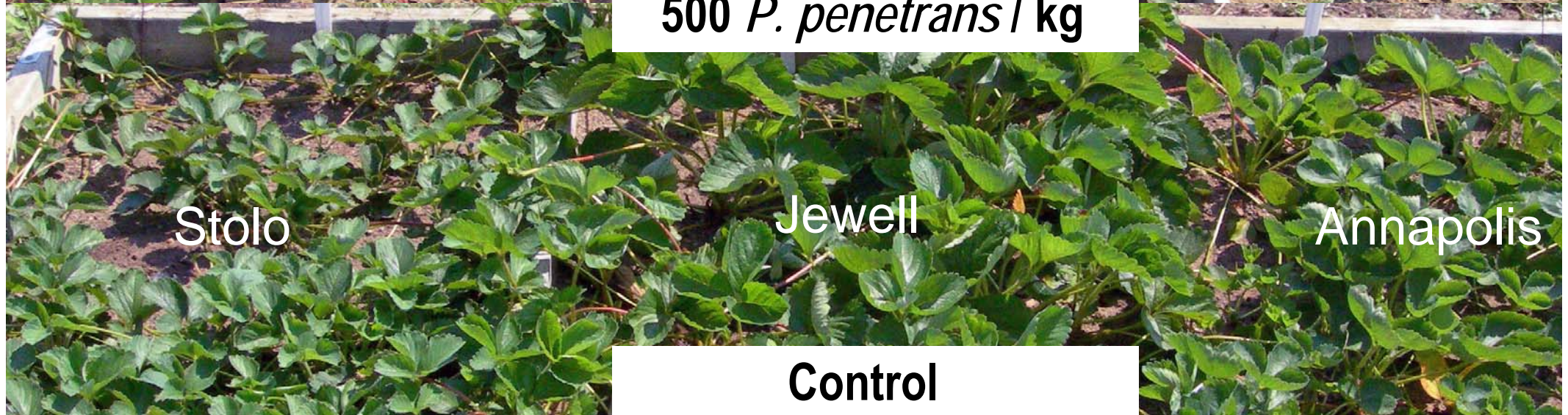


Stolo

Annapolis

Jewell

**500 *P. penetrans* / kg**






Stolo

Jewell

Annapolis

**Control**

# Effect of 2-y crop rotation on nematode population & verticillium wilt symptoms on strawberry cv Jewel

Two consecutive years of cropping	<i>P. penetrans</i> 15 June 06 (/ kg de sol)	Verticillium wilt 28 Aug 06 1= dead; 5= normal	Crowns + daughter plants no.1 (/3 m row)
Oats	328 ab 	2.8	21.3
Canola + white mustard	106 b	3.4	30.0
Corn	524 a 	2.0	12.7
Pearl millet CFPM 101	72 b 	3.5	37.8
Pearl millet Tifleaf 3	319 ab	3.3	34.7

LSD test at 0,05 level

# Treatments

## #1: Pearl millet hybrid CFPM-101

Our standard control to reduce *P. penetrans* and verticillium wilt

## #2: Canola and white mustard

Canola crop ploughed at full bloom, rolled, irrigation (10-25 mm), followed by white mustard crop (effect similar to pearl millet in previous trials).

# Treatments

## #3: Two crops of brown mustard

**Brown mustard ploughed at full bloom, rolled, irrigation (10-25 mm), followed 2<sup>ed</sup> crop of brown mustard (3 vs 4)**

## #4: Canola and brown mustard

**Canola crop ploughed at full bloom, rolled, irrigation (10-25 mm), followed by brown mustard crop (2 vs 4)**

# Treatments

## #5: Canola + plastic and white mustard

Canola crop ploughed at full bloom, rolled, irrigation (10-25 mm), tarping (3-4 weeks), followed by white mustard (additive effect of plastic vs 2)

## #6: Canola + manure and white mustard

Canola crop chopped at full bloom, chicken manure (15 t/ha), ploughed, irrigation (10-25 mm), followed by white mustard (additive effect of manure vs 2)

# Treatments

## #7: Canola + manure + plastic and white mustard

Canola crop chopped at full bloom, chicken manure (15 t/ha), ploughed, irrigation (10-25 mm), plastic (3-4 weeks), followed by white mustard  
(additive effect of plastic mulch vs 6)

## #8: Oats

Standard positive control

# Field activity in 2006 & 2007

Field activity	2006		2007	
	Canola, oats & mustards	Pearl millet	Canola, oats & mustards	Pearl millet
1 <sup>st</sup> sowing	15 May	15 June	10 May	8 June
1 <sup>st</sup> cut or plough	20 July	3 August	23 July	23 July
2 <sup>ed</sup> sowing	9 August	-	14 August	-
2 <sup>ed</sup> plough	11 October	11 October	17 October	17 October

# Effect of treatments on *P. penetrans* densities

Treatment	Trial 2006		Trial 2007	
	15 June 06	15 Sept. 06	29 May 07	13 Sept. 07
Pearl millet CFPM 101	1,960	612	621	119 b
Canola + white mustard	2,113	1,253	1,209	226 ab
Brown mustard + brown mustard	2,833	686	828	254 ab
Canola + brown mustard	1,173	589	910	441 a
Canola, <b>plastic</b> + white mustard	1,000	448	833	<b>0 c</b>
Canola, manure + white mustard	2,776	522	768	322 a
Canola, manure, <b>plastic</b> + white mustard	1,591	547	833	<b>17 c</b>
Oats	1,294	468	621	277 a
Significant level <sup>a</sup>	NS	NS	NS	**

<sup>a</sup> NS = non significatif; \*\* = significatif at 0,01

LSD test at 0,05 level

# Dry matter input per cut or crop (t /ha)

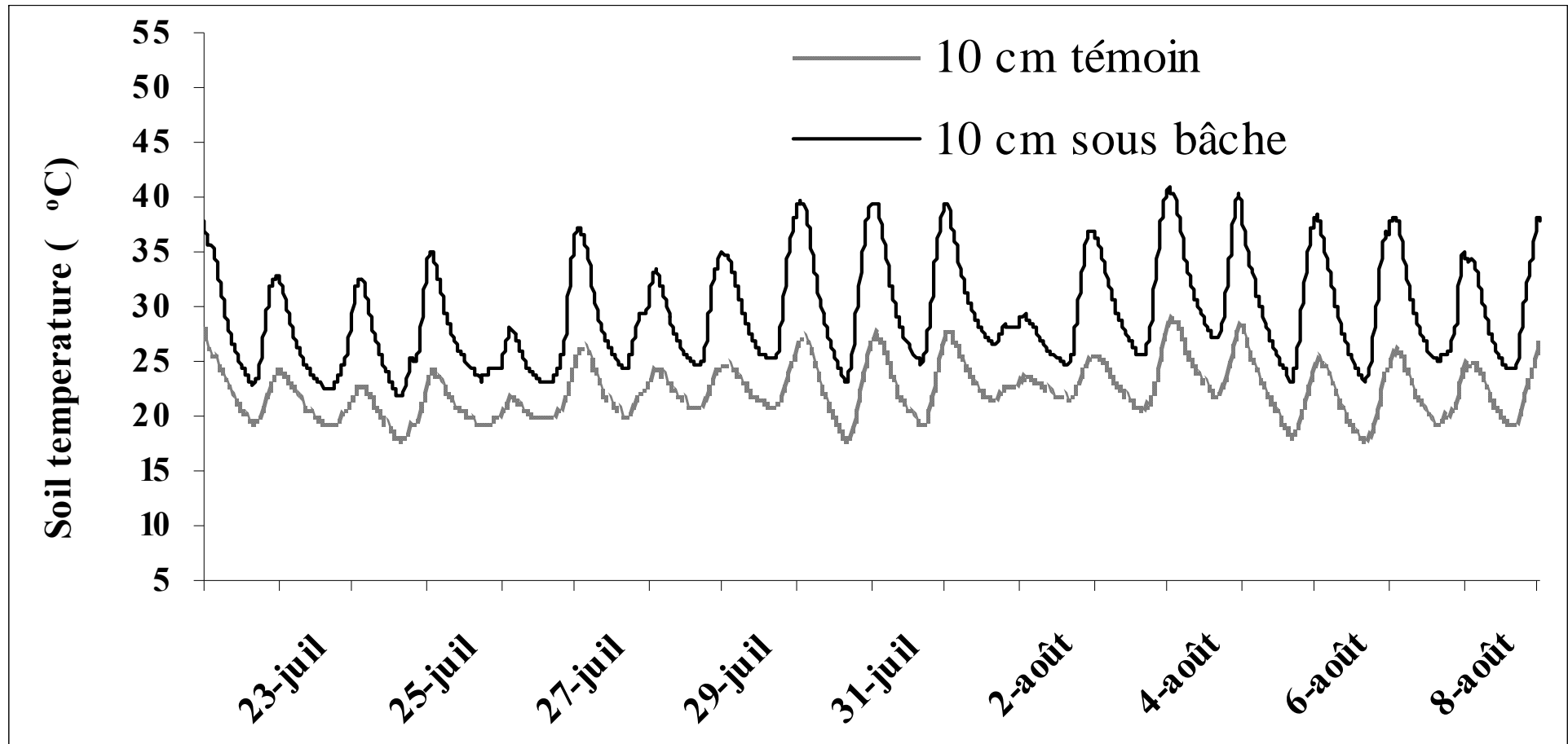
Treatment		2006			2007		
No.	Description	Crop 1	Crop 2	Total	Crop 1	Crop 2	Total
1	Pearl millet CFPM 101	2.5	5.7	8.2	1.5	14.0	<u>15.5</u>
2	Canola + white mustard	6.1	3.8	9.9	5.5	3.3	8.8
3	Brown mustard + brown mustard	6.5	3.7	10.1	5.4	3.3	8.7
4	Canola + brown mustard	6.2	3.8	10.0	5.5	3.2	8.7
5	Canola, plastic + white mustard	6.0	4.0	10.0	5.5	3.2	8.7
6	Canola, manure + white mustard	5.9	4.3	10.2	5.5	4.2	9.7
7	Canola, manure, plastic + white mustard	6.1	4.7	10.8	5.5	3.9	9.4
8	Oats	6.5	3.9	10.4	5.8	2.4	8.2

# Strawberry 2007

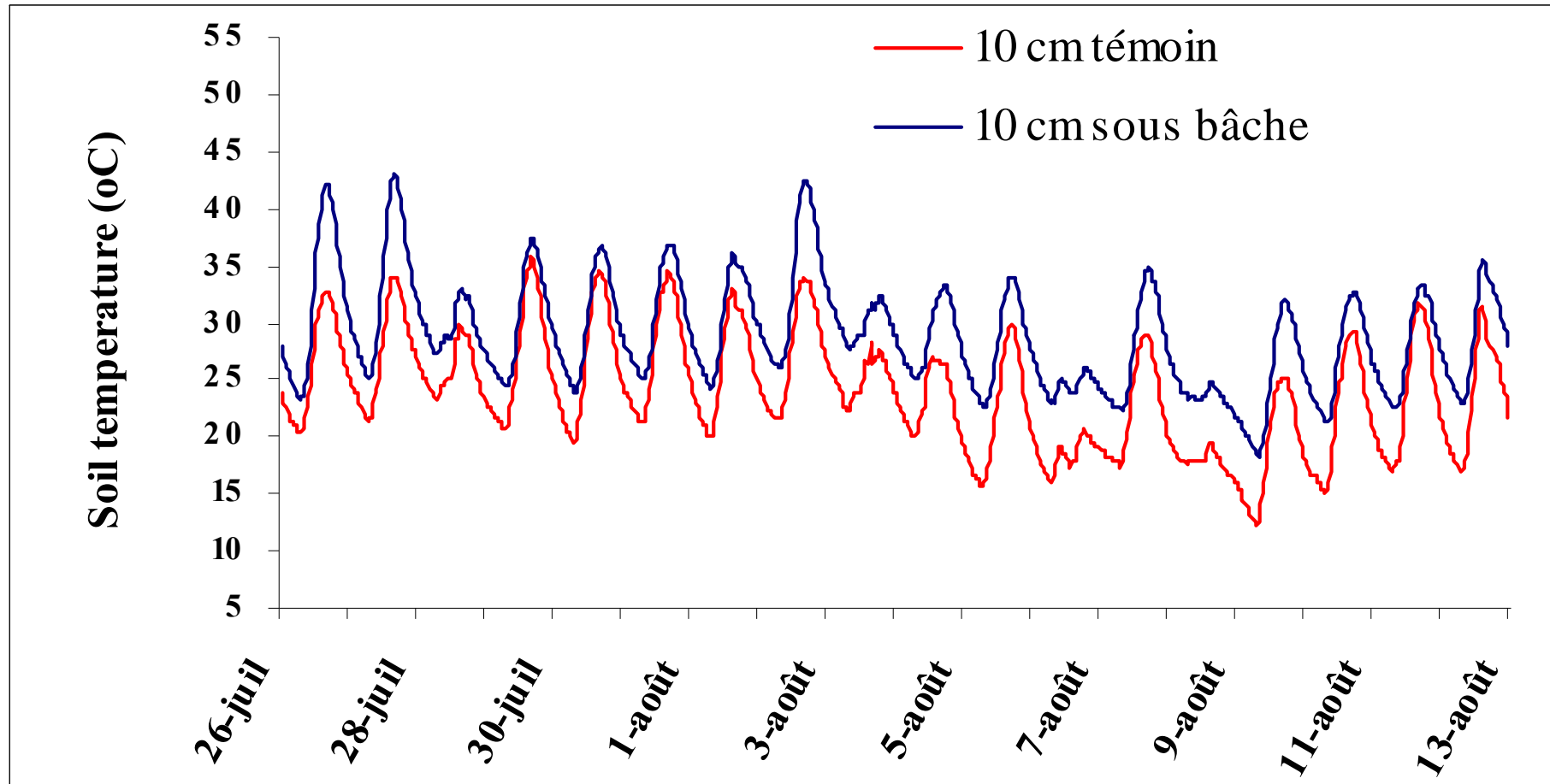
Treatment	<i>P. penetrans</i> (/ kg soil)		28 August		15 October	
	27 May	13 Sept	V W (0-5)	P D (1-5)	V W (0-5)	P D (1- 5)
Pearl millet CFPM 101	795	339	3.2 c	3.4 c	2.7	3.0
Canola + white mustard	850	291	3.4 bc	3.4 c	2.9	3.3
Brown mustard + brown mustard	692	184	3.3 bc	3.2 c	2.8	2.9
Canola + brown mustard	436	291	3.5 ac	3.4 bc	3.3	3.6
Canola, <b>plastic</b> + white mustard	583	236	3.9 ab	3.9 a	3.5	3.7
Canola, manure + white mustard	588	362	4.1 a	3.9 a	3.3	3.8
Canola, manure, <b>plastic</b> + white mustard	518	263	3.6 ac	3.3 c	3.2	3.4
Oats	512	71	3.5 ac	3.6 b	2.9	3.1

VW= verticillium wilt symptoms, where 0= dead plant & 5 = normal; PD= plant development where 1= no growth & 5 = normal growth

# Soil temperature 2006



# Soil temperature 2007



# Conclusion

- **Trial#1**
  - ***P. penetrans* densities not affected by treatments**
  - **No significant improvement from tarping**
  - **Lowest wilt symptoms with biofumigation + manure**
- **Trial#2**
  - **Significant effect of tarping**
  - **No effect of manure**
  - ***P. penetrans* higher following crucifers**
  - **Pearl millet reduce *P. penetrans* densities**
- **In 2008: cv. Caliente + new type of tarping specifically for biofumigation**



Thank you!

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