

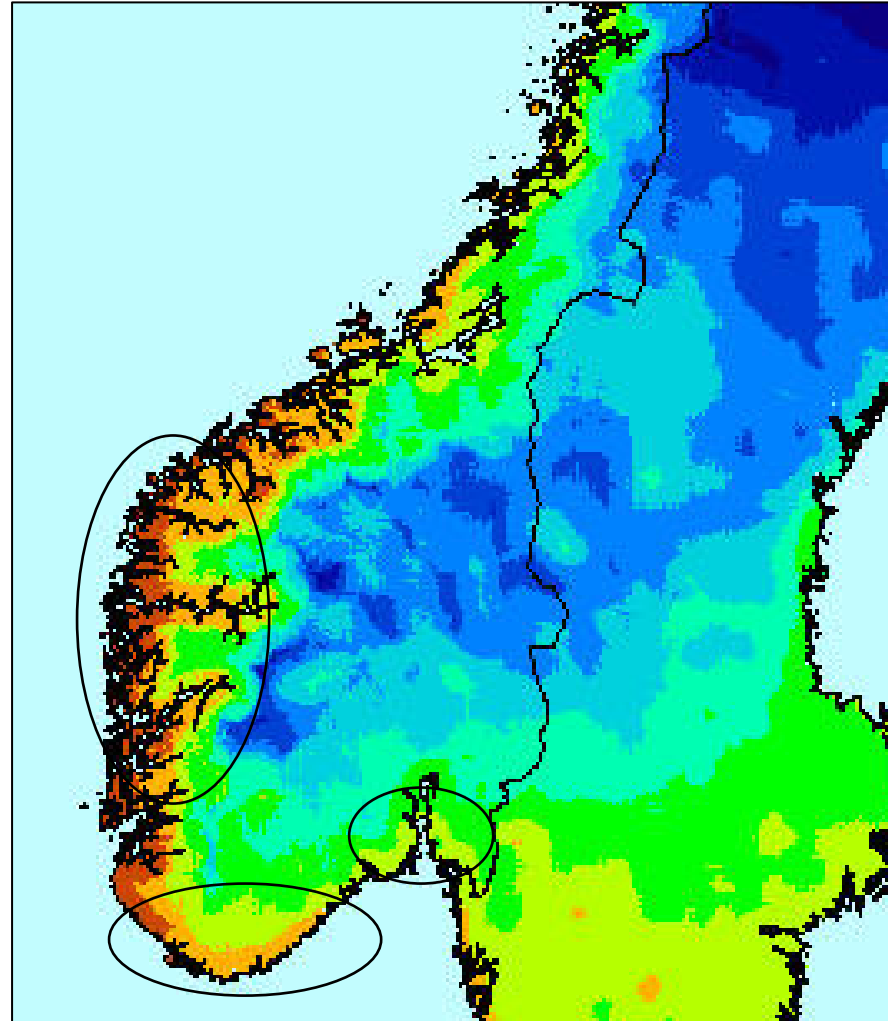
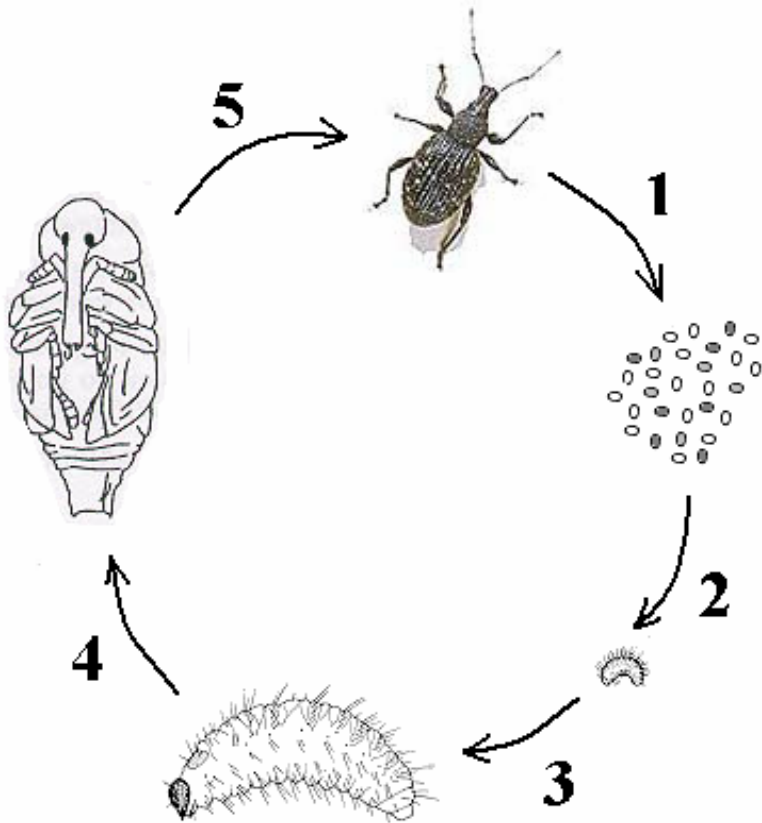
Use of *Steinernema kraussei* in field grown strawberries



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Target pest: *Otiorhynchus sulcatus* (vine weevil)



Crop: Strawberry

Total number of growers: 800 (No)

Total area grown 1700 ha

Annual value approx. 43 mill Euro

Long days,
better tasting
berries!



Aim: To test the cold-active product Nemasys L (*S. kraussei*) under field conditions at low temperatures (below 12C).



Field trials:

Two sites with 3-year old strawberry plants/field naturally infested with vine weevil. Plants grown under black plastic mulch. Trials set up as randomized blocks along strawberry rows, four replicates per treatment. 16 plants per plot. Nematodes applied as drench per plant.

Assessments:

Number of live larvae per plant from 8 plants per plot. Soil samples for presence of nematodes



Treatments:



Field trial	Treatments (per plant)	Assessment time (time after treatment)
1. Spring 04 (Field 1)	<i>H.m.</i> : 30 000 x2 <i>S.k.</i> : 30 000 x1 <i>S.k.</i> : 30 000 x2 <i>S.k.</i> : 15 000 x2	4 weeks (8 plants)
2. Autumn 04 (Field 2)	<i>H.m.</i> : 30 000 x2 <i>S.k.</i> : 30 000 x1 <i>S.k.</i> : 30 000 x2 <i>S.k.</i> : 15 000 x2	5 & 27 weeks (4 + 3 plants) (+ over winter)
3. Autumn 04 + Spring 05 (Field 2)	<i>H.m.</i> : 30 000 x1 <i>S.k.</i> : 30 000 x1	4,5 weeks (4 plants) (same field as above)
4. Spring 05 (Field 2-other area)	<i>H.m.</i> : 25 000 x1 <i>H.m.</i> : 25 000 x2 <i>S.k.</i> : 25 000 x1 <i>S.k.</i> : 25 000 x2	4,5 weeks (8 plants)

Results:

Field 1: Spring treatment 2004

Field 2: Autumn treatment 2004,
two assessments for the autumn
treatment and one assessment for
a spring treatment (2 graphs)

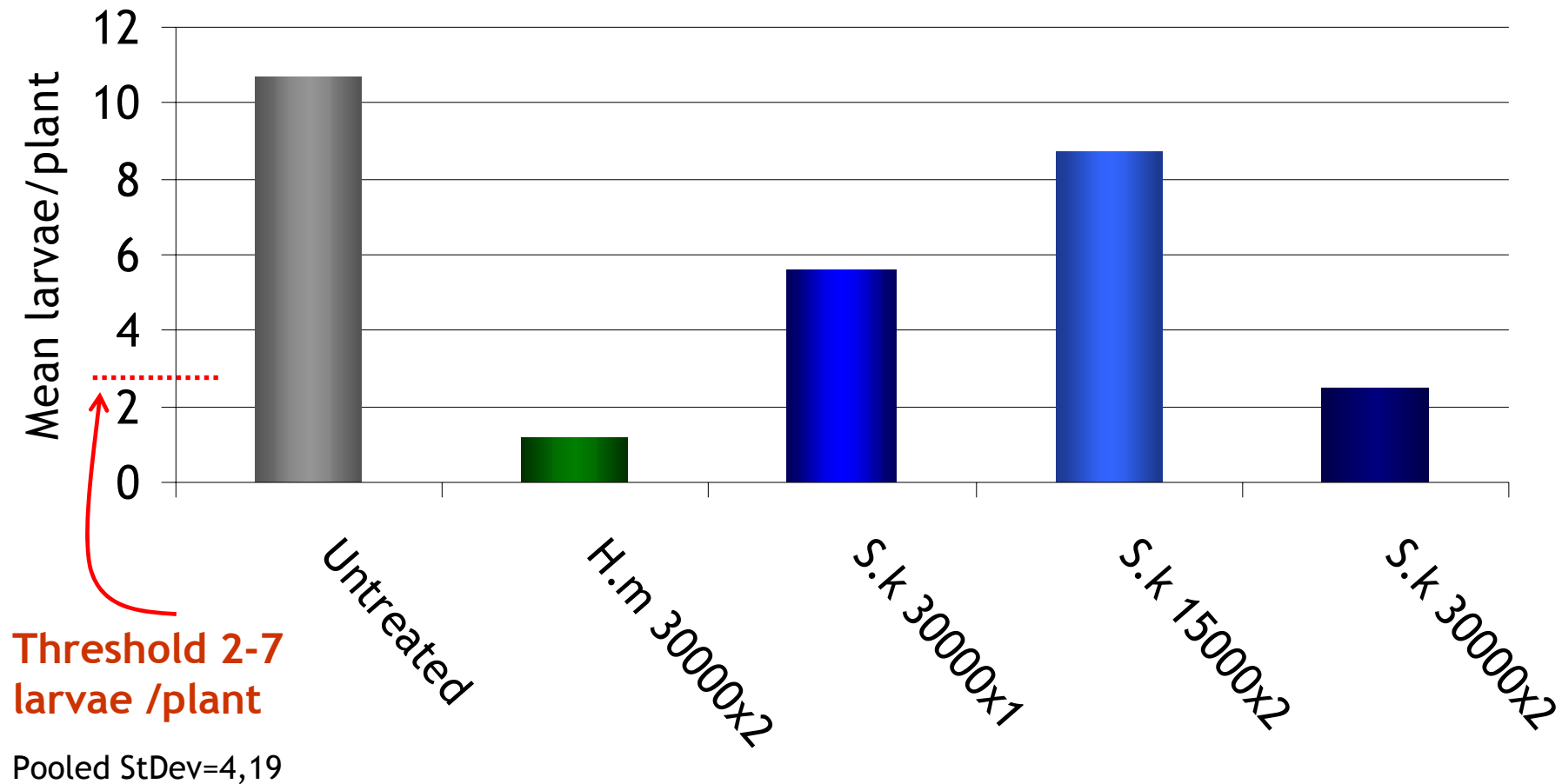
Field 3: Spring 2005



Warm spring! Average soil temperatures above 12C

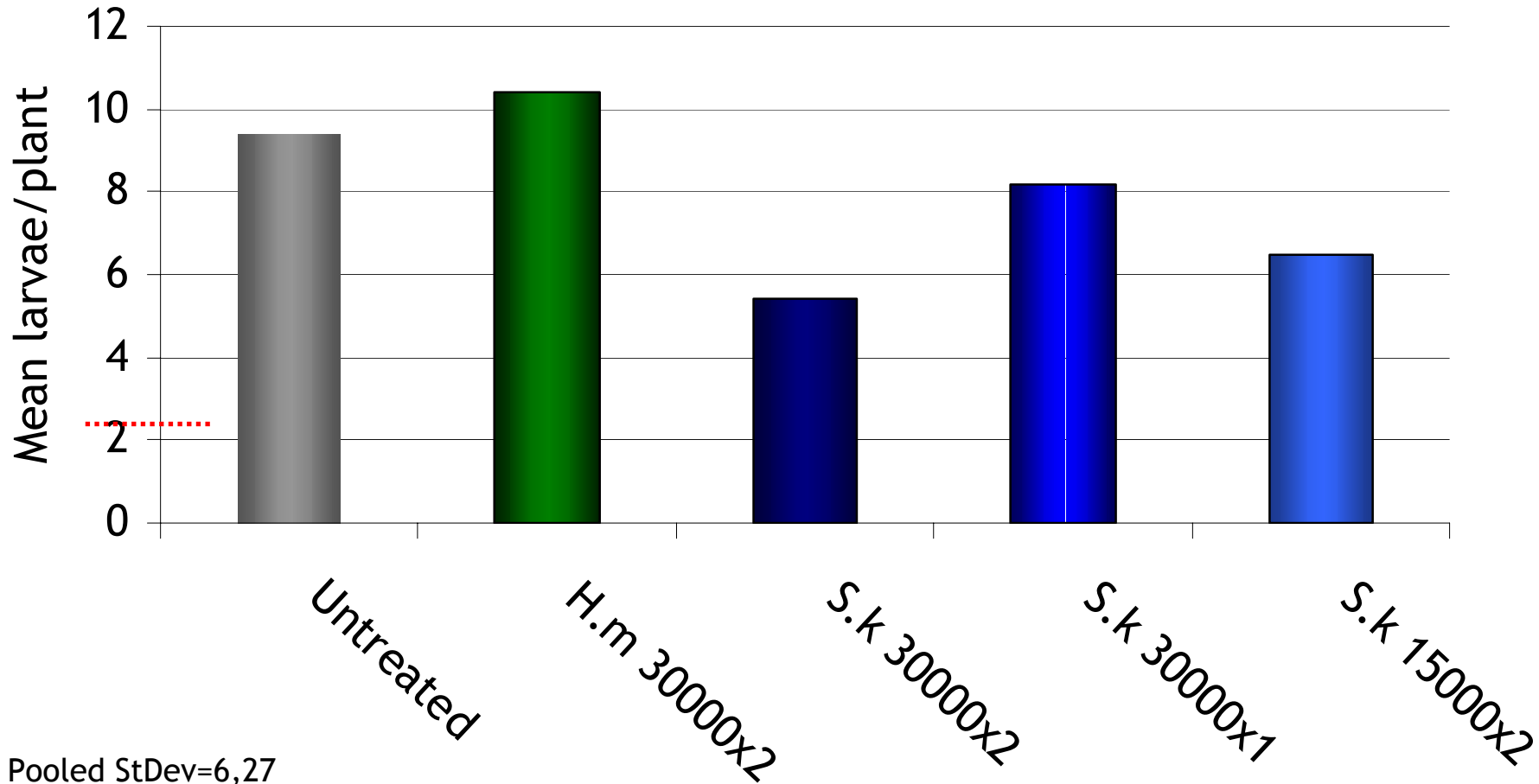


Spring treatment 2004, assessed 4 weeks



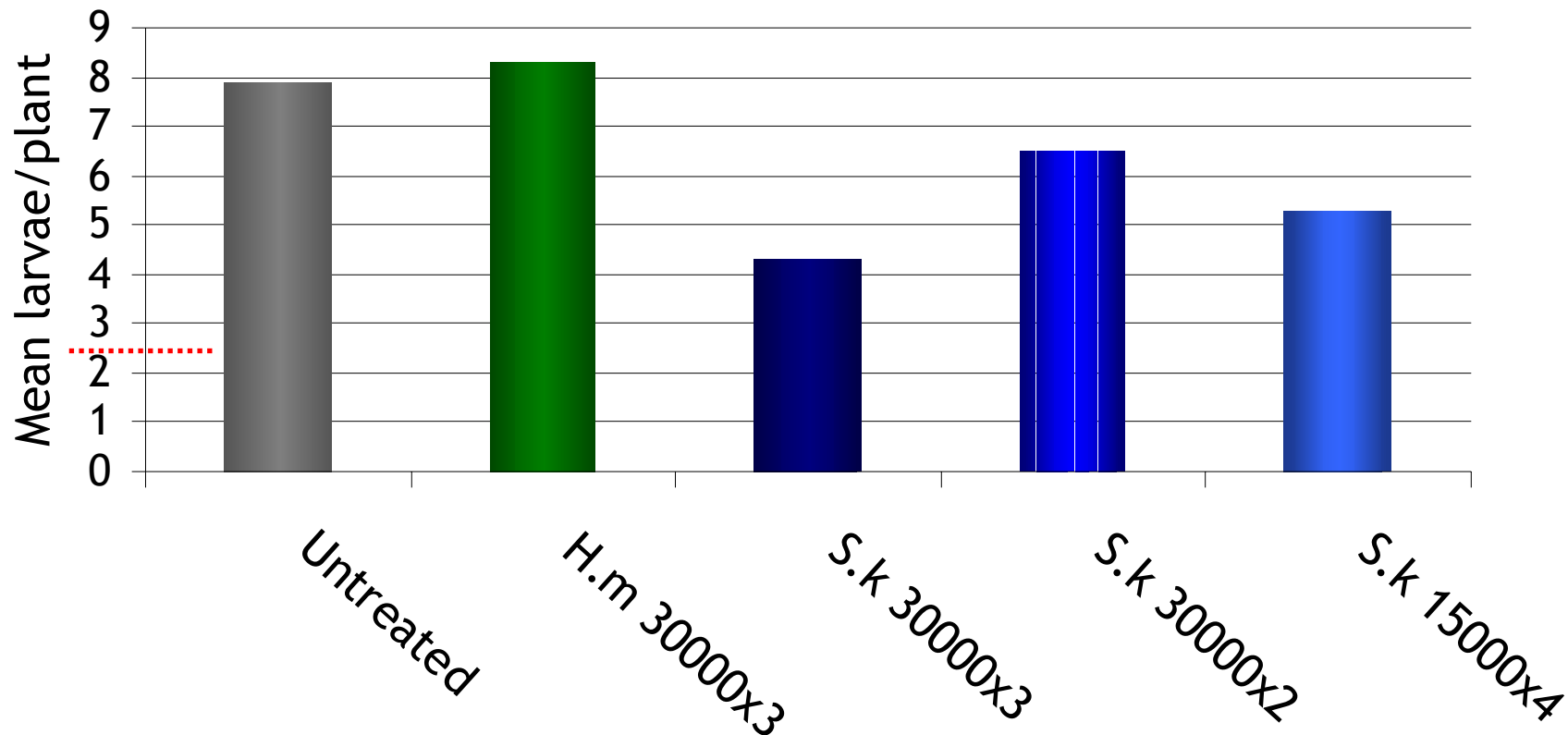
Fairly cold. Average soil temperatures 9C (autumn) and 7C (early spring). No significant control.

Autumn treatment, assessed 4 & 27 weeks



Fairly cold spring. Average soil temperatures 8,8C (6C-12C)
Slight effect observed for highest dose *S.kraussei* treatment

Autumn+Spring 2005 treatment, all 3 assessments pooled.

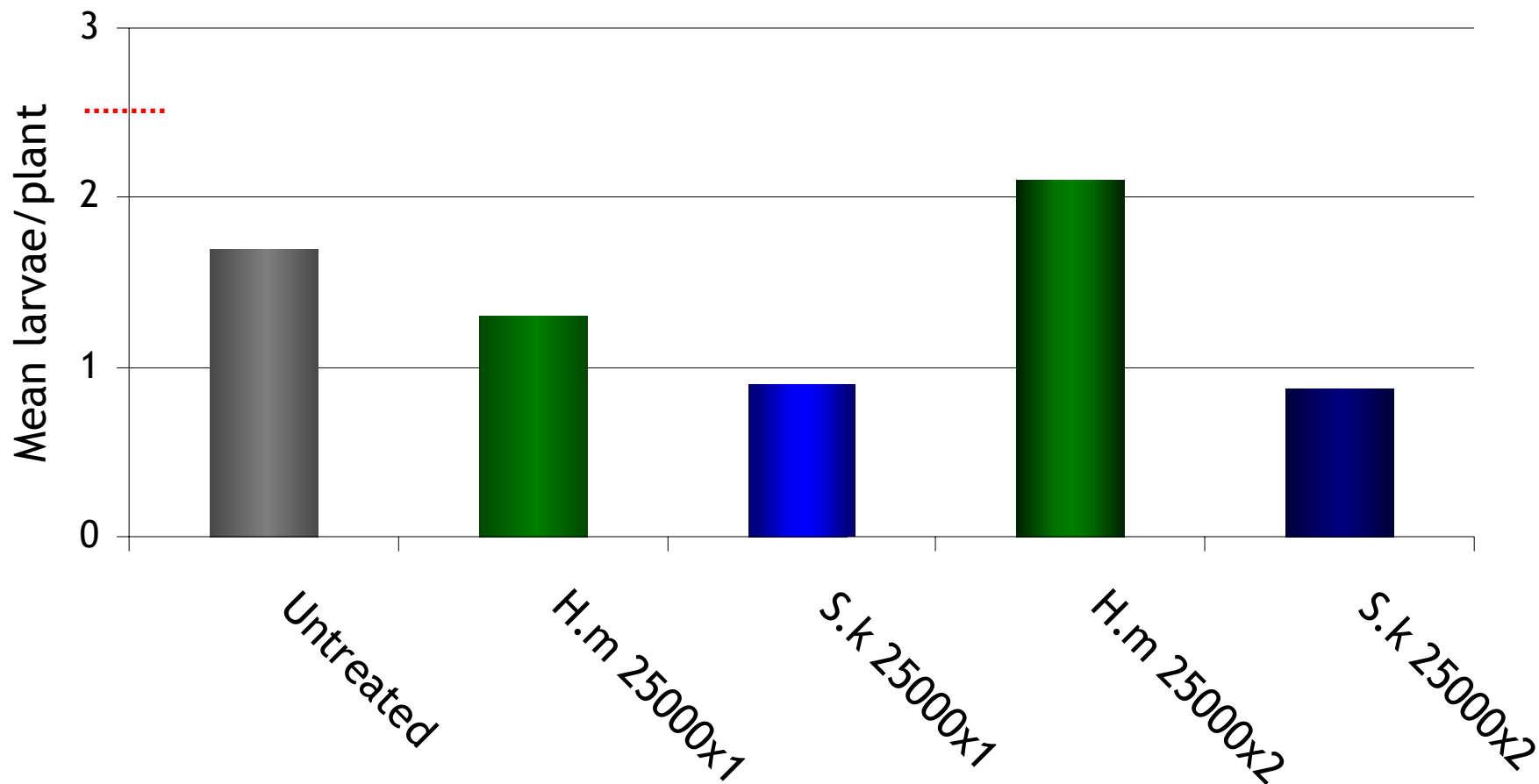


Pooled StDev=5,7

Average soil temperatures 8,8C (6C-12C)

Low vine weevil infestation

Spring 2005 treatment, assessed 4 weeks



Summary:



Field trial	Treatment	Result	Comments	Nematodes in soil
1. Spring 04	<i>H.m</i> : x2 <i>S.k</i> : x2 <i>S.k</i> :x1 & 0,5	89% 77% <50%	Light, sandy soil Temp ok for <i>H. megidis</i>	Yes
2. Autumn 04 (both assessments)	<i>H.m</i> : x2 <i>S.k</i> : x2, x1 & x 0,5	<20% <50%	Heavier soil (silt/clay) Temperature <12C	Yes
3. Autumn 04 + Spring 05	<i>H.m</i> : x1 <i>S.k</i> : x1	30% 50%, <50%	Heavier soil (silt/clay) Temperature <12C	Yes, but low <i>H.megidis</i> Low level detected in 1 untreated plot
4. Spring 05	<i>H.m</i> : x1, x2 <i>S.k</i> : x1,x2	Low infestation of vine weevil	Heavier soil (silt/clay) Temperature <12C	Yes, but low <i>H.megidis</i>

Discussion:

1. Damage threshold
2. Larval exposure time to nems
3. Soil type
4. Application method



Damage threshold

- Few studies on damage threshold in strawberry but a threshold of between 2-7 larvae per plant is mentioned.
- Observations indicate that more than 2 larvae per plant is sufficient to cause serious damage, therefore a nematode application has to cause rather high mortality levels to be effective.



Larval exposure time to nematodes

-Laboratory experiments indicate that at least 3 wks are required for *S. kraussei* to cause significant larval mortality at 6C (Haukeland unpublished, Long et al 2000). In these field trials this "criteria" was fulfilled, either in late autumn or spring, or both.

-Unlikely that higher levels of infection or mortality would be achieved with a later assessment. On the other hand *S. kraussei* appears to be very persistent in soil also after several months....



Soil type

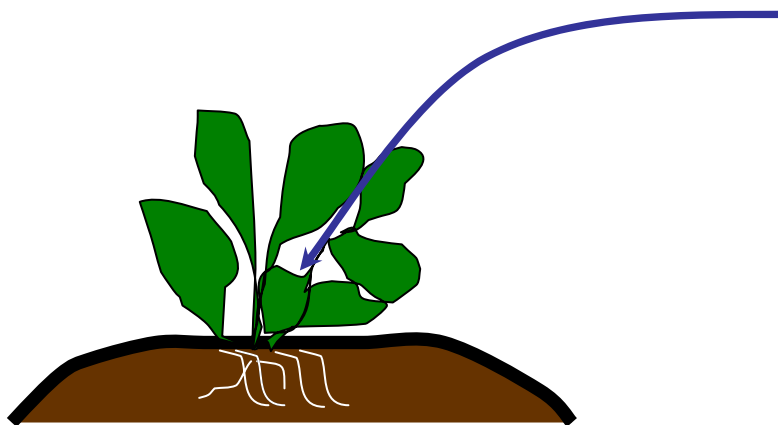
Two different soil types present:

1. In the first spring trial with sandy soil, nematode treatments were quite successful.
2. At the second field site, the soil was a heavier type ("light clay") which might have affected nematode performance.



Application methods

-Plants under black plastic mulch difficult to apply the nematodes, a bit of a challenge..



-But nematodes were recovered in soil after applications



Main conclusions:

1. *S. kraussei* was active at low temperature, but did not give significant control of the target pest *O. sulcatus*
2. *S. kraussei* might have performed better in a lighter soil type at the low temps
3. *H. megidis* was not active or effective at temperatures below 12C



Further work:

1. Improve nematode application in the field

- drip irrigation
- drench
- timing
- Use of other nematode isolates/strains

2. Soil type studies

3. More field trials



A woman with brown hair, wearing a white and grey jacket and dark pants, stands in a field of green plants. She has her arms outstretched and is smiling. The background shows a lush green hillside with a small white patch of snow or ice near the top. There are some wooden posts in the field, and a white van is visible in the distance.

Thanks to:

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