

# The power of monitoring data - analysis of long term codling moth data



Stellenbosch  
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forward together  
sonke siya phambili  
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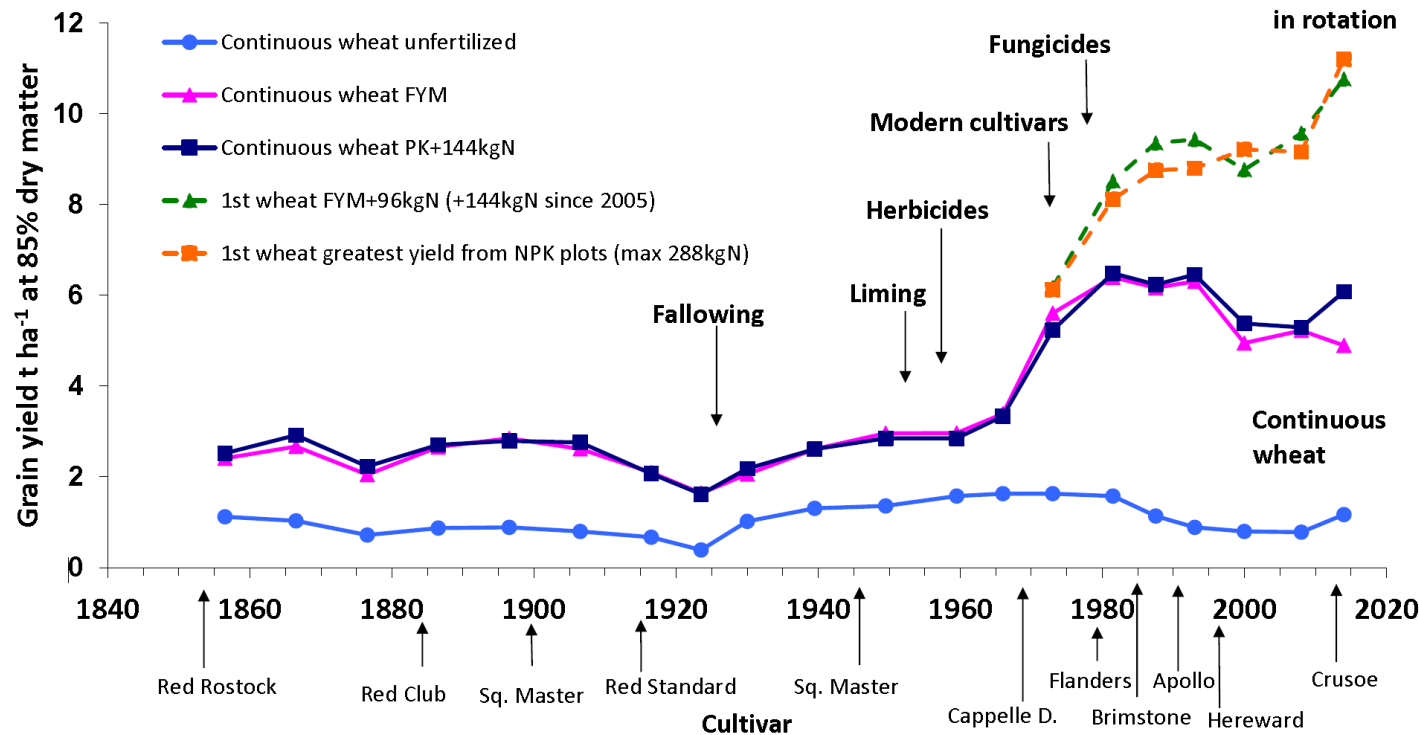




# The power of “FARM” monitoring data

## Examples

**Broadbalk: Mean long-term winter wheat grain yields**



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**Impact**  
Across entire industries

Rothamsted Research (2017). Dataset: Broadbalk mean long-term winter wheat yields *Rothamsted Research* [10.23637/KeyRefOABKyyields](https://data.rothamsted.ac.uk/datastudies/10.23637/KeyRefOABKyyields)

# The power of “FARM” monitoring data

## Burdens

- Cost
- Time consuming
- Lack of knowledge
- Lack of meaningful thresholds
- Ability to store and analyse data

## Benefits Headrick, 2021

- *Early detection of pest populations*
- *Determination of location and density*
- *Establishing population trends*
- *Having a retrievable record*
- *Proper timing of cultural, biological and chemical management tactics*
- *Follow-up assessment of efficacy*

# The “Crux”

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## The Basics

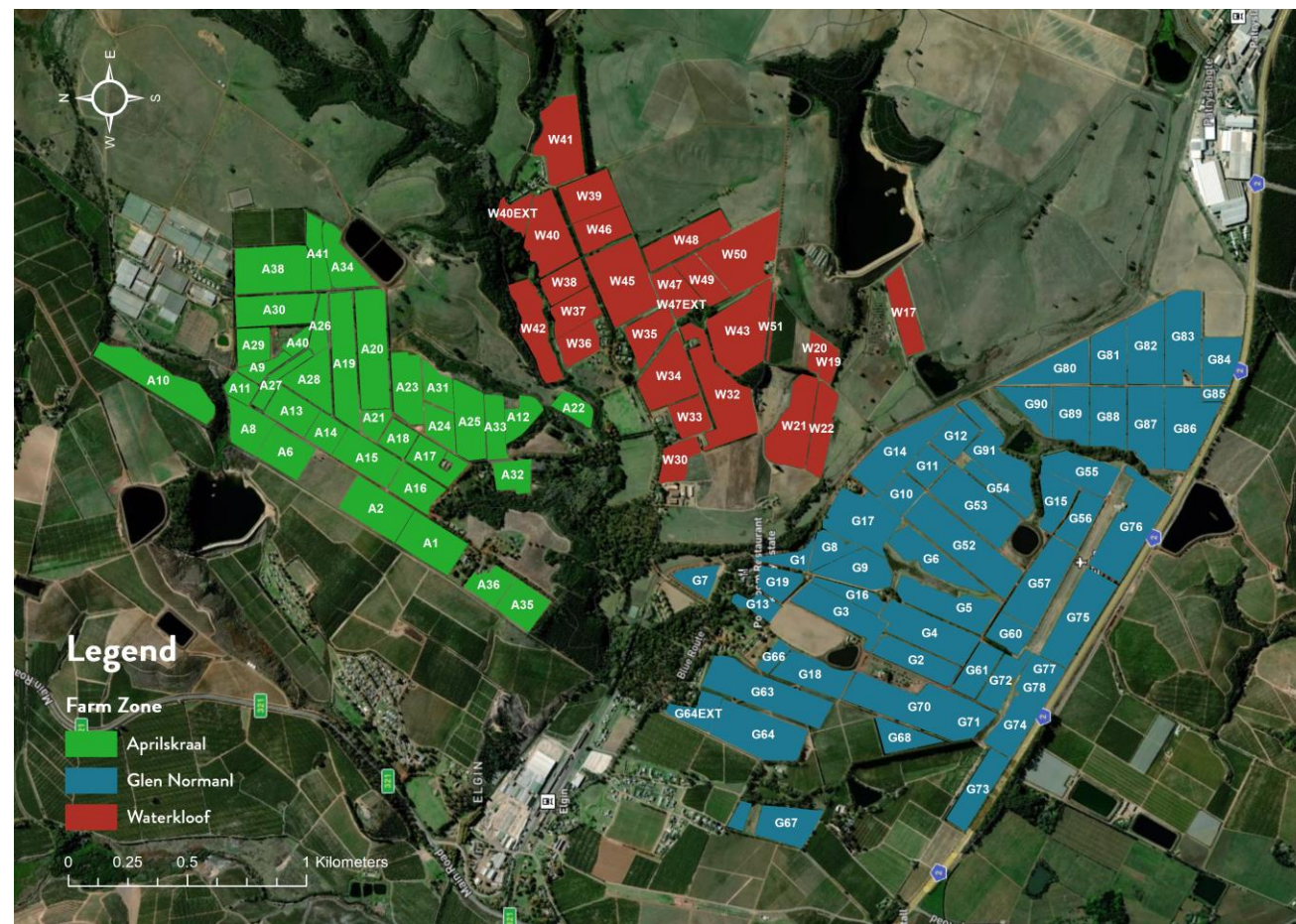
- Standardisation
- Continuity (Spatial & Temporal)

## Why?

- *Integral to good management*
  - Supports your decision making
- *Becomes of great value over time*
  - Generating useful information to improve farming practices.

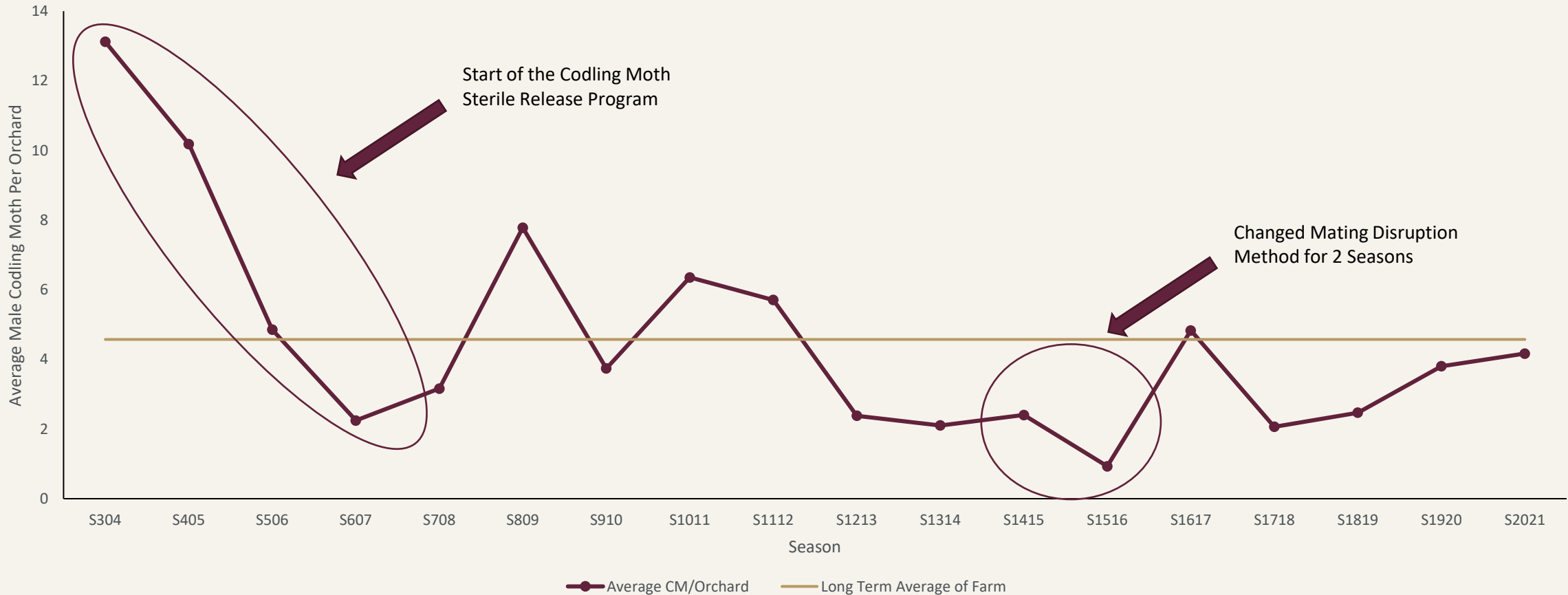
## Farm Data in Action

# Codling Moth Long Term Trap Catch & Fruit Damage Data



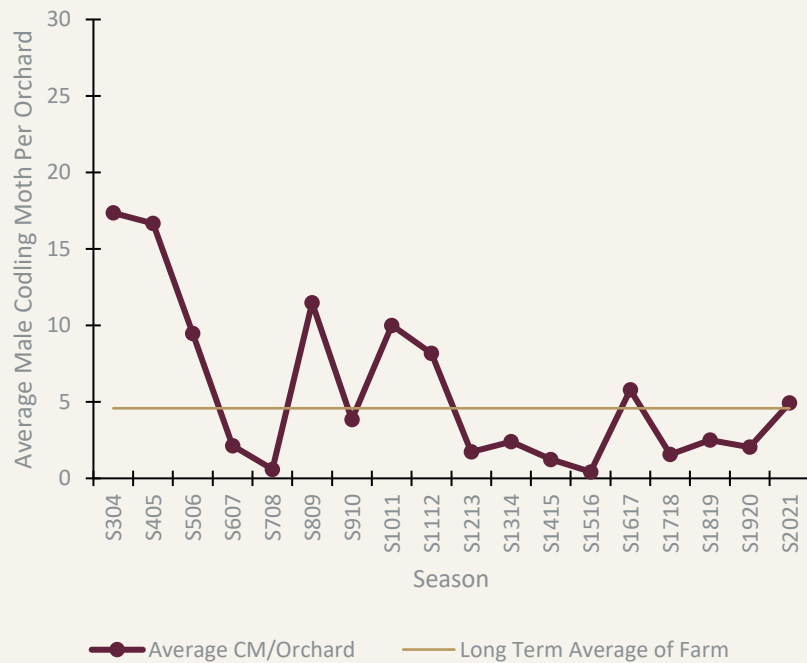
# Long-Term Trends

## Codling Moth Populations

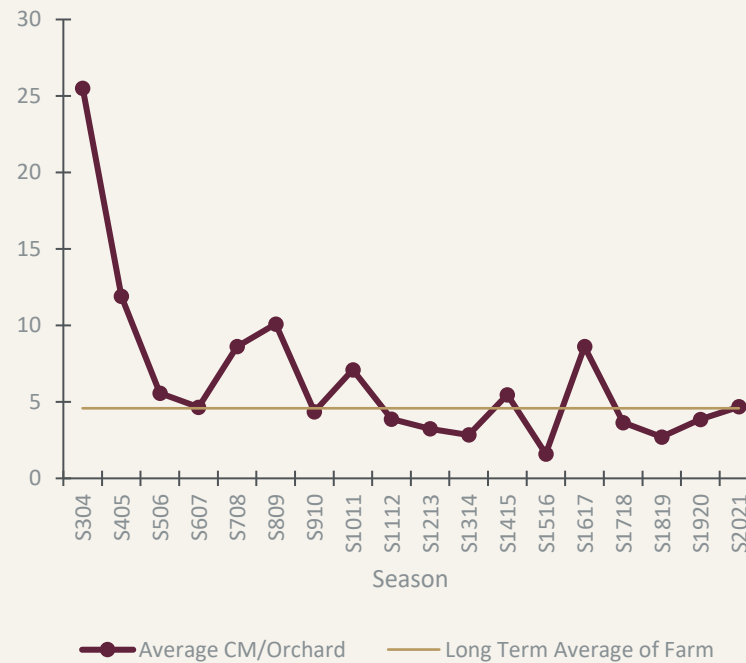


# Long-Term Trends

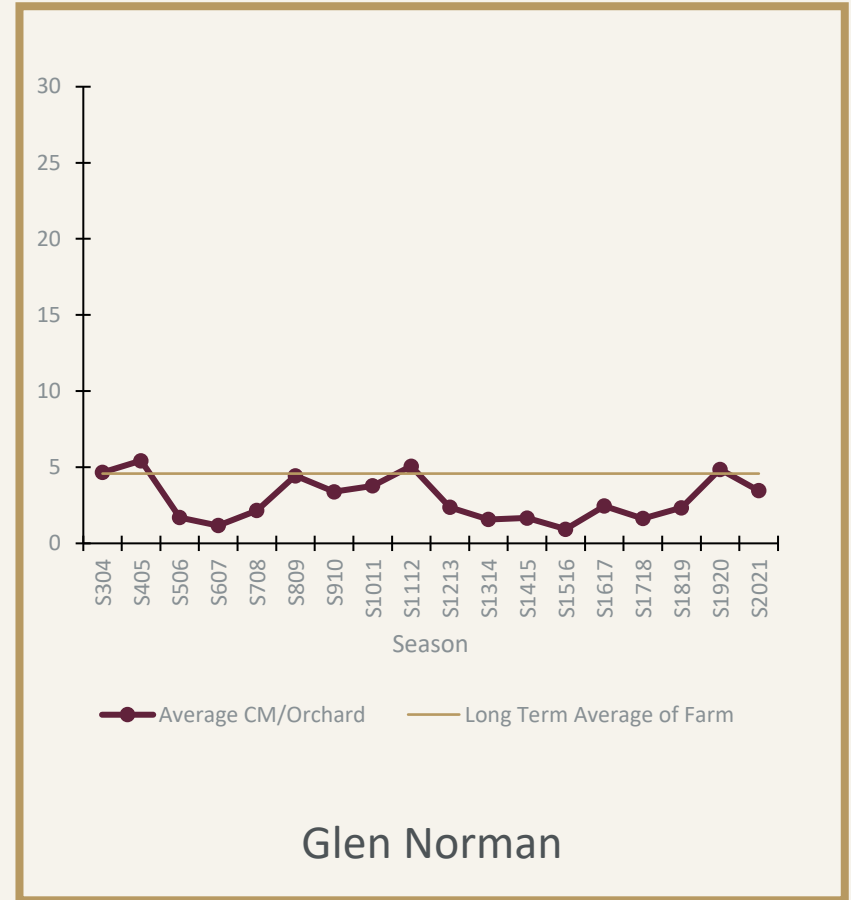
## Codling Moth Populations



Aprilskraal



Waterkloof



Glen Norman

# Long-Term Trends

## Apples - Trap Catch & Fruit Damage / Cultivar

| Apples             |                        |
|--------------------|------------------------|
| Cultivar           | Long Term Avg./Orchard |
| Pink Lady          | 11.37                  |
| Rokewood (GS & GD) | 9.36                   |
| Kanzi              | 7.11                   |
| Golden Delicious   | 6.52                   |
| Braeburn           | 6.37                   |
| Top Red            | 5.74                   |
| Fuji               | 4.46                   |
| Granny Smith       | 4.29                   |
| Royal Gala         | 3.75                   |
| Apple14            | 0.28                   |
| Buks (Big Bucks)   | 0.28                   |

Trap Catch/Cultivar

| Apples           |                        |
|------------------|------------------------|
| Cultivar         | Long Term Avg./Orchard |
| Pink Lady        | 2.07                   |
| Braeburn         | 0.97                   |
| Golden Delicious | 0.88                   |
| Kanzi            | 0.68                   |
| Top Red          | 0.67                   |
| Fuji             | 0.66                   |
| Granny Smith     | 0.58                   |
| Rokewood         | 0.50                   |
| Royal Gala       | 0.16                   |
| Apple14          | 0.00                   |
| Buks (Big Bucks) | 0.00                   |

% Fruit Damage/Cultivar



## Pears - Trap Catch & Fruit Damage / Cultivar

| Pears             |                        |
|-------------------|------------------------|
| Cultivar          | Long Term Avg./Orchard |
| Cheeky            | 5.64                   |
| Abate Fetel       | 4.23                   |
| Packham's Triumph | 2.28                   |
| Beurré Hardy      | 2.08                   |
| Forelle           | 1.68                   |
| Doyenne du Comice | 0.56                   |

Trap Catch/Cultivar

| Pears             |                        |
|-------------------|------------------------|
| Cultivar          | Long Term Avg./Orchard |
| Forelle           | 0.71                   |
| Packham's Triumph | 0.65                   |
| Abate Fetel       | 0.40                   |
| Beurré Hardy      | 0.14                   |
| Cheeky            | 0.00                   |
| Doyenne du Comice | 0.00                   |

% Fruit Damage/Cultivar

# Long Term Trends

# Spatial Distribution of Long Term Codling Moth Fruit Damage



| Orchards | Avg. % Fruit Damage |
|----------|---------------------|
| W39      | 23                  |
| A31      | 13                  |
| A38      | 7                   |
| G83      | 7                   |
| G86      | 7                   |
| G70      | 7                   |
| W45      | 7                   |
| W51      | 6                   |
| A36      | 6                   |
| W48      | 5                   |
| A34      | 5                   |
| W46      | 5                   |
| G91      | 5                   |

7 Seasons  
2009/2010 – 2015/2016



# Long Term Trends

## Spatial Distribution of Long Term Codling Moth Trap Catch



| Orchard | Avg. Trap Catch |
|---------|-----------------|
| A25     | 29              |
| A34     | 23              |
| G83     | 22              |
| W19     | 21              |
| W48     | 21              |
| W39     | 20              |
| W20     | 17              |
| A32     | 15              |
| A40     | 14              |
| A38     | 13              |
| A24     | 13              |
| W51     | 12              |
| G86     | 12              |

18 Seasons  
2009/2010 – 2015/2016

## Spatial Distribution of Codling Moth Fruit Damage & Trap Catch



| Orchard | Area (Ha) | Crop | Cultivar | Rootstock | Plant Year | Age In |
|---------|-----------|------|----------|-----------|------------|--------|
| A34     | 3.02      | A    | GS       | M793      | 1979       | 42     |
| A38     | 6.02      | A    | GD       | M109      | 2017       | 4      |
| W39     | 3.62      | A    | BN       | M793      | 1991       | 30     |
| W48     | 3.88      | A    | GD       | Seedling  | 1984       | 37     |
| G83     | 5.62      | A    | PL       | M109      | 1997       | 24     |
| G86     | 5.73      | A    | PL       | M109      | 1997       | 24     |



# Long Term Trends

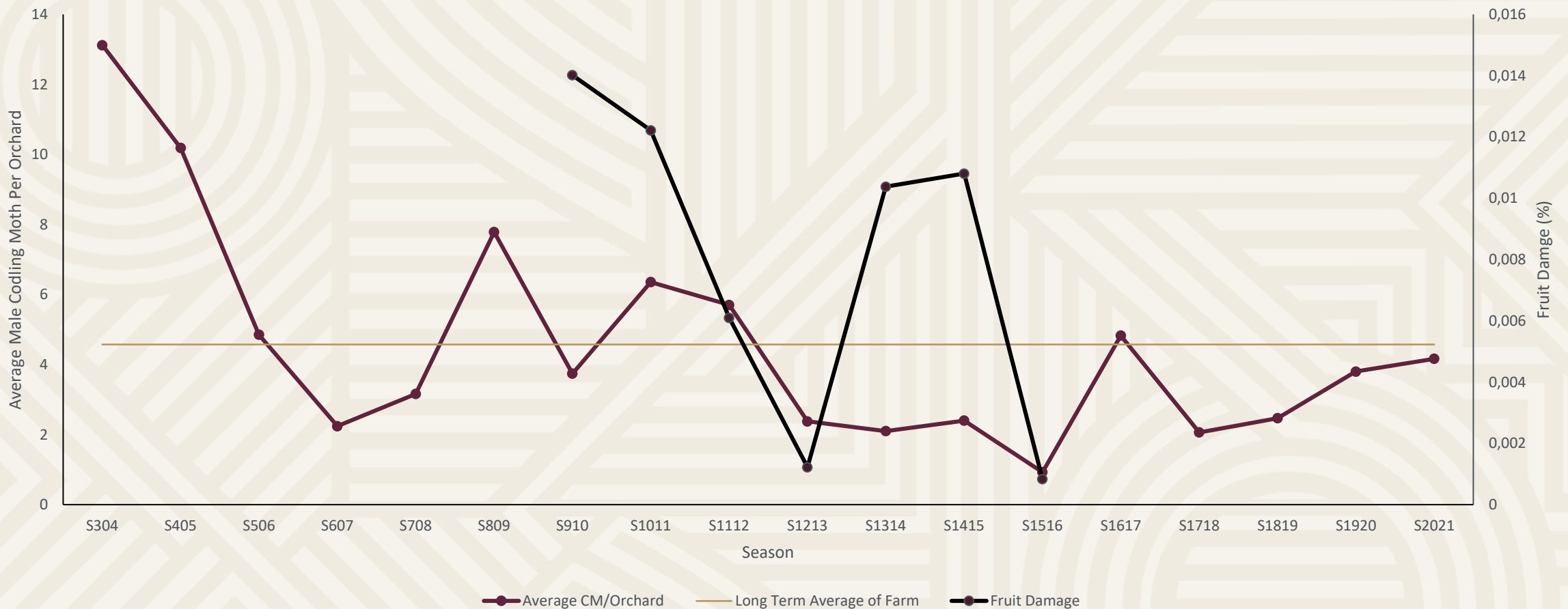
## Questions

- Is there a relationship between codling moth prevalence and fruit damage?
- Does fruit damage & CM prevalence relate to orchard size, age & slope?

# Long Term Trends

What is the relationship between codling moth prevalence and fruit damage?

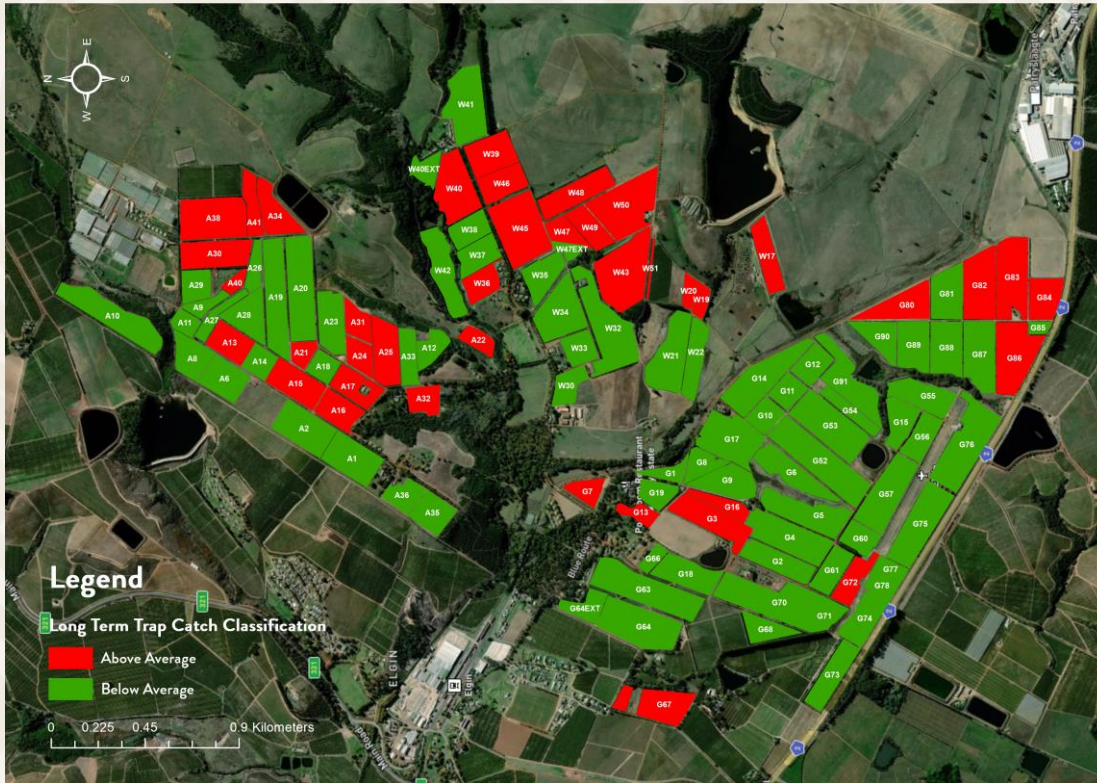
## Codling Moth Prevalence vs. Fruit Damage



# Long Term Trends

What is the relationship between codling moth prevalence and fruit damage?

## Codling Moth Prevalence vs. Fruit Damage



Long Term Trap Catch Classification



Long Term Fruit Damage Classification



# Long Term Trends

What is the relationship between codling moth prevalence and fruit damage?

## Codling Moth Prevalence vs. Fruit Damage

| Correspondence between Codling Moth Trap Catch & Fruit Damage Percentage |                                                 |                                                 |              |
|--------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|--------------|
| Description                                                              | Above Avg. Trap Catch & Above Avg. Fruit Damage | Below Avg. Trap Catch & Below Avg. Fruit Damage | % Similarity |
| Long Term                                                                | 21%                                             | 53%                                             | 74%          |
| 2009/2010                                                                | 13%                                             | 48%                                             | 61%          |
| 2010/2011                                                                | 7%                                              | 48%                                             | 55%          |
| 2011/2012                                                                | 2%                                              | 58%                                             | 60%          |
| 2012/2013                                                                | 6%                                              | 63%                                             | 68%          |
| 2013/2014                                                                | 9%                                              | 66%                                             | 76%          |
| 2014/2015                                                                | 14%                                             | 64%                                             | 79%          |
| 2015/2016                                                                | 0%                                              | 72%                                             | 72%          |

# Long Term Trends

What is the relationship between codling moth fruit damage and orchard size, age & slope?

## % Fruit Damage

| Description                 | Orchard Size (Ha) Classes |         |         |     |
|-----------------------------|---------------------------|---------|---------|-----|
|                             | <=1.8                     | 1.8-2.8 | 2.8-4.4 | >4  |
| % Correspondance Above Avg. | 24%                       | 15%     | 30%     | 31% |
| % Correspondance Below Avg. | 24%                       | 25%     | 27%     | 24% |

Size (ha)

| Description                 | Orchard Age (Years) Classes |         |      |
|-----------------------------|-----------------------------|---------|------|
|                             | 1 - 16                      | 17 - 36 | > 36 |
| % Correspondance Above Avg. | 17%                         | 63%     | 20%  |
| % Correspondance Below Avg. | 12%                         | 35%     | 54%  |

Age (years)

| Description                 | Orchard Slope (Degrees) Classes |                |               |
|-----------------------------|---------------------------------|----------------|---------------|
|                             | Low (2-6°)                      | Medium (6-10°) | High (10-25°) |
| % Correspondance Above Avg. | 46%                             | 38%            | 16%           |
| % Correspondance Below Avg. | 41%                             | 47%            | 11%           |

Slope (degrees)

# Long Term Trends

What is the relationship between codling moth prevalence and orchard size, age & slope?

## Trap Catch

| Description                 | Orchard Size (Ha) Classes |         |         |     |
|-----------------------------|---------------------------|---------|---------|-----|
|                             | <=1.8                     | 1.8-2.8 | 2.8-4.4 | >4  |
| % Correspondance Above Avg. | 27%                       | 18%     | 29%     | 26% |
| % Correspondance Below Avg. | 24%                       | 26%     | 25%     | 25% |

Size (ha)

| Description                 | Orchard Age (Years) Classes |         |      |
|-----------------------------|-----------------------------|---------|------|
|                             | 1 - 16                      | 17 - 36 | > 36 |
| % Correspondance Above Avg. | 17%                         | 62%     | 21%  |
| % Correspondance Below Avg. | 32%                         | 50%     | 18%  |

Age (years)

| Description                 | Orchard Slope (Degrees) Classes |                |               |
|-----------------------------|---------------------------------|----------------|---------------|
|                             | Low (2-6°)                      | Medium (6-10°) | High (10-25°) |
| % Correspondance Above Avg. | 48%                             | 36%            | 17%           |
| % Correspondance Below Avg. | 40%                             | 47%            | 13%           |

Slope (degrees)



# What did we learn?

## Long Term Trends

- Fruit damage corresponded well with trap catch (74% long term).
- Above avg. fruit damage very weekly relates orchards between 16-36 years old (age).
- Below avg. fruit damage very weekly relates to orchards > 36 years (age).
- Neither orchard size, age or slope is a significant driver for trap catch.
- The spatial and temporal drivers trap catch and fruit damage is complex.

# What's Next?

## Excited!

- Access to TERRA CLIM climate variables for each orchard (2016 – current)
  - Redefine CM degree day models for Elgin | Grabouw
- Determine the environmental drivers of CM spatial & temporal patterns



# What can you do?

## Start Monitoring!

- Make it work for you, but get the basics right.



**Thank you  
Enkosi  
Dankie**

Photo by Gulu Bekker