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FruitFlyNet

A Location–aware System for Fruit Fly Monitoring and Pest Management Control

Invasive Fruit Flies

Dacus ciliatus and spring melon (*Cucumis melo*) in the Arava (*InvasiveFlyNet*): Monitoring and Damage

Agricultural University of Athens

CRA
CONSIGLIO PER LA RICERCA E LA SPERIMENTAZIONE IN AGRICOLTURA

UIB Universitat de les Illes Balears

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The 2007-2013 ENPI CBC Mediterranean Sea Basin Programme is a multilateral Cross-Border Cooperation initiative funded by the European Neighbourhood and Partnership Instrument (ENPI). The Programme objective is to promote the sustainable and harmonious cooperation process at the Mediterranean Basin level by dealing with the common challenges and enhancing its endogenous potential. It finances cooperation projects as a contribution to the economic, social, environmental and cultural development of the Mediterranean region. The following 14 countries participate in the Programme: Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Malta, Palestine, Portugal, Spain, Syria (participation currently suspended), Tunisia. The Joint Managing Authority (JMA) is the Autonomous Region of Sardinia (Italy). Official Programme languages are Arabic, English and French (www.enpicbcmed.eu).

The European Union is made up of 28 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

The project FruitFlyNet total budget is 1.662.872,32€ and it is financed, on an amount of 1.496.585,09€ (90 %), by the European Union (ENPI CBC Mediterranean Sea Basin Programme) through the European Neighbourhood and Partnership Instrument.

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Invasive Organisms

- Ecological-Paleobiological Definition:

  Refers to species that expand their geographic range “relatively” fast

- Economic Definition:

  Species that found their way out of their native range and into a novel non-native location via human actions

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Table 17.2 Economic Losses to Introduced Pests in Crops, Pastures, and Forests in the United States, United Kingdom, Australia, South Africa, India, and Brazil (billion dollars per year)

Introduced pest	United States	United Kingdom	Australia	South Africa	India	Brazil	Total
Weeds							
Crops	27.9	1.4	1.8	1.5	37.8	17.0[d]	87.4
Pastures	6.0	—	0.6	—	0.92	—	7.52
Vertebrates							
Crops	1.0[a]	1.2[b]	0.2[c]	—	—	—	2.4
Arthropods							
Crops	15.9	0.96	0.94	1.0	16.8	8.5	44.1
Forests	2.1	—	—	—	—	—	2.1
Plant pathogens							
Crops	23.5	2.0	2.7	1.8	35.5	17.1	82.6
Forests	2.1	—	—	—	—	—	2.1
Total	**78.5**	**5.56**	**3.24**	**4.3**	**91.02**	**42.6**	**228.72**

a = Losses due to English starlings and English sparrows[4]

b = Calculated damage losses from the European rabbit (see text)

c = 34

d = Pasture losses included in crop losses

— = data not available

Data for 2002; Pimentel, Biological Invasions

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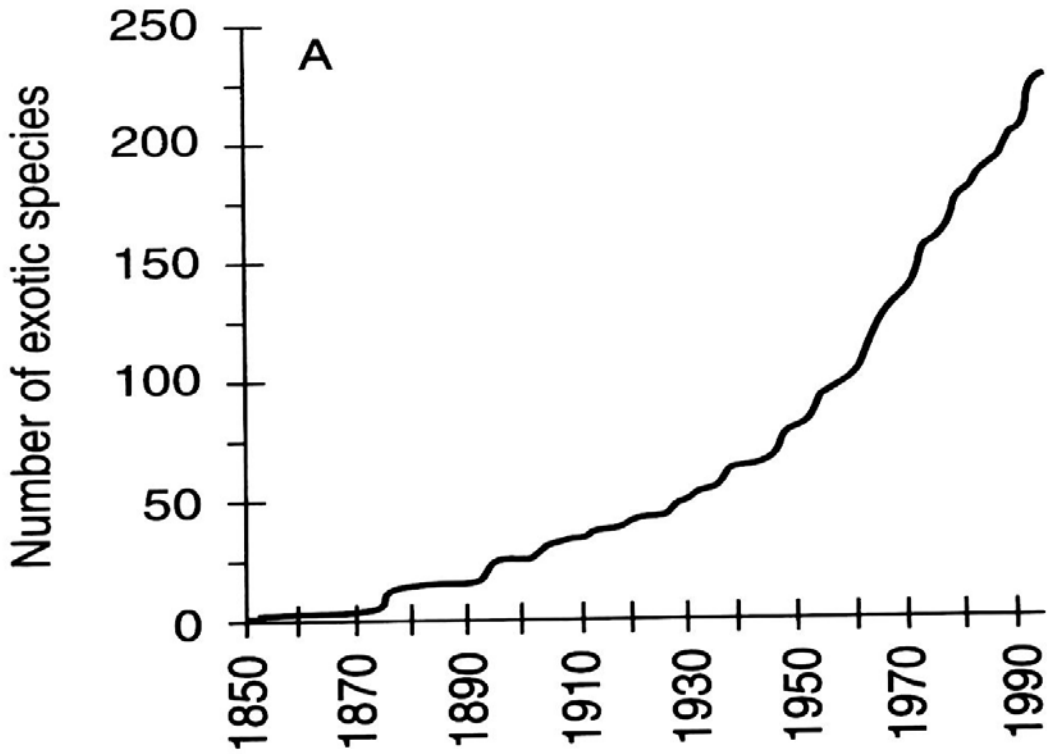
Rate of Invasion (e.g., San Francisco Bay)



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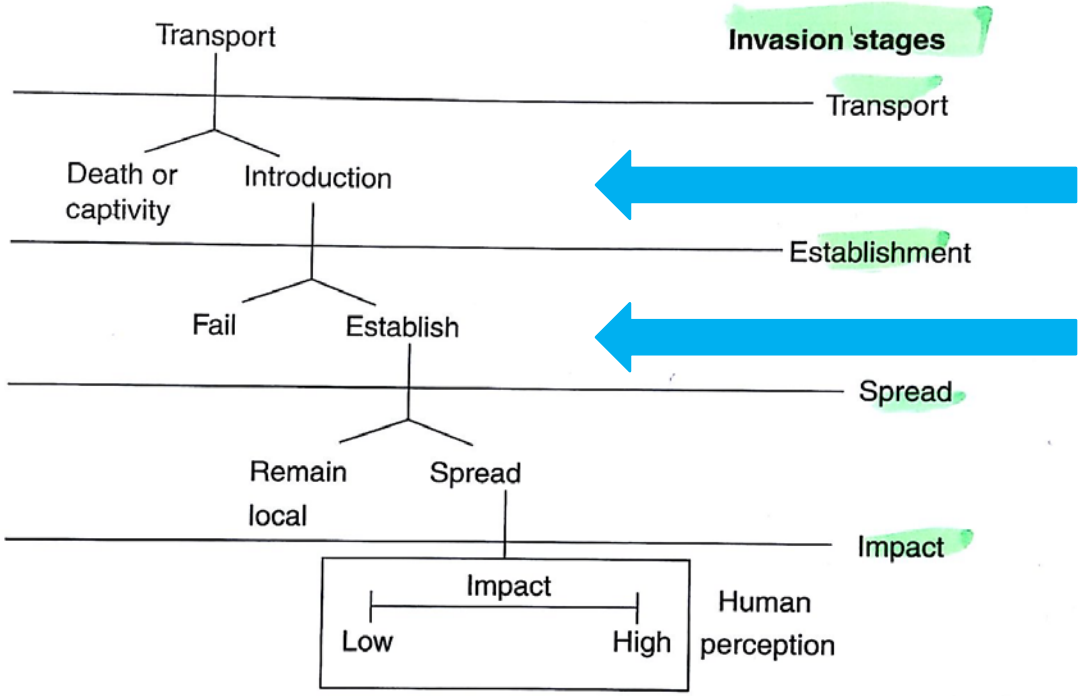

Figure 1.2 **Invasion process model depicting the discrete stages an invasive species passes through as well as alternative outcomes at each stage.**

EARLY WARNING SYSTEMS

Development of Management Systems

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Invasive Fruit Flies in Israel

Dacus ciliatus;
Ethiopian fruit fly

Recently established in the Arava

Bactrocera zonata;
Peach fruit fly

**Frequently Intercepted in the Negev;
Recent Outbreak in Tel Aviv**

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Ethiopian fruit Fly:

Development of Management System

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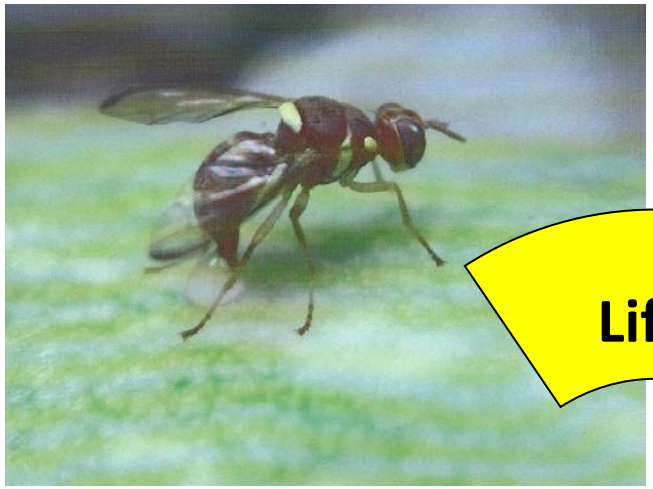
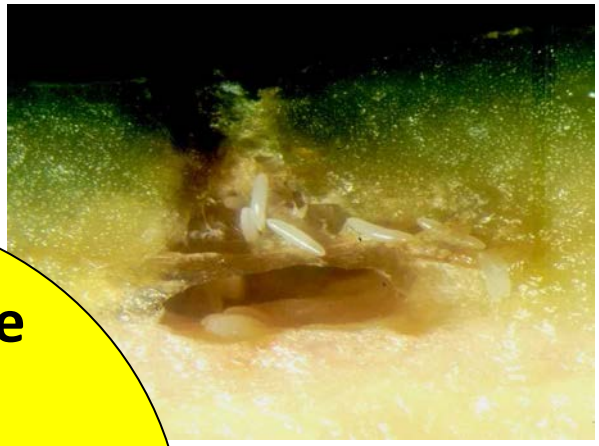
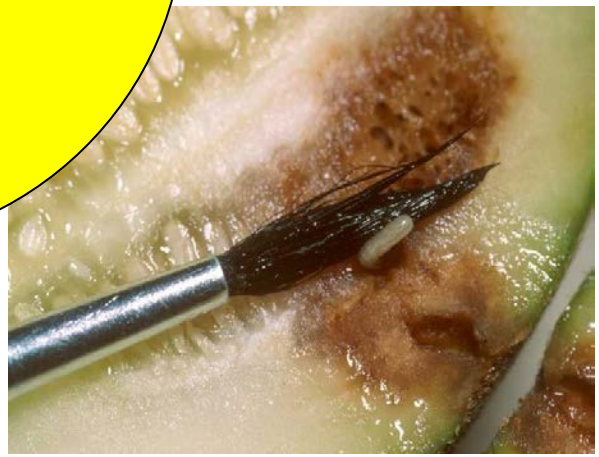




Life Cycle



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Damage

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Aim of the Project

To Inquire on the temporal and spatial dynamics of *D. ciliatus* in a melon growing area of the Arava, and to develop a Management system that incorporates new concepts and technologies (DSS + *ReTIC* Monitoring Systems)

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Geographic Location of the Pilot Site

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Ein-Yahav-Melon Production

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Coexisting Melon Production Systems in Ein Yahav

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Avg. Growing-Tunnel Dimension = 750 m^2

Avg. Production per Growing-Tunnel ca. 8-9 T

Avg. Net Income per Growing-Tunnel € 5,000

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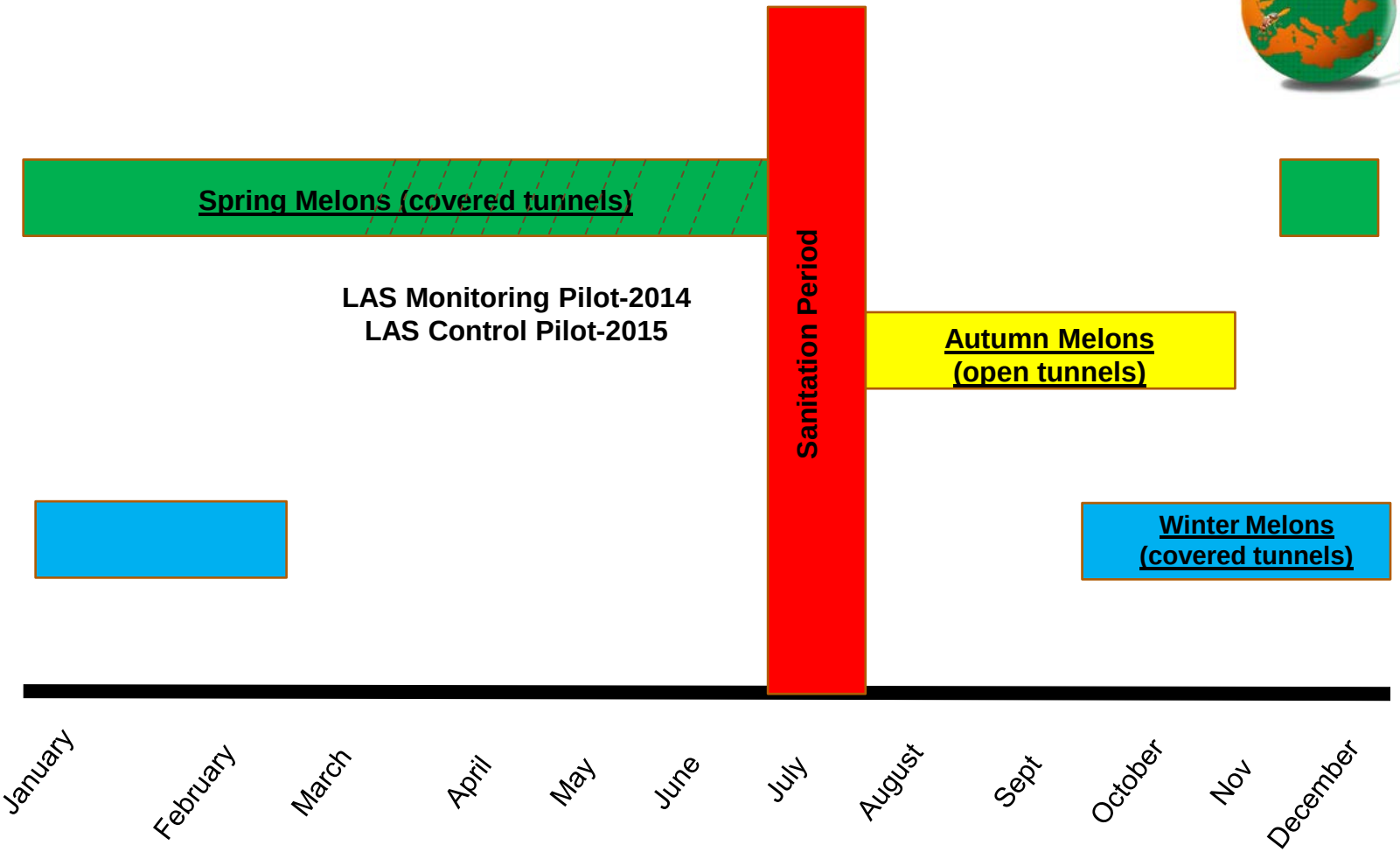

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Ein Yahav – Objectives for 2014

- To determine optimum trap locations for monitoring.
- To study the phenology of *D. ciliatus*.
- To study the relationship between fly activity and fruit damage.

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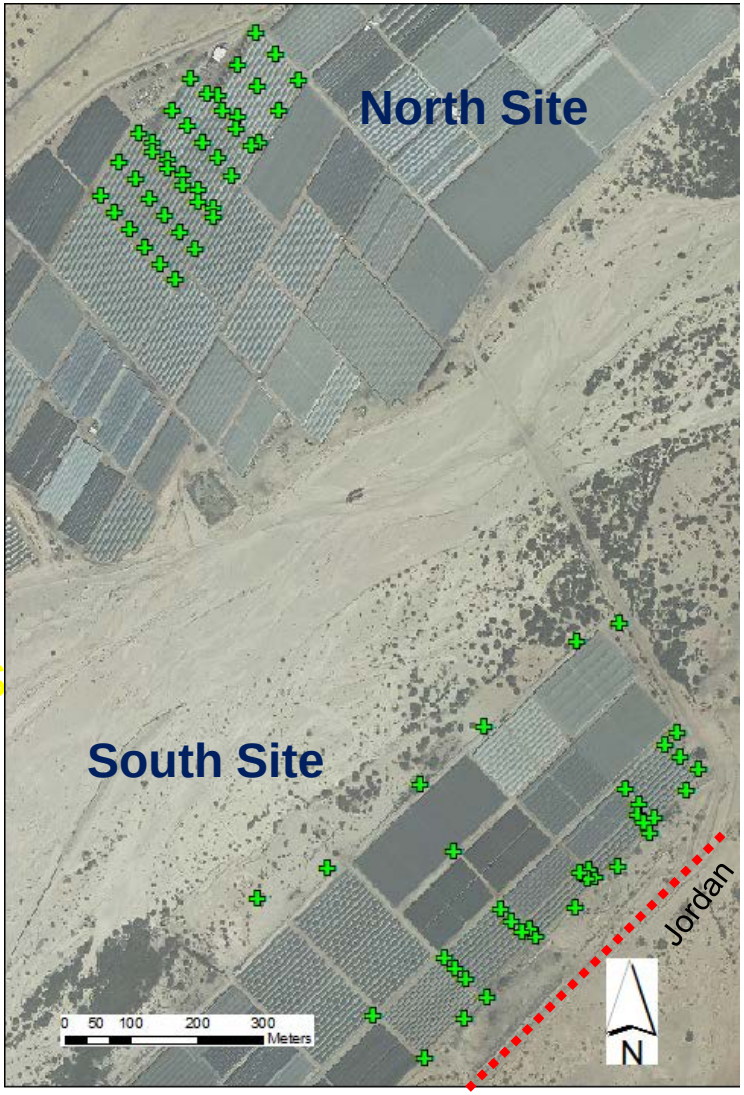
78 Traps
Serviced: Every 15 days



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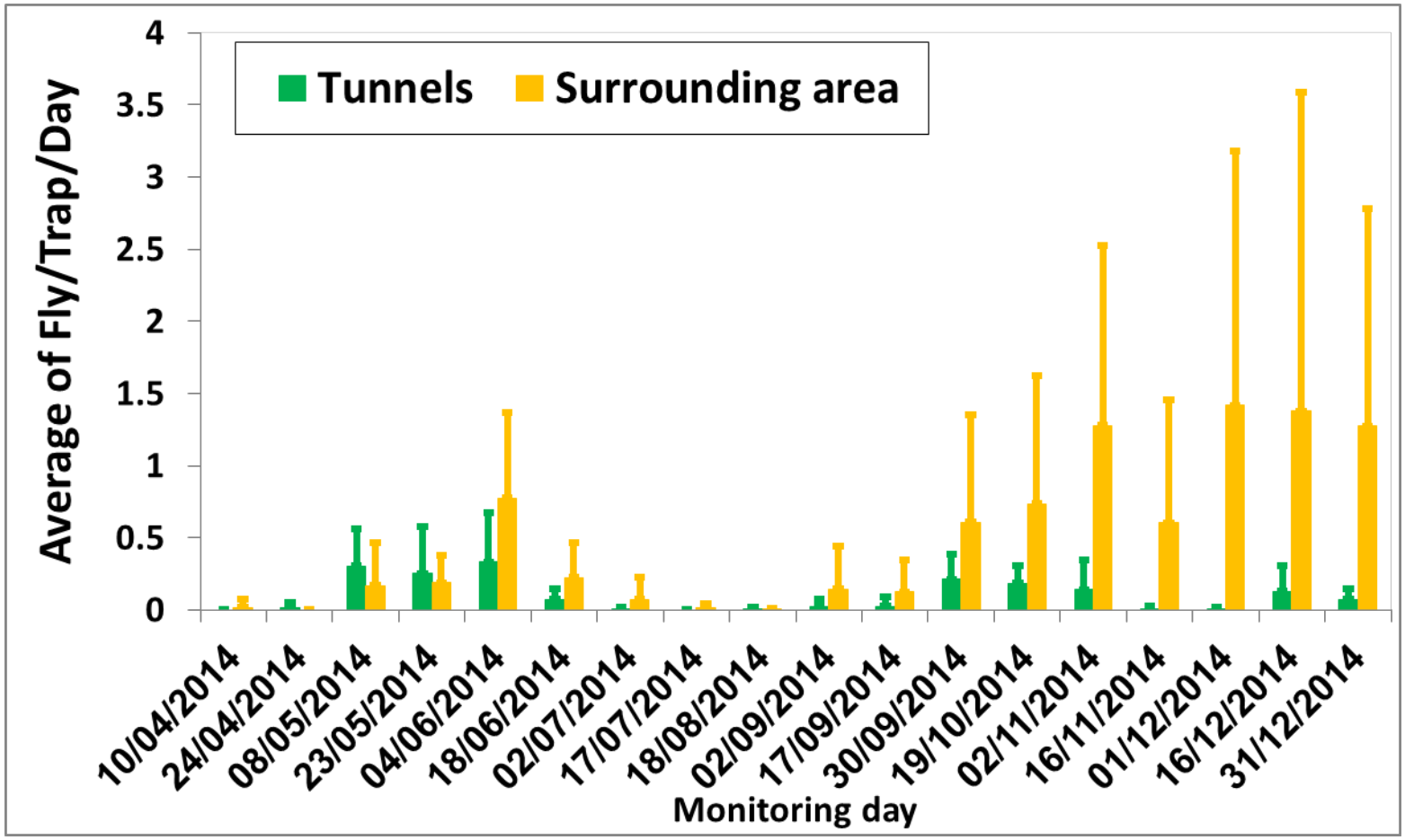
Ein Yahav – Southern Site



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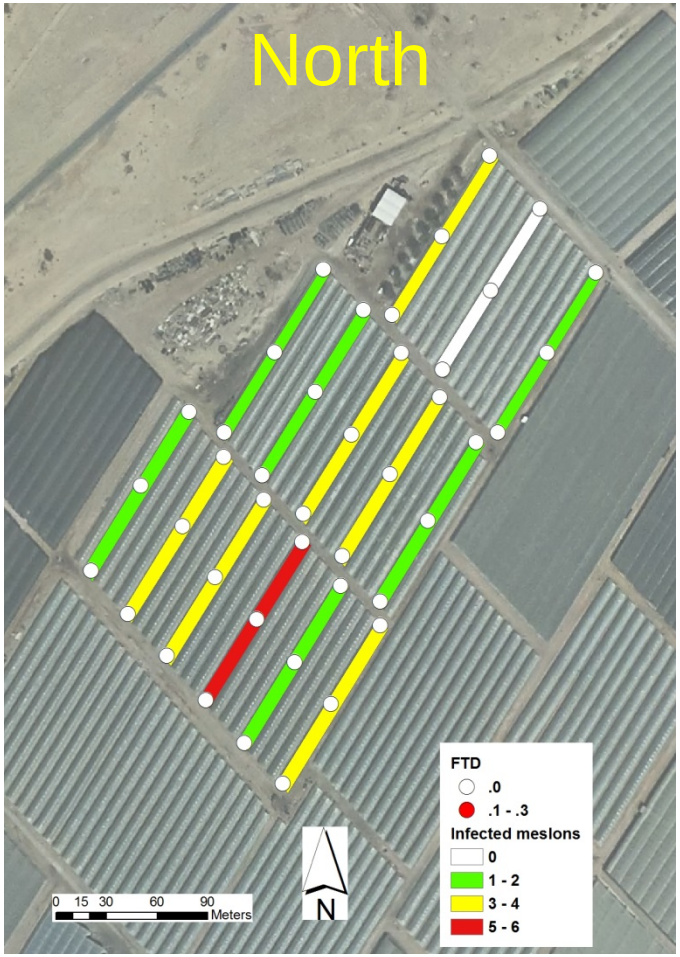
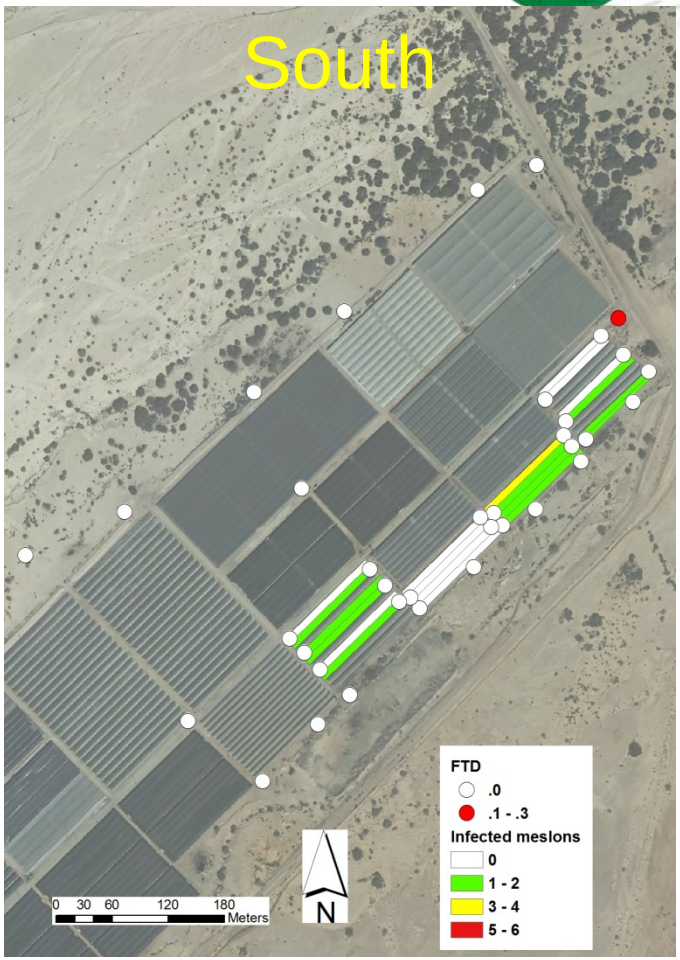
Fly activity and Fruit samples

Sampling dates: traps: April-10-17, 2014





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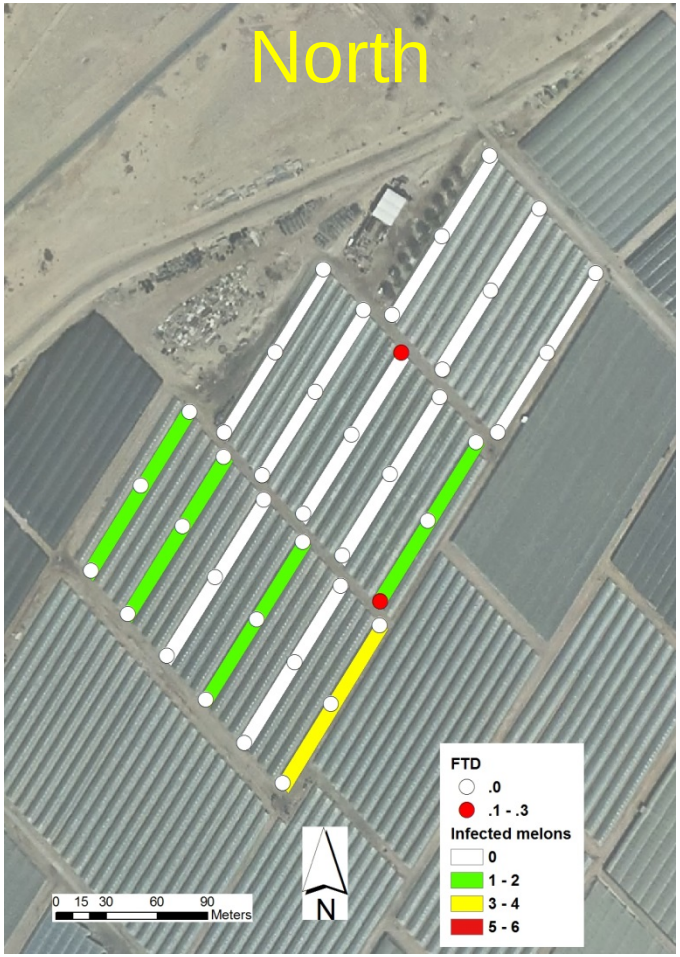
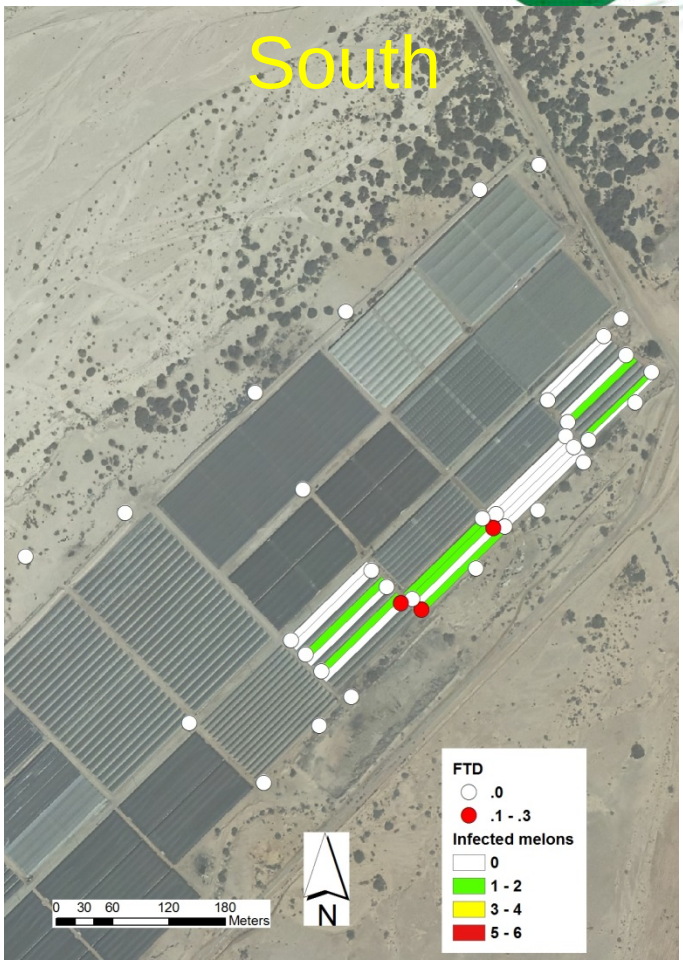
Fly activity and Fruit samples

Sampling dates: traps: April-24-May 5, 2014





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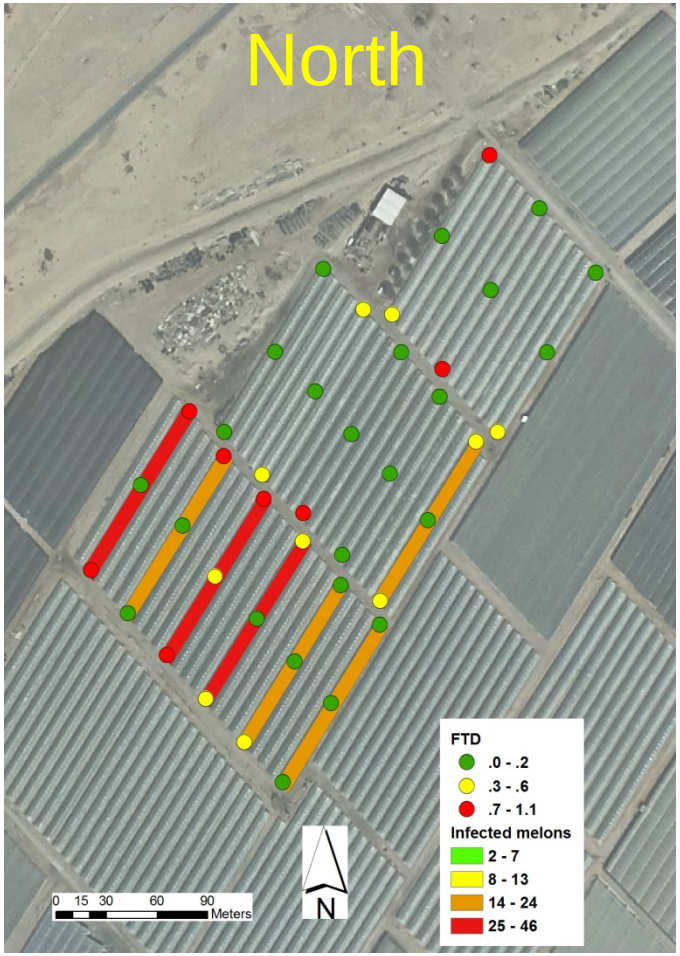
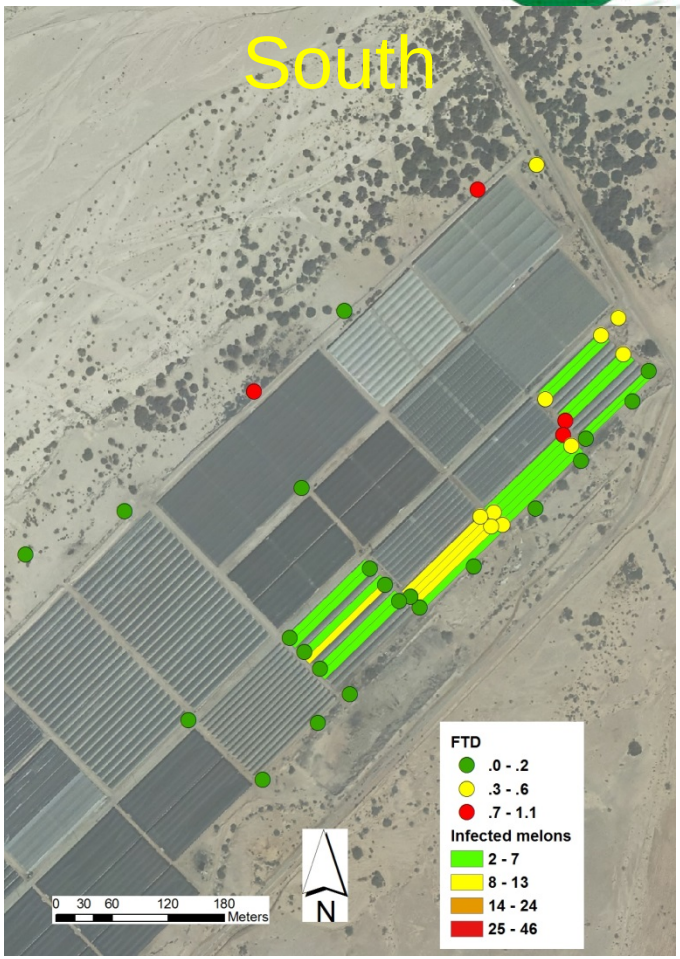
Fly activity and Fruit samples

Sampling dates: traps: May 8-15, 2014





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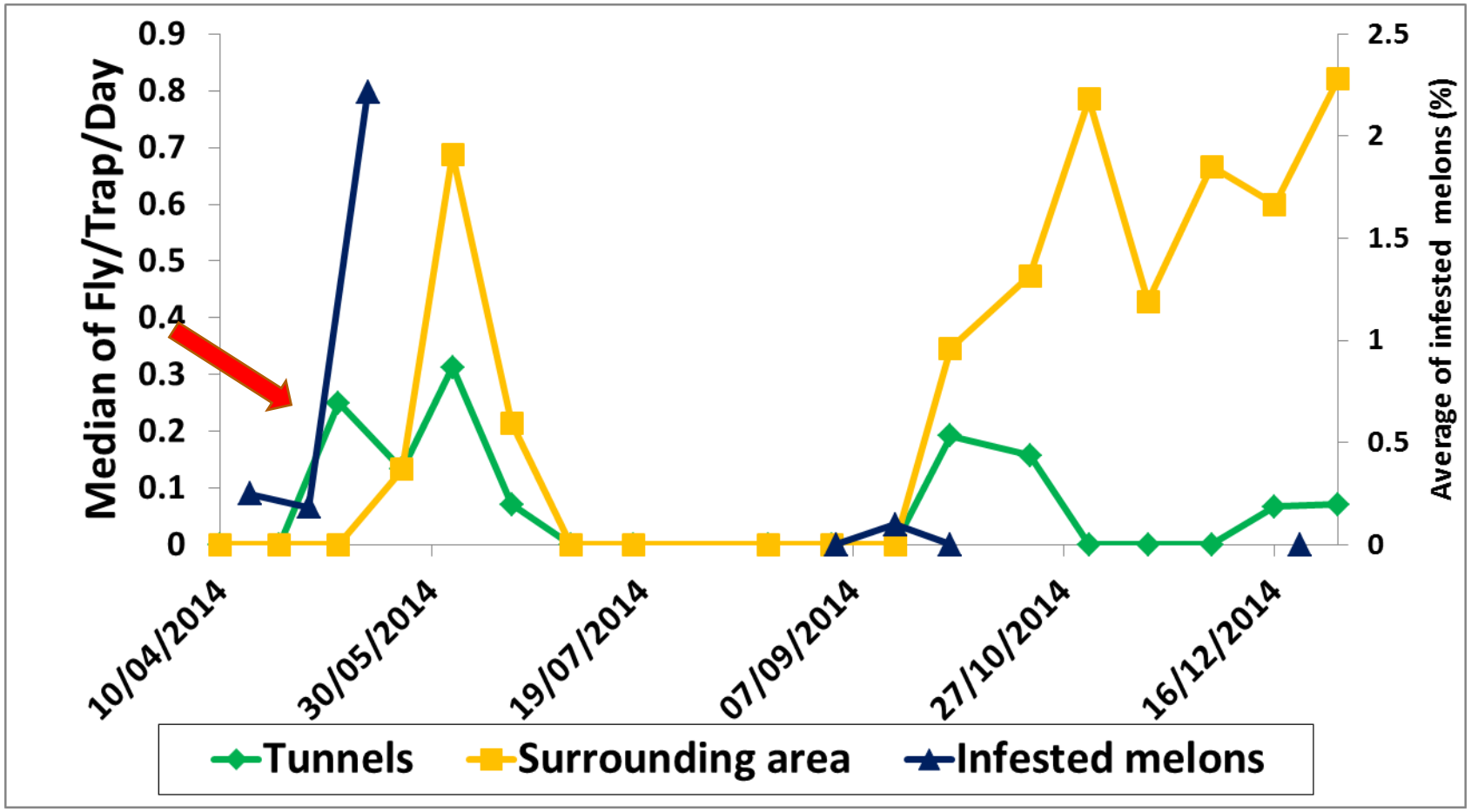
Ein Yahav – South Site



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Conclusions (and structure for Pilot 2015)

- We did not found a significant spatial pattern of *D. ciliatus*; therefore, each tunnel will be used as a management unit
- No clear relation between trap captures and fruit damages, thus, the two parameters should be monitored. As an exercise, we took 0.3 F/T/D as starting threshold for DSS
- Information derived from a single trap is misleading; use several traps to follow population trends and establish risk

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Ein Yahav – Objectives for 2015

- To explore *D. ciliatus* management using the concept of LAS and the results of 2014
- To explore the effectiveness of the *ReTIC* trap developed for Monitoring *D. ciliatus*
- To explore the ability of DSS for *D. ciliatus* under the conditions of the Arava

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Limitation in the Application of LAS Concept for *D. ciliatus* in melon production in the Arava

- Developed for orchards
- No existence of Economic Thresholds for the fly
- No compensatory system for farmer
- No ability to use several areas with similar characteristics

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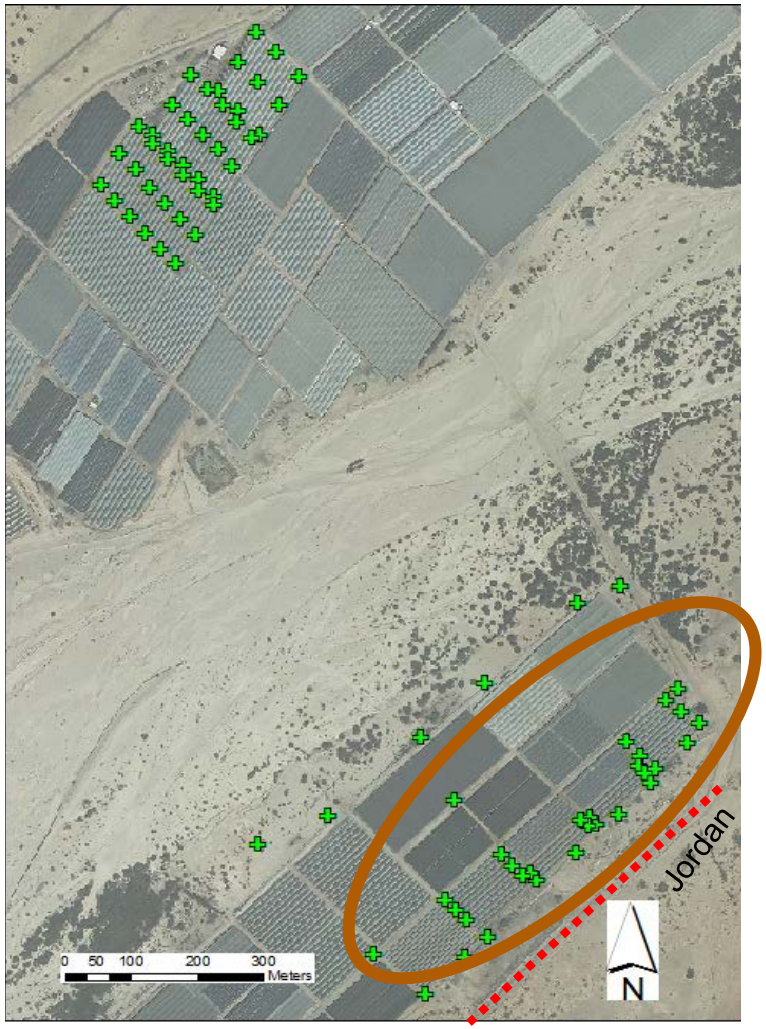

Plan For Pilot in 2015

1) We selected the Southern region (Farmer gave access)
2) We selected area with the same melon variety and similar agronomic practices
3) We used tunnels as the sampling unit
4) Monitoring: Rimi-Traps + several ReTIC traps + fruit damage

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Plan For Pilot in 2015

1) 10 Control Tunnels (sprayed following calendar)
2) 4 LAS Tunnels
3) Traps in all tunnel entrances; up to 10 ReTIC traps in the area
4) Control Tunnels managed with regular sprays against Dacus
5) LAS tunnels managed with a DSS system

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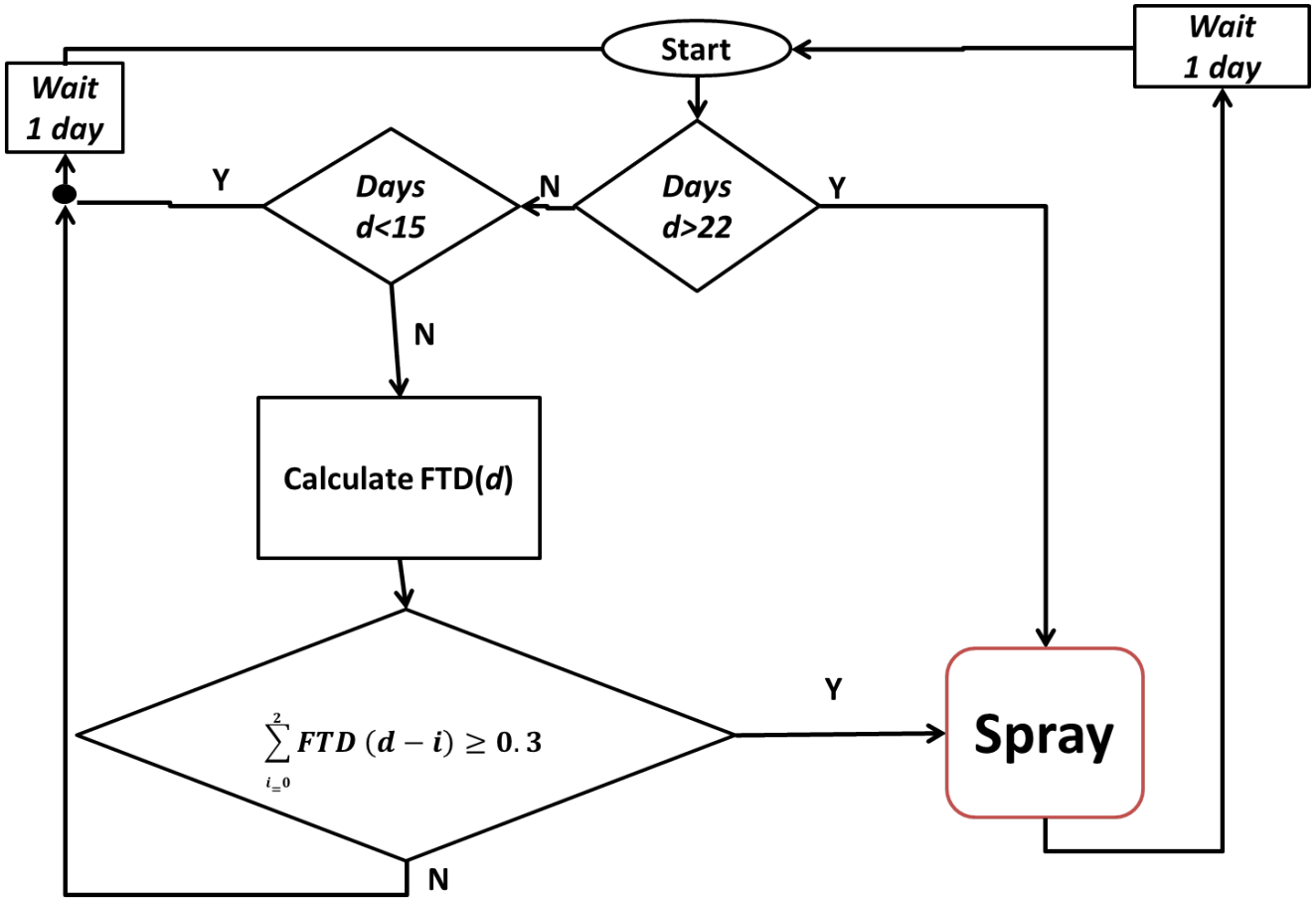
DSS for Dacus ciliatus (developed together with Farmer)



Calendar Spraying = 15 days

Farmer's Risk limit = 22 days

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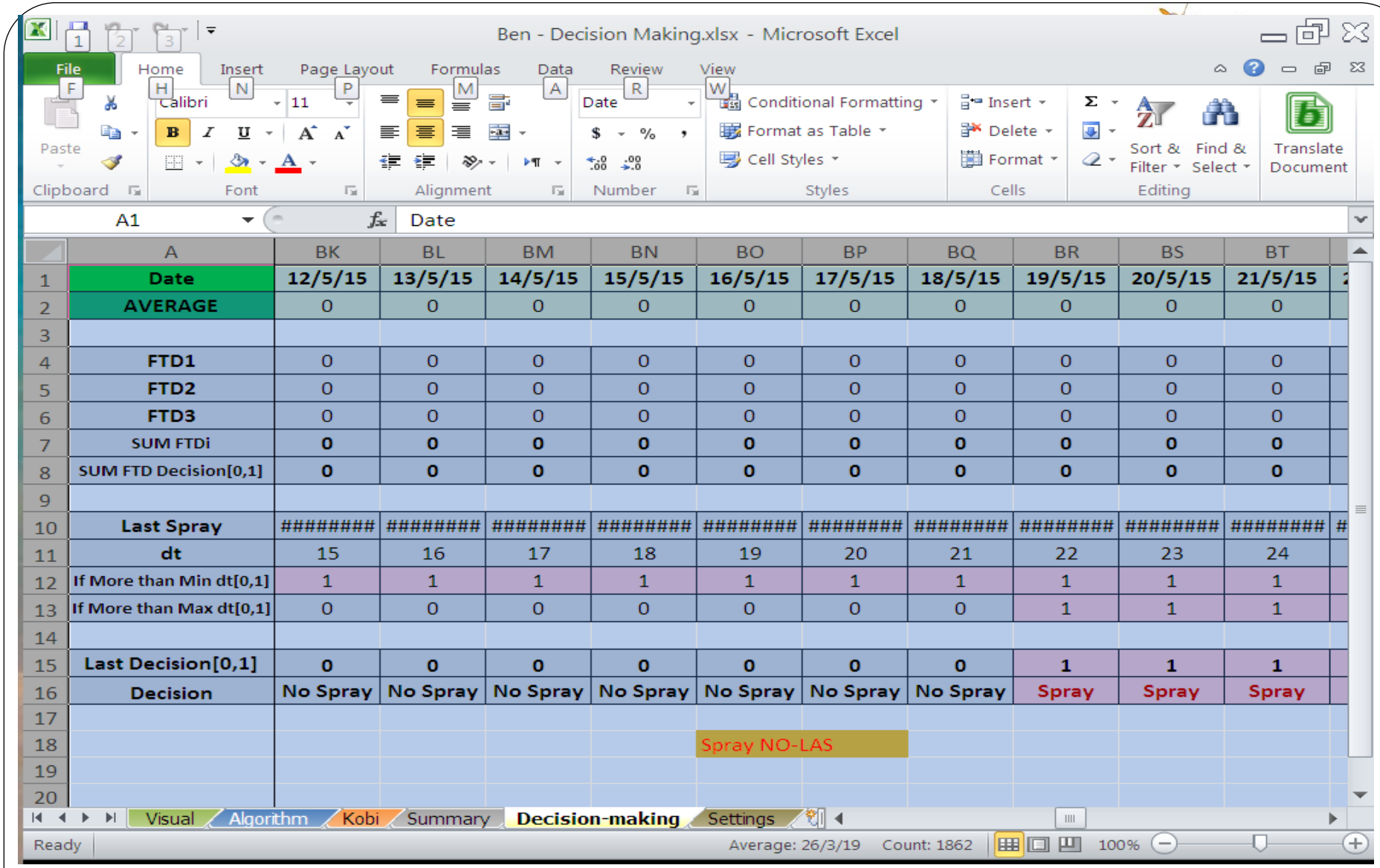

	A	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT
1	Date	12/5/15	13/5/15	14/5/15	15/5/15	16/5/15	17/5/15	18/5/15	19/5/15	20/5/15	21/5/15
2	AVERAGE	0	0	0	0	0	0	0	0	0	0
3											
4	FTD1	0	0	0	0	0	0	0	0	0	0
5	FTD2	0	0	0	0	0	0	0	0	0	0
6	FTD3	0	0	0	0	0	0	0	0	0	0
7	SUM FTDi	0	0	0	0	0	0	0	0	0	0
8	SUM FTD Decision[0,1]	0	0	0	0	0	0	0	0	0	0
9											
10	Last Spray	########	########	########	########	########	########	########	########	########	########
11	dt	15	16	17	18	19	20	21	22	23	24
12	If More than Min dt[0,1]	1	1	1	1	1	1	1	1	1	1
13	If More than Max dt[0,1]	0	0	0	0	0	0	0	1	1	1
14											
15	Last Decision[0,1]	0	0	0	0	0	0	0	1	1	1
16	Decision	No Spray	No Spray	No Spray	No Spray	No Spray	No Spray	No Spray	Spray	Spray	Spray
17											
18											
19											
20											

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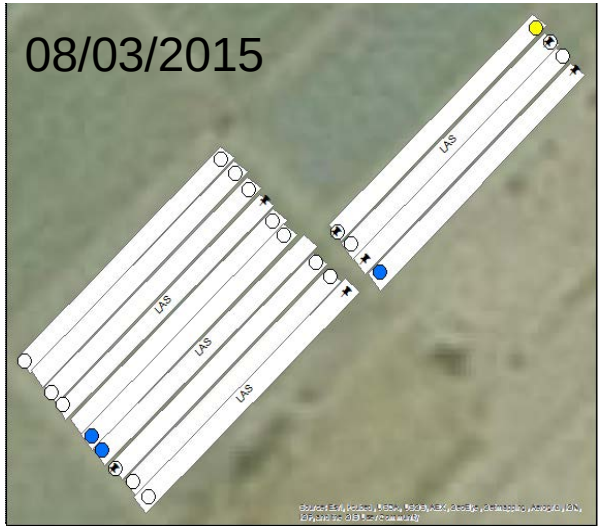

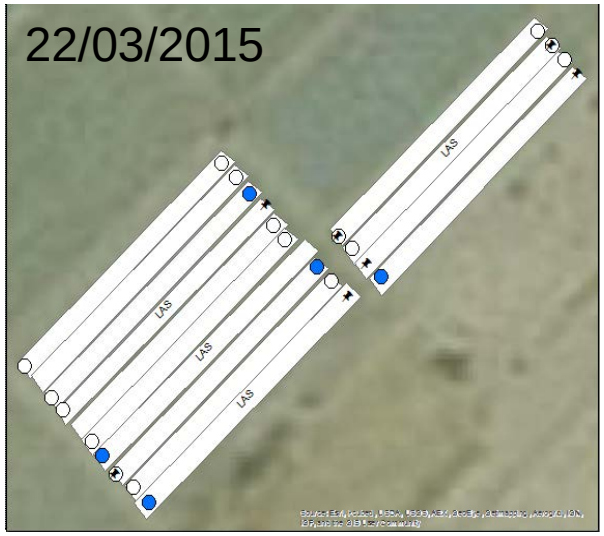

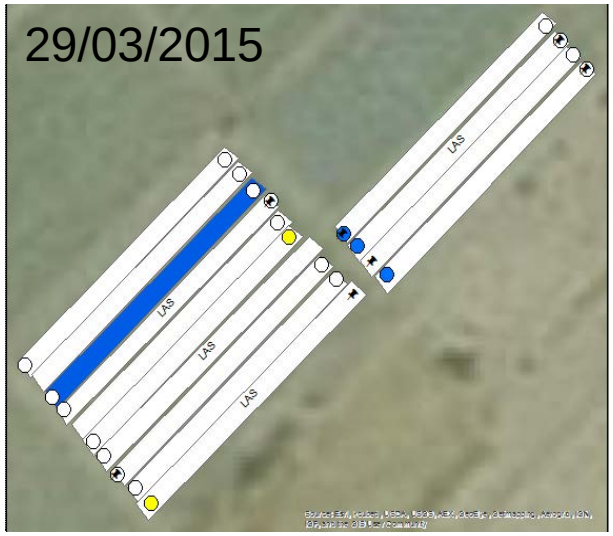

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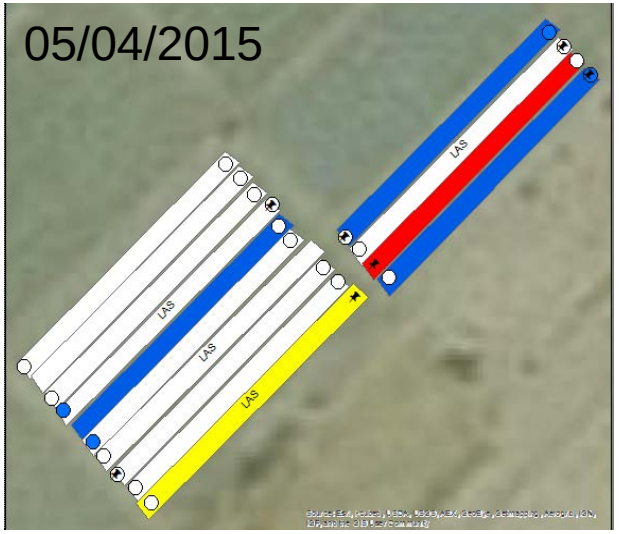

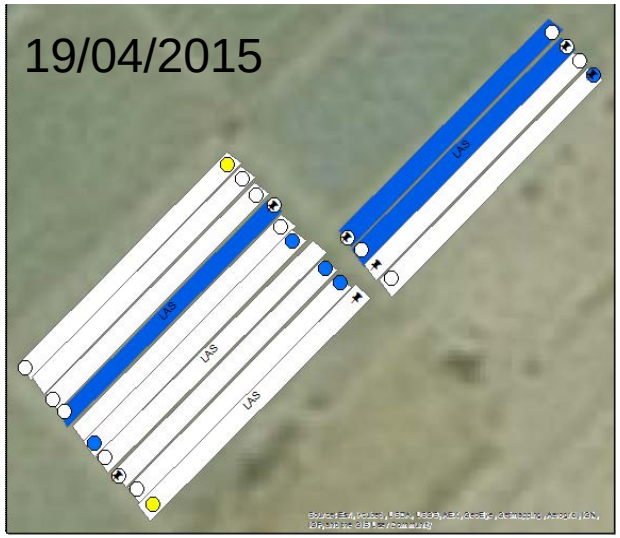

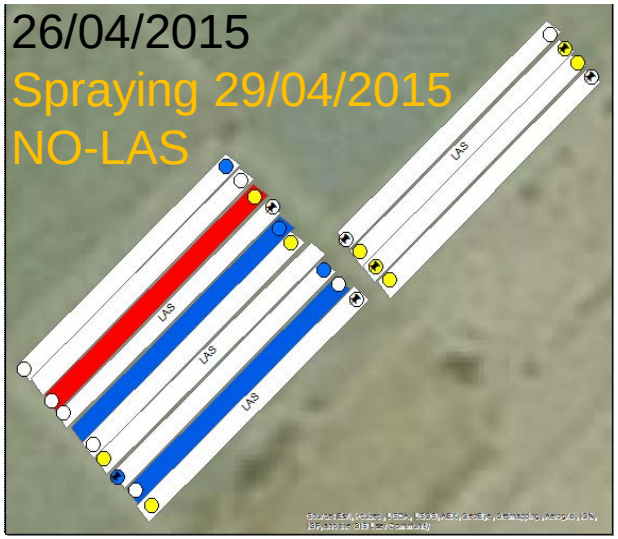

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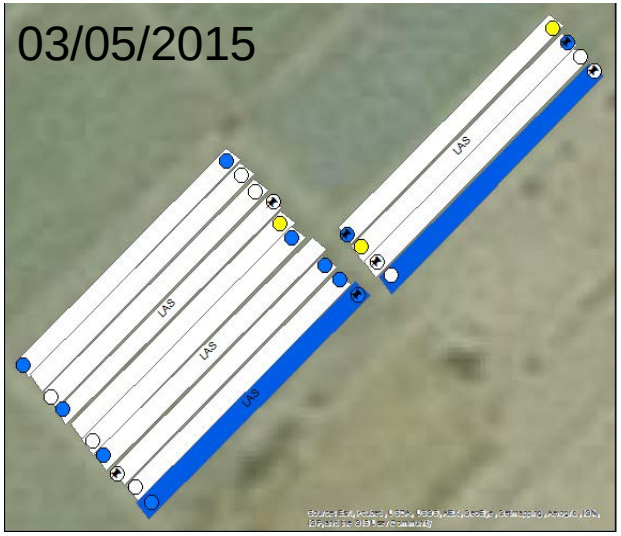

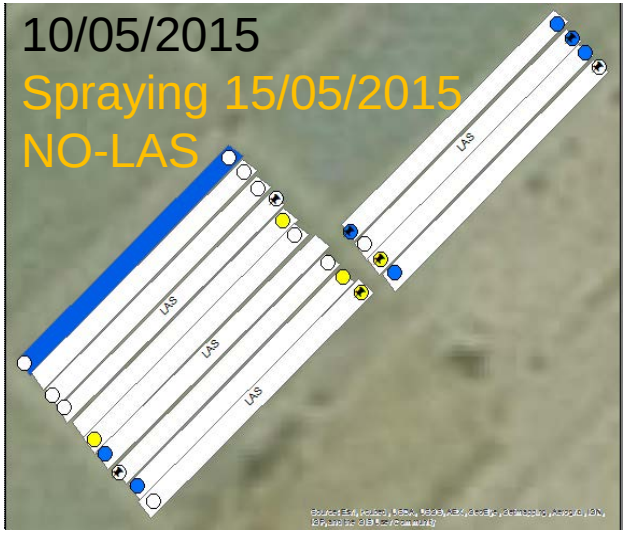

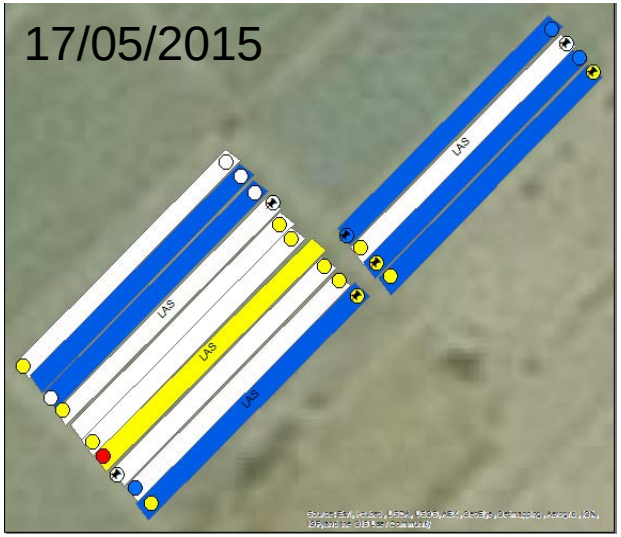

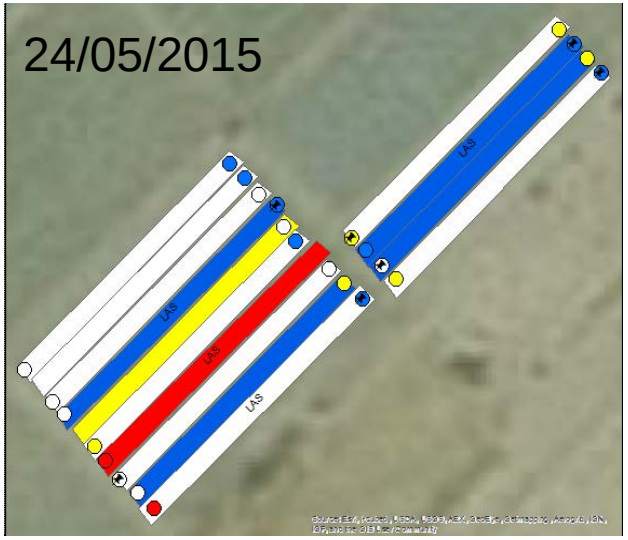

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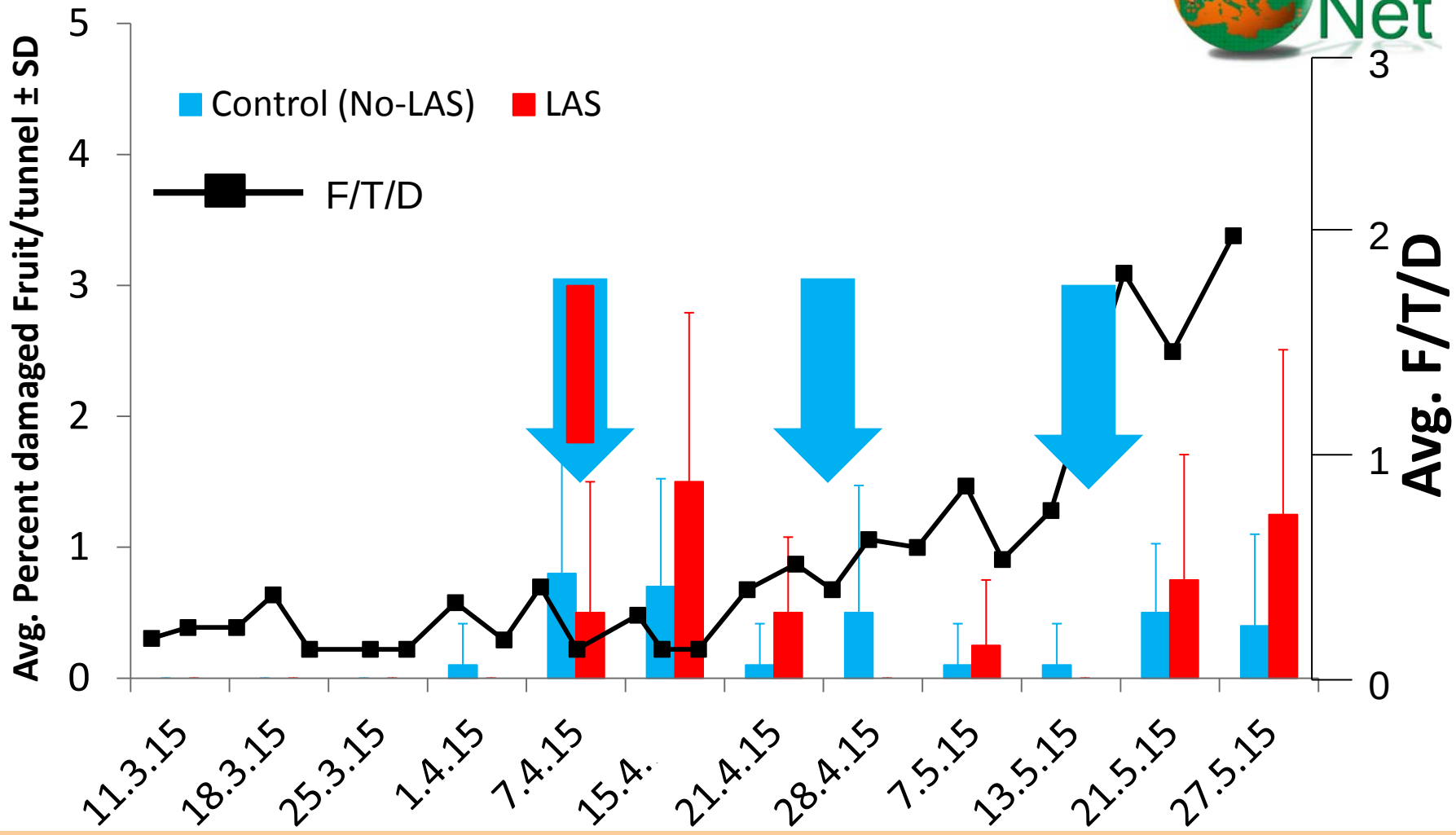
Damage and F/T/D Dynamics in Pilot



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Conclusions-Pilot

- In general, no relationship was detected between F/T/D and damage
- In general, damage in tunnels did not corresponded with F/T/D in tunnel
- Threshold level needs to be revaluated (0.3 F/T/D Is not relevant)
- Damage and FTD were relatively low
- Minimal management of LAS tunnels reduced 2 out of 3 sprays in contrast to calendar spraying in No-LAS tunnels
- DSS system can be improved with this system; the "localized" component of LAS not applicable to the **Dacus-Melon** system in the Arava

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Performance of *ReTIC*

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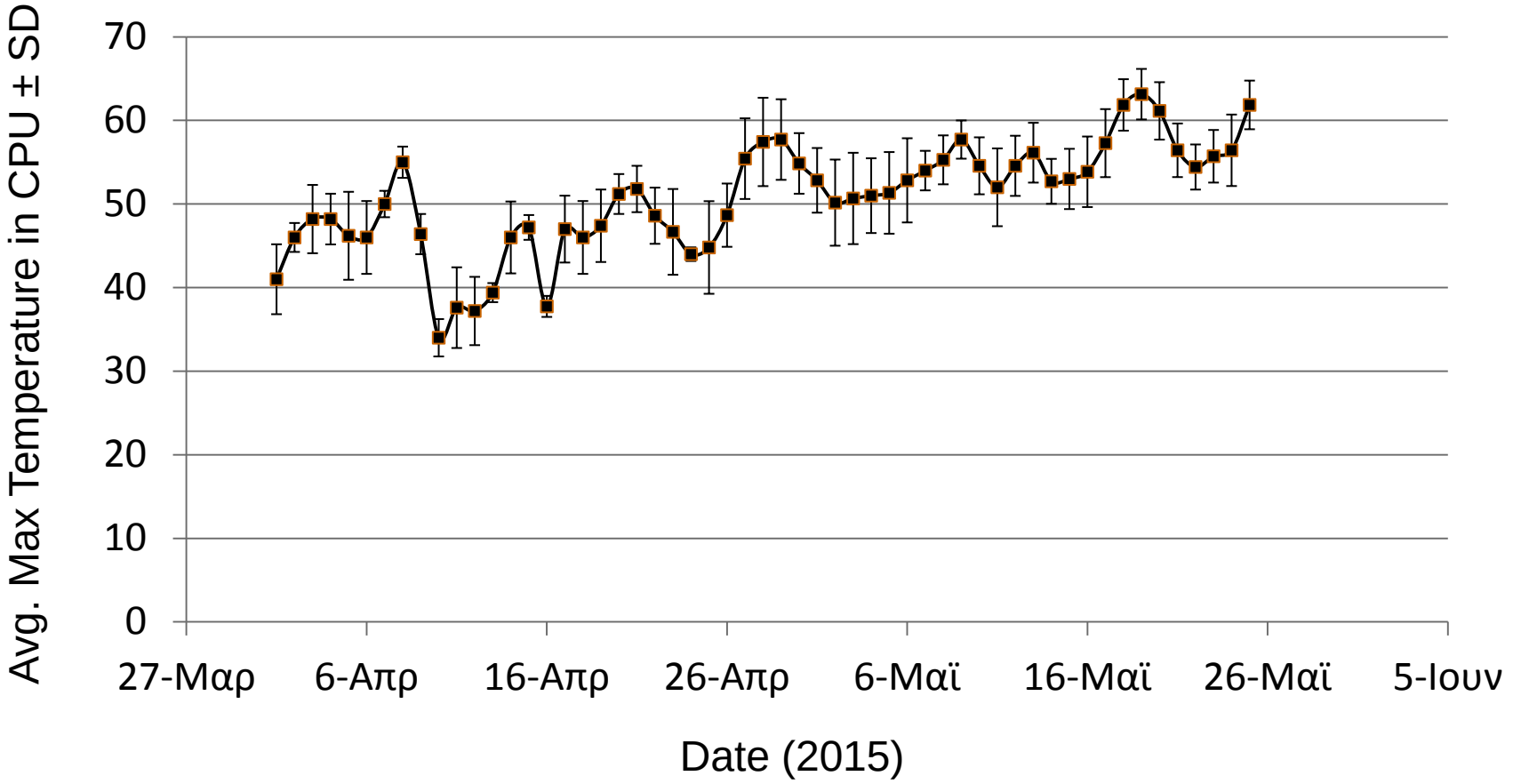
Performance of CPU



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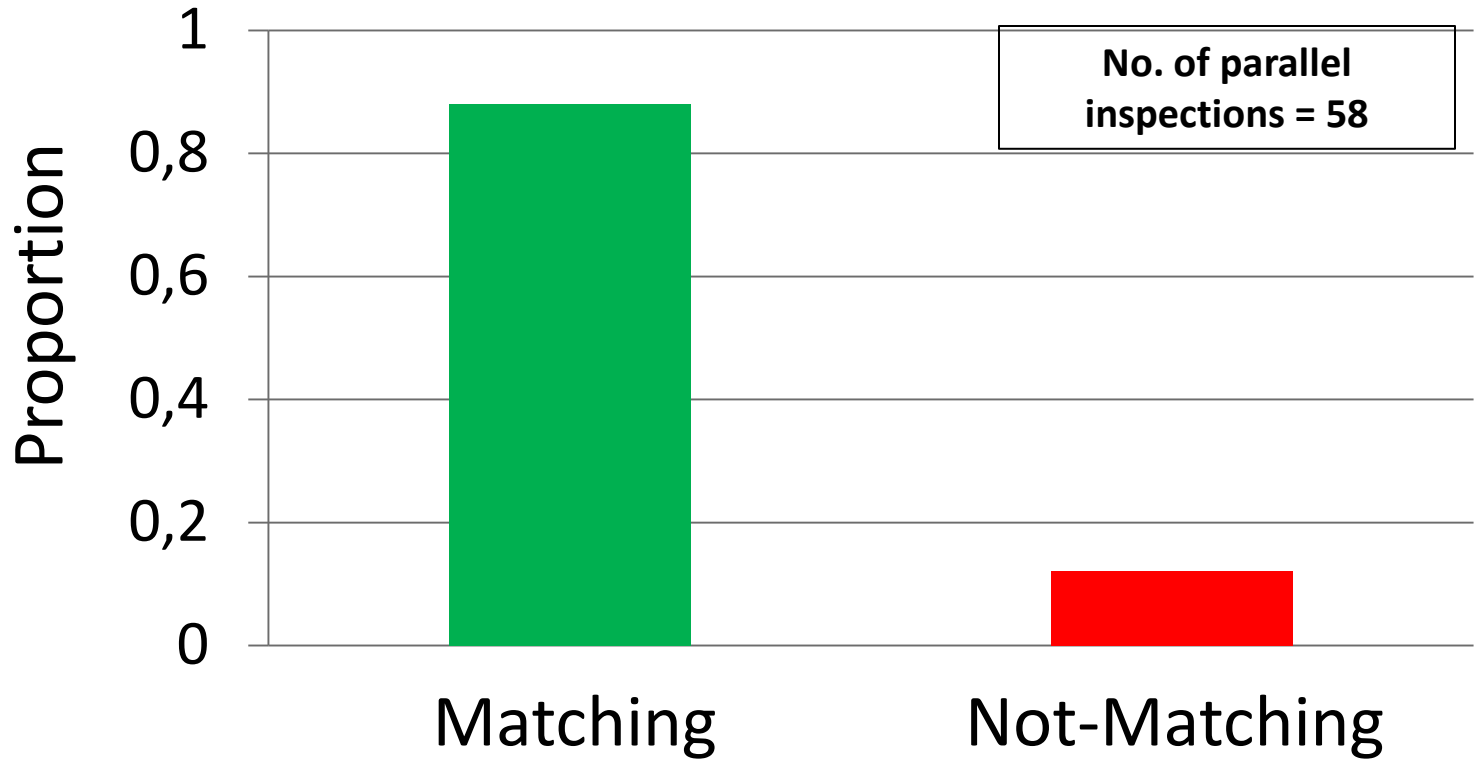
Comparison between Scout Inspection and Desk-Top Inspection of Traps



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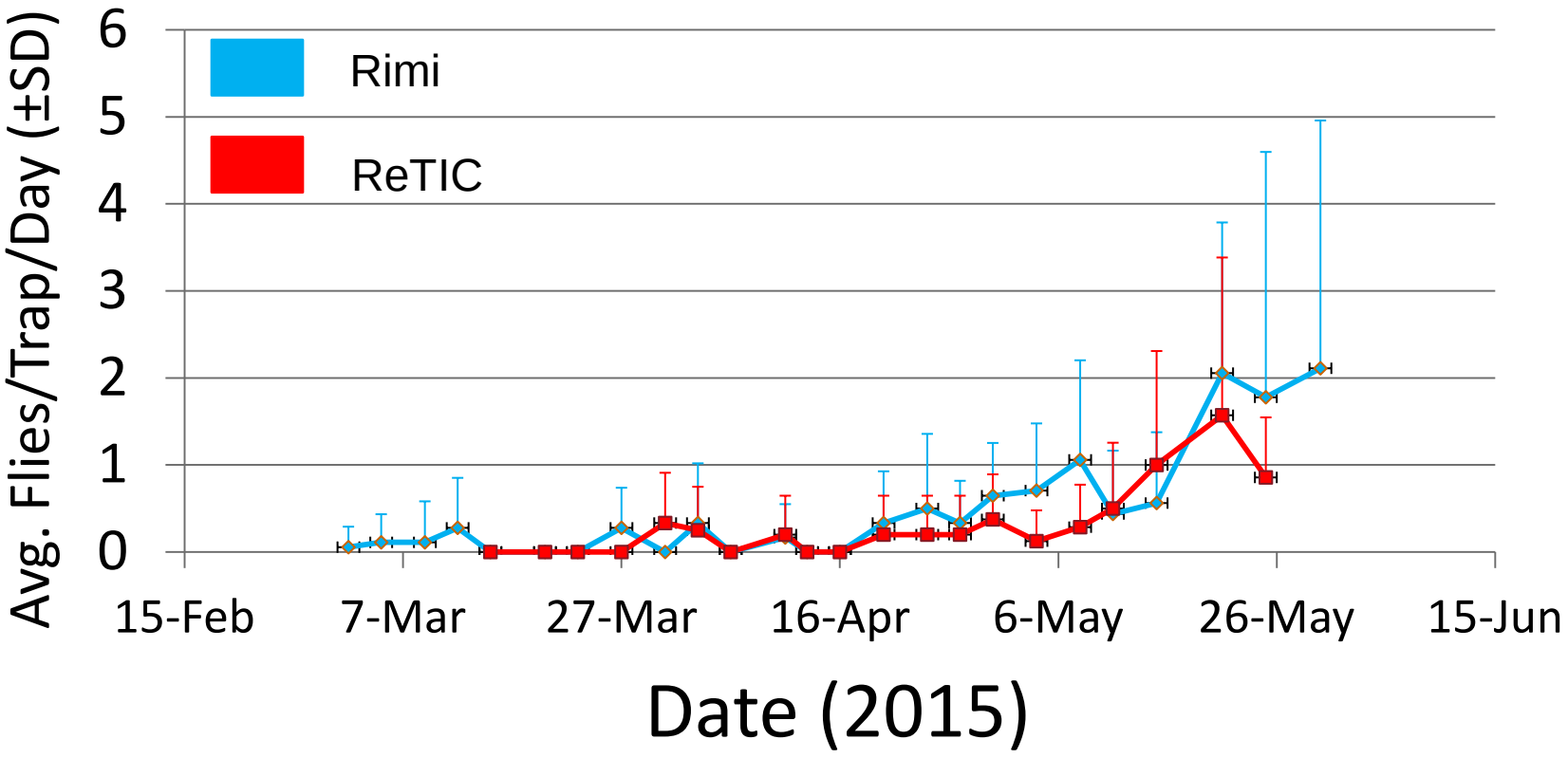
Comparison between Scout Inspection and Visual Inspection of Traps



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Conclusions

- *ReTIC* prototype gave good results
- Differences between Scout sampling and Desk-Top sampling probably related to:
  - Human Error in sampling (e.g., field mistakes)
  - flies out of the field of vision in the Desk-Top
  - Etc.
- Desk-Top images can be viewed and analyzed in retrospective
- ReTIC requires improvements in design and costs, and the application of algorithms to automate counting

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Peach fruit Fly:

Early Warning Systems

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Geographic Location of the Pilot Site

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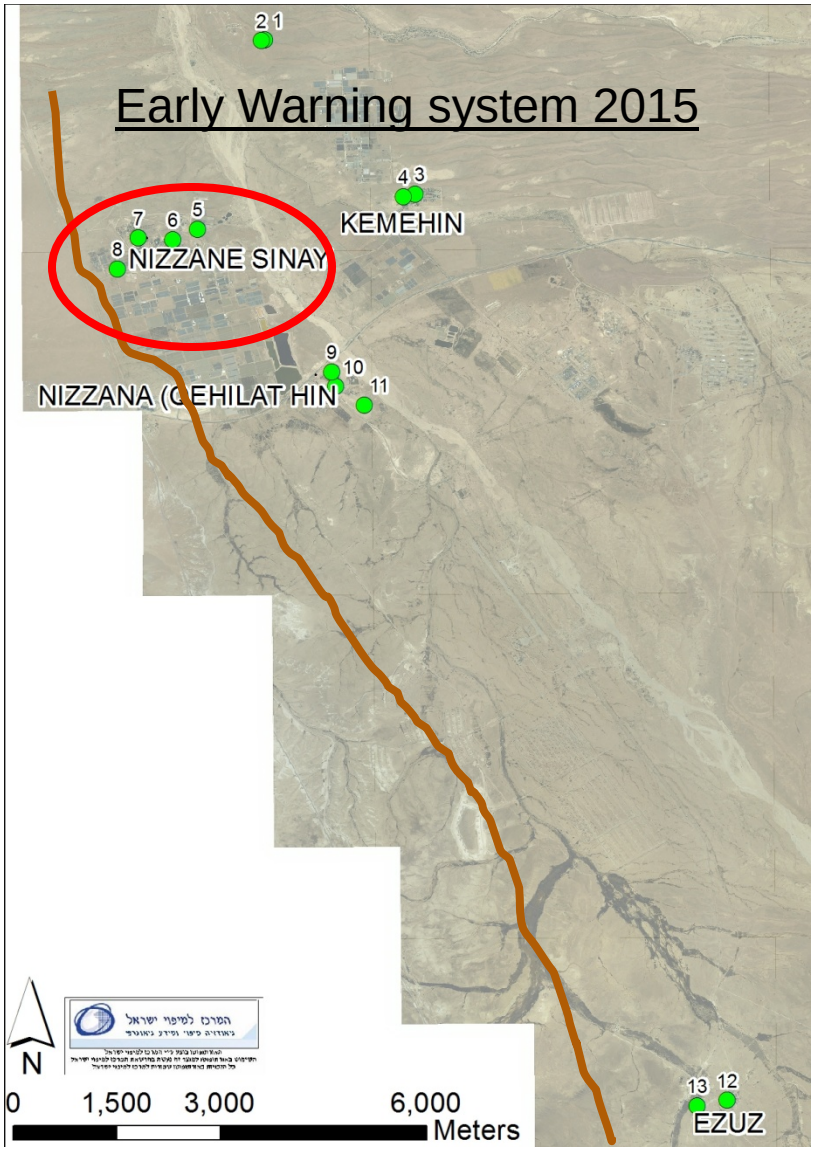
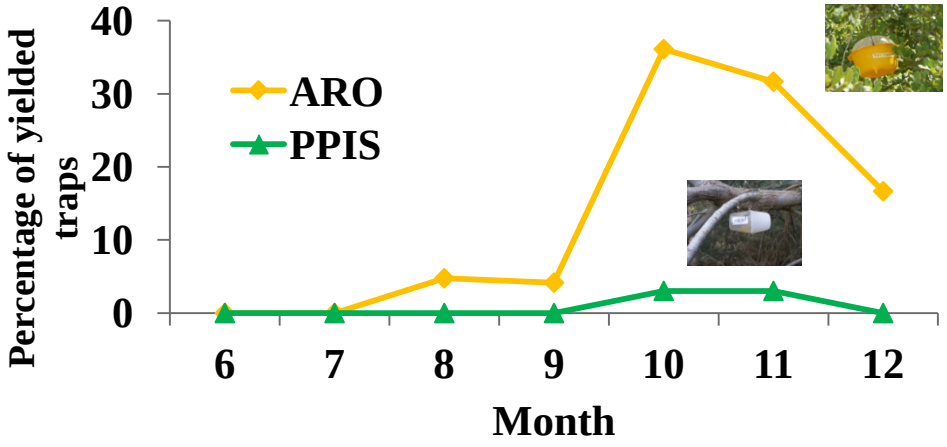


Monitoring during 2014

FruitFly Net

Frequency of traps catching flies in the two surveillance systems



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Pilot 2015 for Peach fruit Fly in the Negev

NO INTERCEPTIONS

of *Bactrocera zonata* in the ReTIC nor in the PPIS surveillance system

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Thank you!!!

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