



Food and Agriculture
Organization of the
United Nations



CIHEAM

Advances in Semiochemical Mediated Technologies Against Red Palm Weevil

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**Scientific Consultation and High-Level Meeting on
Red Palm Weevil Management
Rome, Italy, 29-31 March, 2017**

- ✓ Smart Traps,
- ✓ Pheromones,
- ✓ Kairomones,
- ✓ Dry Traps,
- ✓ Attract and Kill,
- ✓ Repellents



Semiochemicals (Attractants/Repellents)

Semiochemicals are well-known management tools especially for cryptic species (Soroker et al., 2015)

- **RPW Pheromone** : 4S, 5S nonanol & 4S, 5S nonanone
(Hallett et al., 1993)
- **Host Attractants** : ethyl acetate , ethyl alcohol, ethyl propionate, pentan-1-ol , 2-methoxy-4-vinylphenol & gamma-nonanoic lactone
- **RPW Repellents** : methyl salicilate , α -pinene, 1-octen-3-ol & geraniol
(Soroker et al., 2015)

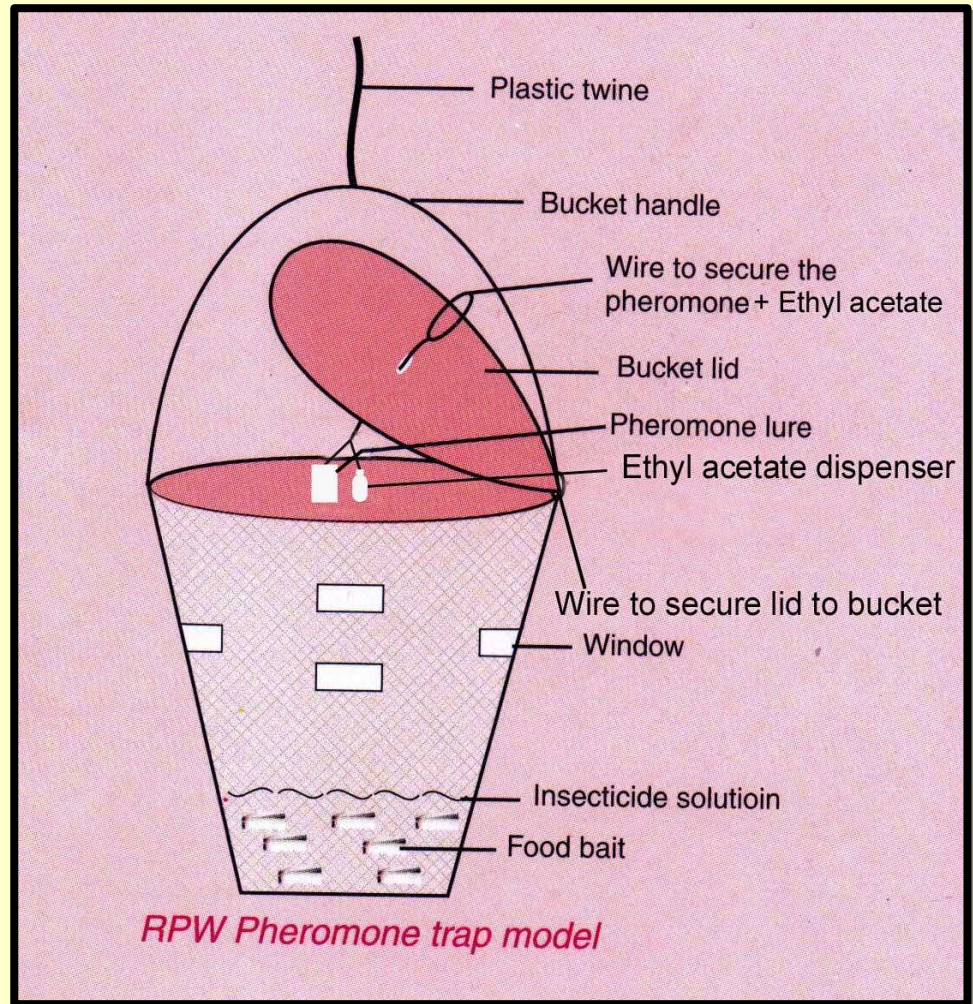
RPW Pheromone Trap

1. Hallett, R.H., Gries, G., Borden, J.H., Czyzewska, E., Oehlschlager, A.C., Pierce H.D., Jr., Angerilli, N.P.D and Rauf, A. 1993. *Naturwissenschaften* 80, 328-331.

**Ferrugineol
(4-methyl-5-nonanol)**

2. Hallett, R. H., Oehlschlager, A.C. and Borden, J.H. 1999. *International Journal of Pest Management* 45 (3), 231-237.

Trapping Protocols



Pheromone Trapping : Overview

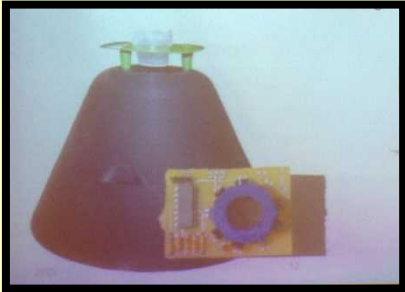
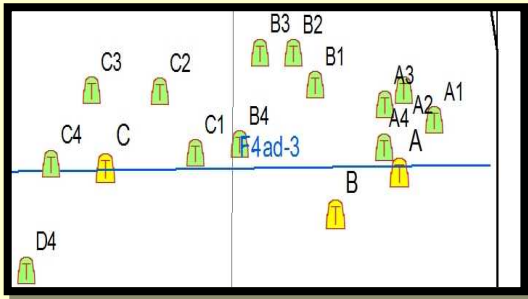
Trap Design and Lures



Food Baits and Kairomones



Trap Density and Smart Traps



Trap & Bait Free Trapping



Trampos

Operario: op Fecha: 04/11/2010

Foco: nombre Foco

Municipio: nombre municipio

Trampa:

Machos: Renovación:

Hembras: Fert:

Comentarios: Feromona:

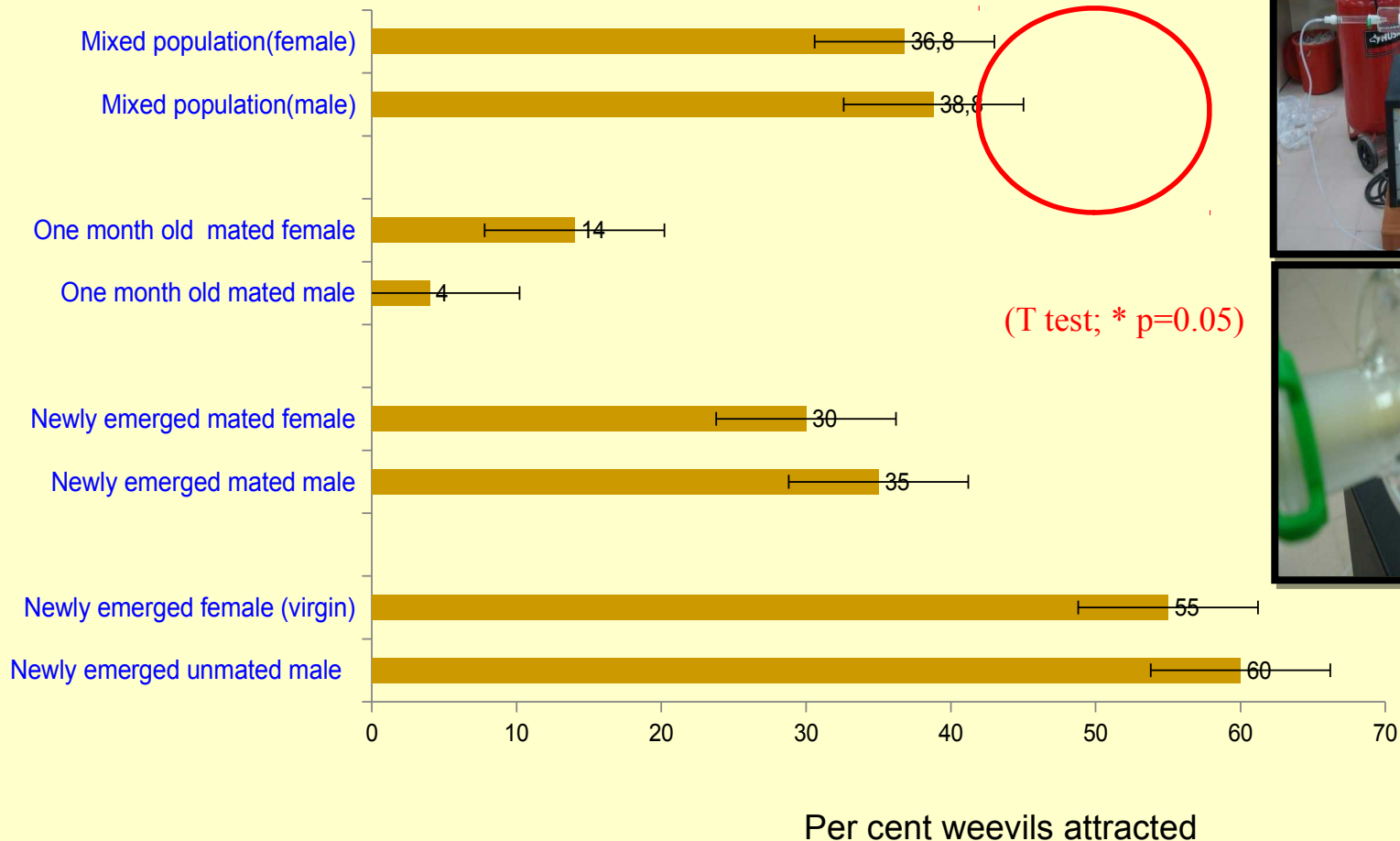
Datos: Censado Inspección Eliminación

Volver

- ✓ Develop mobile application for data collection and transmission

- ✓ Develop a GIS data base

Response of *R. ferrugineus* to the aggregation pheromone in choice olfactometer assays



Faleiro, JR and El-Shafie, HAF . 2012. Red Palm Weevil Symposium. ESA Meeting. Knoxville, Tennessee, USA . 14-16 November, 2012.

Will trapping alone do ?

The North African Experience

Libya



- Trap captures increased from **10 weevils / trap / month** during May ,2009 to over **100 weevils / trap / month** during February, 2010

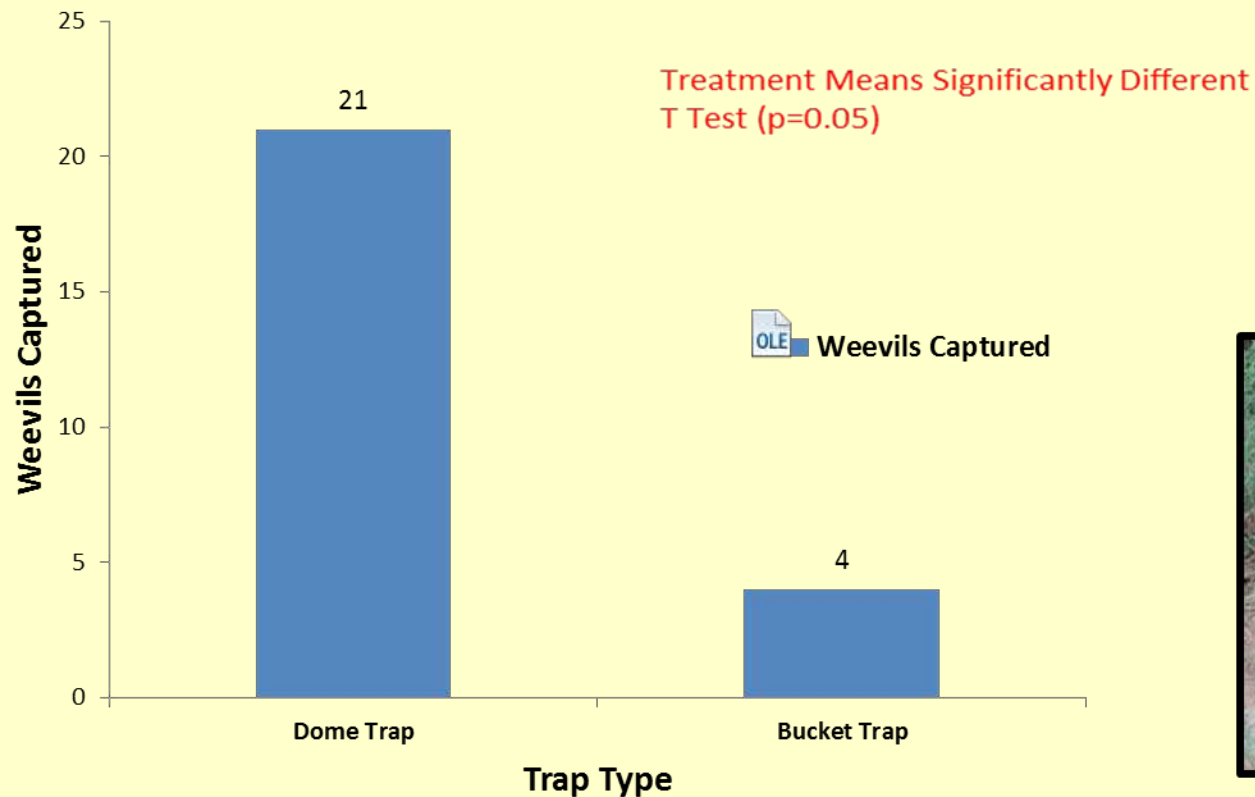
Morocco



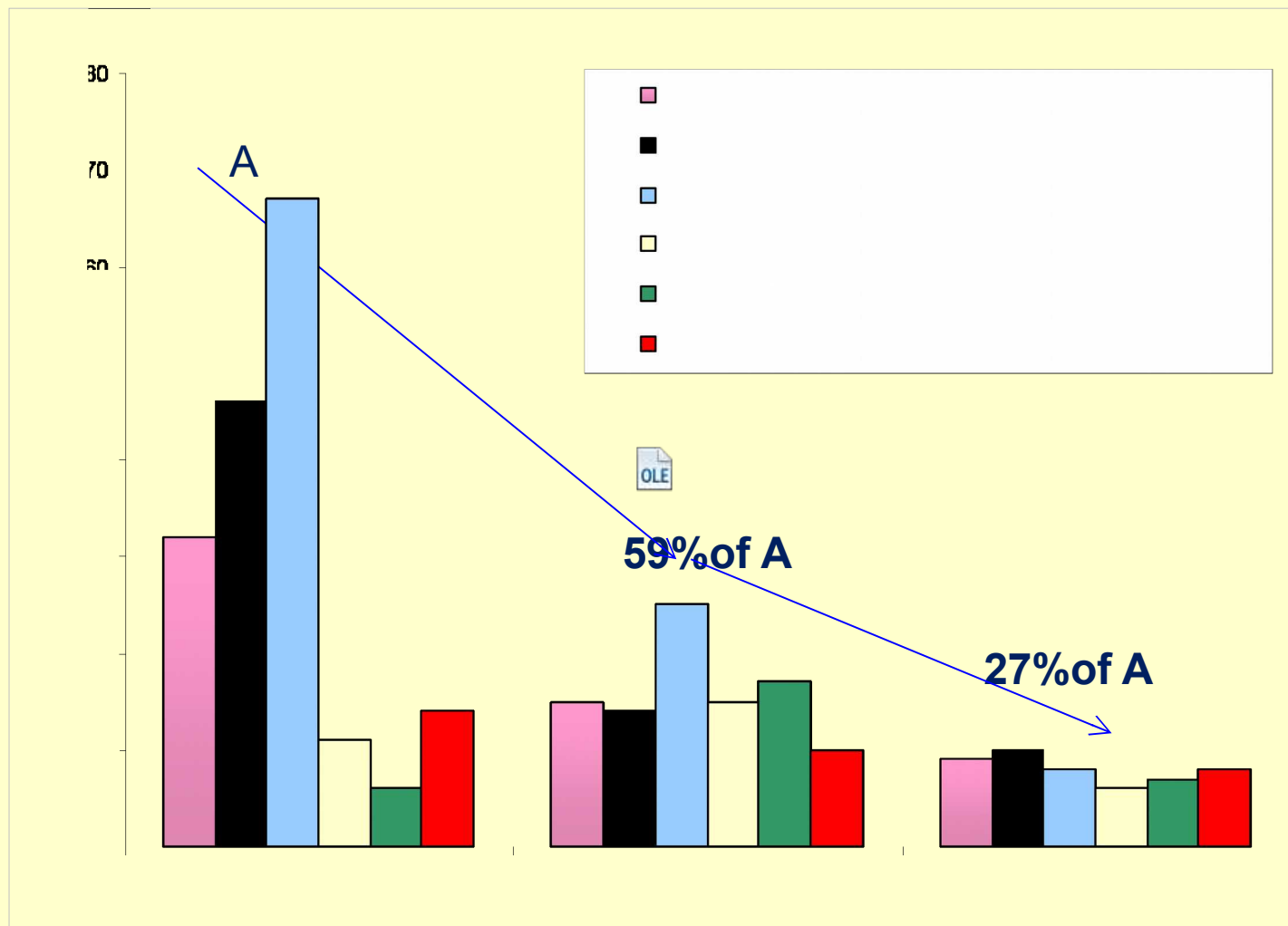
- Trap captures within **2-5 weevils / trap / month** (2009-10) Morocco

Trapping Efficiency : Dome Trap v/s Bucket Trap

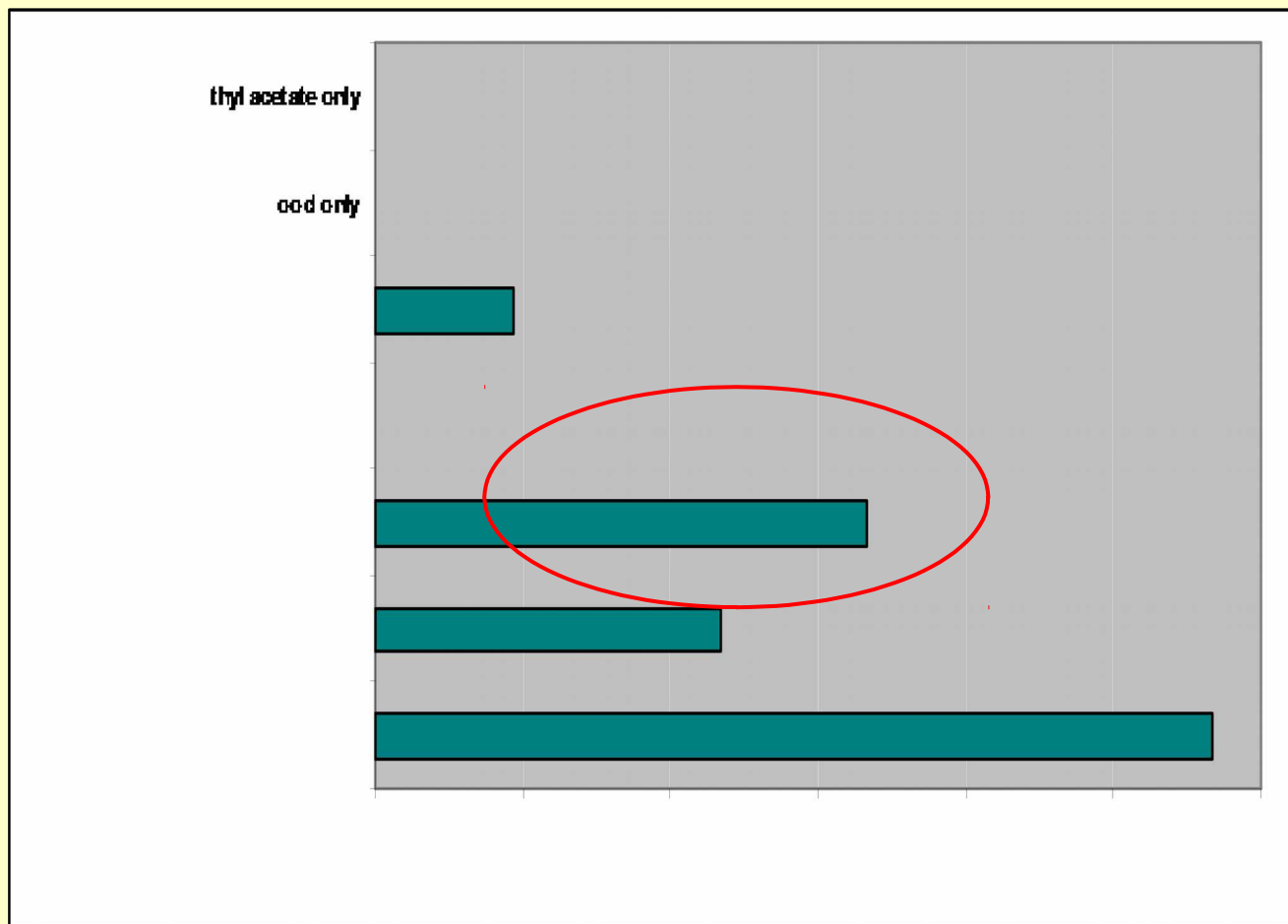
20 Aug – 15 Oct, 2015 : Al-Hassa, Saudi Arabia



Effect of Trap Servicing (replacement of food bait) on Weevil Captures in RPW Pheromone Traps (March, 2002)



Influence of ethyl acetate on *R.ferrugineus* captures in food baited pheromone traps (Goa, India 30/12/2006 and 13/1/2007)

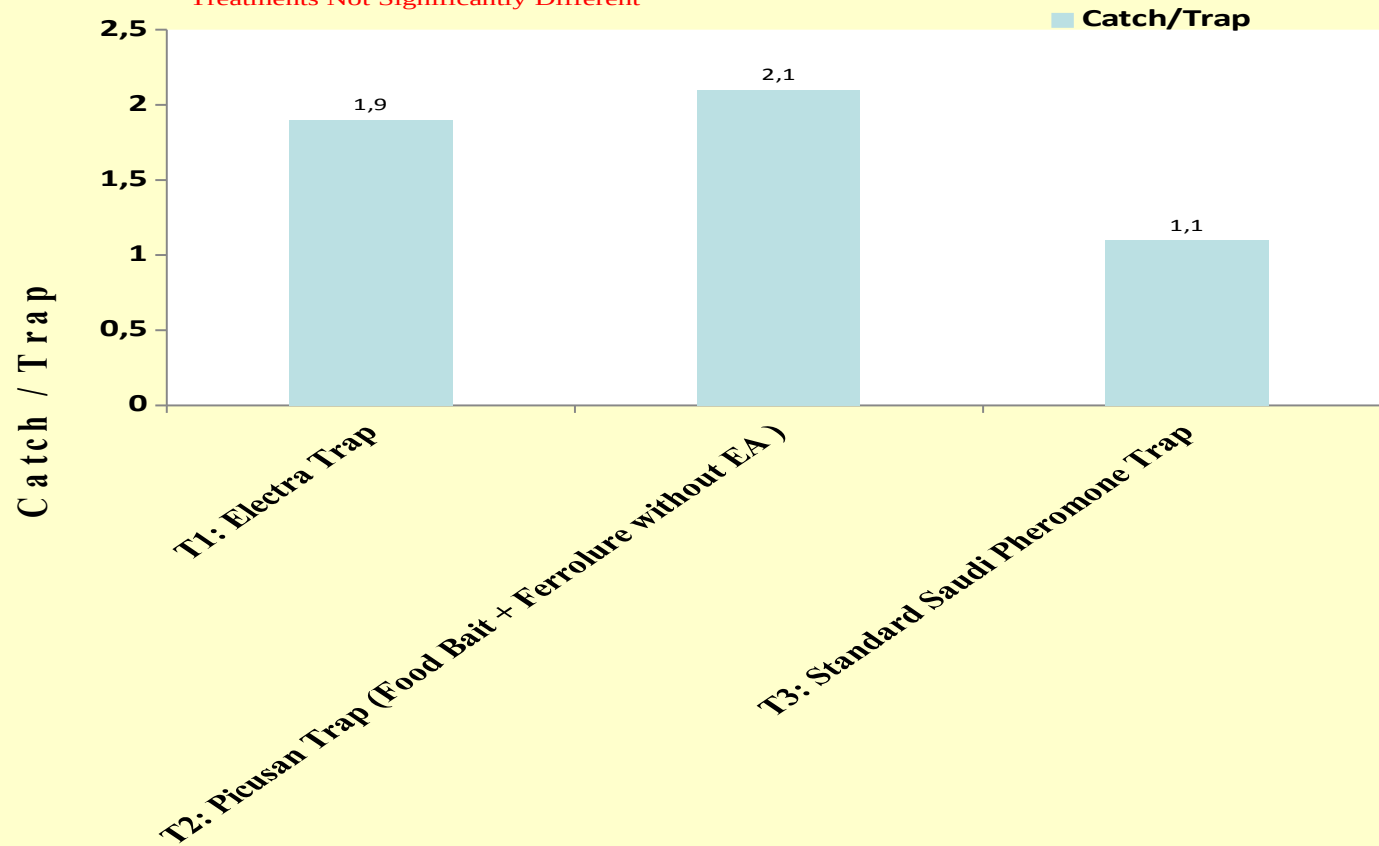


Electra Trap (Without Food Bait) – Dry Trap

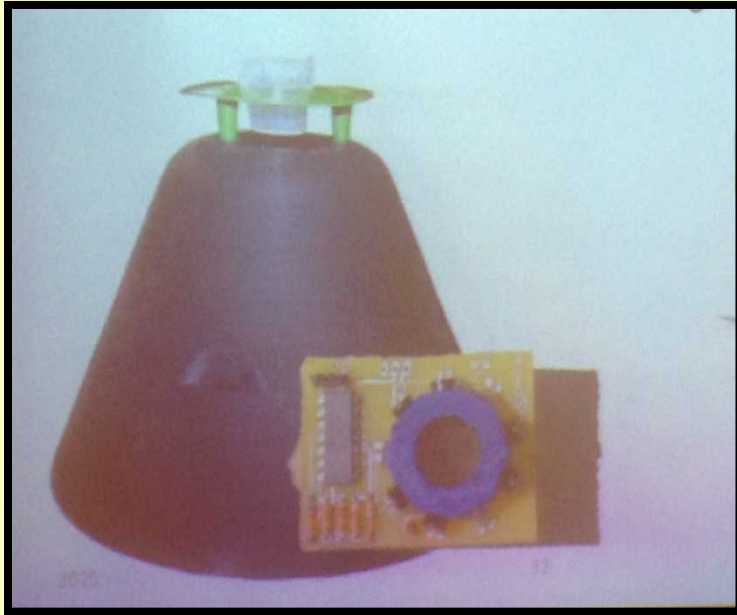


**Weevil Captures in Red Palm Weevil traps
31 Jan-20 Feb, 2016 [Al-Hassa, Saudi Arabia]**

ANOVA (p=0.05)
Treatments Not Significantly Different



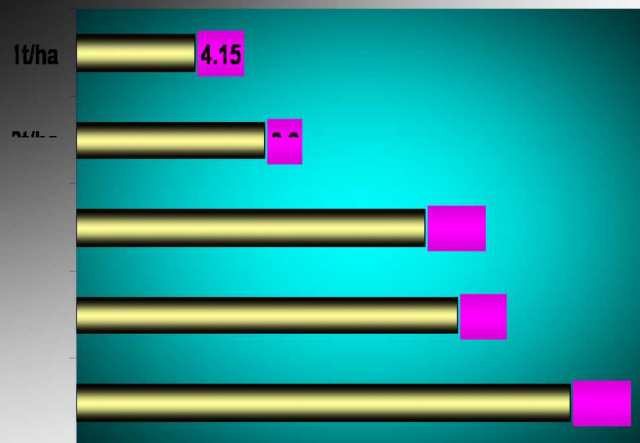
Smart Trap



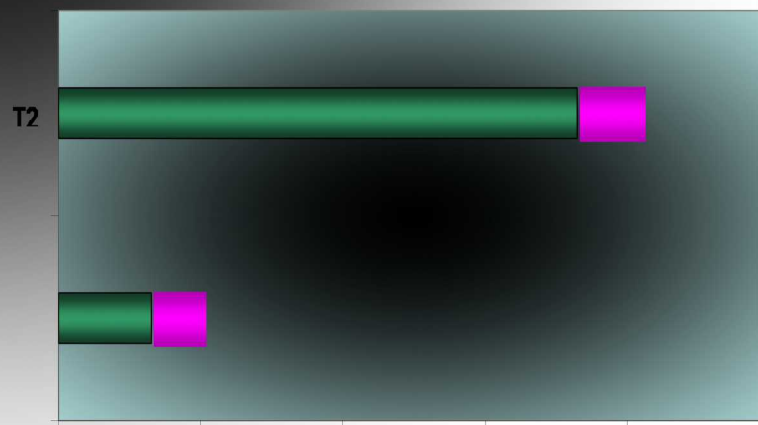
Future Possibility : Fabricate a Smart Dry Trap to Eliminate Servicing & 24x7 Data Collection

Pheromone Trap Density Trial, Al Hassa, 2009

Pheromone Trapping Density:



Weevil Activity: Al-Hassa,



Bait Free Pheromone Technology for RPW



250- 400 A&K Points/ha

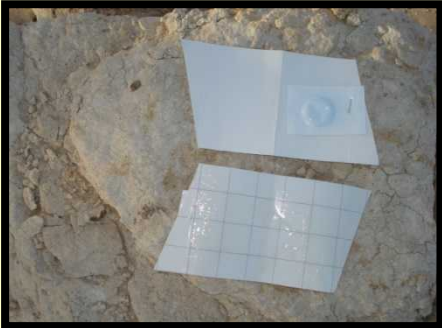
ARAMCO-KFU Project on RPW

What is A & K

In Attract and kill (A&K), the insect pest **attracted** by a semiochemical (pheromone) lure is **not "entrapped"** at the source of the attractant as in mass trapping, but **instead** the insect is **subjected to a killing agent**, which eliminates affected individuals from the population after a short period (El-Sayed et al., 2009).

Bait & Trap-Free Trapping : Attract & Kill

Paste Formulation of A&K Against RPW

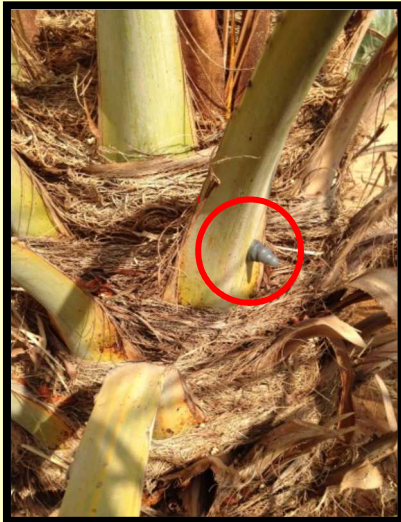


Smart Ferrolure



Hook-RPW

RPW Attract & Kill Products



Hook-RPW

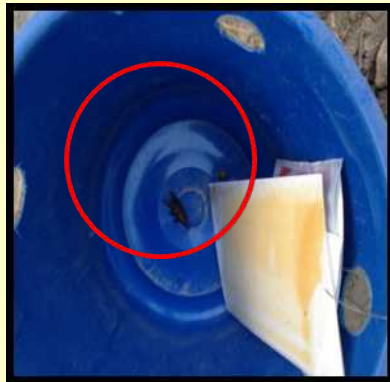


Smart Ferrolure

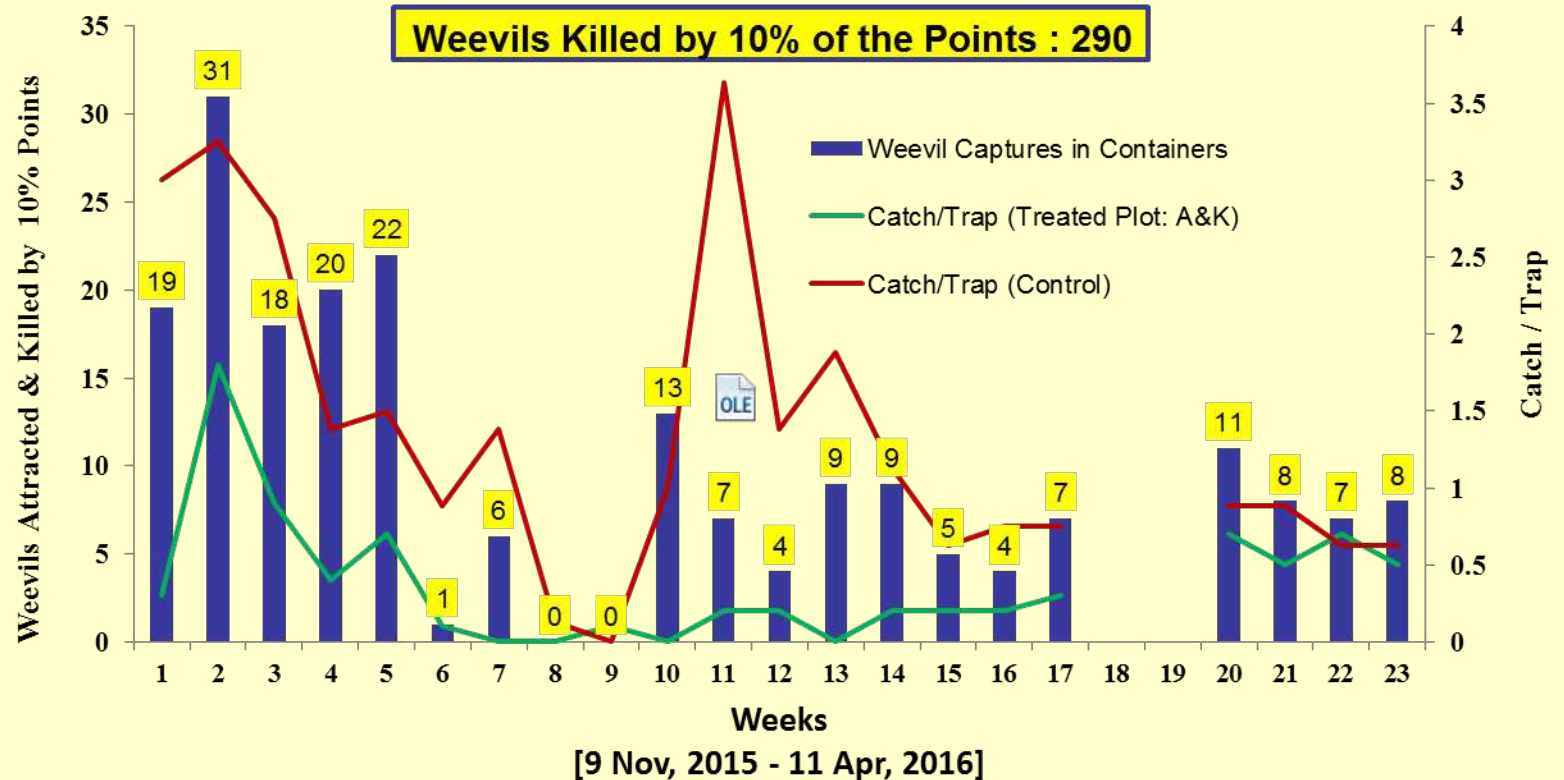


Dead Weevils in A&K Treated Plots

Proof of Kill : 10%- 50% of Points in Containers



A & K Trial with Hook-RPW in Al-Qassim Saudi Arabia



Smart Ferrolure

Card Device :

30points /ha

01 Sep-23 Nov, 2015

Al-Hassa, Saudi Arabia

[Plot Size: 2ha]

Smart Ferrolure

Paste : 250 points/ha

06Sep – 02 Dec, 2015

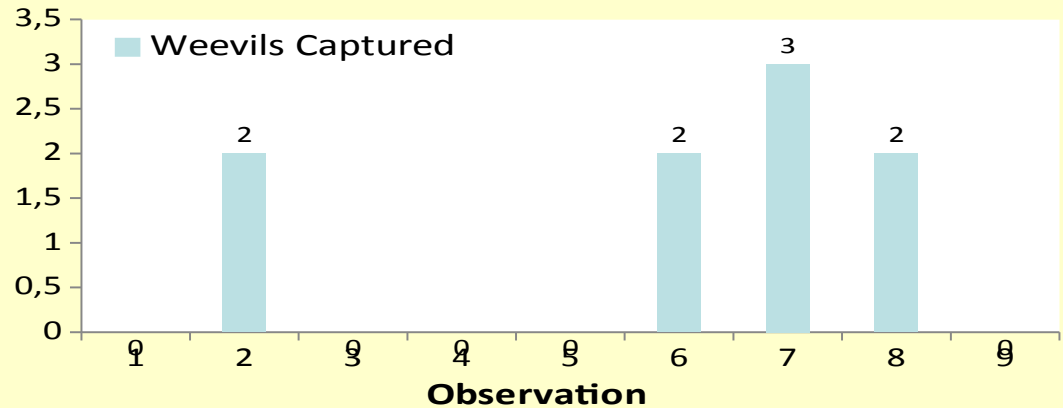
Al-Hassa, Saudi Arabia

[Plot Size : 3ha]

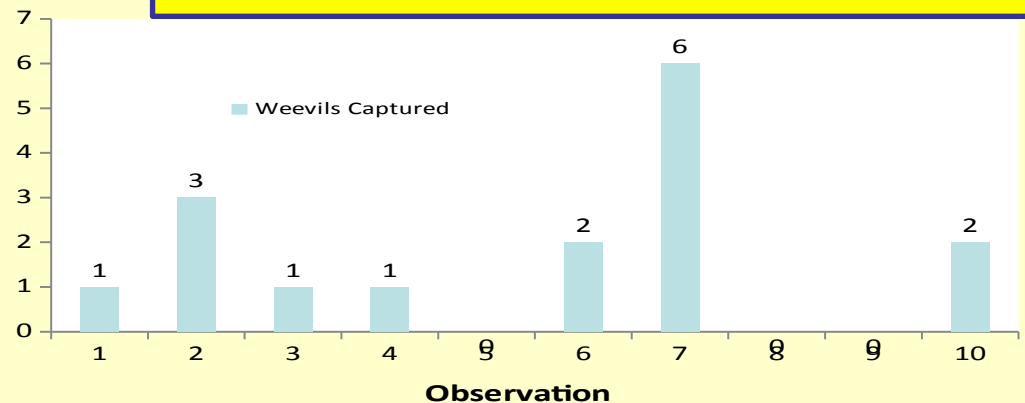
Weevils Captured
50 % of the Points

Weevils Captured in
10% Points set in Containers

Weevils Killed by 50% of the Points : 9

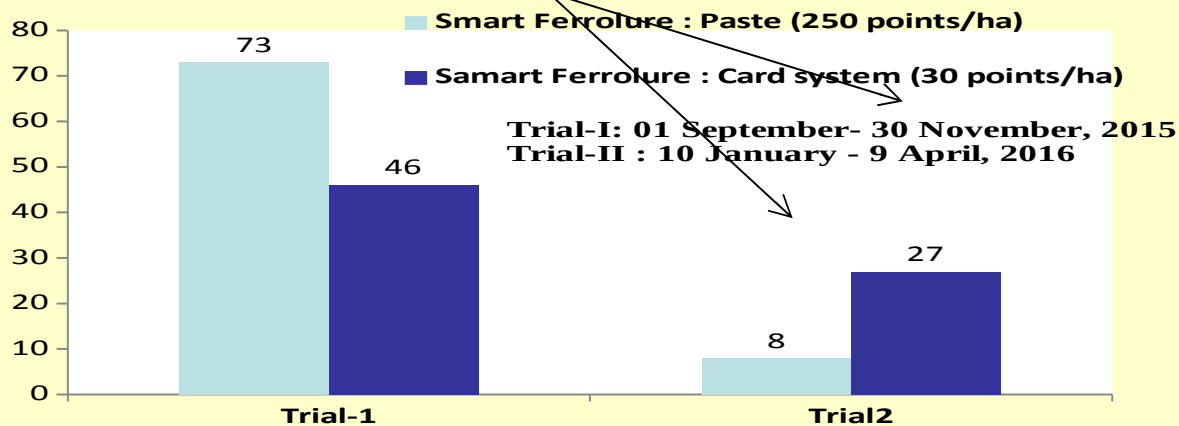


Weevils Killed by 10% of the Points: 16



A&K Trials with Smart Ferrolure in Oil Palm [01 September, 2015 to 09 April, 2016]: Goa, India

Number of Weevils Attracted & Killed
by 15% of the Points





**No-Bait / No-Trap Ferrugineol Based A&K Techniques :
Important to Manage RPW in Neglected Plantations**



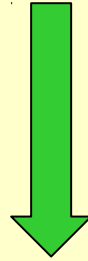
**A&K Technology Deployed
to Control RPW in Mauritania**

Insect Repellents

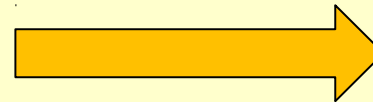
- ✓ **Examples of RPW Repellents** : Methyl salicylate , α -pinene, 1-octen-3-ol and geraniol
- ✓ **Finding RPW Repellents** : Trap Shut Down Studies
- ✓ **Area- wide Testing of RPW Repellents for Palm Protection**
- ✓ **Deploying RPW Repellents (How far are we?)**

The Concept : Push-Pull

Pull : Attractant
Pheromone +EA
+ Food Bait

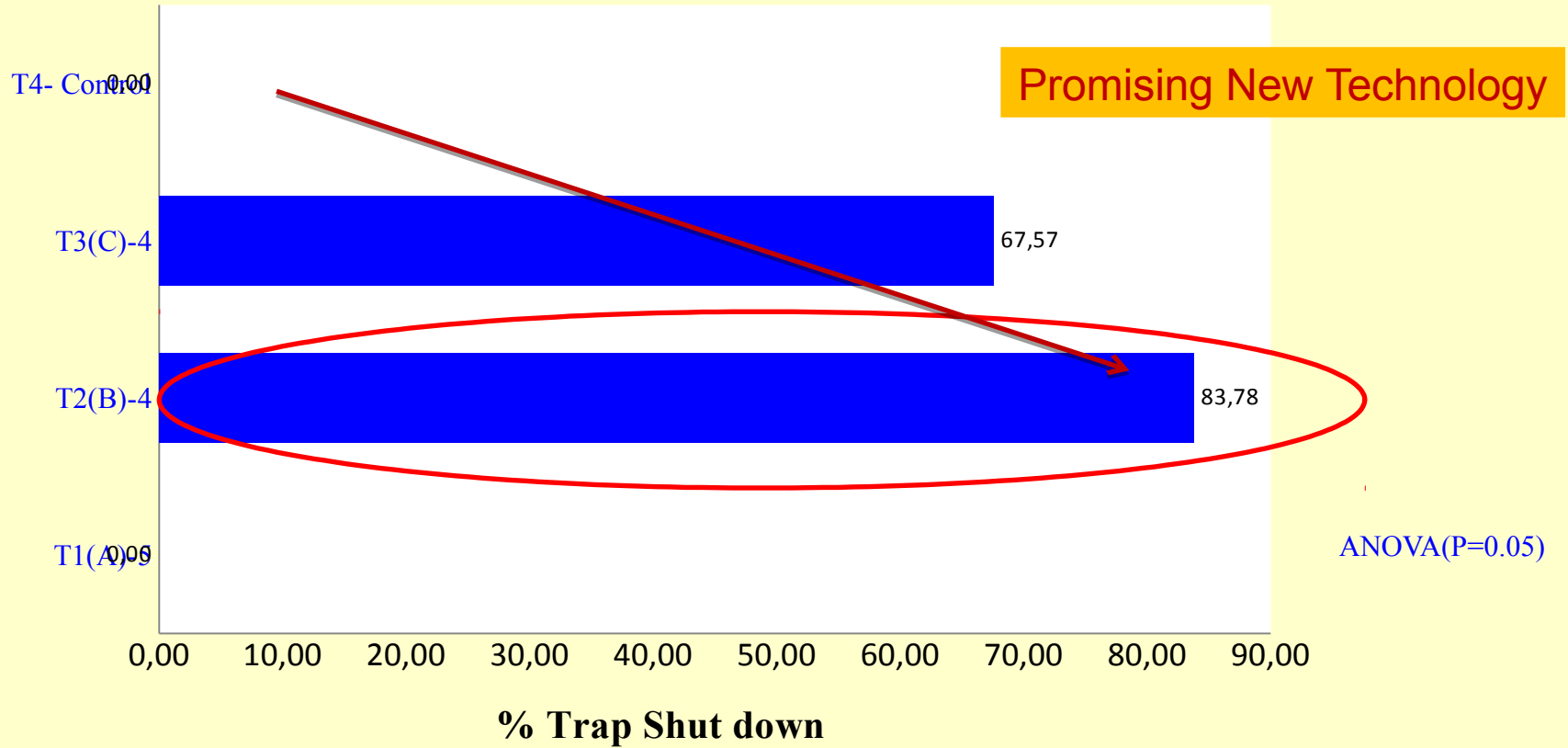


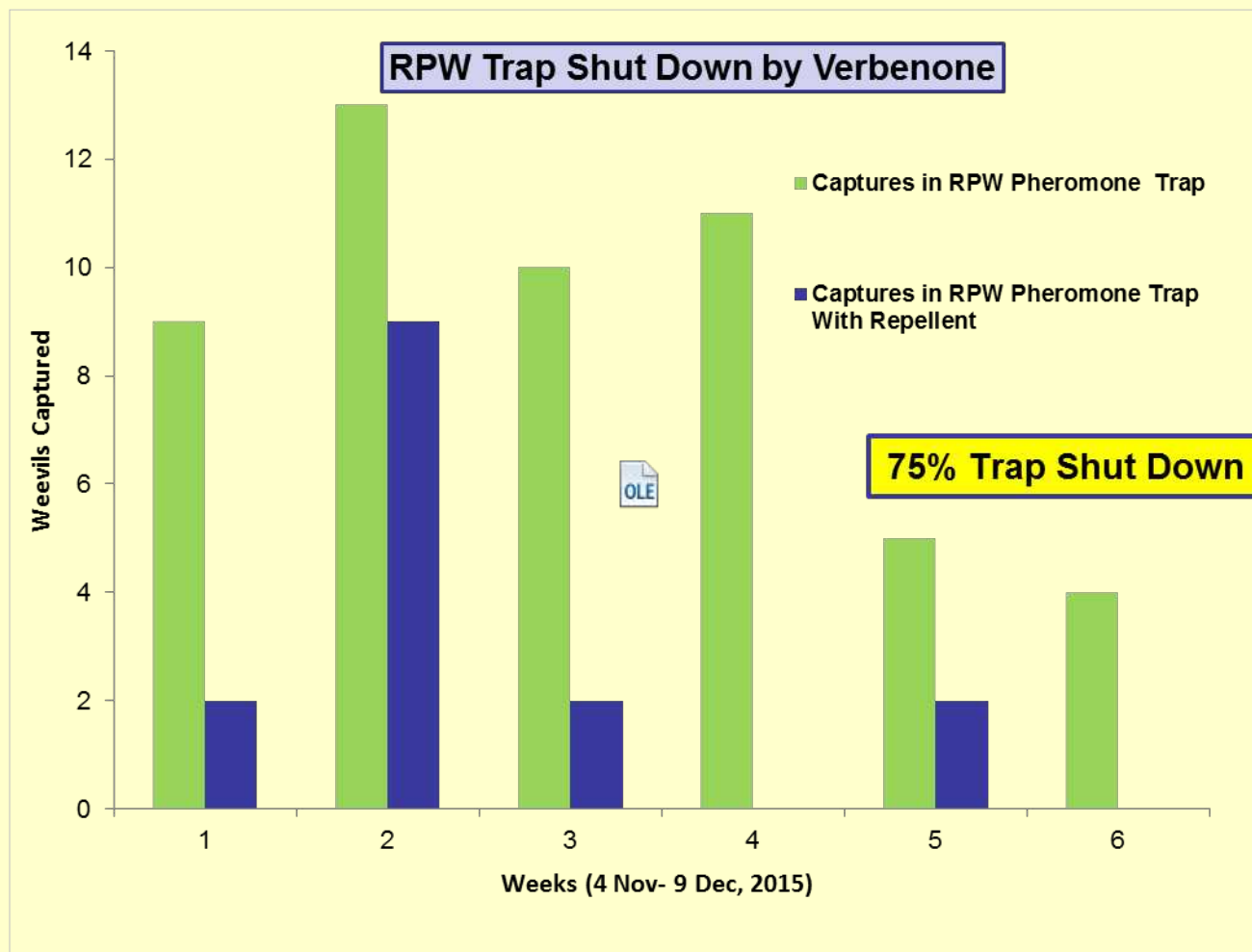
Push : Repellent





RPW Repellents

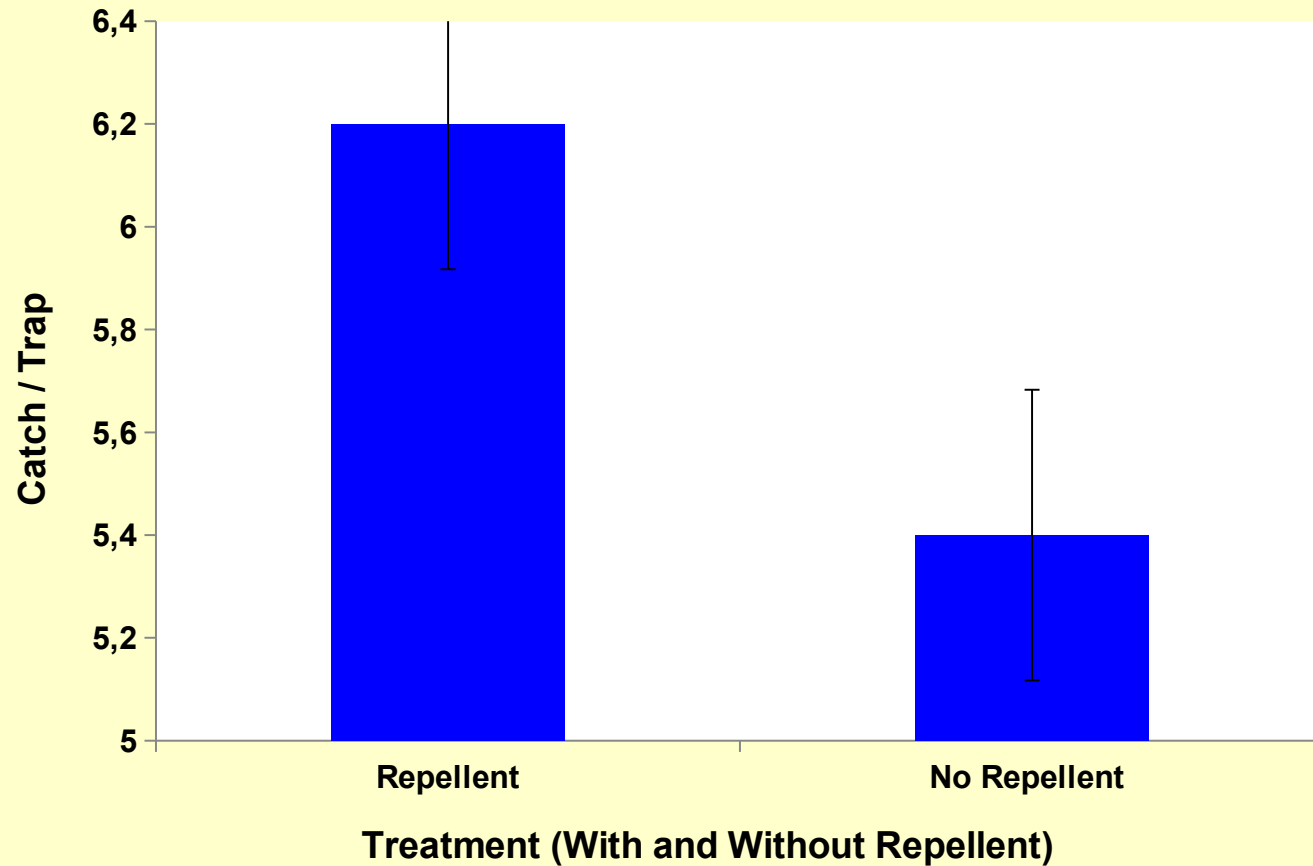




A Push-Pull Strategy using RPW Repellents & Pheromones



Weevil Captures in Plots With and Without Repellents(4) (April-July, 2014)



Conclusion

- ✓ Introduce **attract and kill** as an additional component of the RPW-IPM mass trapping programme.
- ✓ Further **evaluate attract and kill** technology where necessary.
- ✓ Need to **evaluate the dry trap** using electro-magnetic technology and **integrate it with the smart trap**.
- ✓ Develop a **push-pull strategy** using RPW repellents.
- ✓ Managing mass trapping through the use of **GIS with RFID** (bar coding) of traps for **efficient data collection and transmission**.
- ✓ In some countries mass trapping could be taken up by **lead / trained farmers**



THANK YOU

Acknowledgements

- ✓ Food and Agriculture Organization of the UN
- ✓ Ministry of Environment, Water and Agriculture, Kingdom of Saudi Arabia
- ✓ King Faisal University, Kingdom of Saudi Arabia
- ✓ Indian Council of Agricultural Research