

Soil Technologies Corp.
Research and Development Department



Research Report

Title: Evaluation of Applying Organic and Botanical Insecticides Using Injection Techniques in Integrated Programs to Eradicate the Red Palm Weevil in Jordan Valley

Location: Jordan Valley, Jordan

Principal Investigators: Entomologist Researcher at the National Agricultural Research Center
Ministry of Agriculture of Jordan

Crop: Date Palm Trees

Date: 2020

Abstract:

Field Study

The purpose of this study was to evaluate the efficacy of biopesticides on the Red Palm Weevil (RPW) *Rhynchophorus ferrugineus* compared to a synthetic insecticide. Tree injection protocols were evaluated for Armorex¹ and pyrethrum², and compared with the chemical protocol of imidacloprid 35%³ and a no treatment control. Injection rates and methods were established for varying trees sizes. Trials were performed at two farms with RPW infestations. Trees were evaluated at 2 weeks, 30 days, 60 days, and 90 days. Palm recovery rate for each group of trees treated with Armorex was 88% and 96.5%. Pyrethrum treated palms had a recovery rate of 84% and 95%. Imidacloprid 35% treated palms had a recovery rate of 93% and 98%. Palm tree death rates in controls were 100%.

In-Vitro Study

The purpose of this study was to evaluate the efficacy of biopesticides on the Red Palm Weevil compared to a synthetic insecticide. Separate petri dishes for larva, pupa, and adult RPW were treated with Armorex, pyrethrum, and imidacloprid 35%. Percent kill data was obtained at 24 hours, 48 hours, 78 hours, and one week. By the one week observation all three treatments had 100% kill. The kill times of Armorex and imidacloprid were the fastest, and these treatments provided comparable results. The Entomologist Researcher at the National Agricultural Research Center in the Ministry of Agriculture of Jordan recommended Armorex for high efficacy and quick effect compared to the values of the synthetic insecticide imidacloprid.

¹ Armorex botanical OMRI listed pesticide, manufactured by Soil Technologies Corp. Fairfield Iowa USA.

² Pyrethrum natural insecticide made from the dried flower heads of *Chrysanthemum cinerariifolium* and *Chrysanthemum coccineum*

³ Imidacloprid, CAS # 138261-41-3, a synthetic insecticide.

Methodology Summary:

- Infested trees were treated with Armorex, pyrethrum, and imidacloprid 35% at dosages of 100-150ml per tree depending on size.
- Depth and angle of hole depended on stem size and location of infestation
- Tests were performed at two farms with a total of 8 trees tested for each protocol.
- Trees were monitored for 3 months and the data documented was on the recovery from the following symptoms of infestation
 - Gummosis and saw dust infestation symptoms.
 - Yellowing of the tops.
 - Dryness of the heart of the palm tree.
 - Collapse/death of the palm tree.
 - Recovery of the tree.

Results Summary:

Table 1: Average Results of Field Trials

Treatment	Symptoms of Infestation Before Treatment				90 Days After Treatment	
	Dry leaves	Dryness of heart	Yellowing	Gum Presence	Death	Palm recovery
Armorex	70%	0%	71%	92%	0%	90%
Pyrethrum	69%	0%	74%	92%	0%	87%
Imidacloprid 35%	66%	0%	75%	90%	0%	95%
Control	95%	82%	91%	92%	100%	0%

Table 2: Average results from In-vitro Trials

Treatment	Dose ml/l	Insect Stage	%PERCENTAGE OF KILLING			
			TIME EXPOSURE/HOUR			
			24	48	72	1 WEEK
ARMOREX	1ml/l	ADULT	0	50	90	100
	1ml/l	LARVAE	90%	100	100	100
	1ml/l	PUPAE	60	90	100	100
PYRETHRUM	1ml/l	ADULT	0	20	75	100
	1ml/l	LARVAE	40	80	100	100
	1ml/l	PUPAE	20	85	90	100
IMIDACLOPRID 35%	1ml/l	ADULT	20	60	100	100
	1ml/l	LARVAE	90	100	100	100
	1ml/l	PUPAE	80	100	100	100
CONTROL	water	ADULT	0	0	0	0
	water	LARVAE	0	0	0	30
	water	PUPAE	0	0	0	10

Photos from Field Trials:



Photo 1: Drilling angled hole



Photos 2 and 3: Application of treatment and pre treatment

Final Recommendations from Jordan Ministry of Agriculture:

1. Biopesticides are considered to be the best alternative to synthetic pesticides-- they are highly effective, target specific, and reduce environmental risks. These factors lead to the application of biopesticides in pest management programs instead of chemical pesticides throughout the world.
2. Armorex shows a significant result compared with the synthetic insecticide imidacloprid, and nearly matches the high values obtained from the synthetic insecticide.
3. Pyrethrum provided results as good as Armorex, but required additional time to show its effectiveness in controlling RPW.
4. Finally, good injection procedure and good management with good monitoring, all together are leading to an effective eradication for all pests attacking palm trees especially, red palm weevil (RPW).