CARROT / CONTROL OF CARROT PSYLLID (*TRIOZA APICALIS*)

Study directors: Anne Nissinen and Jarmo Ketola

Trial ID	Variety	Location	Experimental starting and completion
I-12-061-06	Bangor	Tammela	June 13th and September 25th 2012

Purpose of trial: Synthetic pyrethroids are used intensively in the control of carrot psyllids on carrot such as several sprayings are needed in some cultivation areas of carrot to get good control against carrot psyllids. The aim of field trial was to test the efficacy of Teppeki WG, Biscaya OD 240 and/or Silwet Gold combined with two times use of Karate 2.5 WG vs. Karate 2.5 WG with six times of applications. The aim of the study was to find products with different MoA which could replace pyrethroids in carrot psyllid control program when the number pyrethroids sprays per season will be limited to two. The field trial was based on the results of greenhouse test with *Trioza* sp. by Eeva Reiman and Anne Nissinen at MTT in 2012.

SUMMARY

Insecticides Teppeki WG (flonicamid 500 g/l) at 140 g/ha, Biscaya OD 240 (thiacloprid 240 g/l) at 300 ml/ha and Silwet Gold (organic silicon 100 g/l) at 100 ml/ha were compared with synthetic pyrethroid Karate 2.5 WG (lambda-cyhalothrin 250 g/l) at 250 g/ha. These products were selected to tests, since they have shown efficacy against hemipterous species. Flonicamid is a feeding inhibitor for aphids and other hemipterous pests (Morita et al. 2007), thiacloprid application resulted in 100% mortality potato psyllid (*Bactericera cockerelli*) nymphs in 48 h (Berry et al. 2009), surfactants have shown insecticidal activity against silwerleaf whitefly (*Bemisia argentifolii*) nymphs (Liu & Stansly 2000). All treatments were tested as a foliar spraying with the volume rate 200 l/ha. The sprayings with Karate 2.5 WG were made two times within the test treatments and six times in the reference treatment (ABCDEF). The timings of the sprayings were the followings:

Application timing: Date	A: 14th June	B: 20th June	C:28th June	D: 4th July	E: 10th July	F: 17th July
BBCH stage	13	14	15-16	16	19	41
Crop height cm	3	5	8	15	20	20

Around the trial was totally 5 hectars of carrot field, which was cultivated according to the normal farming practises of the commercial carrot farm. There was a quite moderate pressure of carrot psyllids in the whole trial field in 2012.

Injure of carrots by carrot psyllids was quite moderate in the trial 2012. The number of carrot psyllids (adult, larvae, egg) stayed low 3.0-14.8 (average number of c. psyllids was 57/sample in the similar trial in June 2011) per sample without statistically significant differences between the treatments. The total yield was between 26.4 tn/ha and 32.2 tn/ha. The proportion of marketable yield was between 67.9 and 80.1 % of total yield. The proportion of injured yield by carrot psyllid was between 11.8 and 16.6 % of total yield. There were no statistically significant differences in any number of yield between the treatments.

Resistance of carrot psyllids against synthetic pyrethroids in some cultivation areas has been suspected for quite long time due to continuous use of pyrethroids since 1980's and therefore new products with different MoA (Mode of action) will be urgently needed. The results of the trial were quite satisfactory: two Karate 2.5 WG sprayings at 250 g/ha combined with Teppeki WG at 140 g/ha, Biscaya OD 240 at 300 ml/ha and/or Silwet Gold at 100 ml/ha gained as good results as six Karate 2.5 WG sprayings at 250 g/ha made in June and July. However, the carrot psyllids pressure at the experimental site was quite moderate this year and therefore the test treatment should be repeated under range of conditions to verify their efficacy. Especially the efficacy of Silwet Gold treatment should be further studied. Silwet Gold was not expected to have an effect on adult psyllids, but it was just targeted to decrease the number of nymphs in vegetation in the end of the psyllid flight period. In 2012, the adult pressure was quite moderate which may explain the good result also in the treatment with four subsequent Silwet Gold applications following two Karate 2.5 WG sprays.

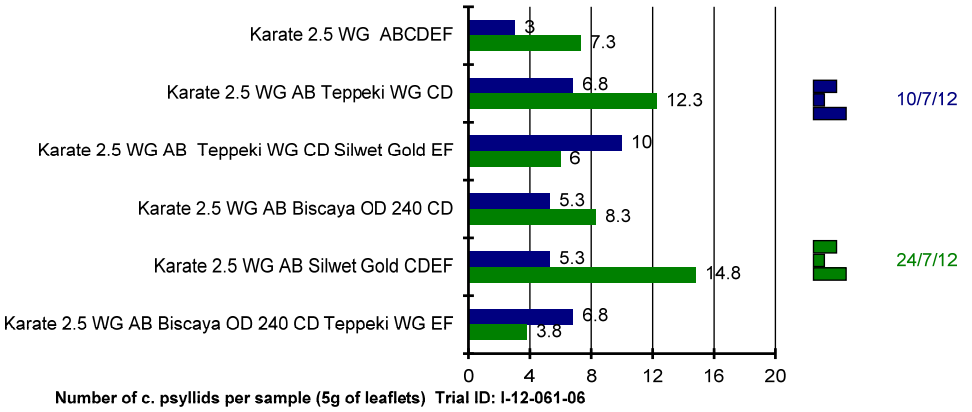

Figure 1. *Total number of carrot psyllids (eggs, larvae, adults) per sample at the sampling dates 10th and 24th July in 2012. The size of raw sample was 800 grams per each plot containing randomly taken carrot leaves. The numbers of carrot psyllids were counted from 5 gram per 10 randomly chosen plants/plot. The samples of frozen carrot leaves were homogenized and filtered before the counting.*

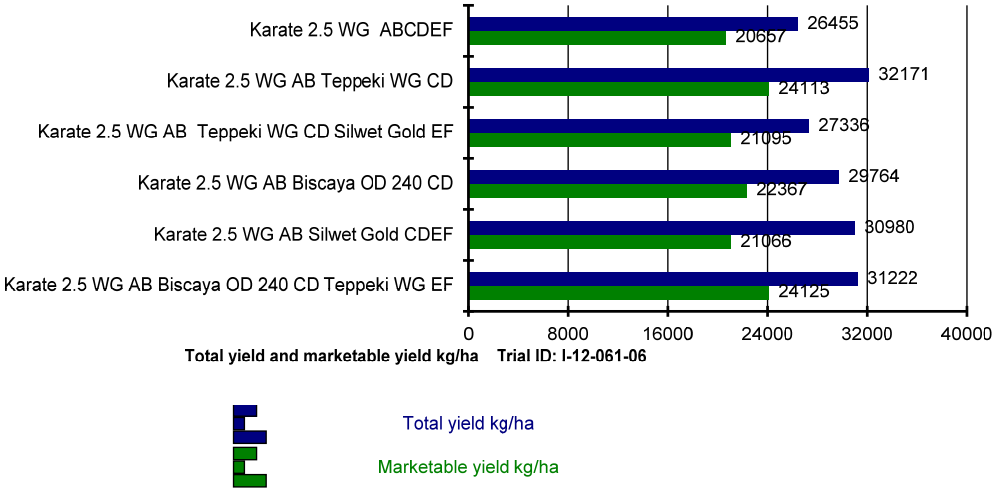

Figure 2*. Total yields and marketable yields (kg/ha). The yields were similar in every treatment without statistically significant differences between the treatments.*

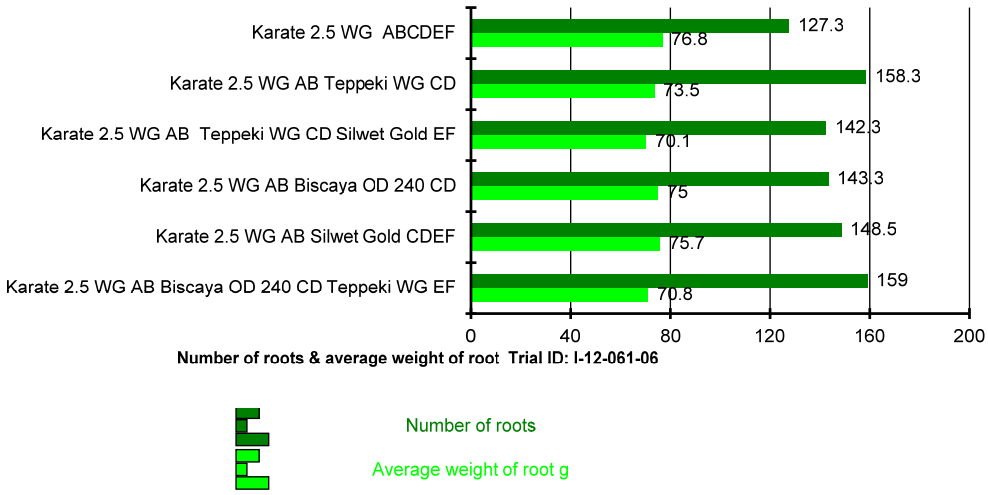

***Figure 3**. Number of roots per 6 rowmeter per plot and the average root weigh (g) at harvest 13th August.*

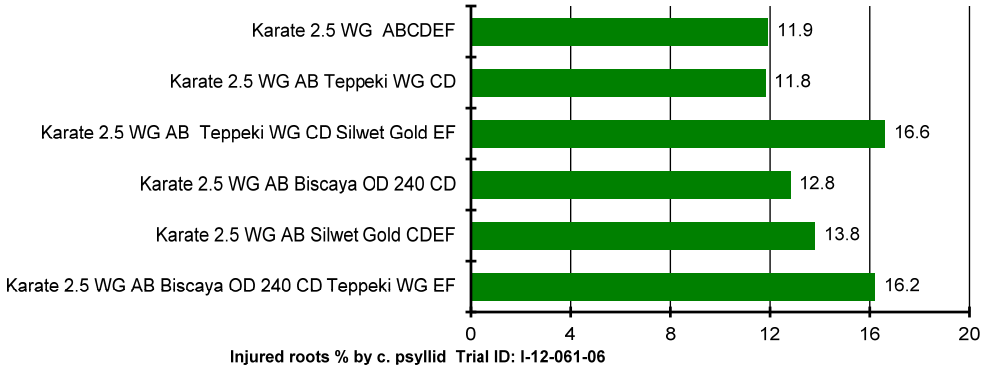

***Figure 4**. Proportion of injured carrots (%) by carrot psyllid per plants on 6 rowmeter at harvest was between 11.9 and 16.6 % without statistically significant differences between the treatments.*

References:
*Berry,N.A. Walker M.K., Butler R.C. 2009. L*aboratory studies to determine the efficacy of selected insecticides on tomato/potato *psyllid. New Zealand Plant Protection 62: 145-151.*

Liu T. X., Stansly P. A. 2000. Insecticidal activity of surfactants and oils against silwerleaf whitefly (Bemisia argentifolii) nymphs (Homoptera: Aleyrodidae) on collards and tomato. Pest Management Science 56: 861-866.
Morita M., Ueda T.,Yoneda T., Kyoanage T., Haga T. 2007. Flonicamid, a novel insecticide with rapid inhibitory effect on aphid feeding. Pest Management Science 63: 969-973.

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CONTROL OF CARROT PSYLLID (TRIOZA APICALIS) ON CARROT .

Trial ID: I-12-061-06 Protocol ID: I-12-061-06
Location: Tammela Study Director: Anne Nissinen, Jarmo Ketola
Project ID: Investigator: Jarmo Ketola
Sponsor Contact:

Trt No.	Treatment Name	Form Conc	Form Type	Lot Code	Rate	Rate Unit	Appl Code
1	Karate 2.5 WG	25	WG	L131291	250	g/ha	ABCDEF
	-lambda-cyhalothrin	25			6.25	g AI	
2	Karate 2.5 WG	25	WG	L131291	250	g/ha	AB
	-lambda-cyhalothrin	25			6.25	g AI	
	Teppeki WG	500	WG	7310-001-05	140	g/ha	CD
	-flonicamid	500			70	g AI	
3	Karate 2.5 WG	25	WG	L131291	250	g/ha	AB
	-lambda-cyhalothrin	25			6.25	g AI	
	Teppeki WG	500	WG	7310-001-05	140	g/ha	CD
	-flonicamid	500			70	g AI	
	Silwet Gold	100	EC	01012011	0.1	L/ha	EF
	-organic silicon	100			10	g AI	
4	Karate 2.5 WG	25	WG	L131291	250	g/ha	AB
	-lambda-cyhalothrin	25			6.25	g AI	
	Biscaya OD 240	240	OD	ECE7100521	300	mL/ha	CD
	-thiacloprid	240			72	g AI	
5	Karate 2.5 WG	25	WG	L131291	250	g/ha	AB
	-lambda-cyhalothrin	25			6.25	g AI	
	Silwet Gold	100	EC	01012011	0.1	L/ha	CDEF
	-organic silicon	100			10	g AI	
6	Karate 2.5 WG	25	WG	L131291	250	g/ha	AB
	-lambda-cyhalothrin	25			6.25	g AI	
	Biscaya OD 240	240	OD	ECE7100521	300	mL/ha	CD
	-thiacloprid	240			72	g AI	
	Teppeki WG	500	WG	7310-001-05	140	g/ha	EF
	-flonicamid	500			70	g AI	

Replications: 4, Design: Randomized Complete Block (RCB), Treatment units: Treated 'Plot' experimental unit size, Dry Form. Unit: g/kg, Treated 'Plot' experimental unit size Width: 2 meters, Treated 'Plot' experimental unit size Length: 8 meters, Application volume: 200 L/ha, Mix size: 2.5 liters, Format definitions: G-All7.def, G-All7.frm

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Location: Tammela Study Director: Anne Nissinen, Jarmo Ketola
Project ID: Investigator: Jarmo Ketola
Sponsor Contact:

General Trial Information

Study Director: Anne Nissinen & Jarmo Ketola
Investigator: Jarmo Ketola **Title:** Research Scientist

Planned Completion Date: 15/12/11

No.	Guideline	Description
1.	PP 1/181(2)	Conduct and reporting of efficacy evaluation trials
2.	PP 1/152(2)	Design and analysis of efficacy evaluation trials
3.	PP 1/135(2)	Phytotoxicity assessment

Personnel

Study Director: Anne Nissinen & Jarmo Ketola
Investigator: Jarmo Ketola **Title:** Research Scientist
Affiliation: MTT Agrifood Research Finland
Address: Laboratorium, Uutetie 1
Location: Jokioinen, Finland
Postal Code: FI-31600 **E-mail:** jarmo.ketola@mtt.fi
Phone No.: +358 29 531 7343

Crop Description

Crop 1: DAUCS Daucus carota subsp. sativus Carrot, garden
Variety: Angor
BBCH Scale: BVRT **Planting Date:** 17/6/12
Planting Method: DRILLE drilled **Rate, Unit:** 50 S/ROWM
Depth, Unit: 2.5 CM
Row Spacing, Unit: 60 CM
Seed Bed: FINE fine
Soil Moisture: WET wet **Emergence Date:** 7/6/12
Harvest Date: 9/8/12
Harvested Width, Unit: 60 CM **Harvested Length, Unit:** 8 M

Pest Description

Pest 1 Type: I **Code:** TRIZSP Trioza sp.
Common Name: Suckers

Site and Design

Plot Width, Unit: 2 m **Site Type:** FIELD field
Plot Length, Unit: 8 m
Plot Area, Unit: 16 m2 **Tillage Type:** CONTIL conventional-till
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

No.	Previous Crop	Previous Pesticides	Year
1.	Oats	MCPA	2011
2.	Oats	MCPA	2010

Maintenance

No.	Date	Maintenance Treatment Name
1.	1/6/12	Karate 2.5 WG
2.	1/6/12	Afalon/Stomp
3.	20/6/12	Agil
4.	29/6/12	Senkor/Afalon

Soil Description

Texture: FS fine sand
pH: 6.5
Fert. Level: G good
Soil Drainage: G good

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Moisture and Weather Conditions

Closest Weather Station: Jokioinen **Distance, Unit:** 20 KM

Application Description

	A	B	C	D	E	F
Application Date:	14/6/12	20/6/12	28/6/12	4/7/12	10/7/12	17/7/12
Application Method:	SPRAY	SPRAY	SPRAY	SPRAY	SPRAY	SPRAY
Application Placement:	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR
Applied By:	JK ER JKo	JK ER JKo	JK ER JKo	JK ER JKo	JKo ER LR	ER VR JKo
Air Temperature, Unit:	18.9 C	12 C	16.4 C	21.6 C	16.8 C	16.7 C
% Relative Humidity:	50	67	78	53	83	68
Wind Velocity, Unit:	2.7 M/S	3.1 M/S	0.5 M/S	1.8 M/S	0.9 M/S	2 M/S
Dew Presence (Y/N):	N no	N no	N no	N no	N no	N no
Soil Temperature, Unit:	14.2 C	12.1 C	15.6 C	18.7 C	16.6 C	17 C
Soil Moisture:	DRY	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
% Cloud Cover:	0					

Crop Stage At Each Application

	A	B	C	D	E	F
Crop 1 Code, BBCH Scale:	DAUCS BVRT	DAUCS BVRT	DAUCS BVRT	DAUCS BVRT	DAUCS BVRT	DAUCS BVRT
Stage Scale Used:	BBCH	BBCH	BBCH	BBCH	BBCH	BBCH
Stage Majority, Percent:	13	14	15	16	17	18
Height, Unit:	3 CM	5 CM	8 CM	15 CM	16.5 CM	20 CM

Pest Stage At Each Application

	A	B	C	D	E	F
Pest 1 Code, Type, Scale:	TRIZSP I	TRIZSP I	TRIZSP I	TRIZSP I	TRIZSP I	TRIZSP I

Application Equipment

	A	B	C	D	E	F
Appl. Equipment:	Plot sprayer	Plot sprayer	Plot sprayer	Plot sprayer	Plot sprayer	Plot sprayer
Equipment Type:	SPRAYE	SPRAYE	SPRAYE	SPRAYE	SPRAYE	SPRAYE
Operation Pressure, Unit:	2.2 bar	2.0 bar	2.4 bar	2.4 bar	2.4 bar	2.4 bar
Nozzle Type:	Hardi4110	Hardi4110	Hardi4110	Hardi4110	Hardi4110	Hardi4110
Nozzle Size:	12	12	12	12	12	12
Nozzle Spacing, Unit:	50 cm	50 cm	50 cm	50 cm	50 cm	50 cm
Nozzles/Row:	4	4	5	5	5	5
Boom ID:	KSU2	KSU3	KSU1	KSU1	KSU1	KSU1
Boom Length, Unit:	2 m	2 m	2,5 m	2,5 m	2,5 m	2,5 m
Boom Height, Unit:	50 cm	50 cm	50 cm	50 cm	50 cm	50 cm
Ground Speed, Unit:	1 mps	1 mps	1 MPS	1 MPS	1 MPS	1 MPS
Carrier:	WATER	WATER	WATER	WATER	WATER	WATER
Spray Volume, Unit:	200 l/ha	200 l/ha	200 l/ha	200 l/ha	200 l/ha	200 l/ha
Mix Size, Unit:	2.5 liters	2.5 liters	2.5 liters	2.5 liters	2.5 liters	2.5 liters

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Pest Code Crop Code Part Rated Rating Type Rating Unit ARM Action Codes				TRIZTI DAUCS EGLAAD P COUINS NO/SAMPL T4	TRIZTI DAUCS EGLAAD P COUINS NO/SAMPL T5	TRIZTI DAUCS ROOTOT C YIELD KG/HA T1	TRIZTI DAUCS ROOMAR C YIELD KG/HA T2	TRIZTI DAUCS INJURE C YIELD KG/HA T3	TRIZTI DAUCS - P NUMBER NO/PLOT	TRIZTI DAUCS ROOTOT - WEIGHT G/ROOT T8
Trt No.	Treatment Name	Rate Rate Unit	Appl Code	4	8	11	13	15	16	21
1	Karate 2.5 WG	250 g/ha	ABCDEF	3.0 a	7.3 a	26455 a	20657 a	3698 a	127.3 a	76.8 a
2	Karate 2.5 WG Teppeki WG	250 g/ha 140 g/ha	AB CD	6.8 a	12.3 a	32171 a	24113 a	3746 a	158.3 a	73.5 a
3	Karate 2.5 WG Teppeki WG Silwet Gold	250 g/ha 140 g/ha 0.1 L/ha	AB CD EF	10.0 a	6.0 a	27336 a	21095 a	4584 a	142.3 a	70.1 a
4	Karate 2.5 WG Biscaya OD 240	250 g/ha 300 mL/ha	AB CD	5.3 a	8.3 a	29764 a	22367 a	3815 a	143.3 a	75.0 a
5	Karate 2.5 WG Silwet Gold	250 g/ha 0.1 L/ha	AB CDEF	5.3 a	14.8 a	30980 a	21066 a	4143 a	148.5 a	75.7 a
6	Karate 2.5 WG Biscaya OD 240 Teppeki WG	250 g/ha 300 mL/ha 140 g/ha	AB CD EF	6.8 a	3.8 a	31222 a	24125 a	5016 a	159.0 a	70.8 a
LSD (P=.05)				9.89	8.27	7218.7	7210.5	3182.7	44.05	10.37
Standard Deviation				6.57	5.49	4790.6	4785.1	2112.1	29.24	6.88
CV				106.47	63.03	16.15	21.52	50.69	19.97	9.34
Bartlett's X2				6.486	9.527	11.927	2.488	1.317	10.593	1.46
P(Bartlett's X2)				0.262	0.09	0.036*	0.778	0.933	0.06	0.918
Replicate F				0.838	10.242	1.255	1.700	0.392	0.665	0.186
Replicate Prob(F)				0.4941	0.0006	0.3253	0.2097	0.7605	0.5863	0.9040
Treatment F				0.503	2.212	0.912	0.429	0.254	0.653	0.609
Treatment Prob(F)				0.7698	0.1073	0.4991	0.8215	0.9312	0.6641	0.6946

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Column 1: T4 = @SUM([1].[3])
Column 2: T5 = @SUM([5].[7])
Column 3: T1 = 2778*[10]/1000
Column 4: T2 = 2778*[12]/1000
Column 5: T3 = 2778*[14]/1000
Column 7: T8 = [10]/[16]
Column 8: T7 = [15]/[11]*100
Column 9: T6 = [13]/[11]*100

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Location: Tammela Study Director: Anne Nissinen, Jarmo Ketola
Project ID: Investigator: Jarmo Ketola
Sponsor Contact:

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	TRIZTI DAUCS INJURE C YIELD % T7 20	TRIZTI DAUCS ROOMAR C YIELD % T6 19
1	Karate 2.5 WG	250	g/ha	ABCDEF	11.9 a	80.1 a
2	Karate 2.5 WG	250	g/ha	AB	11.8 a	74.8 a
	Teppeki WG	140	g/ha	CD		
3	Karate 2.5 WG	250	g/ha	AB	16.6 a	77.0 a
	Teppeki WG	140	g/ha	CD		
	Silwet Gold	0.1	L/ha	EF		
4	Karate 2.5 WG	250	g/ha	AB	12.8 a	74.7 a
	Biscaya OD 240	300	mL/ha	CD		
5	Karate 2.5 WG	250	g/ha	AB	13.8 a	67.9 a
	Silwet Gold	0.1	L/ha	CDEF		
6	Karate 2.5 WG	250	g/ha	AB	16.2 a	76.5 a
	Biscaya OD 240	300	mL/ha	CD		
	Teppeki WG	140	g/ha	EF		
LSD (P=.05)					10.02	15.97
Standard Deviation					6.65	10.60
CV					47.97	14.1
Bartlett's X2					0.526	1.402
P(Bartlett's X2)					0.991	0.924
Replicate F					0.427	0.759
Replicate Prob(F)					0.7364	0.5345
Treatment F					0.409	0.591
Treatment Prob(F)					0.8351	0.7073