

## **2015 Progress report for CFCAB supported Kern County projects**

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***Abstract:** Several trials were conducted in 2015 through 2016 with two still in progress at the time of writing this report. The nematode trial again demonstrated that Nimitz has efficacy as a nematicide for RKN control although this year's trials results were mixed. A new product by Bayer also showed to be promising for RKN control. A second nematode trial was conducted in the fall to evaluate some biological products being promoted as being effective nematicides. Results showed no nematode efficacy for any of the biologicals tested. A seed treatment trial was conducted to evaluate their effectiveness in increasing plant stand and plant vigor. Most treatments had no effect and a few actually had a negative effect on plant stand and plant vigor. A cavity spot trial showed that Ridomil Gold, Ridomil Gold with Quadris and Ranman were the top performing fungicides. A cavity spot variety screening trial is currently in progress as is an herbicide trial evaluating a potential new herbicide for carrots.*

### **Evaluation of Alternative Nematicides for the Control of Root-Knot Nematodes**

The use of fumigants have come under tighter restrictions and regulations in California and elsewhere for several reasons including human safety, VOC emissions (which leads to smog formation), and as an ozone depleter. Although there is much debate on maintaining the use of fumigants in agriculture, alternative methods of nematode management must be investigated. There are viable alternative pesticides for most other soil borne pests but nematodes essentially need to be controlled with the use of fumigants. Fumigants such as 1,3-dichloropropene and metam sodium are routinely used in carrot production in California for nematode control. Carrot production is responsible for the majority of 1,3-dichloropropene and metam sodium use in California. The carrot industry of California urgently needs alternative methods of nematode control if restrictions on the use of fumigants continue to increase.

In cooperation with Drs. Ole Becker and Antoon Ploeg, UCCE Nematology Specialists at UC Riverside, we have been evaluating new non-fumigant nematicides at the UCCE Shafter Research Farm. The spring trial is conducted on a root knot nematode (RKN) infested nursery located at the Farm. Individual plots are 60 inch beds by 30 ft length. All pre-plant applications were made by watering can method on 4/2/15 except Melocon which was applied 4/9/15. After pre-plant applications the beds are mulched and ¼ water applied by solid set sprinklers. Carrots were planted on 4/9/15 with 3 seed lines per bed. Treatments listed as receiving post-plant application were treated on 5/21/15 and 6/25/15. Five random samples (approximately 8 inches of row each) per plot were taken and evaluated for RKN injury.

The results of the trial are somewhat mixed mainly due to the fact that the non-treated control was not the treatment with the highest RKN gall rating (figure 1). The metam sodium and MeloCon treatments were the treatments with the highest root galling index. Numerically the Nimitz with two vydate post-plant applications and Bayer's Velum treatment were the best treatments.

A smaller nematode trial was conducted in the fall of 2015 to evaluate three biological materials that the manufactures claim may have nematicidal activity. These products were compared to DP-1 and Nimitz which have shown to be promising new conventional nematicides for the carrot

industry. These products were applied as previously described. In short none of the biological products showed any efficacy as a nematicide compared to the new conventional products (figure 2).

### **Evaluation of Seed Treatments for Increased Stands and Seedling Vigor**

Seed treatments are an economical and safe method to apply fungicides, nematicides and insecticides. However growers often question the efficacy of such treatments especially on small seeded crops such as carrots which cannot carry much in the way of a pesticide. A trial was conducted in 2015 to learn if seed treatments had an impact on carrot stand and seedling vigor.

Non-treated carrot seed samples of the variety Slendercut of the same seed lot were sent to Syngenta, Bayer and Applied Quantum Energies (AQE) for each company to apply their treatments. Syngenta sent back four seed treatments while Bayer and AQE sent back on each. The treated seed was planted in a commercial grower's field. Each plot was 40 inches wide by 15 feet in length. The plots were planted with three lines per bed with a Clean Seeder (Jang Automation Co.) set up with carrot roller plates on 8/17/15.

Eight weeks after planting one meter of row was harvested from each plot, bagged and taken to the lab at the UCCE office. The tops and roots were separated then the tops and roots weighed separately, number of plants counted and dry weights of the tops and roots weighed after being placed in a drying oven.

Stands were not increased by the seed treatments in comparison to the non-treated seed (figure 3). Syngenta treatments 2 and 3 reduced the canopy size as compared to all other treatments. Root weights were also reduced by Syngenta treatments 2 and 3. The Bayer seed treatment also reduced the total root weight.

The use of seed treatments did not increase stand counts or increase plant vigor. The use of some seed treatments actually reduced the stand and plant vigor. It must be noted that seedling diseases were not an issue in this field. In the presence of higher disease pressure the positive effects of a seed treatment may have out-weighed any phytotoxicity caused by the seed treatment.

### **Cavity Spot Fungicide Trial and Carrot Variety Screening Trial**

A fungicide trial was conducted in 2015 at the Shafter Research Farm at a cavity spot nursery being developed at the research farm. Various fungicides, some numbered compounds and combinations of material were tested. Figure 4 lists the treatments applied and the application dates. Each plot was 20 feet in length by one 30 inch bed with three seed lines per bed. The treatments were replicated 4 times in a randomized complete block design. Treatments were applied with the use of a watering can followed by a 2 hour irrigation to move the material down into the root zone.

Analysis of variance (ANOVA) showed no significant differences among the treatment means. However analysis by contrast comparisons did show significant differences of some treatments in comparison to the non-treated control. Ridomil Gold, Ridomil Gold and Quadris tank mix,

Ranman and Presidio tank mixed with the numbered compound V-10208 all had significantly less cavity spot compared to the non-treated control.

### **Trials in Progress**

Trials that are still in progress include a cavity spot variety and a herbicide trial with a nonregistered product. The cavity spot variety screening trial is being conducted in collaboration with Mary Ruth MacDonald at the University of Guelph. We each have some standards at each of our locations and the rest of trial consists of commercial varieties being used by the California carrot industry (figure 5). The trial is being conducted at the cavity spot nursery at the Shafter research farm.

The second trial in progress is a herbicide with the compound pyroxasulfone sold commercially as Zidua. Zidua is registered in the US for use on corn, cotton, soybeans and wheat. Dr. Clarence Swanton from the University of Guelph found that pyroxasulfone applied at below labeled rates would not harm carrots and still be very effective as an herbicide. However his findings also revealed that it could only be used post-plant on mineral soils otherwise severe crop toxicity would occur.

Zidua is a BASF product and they have indicated that they have some interest in expanding the label to possibly include carrots. A trial is being conducted at the Shafter research farm looking at different rates of Zidua and in combination with linuron and another BASF product Select-Max (figure 6). Linuron pre and post-plant will be the standard for comparison along with a non-treated control.

### **Variety Trials**

Several variety trials are conducted each year by our group. A Kern County carrot variety trial is conducted each year on a grower's field. Each January growers, breeders and seed growers come to evaluate new carrot varieties side-by-side with material from all the major carrot seed companies. The trial includes cellos, cut and peel and colored carrots.

A Carrot Improvement for Organic Agriculture (CIOA) trial is also conducted each year in Kern County and at several locations throughout the US. Thirty six varieties are planted in small plots in commercial conventional and organic fields in Kern County. Evaluations are made to indentify which varieties may show to perform better in organic production systems. The project is spearheaded by Dr. Phil Simon.

Our group also lends support to the carrot winter nursery in Desert Research and Extension Center located in Imperial Valley. We help in the harvest and through my office cover the expenses of having the trial at the DREC.

**Figure 1. 2015 Spring Carrot Nematode Trial at Shafter Research Farm**

<u>Treatment</u>	<u>Rate</u>	<u>Nematode Rating*</u>
1. Control		2.4 BC
2. Metam Sodium	75 gal/A	3.4 AB
3. Nimitz pre-plant	80 fl oz/A	2.3 C
4. Nimitz pre & Vydate 2 post	1 gal/A	1.9 C
5. Bayer Velum pre & 2 post	8.55 oz/A	1.9 C
6. Nimitz pre & Bayer Velum 2 post		2.8 ABC
7. DP1 pre & 2 post	30.7 fl oz/A & 15.4 fl oz/A	2.9 ABC
8. <u>Melocon pre at</u>	<u>4 lbs/A</u>	<u>3.5 A</u>
Probability		0.0745
%CV		34.79
LSD <sub>P=0.10</sub>		3.134

\* Nematode rating: 1=0% root infection, 10= 100% root infection

**Figure 2. 2015 Fall Carrot Nematode Trial at Shafter Research Farm**

<u>Treatment</u>		<u>Root Rating*</u>
1. Control		1.3 BC
2. DP-1	30.7 fl oz/A	1.0 C
3. Nimitz	80 fl oz/A	1.4 BC
4. DP-3	5 gal/A	2.2 AB
5. Em-une	2 gal/A	2.7 A
6. <u>Marrone</u>	<u>2 gal/A</u>	<u>2.0 ABC</u>
Prob.=	0.1056	
%CV=	54.65	
LSD <sub>P=0.10</sub>	1.059	

\* Nematode Rooting Scale: 1=best, 10=worst

Treatments 2-5 applied on 9/23/15

Treatment 6 applied on 10/8/15

Planted on 10/8/15

Harvested on 12/8/15

**Figure 3.****2015 Carrot Seed Treatment Trial**

Treatment	Stand Count	Dry Root Weight (g)	Dry Top Weight (g)
1. Control	419	8.9 A	66.9 A
2. Bayer	429	8.9 A	52.9 BC
3. Syngenta 1	392	8.9 A	62.9 AB
4. Syngenta 2	363	6.4 BC	55.5 BC
5. Syngenta 3	342	5.5 C	41.0 C
6. Syngenta 4	437	8.0 AB	56.5 AB
7. AQE treatment "A"	420	9.4 A	65.5 A
Probability	0.3682	0.0181	0.0049
%CV	16.75	19.79	14.80
LSD p=0.05	99.612	2.347	12.504

Planted 8/17/15

1 meter of row harvested on 10/7/15, number of plants counted, tops and roots separated and placed in drying oven to obtain dry weights in grams.

**Figure 4.****2015 Cavity Spot Trial**

<b>Treatment</b>	<b>Rate</b>	<b>Percent Cavity Spot</b>
1. Control		7.5
2. Ridomil Gold	8 fl oz/A	3.3
3. Ridomil Gold & Qudris	9 fl oz/A	2.8
4. Teagro	5.2 oz/A	4.3
5. Reason	8.2 fl oz/A	5.5
6. Ranman	24 fl oz/A	2.5
7. Presidio	0.125lb/A	6.5
8. V-10208	8 oz/A	3.8
9. Presidio & V-10208		2.8
10. Serenade Soil	2 qt/A	7.3
11. Fungi-Phite	2 qt/A	5.3
12. Fungi-Phite & Ridomil Gold		5.5
Probability		0.4136
%CV		72.74
LSD		Not Significant

**Contrast Comparisons**

Control vs All Treatments, Prob=0.102

Control vs Ridomil Gold, Prob=0.09

Control vs Ridomil &amp; Quadris, Prob=0.059

Control vs Ranman, Prob=0.048

Control vs Presidio &amp; V-10208, Prob=0.059

(application dates: 2/26/15, 2/26/15, 3/23/15)

**Figure 5. Cavity Spot Variety Screening Trial - In Progress**

1	KXPC 222	21	Creampak
2	KXPC 104	22	Poseidon
3	KXPC 162	23	KXPC 107
4	CR 1706	24	PSI 603
5	Copperhead	25	HoneySnax
6	Olympus	26	TriplePlay
7	PS 1441	27	Slender Cut
8	Triton	28	CR 1640
9	CR 2289	29	Imperial Cuts
10	Legend	30	Purple Elite
11	Zeus	31	Purple Snax
12	Maverick	32	Top Cut
13	Red 42	33	Upper Cut
14	Snowman	34	Candy Snax
15	Yellow Bunch	35	Org Carrot Atomic Red
16	Navajo	36	Cello Bunch
17	Slim Cut	37	Envy
18	Rebec	38	Purple Haze
19	Sun 255	39	B5367B- 365-1
20	Crispy Cut	40	B2226B-V104073



## Figure 6. Zidua (pyoxasulfone) Herbicide Trial

1. Non-Treated Control
2. linuron at 0.5 lb ai/A at planting and 1 lb ai/A at 4 leaf stage
3. Linuron 0.5 lb ai/A pre-plant and Zidua WG @ 1.5 oz/A post-plant at 4 leaf stage
4. Zidua WG @ 1 oz/ A post-plant at 4 leaf stage
5. Zidua WG @ 1.5 oz/A post-plant at 4 leaf stage
6. Zidua WG 2 oz/A post-plant at 4 leaf stage
7. Zidua WG @ 2 oz/A + Select Max @ 13 fl oz + COC tank mix post-plant 4 leaf stage

planted 11/9/15

Linuron pre-plants applied 11/10/15