

TOMATO: *Lyopersicon esculentum* Miller

‘Sanibel’

Beet armyworm: *Spodoptera exigua* (Hubnner)

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EVALUATION OF INSECTICIDES FOR CONTROL OF BEET ARMYWORM

ON ‘SANIBEL’ TOMATO, SPRING 2017. ‘Sanibel’ tomato seedlings were planted on raised beds on 4 April, 2017 at TREC. Beds were covered with polyethylene mulch. The soil type of the beds were a Krome gravelly loam (loamy-skeletal, carbonatic hyperthermic lithic Udorthents), which consists of about 33% soil and 67% pebbles (>2mm).

Seedlings were placed 18 inches apart within rows and 36 inches apart in between rows. Plants were drip irrigated twice a day and fertigated once a week with 4-0-8. Each treatment plot consisted of a 40 ft long two beds and was arranged in a randomized complete block design with four replications. A 5 ft wide nonplanted area separated blocks from each other.

Treatments evaluated were:

Treatment	Rate [oz]/acre
Cormoran	9.0
Radiant	6.0
Coragen	4.0
Intrepid	6.0
Untreated	

Treatments were applied once on 20 April 2017 by using a backpack sprayer delivering 60 GPA at 30 PSI. Treatments were evaluated 7d after each application for four consecutive weeks.

Effectiveness of treatments for controlling beet armyworm was conducted by counting all BAW larvae on randomly selected 10 plants per treatments plot. While counting, larvae were separated visually into small (1st & 2nd instars), medium (3rd & 4th instars) and large (5th instar). Tomato

foliage was rated once on 11 May for beet armyworm feeding damage on a scale 1 (little damage) to 10 (almost all leaves were damaged).

Small BAW larvae. Mean numbers of BAW small larvae in the prespray samples collected from the treated plots on 20 April did not differ from the nontreated control plot (Table 1). Mean numbers of BAW small larvae in the first post treated samples seven days after the first application were significantly fewer in all treated plots than the nontreated control plots. Effectiveness of insecticide treatments effectively suppressed BAW small larvae on the following two sampling dates on 4 and 11 May. When means across the sampling dates are considered, insecticide treatments significantly reduced BAW small larvae as compared to the nontreated control.

Medium BAW larvae. Mean numbers of medium larvae were low in all plots before insecticide application and did not differ statistically (Table 2). On the first post spray sampling date (27 April), all insecticide treatments significantly reduced medium larvae as compared to the nontreated control. Similarly, mean numbers of medium larvae were significantly fewer in all treated plots on the following two sampling dates (4 and 11 May) than the nontreated control plot. When all means across the sampling dates were averaged, insecticide treatments showed significant reduction in the number of BAW as compared to the nontreated control.

Large BAW larvae. Due to the application of insecticides at the initiation of infestation, large BAW larvae was very low in this study (Table 3). The mean numbers of large larvae in Cormoran treated plants were almost zero on all sampling date resulting in 0.025 larvae/plant when means across the season were averaged. Overall, all insecticide treatments significantly reduced large BAW larvae as compared to the nontreated control.

Foliage rating for BAW feeding damage. BAW feeding damage was low (Table 5) on the treated plants due to the control of larvae (Table 4). Insecticide treatments significantly reduced BAW feeding damage as compared to the nontreated control.

Table 1. Mean number of beet armyworm (BAW) small larvae/ Sanibel' tomato plant treated with various insecticides, spring 2017

Mean number of small larvae/plant

Treatment	Rate [oz]/acre	20 April	27 April	4 May	11 May	Seasonal mean
Cormoran	9.0	3.35a	0.25b	0.20b	0.10bc	0.97b
Radiant	6.0	2.70a	0.50b	0.15b	0.10bc	0.86b
Coragen	4.0	2.45a	0.35b	0.15b	0.00c	0.74b
Intrepid	6.0	3.20a	0.75b	0.45b	0.35b	1.19b
Untreated		2.85a	2.20a	0.95a	0.80a	1.70a

Means within a column followed by a same letter do not differ statistically ($P > 0.05$; DMRT).

Table 2. Mean number of beet armyworm (BAW) medium larvae/ Sanibel' tomato plant treated with various insecticides, spring 2017

Mean number of medium larvae/plant

Treatment	Rate [oz]/acre	20 April	27 April	4 May	11 May	Seasonal mean
Cormoran	9.0	0.95a	0.35b	0.10b	0.05b	0.36b
Radiant	6.0	0.70a	0.30b	0.05b	0.05b	0.27b
Coragen	4.0	0.75a	0.30b	0.20b	0.20b	0.36b
Intrepid	6.0	1.15a	0.50b	0.30b	0.25b	0.55b
Untreated		0.95a	1.95a	0.85a	0.70a	1.11a

Means within a column followed by a same letter do not differ statistically ($P > 0.05$; DMRT).

Table 3. Mean number of beet armyworm (BAW) large larvae/Sanibel' tomato plant treated with various insecticides, spring 2017

Mean number of large larvae/plant

Treatment	Rate [oz]/acre	20 April	27 April	4 May	11 May	Seasonal mean
Cormoran	9.0	0.00a	0.00b	0.00b	0.10b	0.025b
Radiant	6.0	0.05a	0.05b	0.05ab	0.05b	0.05b
Coragen	4.0	0.00a	0.00b	0.05ab	0.00b	0.01b
Intrepid	6.0	0.15a	0.10b	0.10ab	0.05b	0.10b
Untreated		0.05a	0.35a	0.20a	0.30a	0.22a

Means within a column followed by a same letter do not differ statistically ($P > 0.05$; DMRT).

Table 4. Mean number of all beet armyworm (BAW) sm-med-large larvae/Sanibel' tomato plant treated with various insecticides, spring 2017

Mean number of combined larvae/plant

Treatment	Rate [oz]/acre	20 April	27 April	04 May	11 May	Seasonal mean
Cormoran	9.0	4.30a	0.60b	0.30c	0.25b	1.36bc
Radiant	6.0	3.45a	0.85b	0.25c	0.20b	1.19bc
Coragen	4.0	3.20a	0.65b	0.40bc	0.20b	1.11c
Intrepid	6.0	4.50a	1.35b	0.85b	0.65b	1.84b
Untreated		3.85a	4.50a	2.00a	1.80a	3.04a

Means within a column followed by a same letter do not differ statistically ($P > 0.05$; DMRT).

Table 5. Mean rating of beet armyworm (BAW) feeding damage on ‘Sanibel’ tomato plant treated with various insecticides, spring 2017

Mean foliage rating

Treatment	Rate [oz]/acre	11 May
Cormoran	9.0	0.13bc
Radiant	6.0	0.13bc
Coragen	4.0	0c
Intrepid	6.0	0.31b
Untreated		2.75a

Means within a column followed by a same letter do not differ statistically ($P > 0.05$; DMRT).

```

data adama tomato worm;
input date trt $ bl $ pl sm med lar;
    sqsm=sqrt(sm+.25);
    sqmed=sqrt(med+.25);
    sqlar=sqrt(lar+.25);
    tot= sm+med+lar;
    sqtot=sqrt(tot+.25);
cards;

```

```

420  corm  a    1    5    2    0
420  corm  a    2    0    3    0
420  corm  a    3    7    0    0
420  corm  a    4    7    0    0
420  corm  a    5   12    2    0

```

```

420  rad   a    1    7    0    1
420  rad   a    2    4    3    0
420  rad   a    3    0    3    0
420  rad   a    4    2    2    0
420  rad   a    5    0    2    0

```

```

420  cor   a    1    0    3    0
420  cor   a    2    5    0    0
420  cor   a    3    5    2    0
420  cor   a    4    3    2    0
420  cor   a    5    8    0    0

```

```

420  int   a    1    5    4    0
420  int   a    2    4    2    1
420  int   a    3    6    2    0
420  int   a    4    2    0    1
420  int   a    5    2    3    0

```

```

420  con   a    1    3    4    0
420  con   a    2    6    3    0
420  con   a    3    6    2    1
420  con   a    4    4    1    0
420  con   a    5    3    2    0

```

```

420  corm  b    1    3    1    0
420  corm  b    2    4    0    0
420  corm  b    3    5    2    0
420  corm  b    4    5    2    0
420  corm  b    5    3    0    0

```

```

420  rad   b    1    3    0    0
420  rad   b    2    6    0    0
420  rad   b    3    6    0    0
420  rad   b    4    5    0    0
420  rad   b    5    0    2    0

```

```

420  cor   b    1    4    1    0
420  cor   b    2    3    1    0
420  cor   b    3    0    0    0
420  cor   b    4    2    2    0
420  cor   b    5    2    0    0

```

420	int	b	1	3	2	0
420	int	b	2	5	3	0
420	int	b	3	6	0	0
420	int	b	4	5	0	0
420	int	b	5	2	1	0
420	con	b	1	4	2	0
420	con	b	2	4	1	0
420	con	b	3	0	1	0
420	con	b	4	3	0	0
420	con	b	5	5	0	0
420	corm	c	1	0	0	0
420	corm	c	2	2	2	0
420	corm	c	3	2	1	0
420	corm	c	4	4	0	0
420	corm	c	5	2	0	0
420	rad	c	1	4	0	0
420	rad	c	2	3	0	0
420	rad	c	3	0	0	0
420	rad	c	4	0	0	0
420	rad	c	5	4	0	0
420	cor	c	1	5	2	0
420	cor	c	2	0	0	0
420	cor	c	3	0	0	0
420	cor	c	4	2	0	0
420	cor	c	5	0	1	0
420	int	c	1	5	0	0
420	int	c	2	7	2	0
420	int	c	3	0	0	0
420	int	c	4	0	0	0
420	int	c	5	1	1	0
420	con	c	1	6	0	0
420	con	c	2	0	0	0
420	con	c	3	0	2	0
420	con	c	4	2	0	0
420	con	c	5	3	0	0
420	corm	d	1	2	3	0
420	corm	d	2	0	0	0
420	corm	d	3	0	0	0
420	corm	d	4	4	1	0
420	corm	d	5	0	0	0
420	rad	d	1	4	0	0
420	rad	d	2	4	0	0
420	rad	d	3	0	1	0
420	rad	d	4	0	0	0
420	rad	d	5	2	1	0
420	cor	d	1	5	1	0
420	cor	d	2	2	0	0
420	cor	d	3	3	0	0

420	cor	d	4	0	0	0
420	cor	d	5	0	0	0

420	int	d	1	4	3	0
420	int	d	2	6	0	1
420	int	d	3	0	0	0
420	int	d	4	0	0	0
420	int	d	5	1	0	0

420	con	d	1	4	1	0
420	con	d	2	4	0	0
420	con	d	3	0	0	0
420	con	d	4	0	0	0
420	con	d	5	0	0	0

427	corm	a	1	0	0	0
427	corm	a	2	0	0	0
427	corm	a	3	1	1	0
427	corm	a	4	1	0	0
427	corm	a	5	0	0	0

427	rad	a	1	0	0	1
427	rad	a	2	1	0	0
427	rad	a	3	0	1	0
427	rad	a	4	1	0	0
427	rad	a	5	0	0	0

427	cor	a	1	0	0	0
427	cor	a	2	0	1	0
427	cor	a	3	1	0	0
427	cor	a	4	0	0	0
427	cor	a	5	1	0	0

427	int	a	1	2	1	0
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427	int	a	2	1	0	0
427	int	a	3	0	0	0
427	int	a	4	0	1	1
427	int	a	5	0	0	0

427	con	a	1	4	5	1
427	con	a	2	6	5	0
427	con	a	3	6	6	1
427	con	a	4	3	8	0
427	con	a	5	2	3	0

427	corm	b	1	0	1	0
427	corm	b	2	0	0	0
427	corm	b	3	0	2	0
427	corm	b	4	1	2	0
427	corm	b	5	1	0	0

427	rad	b	1	2	0	0
427	rad	b	2	1	0	0
427	rad	b	3	0	0	0
427	rad	b	4	0	0	0
427	rad	b	5	1	2	0

427	cor	b	1	1	1	0
427	cor	b	2	0	1	0
427	cor	b	3	0	0	0
427	cor	b	4	2	2	0
427	cor	b	5	0	0	0
427	int	b	1	0	2	0
427	int	b	2	3	3	0
427	int	b	3	2	0	0
427	int	b	4	0	0	0
427	int	b	5	2	1	0
427	con	b	1	4	0	1
427	con	b	2	1	3	0
427	con	b	3	2	0	0
427	con	b	4	0	0	0
427	con	b	5	0	1	1
427	corm	c	1	0	0	0
427	corm	c	2	1	0	0
427	corm	c	3	0	0	0
427	corm	c	4	0	0	0
427	corm	c	5	0	0	0
427	rad	c	1	1	0	0
427	rad	c	2	0	0	0
427	rad	c	3	0	0	0
427	rad	c	4	1	1	0
427	rad	c	5	0	0	0
427	cor	c	1	0	0	0
427	cor	c	2	0	0	0
427	cor	c	3	1	0	0
427	cor	c	4	0	0	0
427	cor	c	5	0	1	0
427	int	c	1	1	0	0
427	int	c	2	0	1	0
427	int	c	3	1	0	0
427	int	c	4	0	0	0
427	int	c	5	1	0	0
427	con	c	1	3	2	0
427	con	c	2	3	0	0
427	con	c	3	0	1	1
427	con	c	4	2	0	0
427	con	c	5	0	0	0
427	corm	d	1	0	0	0
427	corm	d	2	0	0	0
427	corm	d	3	0	0	0
427	corm	d	4	0	1	0
427	corm	d	5	0	0	0
427	rad	d	1	0	1	0
427	rad	d	2	0	0	0

427	rad	d	3	0	1	0
427	rad	d	4	0	0	0
427	rad	d	5	2	0	0
427	cor	d	1	0	0	0
427	cor	d	2	0	0	0
427	cor	d	3	0	0	0
427	cor	d	4	0	0	0
427	cor	d	5	1	0	0
427	int	d	1	1	0	0
427	int	d	2	0	0	1
427	int	d	3	1	1	0
427	int	d	4	0	0	0
427	int	d	5	0	0	0
427	con	d	1	2	2	1
427	con	d	2	0	1	0
427	con	d	3	3	0	1
427	con	d	4	3	2	0
427	con	d	5	0	0	0
504	corm	a	1	0	0	0
504	corm	a	2	1	0	0
504	corm	a	3	0	0	0
504	corm	a	4	0	0	0
504	corm	a	5	0	0	0
504	rad	a	1	0	0	1
504	rad	a	2	0	0	0
504	rad	a	3	0	0	0
504	rad	a	4	0	0	0
504	rad	a	5	0	0	0
504	cor	a	1	0	0	0
504	cor	a	2	0	1	0
504	cor	a	3	0	0	0
504	cor	a	4	0	0	0
504	cor	a	5	0	0	0
504	int	a	1	1	0	0
504	int	a	2	0	0	0
504	int	a	3	0	0	0
504	int	a	4	0	1	1
504	int	a	5	0	0	0
504	con	a	1	3	1	1
504	con	a	2	2	1	0
504	con	a	3	2	0	1
504	con	a	4	0	1	0
504	con	a	5	0	2	0
504	corm	b	1	0	0	0
504	corm	b	2	0	0	0
504	corm	b	3	0	0	0
504	corm	b	0	1	0	0

504	corm	b	5	0	0	0
504	rad	b	1	0	0	0
504	rad	b	2	1	0	0
504	rad	b	3	0	0	0
504	rad	b	4	0	0	0
504	rad	b	5	0	0	0
504	cor	b	1	1	0	0
504	cor	b	2	0	0	0
504	cor	b	3	0	0	0
504	cor	b	4	0	2	0
504	cor	b	5	0	0	0
504	int	b	1	0	1	0
504	int	b	2	0	1	0
504	int	b	3	2	0	0
504	int	b	4	0	0	0
504	int	b	5	1	1	0
504	con	b	1	0	1	0
504	con	b	2	2	0	0
504	con	b	3	0	0	0
504	con	b	4	0	1	0
504	con	b	5	1	1	0
504	corm	c	1	0	0	0
504	corm	c	2	0	0	0
504	corm	c	3	0	1	0
504	corm	c	4	1	0	0
504	corm	c	5	0	0	0
504	rad	c	1	1	0	0
504	rad	c	2	0	0	0
504	rad	c	3	0	0	0
504	rad	c	4	0	0	0
504	rad	c	5	0	0	0
504	cor	c	1	0	0	0
504	cor	c	2	0	0	0
504	cor	c	3	0	0	0
504	cor	c	4	0	0	0
504	cor	c	5	1	0	0
504	int	c	1	0	0	0
504	int	c	2	0	0	0
504	int	c	3	0	0	0
504	int	c	4	1	1	0
504	int	c	5	1	0	0
504	con	c	1	3	1	0
504	con	c	2	2	0	0
504	con	c	3	0	2	0
504	con	c	4	0	1	0
504	con	c	5	1	0	0
504	corm	d	1	1	0	0

504	corm	d	2	0	0	0
504	corm	d	3	0	0	0
504	corm	d	4	0	1	0
504	corm	d	5	0	0	0
504	rad	d	1	0	0	0
504	rad	d	2	0	0	0
504	rad	d	3	0	1	0
504	rad	d	4	1	0	0
504	rad	d	5	0	0	0
504	cor	d	1	0	0	1
504	cor	d	2	1	0	0
504	cor	d	3	0	1	0
504	cor	d	4	0	0	0
504	cor	d	5	0	0	0
504	int	d	1	0	1	0
504	int	d	2	1	0	0
504	int	d	3	0	0	0
504	int	d	4	0	0	0
504	int	d	5	2	0	1
504	con	d	1	0	0	0
504	con	d	2	0	2	1
504	con	d	3	1	2	0
504	con	d	4	2	1	0
504	con	d	5	0	0	1
511	corm	a	1	0	0	0
511	corm	a	2	0	0	0
511	corm	a	3	0	0	0
511	corm	a	4	0	0	0
511	corm	a	5	1	0	0
511	rad	a	1	0	0	0
511	rad	a	2	0	0	0
511	rad	a	3	0	0	0
511	rad	a	4	0	0	0
511	rad	a	5	0	0	0
511	cor	a	1	0	0	0
511	cor	a	2	0	1	0
511	cor	a	3	0	0	0
511	cor	a	4	0	0	0
511	cor	a	5	0	0	0
511	int	a	1	0	2	0
511	int	a	2	0	0	0
511	int	a	3	0	0	0
511	int	a	4	1	0	0
511	int	a	5	0	0	0
511	con	a	1	2	3	0
511	con	a	2	2	0	0
511	con	a	3	2	0	1

511	con	a	4	0	1	0
511	con	a	5	0	0	0
511	corm	b	1	0	0	0
511	corm	b	2	0	0	0
511	corm	b	3	0	0	0
511	corm	b	0	0	0	0
511	corm	b	5	0	1	0
511	rad	b	1	0	0	0
511	rad	b	2	0	0	0
511	rad	b	3	0	0	0
511	rad	b	4	0	0	0
511	rad	b	5	1	0	0
511	cor	b	1	0	0	0
511	cor	b	2	0	0	0
511	cor	b	3	0	0	0
511	cor	b	4	0	1	0
511	cor	b	5	0	0	0
511	int	b	1	1	0	0
511	int	b	2	0	1	0
511	int	b	3	0	0	0
511	int	b	4	0	0	0
511	int	b	5	1	1	0
511	con	b	1	1	1	1
511	con	b	2	0	0	0
511	con	b	3	1	2	1
511	con	b	4	0	0	0
511	con	b	5	1	1	0
511	corm	c	1	1	0	0
511	corm	c	2	0	0	0
511	corm	c	3	0	0	0
511	corm	c	4	0	0	1
511	corm	c	5	0	0	0
511	rad	c	1	0	0	1
511	rad	c	2	0	0	0
511	rad	c	3	0	0	0
511	rad	c	4	0	0	0
511	rad	c	5	1	0	0
511	cor	c	1	0	0	0
511	cor	c	2	0	0	0
511	cor	c	3	0	0	0
511	cor	c	4	0	0	0
511	cor	c	5	0	1	0
511	int	c	1	1	1	0
511	int	c	2	0	0	0
511	int	c	3	0	0	0
511	int	c	4	0	0	0
511	int	c	5	1	0	0

511	con	c	1	2	1	1
511	con	c	2	0	2	0
511	con	c	3	2	0	0
511	con	c	4	0	0	0
511	con	c	5	1	0	1
511	corm	d	1	0	0	0
511	corm	d	2	0	0	0
511	corm	d	3	0	0	0
511	corm	d	4	0	0	0
511	corm	d	5	0	0	1
511	rad	d	1	0	1	0
511	rad	d	2	0	0	0
511	rad	d	3	0	0	0
511	rad	d	4	0	0	0
511	rad	d	5	0	0	0
511	cor	d	1	0	0	0
511	cor	d	2	0	0	0
511	cor	d	3	0	1	0
511	cor	d	4	0	0	0
511	cor	d	5	0	0	0
511	int	d	1	0	0	0
511	int	d	2	1	0	0
511	int	d	3	0	0	0
511	int	d	4	1	0	0
511	int	d	5	0	0	1
511	con	d	1	2	1	0
511	con	d	2	0	0	0
511	con	d	3	0	1	1
511	con	d	4	0	1	0
511	con	d	5	0	0	0

```

proc sort; by date trt;
proc glm; by date;
class trt;
model sm sqsm med sqmed lar sqlar tot sqtot=trt;
means trt/duncan; run;
proc glm;
class trt;
model sm sqsm med sqmed lar sqlar tot sqtot=trt;
means trt/duncan; run;

```

```
data adama tomato worm dam;
input date trt $ bl $ rate;
sqrte=sqrt(rate+.25);
cards;
```

```
511 corm a .25
511 corm b 0
511 corm c 0
511 corm d .25
```

```
511 rad a .25
511 rad b .0
511 rad c .0
511 rad d .25
```

```
511 cor a 0
511 cor b 0
511 cor c 0
511 cor d 0
```

```
511 int a .5
511 int b .5
511 int c 0
511 int d .25
```

```
511 con a 3
511 con b 3
511 con c 2
511 con d 3
```

```
proc glm;
class trt;
model rate sqrte=trt;
means trt/duncan; run;
```