

# Nematode Management in Florida Organic Strawberries

## Part 1 – Organic Nematicides and Varieties

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### Summary

Seven organic nematicides and two common cultivars were evaluated in a field trial at the newly established organic research farm at the GCREC. FL Brilliance performed significantly better than FL Beauty in the organic field experiment, having on average 23% higher yield. No effect of any of the nematicides on fruit yield was noted in the field trial, probably because nematode pressure was very low (nematode data are still pending). None of the biological nematicides adversely affected crop stand, plant vigor or yield of the two strawberry varieties. The same organic nematicides, as well as some chemical nematicides, were also evaluated against sting nematodes in a strawberry greenhouse trial at the GCREC. This trial has just been finished and will be reported on later.

### Background

Plant-parasitic nematodes are one of the major constraints to crop production in Florida, and to strawberries in particular. Strawberry production in Florida is negatively affected by four main nematode species. Sting nematode (*Belonolaimus longicaudatus*) is native to Florida, having a widespread distribution and causing significant injury to strawberry roots. This is the most important nematode for Florida strawberries. Northern root-knot nematode (*Meloidogyne hapla*) is also very common in FL strawberry fields and causes root galling and late season damage on strawberry, but probably poses more of a threat to double-cropped vegetables. Northern lesion nematode (*Pratylenchus penetrans*) is less common, causing necrotic root lesions that predispose roots to secondary infection with fungal pathogens. Foliar nematode (*Aphelenchoides besseyi*) attacks buds and leaves of strawberry and can be very destructive as well. Root-knot, lesion and foliar nematodes can all be carried on strawberry plant material.

Without fumigants, the only option for organic growers to manage nematodes is to use cultural practices (crop rotation, cover crops, solarisation, ASD, etc) and apply bio-nematicides and organic approved soil amendments. It is therefore important that we start generating baseline data on the usefulness of these products in Florida strawberries. Also, as variety testing of FL

varieties is always done on fumigated land, there is no information on how these varieties compare under organic (non-fumigated) management.

## Methods

Seven biological nematicides were tested on two strawberry varieties (FL Brilliance and FL Beauty) in the newly established organic research farm at the GCREC. Products were all applied thru the drip irrigation system (1 drip tape in the center of the bed) in 38 ft long plots. All treatments were applied three times, the first application was done 4-5 days before planting, and the following applications 15 and 35 days after planting. Bare-rooted strawberry seedlings were transplanted on October 29, 2019. Each cultivar was planted in 13 ft double-row sections within each treated plot. The experiment was conducted as a randomized complete block design with five replicates per treatment. OMRI-approved fertilizer was applied throughout the season. No insecticide or fungicide sprays were done, and weeds were hand-pulled as needed. Crop stand was counted at 17, 49 and 92 days after transplanting (DAT). Plant vigor was measured every two weeks (from November 13<sup>th</sup>, 2019 to March 4<sup>th</sup>, 2020) by using a GreenSeeker™ hand-held sensor (Trimble, Sunnyvale, CA, USA) which generates a normalized difference vegetation index (NDVI) value based on the reflection of infrared light from the plant canopy. Harvest was performed 14 times from December 13<sup>th</sup>, 2019 to March 5<sup>th</sup>, 2020.

**Table 1.** Biological Nematicides used in GCREC organic trial, 2019-20.

Trt #	Product(s)	Rate/A	Application timing
1	Majestene	2 gal + 1 gal + 1 gal	@plant + 3 wap + 6 wap
2	Dazitol	5.35 gal + 5.35 gal + 5.35 gal	@plant + 3 wap + 6 wap
3	Kyte Gold	3 qt + 3 qt + 3 qt	@plant + 3 wap + 6 wap
4	Nemakill	64 oz + 64 oz + 64 oz	@plant + 3 wap + 6 wap
5	Zap*	1 gal + 1 gal + 1 gal	@plant + 3 wap + 6 wap
	ProMax	1 gal + 1 gal + 1 gal	
6	Ecozin+	56 oz + 56 oz + 56 oz	@plant + 3 wap + 6 wap
7	Melocon	4 lbs + 4 lbs + 4 lbs	@plant + 3 wap + 6 wap
8	UTC		

- Caution – Zap is not OMRI-approved and should not be applied in organic fields

## Results

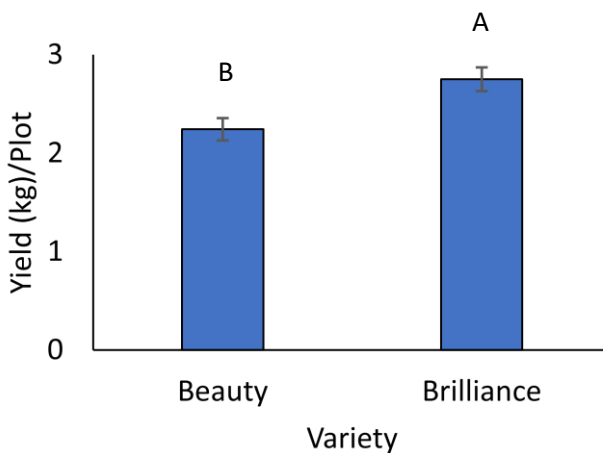


Figure 1. FL Brilliance produced more yield than FL Beauty in the organic field experiment. Bars represent standard errors of the means; different letters indicate statistically different yield ( $P < 0.05$ ).

Crop stand or plant vigor was not affected by any of the nematicides (Table 1). FL Beauty had somewhat higher plant counts at the end of January (after 92 days) as compared to FL Brilliance, but FL Brilliance had higher plant vigor throughout the season (except for the first two months) (Table 1). For fruit yield, no significant difference was found between the biological nematicide treatments and the untreated control (Table 2). FL Brilliance produced 23% higher yield than FL Beauty (Fig. 1), which was mostly due to higher yields in January. Pest, disease and weed pressure was low except towards the end of the season. Nematode counts are pending, but nematode pressure seemed low, and nematodes are not expected to have had an effect on yield.

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**Table 1.** Strawberry crop stand and plant vigor throughout the 2019-20 season in the organic field trial at GCREC.

Nematicide	Variety	Crop stand			Plant vigor								
		17 DAT	49 DAT	92 DAT	15 DAT	29 DAT	43 DAT	55 DAT	71 DAT	85 DAT	99 DAT	113 DAT	125 DAT
Majestene	Brilliance	18.2 a	16.8 a	16.6 a	0.17 a	0.19 a	0.33 a	0.37 a	0.56 a	0.43 a	0.49 a	0.63 ab	0.65 a
	Beauty	18.6 a	17.4 a	18.6 a	0.17 a	0.18 a	0.29 a	0.35 a	0.52 a	0.47 a	0.55 a	0.62 ab	0.58 a
Dazitol	Brilliance	18.8 a	17.2 a	16.6 a	0.18 a	0.21 a	0.32 a	0.34 a	0.50 a	0.45 a	0.47 a	0.57 abc	0.61 a
	Beauty	18.4 a	17.6 a	18.4 a	0.26 a	0.20 a	0.30 a	0.37 a	0.56 a	0.49 a	0.51 a	0.59 abc	0.62 a
Nemakill	Brilliance	18.6 a	16.4 a	16.8 a	0.18 a	0.19 a	0.32 a	0.32 a	0.48 a	0.37 a	0.42 a	0.49 c	0.65 a
	Beauty	18.4 a	18.4 a	18.4 a	0.24 a	0.17 a	0.26 a	0.29 a	0.54 a	0.47 a	0.51 a	0.56 abc	0.59 a
Kyte Gold	Brilliance	18.2 a	15.6 a	14.4 a	0.21 a	0.19 a	0.31 a	0.32 a	0.49 a	0.36 a	0.41 a	0.51 bc	0.64 a
	Beauty	17.6 a	16.6 a	17.6 a	0.19 a	0.16 a	0.32 a	0.33 a	0.53 a	0.48 a	0.49 a	0.62 abc	0.58 a
Zap+Promax	Brilliance	18.6 a	17 a	16.6 a	0.19 a	0.18 a	0.29 a	0.34 a	0.54 a	0.42 a	0.45 a	0.57 abc	0.62 a
	Beauty	18 a	17.4 a	17.4 a	0.16 a	0.18 a	0.32 a	0.33 a	0.53 a	0.44 a	0.50 a	0.61 abc	0.60 a
Ecozin Plus	Brilliance	17.8 a	17 a	15.6 a	0.28 a	0.22 a	0.30 a	0.32 a	0.52 a	0.44 a	0.50 a	0.59 abc	0.62 a
	Beauty	16.8 a	16.8 a	16.4 a	0.19 a	0.17 a	0.25 a	0.31 a	0.48 a	0.42 a	0.47 a	0.56 abc	0.62 a
Melocon	Brilliance	19 a	17.2 a	16.6 a	0.21 a	0.23 a	0.34 a	0.33 a	0.47 a	0.39 a	0.43 a	0.58 a	0.64 a
	Beauty	18.8 a	18.2 a	18.6 a	0.17 a	0.18 a	0.30 a	0.36 a	0.54 a	0.50 a	0.54 a	0.66 abc	0.59 a
UTC	Brilliance	19.4 a	17.8 a	17.2 a	0.22 a	0.23 a	0.35 a	0.36 a	0.54 a	0.41 a	0.46 a	0.57 abc	0.64 a
	Beauty	17.8 a	17.4 a	17.4 a	0.16 a	0.15 a	0.31 a	0.32 a	0.57 a	0.41 a	0.48 a	0.57 abc	0.57 a
P-value	Nematicide	0.6817	0.8886	0.5551	0.4410	0.7447	0.5643	0.4392	0.3899	0.6761	0.8512	0.0092	0.9995
	Variety	0.2227	0.2840	0.0052	0.3469	0.0053	0.0635	0.7274	0.1046	0.0025	0.0166	0.0126	0.0026
	Nematicide*Variety	0.9724	0.9760	0.9081	0.1509	0.6520	0.7124	0.8084	0.2219	0.2101	0.7765	0.1432	0.6349

**Table 2.** Strawberry fruit yield throughout the 2019-20 season in the organic field trial at GCREC.

Nematicide	Variety	Early season (kg) (December 2019)	Mid-season (kg) (January 2020)	End season (kg) (February 2020)	Total (kg)
Majestene	Brilliance	0.19 a	1.42 ab	2.45 a	2.96 a
	Beauty	0.20 a	0.91 ab	1.94 a	2.19 a
Dazitol	Brilliance	0.22 a	1.44 ab	1.99 a	2.84 a
	Beauty	0.27 a	0.73 b	1.97 a	2.25 a
Nemakill	Brilliance	0.23 a	1.35 ab	1.51 a	2.52 a
	Beauty	0.22 a	0.82 ab	2.25 a	2.47 a
Kyte Gold	Brilliance	0.17 a	1.27 ab	1.40 a	2.29 a
	Beauty	0.32 a	0.75 b	2.22 a	2.49 a
Zap+Promax	Brilliance	0.23 a	1.42 ab	2.11 a	2.75 a
	Beauty	0.26 a	0.72 b	1.63 a	1.96 a
Ecozin Plus	Brilliance	0.19 a	1.44 ab	2.30 a	2.93 a
	Beauty	0.19 a	0.76 b	1.86 a	2.12 a
Melocon	Brilliance	0.23 a	1.43 ab	1.55 a	2.56 a
	Beauty	0.29 a	0.71 b	2.15 a	2.29 a
UTC	Brilliance	0.28 a	1.54 a	2.15 a	3.15 a
	Beauty	0.24 a	0.71 b	1.98 a	2.16 a
	Nematicide	0.9200	0.9862	0.6572	0.9788
P-value	Variety	0.3428	<0.0001	0.5640	0.0012
	Nematicide*Variety	0.8931	0.9472	0.0084	0.4408

UTC = Untreated control

Within columns, treatment means with different letters indicates statistical significance (P-value  $\leq 0.05$ ) according to Tukey-Kramer.