NOTE

Control of Red Imported Fire Ant in Blueberries with Fenoxycarb[1]

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J. Entomol. Sci. 28(2):236-239 (April 1993)

KEY WORDS *Solenopsis invicta*; Red Imported Fire Ant; *Vaccinium ashei;* Rabbiteye Blueberry; Hymenoptera; Formicidae.

Fire ant, *Solenopsis invicta* Buren and *S. richteri* Forell, damage to field crops in the southeastern U. S. was first documented in the spring of 1935 when damage to a corn crop was noted near Fairhope, Alabama (Eden, W. G. and F. S. Arant, J. Econ. Entomol. 42: 976-979, 1949). Red imported fire ant (RIFA), *S. invicta,* is widespread throughout the southeastern United States. Adams (Fire Ants & Leaf Cutter Ants, Westview Press, pp. 48-57, 1986) listed numerous agricultural crops seriously affected by imported fire ants (e. g. citrus, soybeans, eggplant, okra). Many commercial rabbiteye blueberry, *Vaccinium ashei* Reade, fields in the southeastern U. S. are severely infested with this pest (pers. obs.); RIFA mounds are often present at the base of the plants. Blueberries have extensive, shallow root systems. Soil excavated for RIFA mounds may disrupt roots and expose them to the surface environment. Infested plants appear to be weaker and chlorotic when compared to non-infested plants (pers. obs.). Although no data regarding damage to blueberry plants appears in the literature, RIFA have been observed feeding on ripe blueberries (Payne, J. A., D. L. Horton & A. A. Amis, Entomology of Indigenous and Naturalized Systems in Agriculture, Westview Press, pp. 99-124, 1988). Red imported fire ants also present a hazard to workers and pickers in the field and are of particular concern to growers who market their blueberries through a "pick-your-own" business (Meyer, J. R., J. A. Payne and D. L. Horton, GA Coop. Ext. Serv. Bull. 1022, pp. 42-55, 1989). Previous studies have shown that fenoxycarb bait can reduce RIFA population indices by as much as 100% (Collins, H. L., A-M. Callcott, T. C. Lockley and A. Ladner, J. Econ. Entomol., 85(6): 2131-2137, 1992). The objective of this study was to assess RIFA damage to commercially grown blueberries and evaluate fenoxycarb bait as a potential fire ant control in blueberries.

[1]Accepted for publication 24 March 1993.
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The trial was conducted on an 8 ha RIFA-infested blueberry farm located in Covington County, MS (latitude 31.4 N). Rabbiteye blueberry plants had been established in 1981 and 1984 on a Ruston fine sandy loam soil with a pH of 6.1-6.4. The soil pH had dropped to 5.6 by 1990 when this study was initiated. Peat moss was incorporated into each planting hole prior to planting. Plants were maintained following recommended fertilizer and cultural procedures (Spiers, J. M., J. H. Braswell and C. P. Hegwood, MS Agric. For. Exper. Sta. Tech. Bull. 941, 13 pp. 1985). Plants were irrigated via drip irrigation system with an emitter located at the base of each plant. Water was applied to each plant on an as-needed basis (ca. 8 liters/day during the growing season).

A pre-treatment survey of the field's RIFA infestation was conducted using the population index method (Harlan, D. P., W. A. Banks, H. L. Collins and C. E. Stringer, Southw. Entomol. 6: 150-157, 1981) as modified by Lofgren, C. S. and D. F. Williams (J. Econ. Entomol. 75: 798-803, 1982). A normal, healthy colony should contain worker larvae and pupae. The absence of worker brood is a strong indication that a colony either doesn't contain a queen or the queen is not producing workers because of the effects of an insect growth regulator such as fenoxycarb. The presence or absence of worker brood combined with the number of worker ants in a colony is used to establish a population index. Each colony is evaluated according to the following scale:

	Colony Class			
No. Worker Ants	Without Worker Brood	Weighting Factor	With Worker Brood	Weighting Factor
< 100	1	1	6	5
100 - 1000	2	2	7	10
1000 - 10000	3	3	8	15
10000 - 50000	4	4	9	20
> 50000	5	5	10	25

The Population Index for RIFA is calculated by multiplying the number of colonies in each class by its weighting factor and totaling all classes within a given sampling area.

The study site was divided into two replications based on age of the plants (8 and 4 years old). Two treatments (untreated [control] and treated) were applied. Each plot consisted of one row of 75 to 100 'Tifblue' variety plants. Logic® fire ant bait (1% fenoxycarb) was applied at a rate of 1.68 kg/ha to a strip within each treatment plot 11 m wide by ca. 180 m long on 19 July 1989 and 23 July 1990. A treated strip was centered on rows 10 and 100 with row width spaced at 3.7 m. An untreated buffer zone of more than 100 m was left between the treated areas and the control plots (Rows 40 and 70).

On 13 November 1989, four months after the initial fenoxycarb treatment, every fifth plant in the 4 treatment rows was measured for height and width, and volume was calculated ($\frac{1}{2}$ [$H\pi r^2$]). On 22 May 1990, ten months after the initial treatment, and again on 15 June 1991, eleven months after the second treatment, the height and width of the same plants were measured and a volume calculated. The change in plant size was calculated by subtracting the initial plant size (13 November 1989) from the plant size on 22 May 1990 and 15 June 1991. All berries on six plants from the treated plots and six plants from the control plots were hand-harvested ca. one week before the berries were ripe, and berry size was determined as the average weight of 25 randomly chosen berries from each plant. Population index surveys of RIFA infestation were made 30, 120, 300, and 757 days after the initial application. Statistical calculations were performed with Statistical Analysis Software (SAS Institute Inc., Cary, NC) procedures. RIFA population data were subjected to CoVariance analysis using the population index at the initiation of the study as an error term. Yield, berry size and plant size data were subjected to analysis of variance and F values and probability levels were determined.

Logic® effectively eliminated RIFA from the treated area of the field within 10 months of application; these areas remained uninfested during the course of the study (Table 1). There were no significant differences (P = 0.05) between treatments at the initiation of the study in plant height, width or volume (Table 2). There were significant differences in the relative change in height and volume between plants in the infested (control) and non-infested (treated) plots the spring following the initial treatment (Table 2). Treated plants had a significantly greater increase in each size parameter compared to untreated plants. Untreated plants were slightly shorter at the end of the study than they were at the start of the study. This was probably due to the bending of the top branches caused by the weight of the berries.

Table 1. Red Imported Fire Ant Populations in 'Tifblue' Rabbiteye Blueberries Treated with Logic® (fenoxycarb) on 15 July 1989 and 23 July 1990.

Plant Age	Treatment	RIFA Population Index Days After First Application				
		0	30	120	300	696
8 yrs	Fenoxycarb[1]	415	24 a	10 a	3 a	0 a
8 yrs	Untreated	352	245 b	450 b	130 b	370 b
4 yrs	Fenoxycarb	330	52 a	3 a	0 a	0 a
4 yrs	Untreated	225	240 b	290 b	110 b	385 b
	CoVar[2] Pr>F		.0001	.0003	.0003	.0001

[1]Fenoxycarb applied broadcast at the rate of 1.68 kg/ha.

[2]CoVariance calculated using RIFA population index at initiation of study as an error term.

Berries were harvested before they were fully ripe, since the study was located in a commercial pick-your-own field, and yield data had to be collected before harvest. No significant differences in yield or average berry size was

Table 2. Comparisons of Plant Size Among 'Tifblue' Rabbiteye Blueberry Bushes Treated with Logic® (fenoxycarb) (n = 35) and Untreated (n = 40) 'Tifblue' Rabbiteye Blueberry Bushes (1990).

Treatment	13 Nov 89			22 May 90			Relative Change		
(RIFA Status)	Height (cm)	Width (cm)	Vol.* (dm^3)	Height (cm)	Width (cm)	Vol. (dm^3)	Height (cm)	Width (cm)	Vol. (dm^3)
Fenoxycarb (non-infested)	175.2 ± SE	133.8	1334	181.2	161.2	2047	6.0	27.4	713
Untreated (infested)	175.9	128.9	1289	166.4	149.9	1707	-9.5	20.9	418
Pr>	0.93	0.48	0.79	0.16	0.20	0.19	0.04	0.15	0.04

* Volume calculated for each bush by formula for area of a cone [$^1/_2$ $H\pi r^2$)].

noted between the infested and non-infested plants harvested in 1990, possibly because many of the flowers on the plants in the test field were killed by two late freezes in the spring of that year. Average yield of the 12 bushes sampled was only 952 ± SE g/bush; compared to an expected yield of 8000 g or more per bush (Spiers, J. M., J. H. Braswell and C. P. Hegwood, MS Agric. For. Exper. Sta. Tech. Bull. 941, 13 pp, 1985). Berry size was small (0.9 g/berry) because most of the berries were green at the time they were collected. There was a significantly greater increase in plant volume for the non-infested plants (811 cm^3) when compared to the infested plants (604 cm^3).

Following the 23 July 1990 treatment, the population index for the treated rows remained at 0. On 15 June 1991, 20 plants from each treatment were measured and an average yield determined. There were no significant overall differences in 1991 in plant volume (average 2039 cm^3), yield (average 1865 g/bush) or berry size (average 0.5 g/berry). Yield per bush volume was greater ($P < 0.1$) in the uninfested plants (1.0 ± SE g/cm^3) than in the infested plants (0.8 ± SE g/cm^3).

In spite of the problems associated with conducting a field trial where the error terms were increased due to the distance required between plots and yield reduction following late spring freezes, these data indicate that RIFA caused direct injury to blueberry plants. They also contributed indirectly to economic loss. The presence of RIFA mounds among and between the rows of blueberries can discourage potential customers in "pick-your-own" fields. Also RIFA mounds are often excavated by armadillos. If the mound is at the base of a blueberry plant, the bush can be completely uprooted. The excavation often damages drip irrigation systems as well (pers. obs.).

Diazinon as a drench is currently used to control RIFA in blueberry fields. Individual mound drenches require large volumes of water and are labor intensive. The broadcast application of Logic® would seem to be logistically and ecologically sound method of control for RIFA in blueberries.