Crop Protection 114 (2018) 223–227

Contents lists available at ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Evaluation of insecticides for the management of rough sweetpotato weevil, *Blosyrus asellus* (Coleoptera: Curculionidae) in Hawai'i island

Ishakh Pulakkatu-thodi[a], Sharon Motomura-Wages[b], Susan Miyasaka[b,*]

[a] University of Hawai'i at Manoa (UH-M), Department of Plant and Environmental Protection Sciences, Komohana Research and Extension Center (KREC), 875 Komohana St., Hilo, HI, 96720, USA

[b] UH-M, Department of Tropical Plant and Soil Science, KREC, 875 Komohana St., Hilo, HI, 96720, USA

ARTICLE INFO

Keywords:
Rough sweetpotato weevil
Hawai'i
Insecticides
Efficacy

ABSTRACT

Sweetpotato is an important staple food crop in Hawai'i, both for local consumption and export. Insect damage, especially from weevils, is a major production constraint of sweetpotato in the state of Hawai'i. Rough sweetpotato weevil, *Blosyrus asellus* (Olivier) is an invasive pest recently detected in the Hawaiian Islands. The immature stages of the weevil gouge shallow grooves on surfaces of storage roots that adversely affect their appearance, reduce their marketability, and result in wounds that could allow secondary microbial infections. Sustainable pest management practices are limited for this pest, due to its recent introduction in Hawai'i. As an interim approach, the efficacy of four insecticides including one bio-insecticide were compared against a control to manage this pest in the field. Results from two replicated trials indicate that broad spectrum insecticides such as Belay 16 WSG (Clothianidin) and Sevin XLR Plus (Carbaryl) are effective in managing this pest. Bio-insecticide BotaniGard (*Beauveria bassiana* strain GHA) was not very effective at the tested rate. Planting sweetpotatoes continuously in the same area would likely increase pest pressure in subsequent crop cycles because of the buildup of populations in the field. Cultural practices such as crop rotation and use of clean planting materials should help to reduce the incidence of pests in the field.

1. Introduction

Sweetpotato, *Ipomoea batatas* (Olivier), is an important staple food crop in Hawai'i and critical to food security in these geographically isolated islands. The sweetpotato has been grown commercially in Hawai'i since the mid-1800s (Chung, 1923). In 2007, 76% of sweetpotatoes consumed in Hawai'i were produced within the state (HDOA, 2008). In addition to local consumption, it has developed into a major export crop with a total farm value of $7.3 million in 2011 (HDOA, 2011).

Sweetpotato production in Hawai'i faces several challenges from weevil pests such as sweetpotato weevil (SW), *Cylas formicarius* Elegantus, West Indian sweetpotato weevil, *Euscepes postfasciatus* Fairmaire, stem borers such as sweetpotato vine borer, *Omphisa anastomasalis* Guenee, and reniform nematodes, *Rotylenchulus reniformis* Linford & Oliveira (Sherman and Tamashiro, 1954). Rough sweet potato weevil (RSW) *Blosyrus asellus* (Olivier), (Coleoptera: Curculionidae) (HDOA, 2011) (Fig. 1) is a recent addition to this growing list of sweetpotato pests in Hawai'i. This pest was first detected on a commercial sweetpotato farm on the island of Oahu in 2008, with subsequent detection on the island of Hawai'i in 2014 (Heu et al., 2011; McQuate et al., 2016). In contrast to other weevil pests of sweetpotato in Hawai'i where the immature stages (grubs) feed inside the storage root, the grubs of rough sweetpotato weevils feed on surfaces of storage roots, severely damaging their appearance and reducing marketability (McQuate et al., 2016).

At present, this pest is not known to occur on the continental U. S., but the New Pest Advisory Group (NPAG) of USDA has identified several southern states under the risk of establishment. The weevil is a consistent pest in African countries that grow sweetpotatoes, such as Uganda, and causes substantial damage during harvest (Ebregt et al., 2007). It is important to have a short-term strategy to manage this insect, while further research is conducted on more sustainable methods of pest management. We investigated the efficacy of five treatments that included four insecticides (including one bio-insecticide) that are already approved for use against weevils in sweetpotato plus a control treatment (none).

* Corresponding author. Komohana Research and Extension Center- CTAHR, 875 Komohana St, Hilo, HI USA.
E-mail address: miyasaka@hawaii.edu (S. Miyasaka).

https://doi.org/10.1016/j.cropro.2018.08.035
Received 12 March 2018; Received in revised form 28 August 2018; Accepted 30 August 2018

Fig. 1. Adult rough sweetpotato weevil (photo courtesy of Grant McQuate, USDA).

Fig. 2. Intensity of damage by RSW assessed visually based on the extent of damage on the storage root indicated by the arrows. A, low damage. B, medium damage and. C, high damage.

2. Materials and methods

2.1. Cropping cycle 1

Cuttings of sweetpotato cultivar Okinawan were planted on 01 April 2015 at Pepeekeo, Hawai'i Island (19.835°N lat., 155.102°W long.) in a field with a history of past RSW infestation. Each plot contained 30 cuttings spaced 1 foot (0.3 m) apart in planting beds spaced 5 feet (1.5 m) apart and 30 feet long (9.1 m). An outer border row was planted with the same cultivar surrounding the entire experimental area.

Agronomic practices including fertilizers and soil amendments recommended for sweetpotato cultivation were based on Valenzuela et al. (1994). Phosphorus was applied as treble superphosphate (analysis 0-46-0) in a band within a row at 200 lbs P/acre (227 kg/ha). Nitrogen (N) and potassium fertilizer (A-1, analysis 23-0-36, Brewer Environmental Industries, Hilo, HI) were applied at 100 lbs N/acre (113 kg/ha) in split applications at approximately 15, 45, and 75 days after planting (DAP).

The five treatments were Belay, Sevin, Provado, Botanigard and control (Table 1). The five treatments were repeated four times in a randomized complete block design. Belay was applied once before planting as a soil drench. Sevin was applied at 15, 45, 75 and 105 DAP. Provado was applied at 30, 60, and 90 DAP. BotaniGard, a bio-insecticide was applied as a soil drench on each bed 30 DAP and sprayed on the bed at 60 and 90 DAP. All treatments including control plots received 3 applications (30, 60, and 90 DAP) of Success insecticide (Spinosad; Dow AgroSciences, Indianapolis, IN) at the rate of 6 fl oz/acre (0.41 l/ha) to control sweetpotato vine borer [*Omphisa anastomosalis* (Lepidoptera: Pyralidae)]. The number of applications for each of the treatment compounds did not exceed the labeled rate.

Harvesting was done mechanically. In cropping cycle 1, blocks A and B were mechanically harvested on 26 August 2015, and blocks C and D on 27 August 2015. The harvested storage roots were washed and graded based on the standard for Hawai'i-grown sweetpotatoes (Department of Agriculture, Division of Marketing and Consumer Services, Honolulu). These grades include Hawai'i Fancy (Grade AA), Hawai'i No.1 (Grade A) and Hawai'i No.2 (Grade B). Unmarketable storage roots were included in Off-Grade. RSW damage was ignored while grading. Storage roots in each grade were closely examined for feeding damage by RSW, and labeled as damaged or undamaged by RSW based on the presence or absence of feeding damage. Because of low yield in some grades and for meaningful statistical comparison, the first three grades were pooled into the “marketable” category.

Storage roots with RSW damage were further grouped into three categories based on the extent of damage on each storage root. Storage roots with inconspicuous damage were categorized as low damage (Fig. 2A), storage roots with visible but scattered feeding damage were categorized as medium damage (Fig. 2B), and storage roots with widespread damage were categorized as high damage (Fig. 2C).

2.2. Cropping cycle 2

The trial was repeated in the Cropping Cycle 2. The plot selected for the second study was adjacent to the first study plot. Planting and agronomic practices were the same as the first cropping cycle. The sweetpotato cuttings were planted on 20 August 2015 in four blocks. The treatments were randomized differently from Cropping Cycle 1. A spray schedule was followed similar to Cropping Cycle 1. Harvesting of the second cropping cycle's crop was carried out on 5 January 2016.

2.3. Statistical analysis

Analysis of variance for both trials combined was conducted using PROC GLIMMIX in statistical software SAS (SAS version 9.1 for Windows; SAS Institute, Cary, NC). The variables of interest were yield, percent of sweetpotato storage roots that showed signs of characteristic

Table 1
Details of the treatments including the names of active ingredients, names of commercial formulations and the rate of application used to manage the rough sweetpotato weevil in Hawai'i Island.

Treatments	Manufacturer	Active ingredients	Rate of applications
Sevin XLR Plus	Bayer Crop Science, Research Triangle Park, NC	Carbaryl 44.1% by wt	2 quarts/acre (4.61 l/ha)
Belay 16 WSG	Valent U.S.A. Corp., Walnut Creek, CA	Clothianidin 23% by wt	12 fl oz/acre (0.87 l/ha)
BotaniGard	Laverlam International Corp., Butte, MT	*Beauveria bassiana* Strain GHA 11.3% by wt	3.6 g/l of water
Provado 1.6 Flowable Insecticide	Bayer Crop Science, Research Triangle Park, NC	Imidacloprid 17.4%	3.5 fl oz/acre (0.25 l/ha)
Control	–		–