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COMPARING THE PERFORMANCE OF TRAPPING SYSTEMS USED IN MONITORING AND MANAGEMENT OF THE SWEET POTATO WEEVIL (*CYLAS FORMICARIUS*) IN ST. KITTS

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ABSTRACT: The widespread planting of early maturing susceptible varieties of sweet potato coupled with intense mono cropping, has contributed to the build-up of high populations of the West Indian sweet potato weevil pest, *Cylas formicarius* (Fabricius) (Coleoptera: Apionidae), in St. Kitts over the last two decades. Pest management techniques traditionally rely on cultural practices. In 2000, CARDI introduced a mass trapping technique that involves the use of the funnel trap (FT) fitted with a lure, bought from Great Lakes IPM impregnated with a female sex pheromone that attracts male weevils. By 2007, the Republic of China on Taiwan Agricultural Mission in St. Kitts shared a new trap-lure combination produced by the Taiwan Council of Agriculture (TCOA) with CARDI for evaluation in the field. Studies were done in 2007 to determine the comparative efficacy of the two systems. The traps with their corresponding lures were tested in a typical sweet potato field in Belmont Estate in June, a low rainfall month and again in October during the peak of the rainy season. After two days in the field, weevil catch was counted. This experiment was repeated four times. The TCOA model caught a significantly greater numbers of weevils than the traditional trapping system (P= 0.05). The TCOA caught 1,288(SE 366.26) weevils per day compared to 213 (SE 98.28) weevils per day in the case of the funnel trap. During the wetter part of the year a greater number of insects were captured but there was no significant difference in catch due to seasons. The implications of these findings and the role of mass trapping, as a component of Integrated Pest Management (IPM) are discussed.

Keywords: West Indian sweet potato weevil, male sex pheromone, traps, integrated pest management.

INTRODUCTION

Sweet potato is the major root crop grown in the Federation. Between 1997 and 2005 annual output averaged 136,000 kg; this amount more than doubled all other root crops combined. In 2006 there was a dramatic increase from 136,000 kg to 272, 000 kg (Department of Agriculture, 2007). The demand for the crop is high as it is consumed daily as a staple. It may be used in salads, pudding, and for the traditional dish of conky. The crop is grown year round, but market supply is unpredictable because of agronomic challenges, for example there are periods of no tuberization, also frequently high incidences of sweet potato weevils and soil grubs. Evaluation conducted in St. Kitts in 2001 with *Cylas* indicated weevil damage in the field may reach 24% with further losses of up to 80% during storage (CARDI St. Kitts Nevis Annual Report, 2001).

Similar losses have been observed globally due to minimal pest management during production (Hwang, 1994; Jansson and Raman, 1991; Chalfant 1990). CARDI, St. Kitts has worked with at least 42 types of sweet potatoes, classified on the basis of leaf shape, skin and flesh colour, and donor country: Eleven types have been given local names by the farmers. The most widely grown cultivars are *Clarke, Sugar Root, LRSOF* (Local red skin orange flesh), *Never Miss* and *Carrot/ Pumpkin*, most of which are sweet, early maturing and high in carotene content but very susceptible to the weevil. In 2000 CARDI received twenty cultivars from the USDA -

APHIS to be evaluated for their tolerance to *Cylas*. Two cultivars, *Regal* and *Sumour*, showed reasonable tolerance but neither of them received wide acceptability in the local market, as they are dry when cooked and bland to the taste. Four red skin white flesh cultivars from St. Vincent and the Grenadines (held by CARDI) are known to be attacked by the sweet potato weevil as well. The Republic of China on Taiwan (ROC) has been conducting yield trials on three exotic, susceptible cultivars, and recently added four other cultivars, which are undergoing adaptability and weevil tolerance tests. However, the development of weevil-resistant/ tolerant cultivars in the near future is unlikely, for globally, despite years of intensive research, no varieties with significant levels of tolerance to the pest are yet available (Collins et al., 1991).

LOSSES CAUSED BY THE WEEVIL

To date, no impact assessment studies have been carried out, but every Kittian farmer has experienced revenue losses, sometimes in excess of 45% tuber damage due to weevil contamination. Adult weevils feed on the surface of exposed roots and in some places they also feed on the foliage, but such occasional damage is rarely serious (Talekar, 1988). The larva prefers to feed on the root, thus causing direct losses to the producer. An infested tuber is often riddled with cavities as a result of tunneling activities. It becomes spongy, brownish to blackish in appearance, and has a bitter taste and foul odor as it produces terpenoids. Before tuber formation, the larva feeds on the vine. A damaged vine is discolored, cracked, or wilted and may sustain secondary infection by bacteria and fungi (Sutherland, 1986).

WEEVIL MANAGEMENT IN THE FEDERATION

Cultural control is the major means of pest management for this low input crop grown island wide. Practices include the use of clean planting material, crop moulding or hilling up and the disposal of crop residue. Vine tips are used as seed material as they tend to be free of insects. A small number of local farmers plant the vines deep into the ridge so that the developing tubers are far from the soil surface where they are readily accessible to pests. Manual weeding and moulding has the advantage of filling soil cracks, blocking entry routes used by *Cylas* and *Euscepes*. Unfortunately, the practice of moulding or "*hilling up*" is now rarely undertaken as in past decades. After harvest, many farmers either leave the crop residue in the vicinity of the farm or plough it under. Once there are discarded tubers, vines, wild hosts or another sweet potato field nearby, the pest will survive and increase its population from season to season.

Since the introduction of trapping in 2000 there has been widespread acceptability of this method of controlling the weevil, perhaps because it does not involve the use of chemical pesticides, and because the technology can be duplicated using locally available, inexpensive materials and the baits are cheap and easy to use. In 2007 a new trapping system developed by Taiwan Agricultural Chemicals and Toxic substances Research Institute and Taiwan Council of Agriculture (TCOA) was introduced to determine its efficacy compared to that of the established system of the funnel trap baited with a lure from Great Lakes IPM.

MATERIALS AND METHODS

Belmont estate was selected as the trial site, as it is a typical farming district where sweet potato is available year-round in different stages of development. Mature fields, four months old were used. The fields had a mixture of vine types growing in them because typically Kittian farmers do not establish pure stands of any one cultivar, but tend to plant a mixture instead.

Two traps, one of each type placed at least thirty metres apart were used in the trial. A funnel trap with a rubber lure, manufactured by Great Lakes IPM (Figures 2 & 3), was suspended about six inches above the foliage by means of a tripod. The TCOA mechanism uses a trap which resembles two standard rain gauges stacked. This was placed on the ground among the foliage with a plastic lure inside (Plates 2 & 3). After determining wind direction, both traps were placed down wind in the potato field in a straight line that makes it perpendicular to wind direction such that there could be no cross contamination of scents between the traps. Both lures dispense the same synthetic male sex attractant into the wind, and this chemical has been identified as (z)-3-dodecenyl-1-ol (E)-2 butenone (Smith, Downham, Laboke, Hall and Odongo, 2000; Jansson and Raman, 1991). Traps were left in the field for two nights in each week of June and October; then their contents were emptied and the weevils counted (Figure 1).

RESULTS AND DISCUSSION

An analysis of variance was performed using the statistical programme Genstat, Version 3. No significant difference in weevil catch was observed based on season ($F= 4.18$, $df= 1,12$, $p = 0.063$), and there was no interaction between trap type and time ($F= 2.01$, $df=1,12$, $p = 0.182$), (Figure 1). This observation contrasts with the findings of Talekar (1988), who observed that trap catch is markedly reduced on rainy nights.

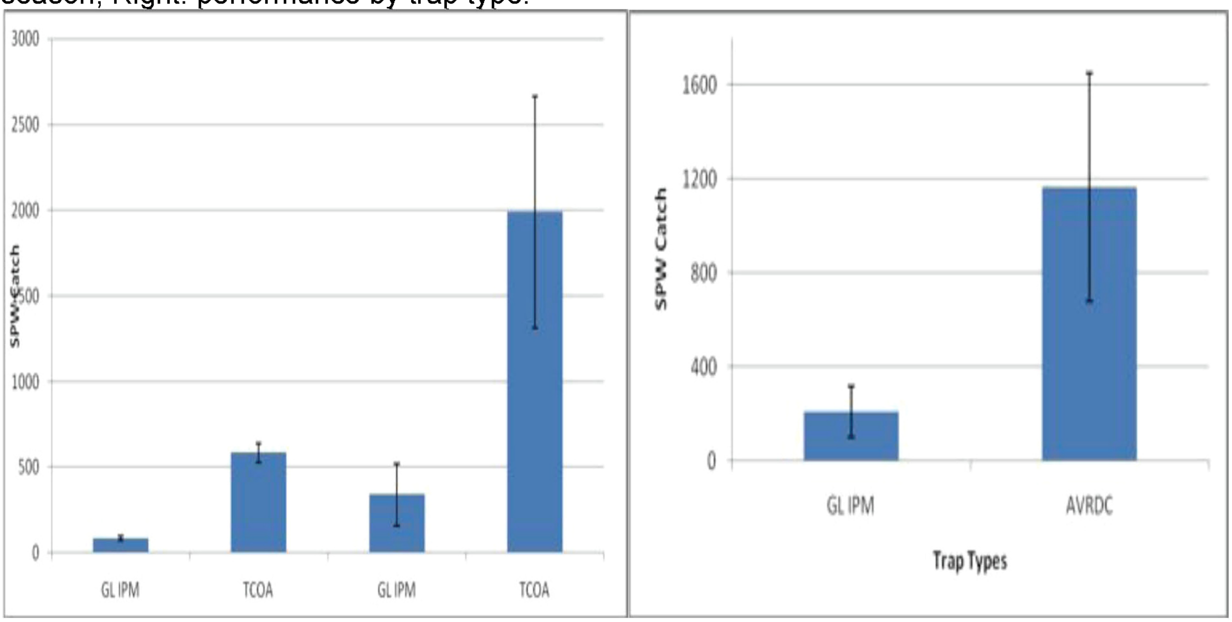
However a significant difference was observed between the different types of trap ($F= 7.02$, $df= 1,12$, $p= 0.021$). The FT mean trap catch was 213 (Se 98.28) weevils compared to 1,288 (Se 366.26) trapped by TCOA model (Figure 1). These preliminary findings suggest that the TCOA trap/lure combination was superior to the funnel trap/GL lure apparatus. Chemical concentration of the lures may have accounted for differences in performance, in that Great Lakes offer their pheromones in concentrations 0.25 mg whereas the TCOA ones are 1.0 mg, which is four times stronger. These newer pheromones are cheap and can be purchased locally at EC $1.00 each. The commercially made TCOA traps are hard to find, but homemade versions, from discarded water bottles, are equally effective and readily available. However, Kittian farmers must be cautioned against an over reliance on trapping alone; effective pest management must consider cultural operations like sequential planting, moulding up, timely harvests, removal of alternate hosts and proper disposal of crop residues. It should also make provisions for technological advances using life tables, pest forecasting, population dynamics studies, and the use of entomopathogenic organisms as well.

While a more efficient capture mechanism has been found in the TCOA model farmers must be mindful of the inconclusiveness about trapping, as the impact of trapping has received mixed reviews. Experiences in farmers' fields have been mixed, with often no measurable impact on weevil damage despite large numbers of weevils trapped (Sutherland, 1986). However, Hwang Jenn-Sheng (2000) noted the use of pheromone-baited traps placed at a density of four traps/0.1 ha reduced damage to tubers caused by SPW by 57 to 65% in Taiwan. The results of this experiment suggest that mass trapping can be used to reduce the number of weevils in a population. However, agriculturalists should be reminded that this trapping cannot be effective as a stand alone measure; therefore, one should ensure that it is used as a component of an Integrated Pest Management (IPM) Programme.

Table 1: Average number of weevils captured in Belmont District, St. Kitts, for two nights, per week in the months of June and October 2008.

Funnel Trap/GL,IPM lure		TCOA weevil trap & lure		
Period	June	October	June	October
Week 1	81.5	969	581	626.5
Week 2	127.5	172	460	3,911
Week 3	89.5	135.5	766.5	2,608
Week 4	45.5	86.5	535	815
Total	344	1,363	2,342.5	7,960.5
Daily Average	86	341	586	1,990

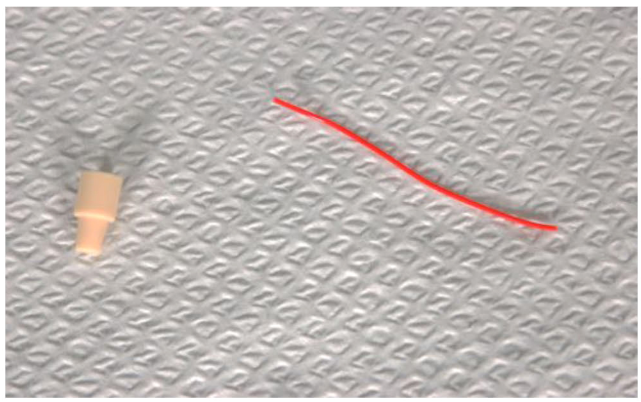
Figure 1: Performance of sweet potato trapping systems, Belmont St Kitts. Left: Performance by season; Right: performance by trap type.



ANOVA : F=4.18; df=1,15; P>0.063. ANOVA: F=7.02; df=1,12;P>0.021

Figure 2: Sweet potato traps used in efficiency trial, Belmont, St. Kitts. (Left) Taiwan Council of Agriculture (TCOA) trap, (right) Funnel (FT) trap.

Figure 3: Lures used in efficacy trial at Belmont. Left: Great Lakes IPM lure (rubber septra). Right: Taiwan Council of Agriculture lure (plastic micro tubule).



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