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STRATEGIES TO DEVELOP AN INTEGRATED PEST MANAGEMENT PROGRAM FOR SWEET POTATO WEEVIL COMPLEX IN THE CARIBBEAN

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ABSTRACT

The most serious insect pests damaging sweet potatoes in the Caribbean region are a complex of weevils, commonly called «Sweet Potato Weevils» which attack the stems and storage roots. Losses due to sweet potato weevils usually range from 50-80 %, depending on the time during which the crop remains in the ground. Several weevil species are reported to damage sweet potato roots and stems ; in the Caribbean two species, ÷12*Cylas formicarius elegantulus* and *Euscepes posfasciatus* are significant in terms of their damage over wide areas.

Recently, the International Potato Center (CIP), in collaboration with national programs of the Caribbean Region have identified research priorities for integrated pest management (IPM) of sweet potato weevils. These include farmer interviews, testing *germplasm* for resistance utilizing sex pheromones Z3- 1, 2 : E2 Butenoate for monitoring and mass trapping ; biological control using entomophilic nematodes and the use of agronomic practices. Dominican Republic has taken a lead in testing these control components. Brief details of these projects and the implementation of projects related to IPM of sweet potato weevils in other countries of Caribbean are discussed.

RESUME

STRATEGIES DE LUTTE INTEGREE CONTRE LES CHARANCONS DE LA PATATE DOUCE DANS LA CARAIBE

Les ravageurs les plus importants sont des charançons qui s'attaquent aux tiges et aux tubercules stockés. Les pertes causées par ces insectes atteignent 50 à 80 % et sont fonction du temps passé par le légume dans le sol. Plusieurs espèces ont été recensées comme dommageable dont deux dans les Caraïbes : *Cylas formicarius elegantulus* et *Euscepes postfaciatus*.. Récemment, le CIP (International Potato Center) a dégagé des priorités de recherche en lutte intégrée, en collaboration avec les programmes nationaux de la zone Caraïbe. Ces priorités sont les suivantes : tests précoces de résistance ; piégeage de masse et avertissement agricole par l'utilisation de la phéromone sexuelle (Z3-1,2 : E2 Butenoate) ; lutte biologique à l'aide de nématodes entomoparasites ; techniques culturales.

La République Domicaine est engagée dans ces différents programmes. Le détail de ces projets ainsi que leurs relations
avec les programmes de lutte intégrée contre les charançons de la patate douce dans les autres pays de la Caraïbe sont discutés dans ce travail.

1.0 INTRODUCTION

Sweet potato is considered the sixth most important crop in the world, after wheat, rice, corn, potato and barley (Vietmeyer, 1986). In the Caribbean, sweet potatoes are an important staple in the human diet. More recently they are reported as an important foreign exchange earner in some islands. They therefore represent an important food crop group. In the English speaking Caribbean, Jamaica is the largest producer followed by St. Vincent, Grenadines and Barbados. Insect pests cause major losses to sweet potato production in developing countries ; over 300 species of insects and mites infest sweet potato throughout the world (Talekar, 1988). In the Caribbean, 27 pest species are reported to be associated with sweet potato (Suah, 1981). The most serious insect pests in this region are a complex of weevils, commonly called «sweet potato weevil» which attack the stems and storage roots. Losses due to sweet potato weevils usually range from 50-80 % depending on the time during which the crop remains in the ground. Recently, the International Potato Center (CIP) in collaboration with nationl programs of Central and South America have identified research priorities for sweet potato improvement and utilization. Details of the recommendations made during this planning conference are reported in CIP 1988. During

November, 1987 CIP organized the first workshop for developing collaborative projects on sweet potato pest management in Dominican Republic. National scientists from several Central American countries participated. At the end of this workshop ths sweet potato weevil complex was identified as a major constraint to sweet potato production in Central American and Caribbean and the development of integrated pest management (IPM) for this pest was given high priority.

2.0 MAJOR SWEET POTATO WEEVIL SPECIES

In the Caribbean and Central America, the sweet potato weevil species, *Cylas formicarius elegantulus* and *Euscepes postfasciatus(Coleoptera : Curculionidae*) are reported as the most important in terms of their damage. *C. Formicarius elegantulus* is a major pest in Barbados, Cuba, Domincan Republic, Guayana, Haiti, Jamaica, Puerto Rico, and St. Kitts.

E. postfasciatus has been reported of major concern in Barbados, Cuba, Dominican Republic, Grenada, Guadalupe, Guayana, Haiti, Jamaica, Martinique, Puerto Rico, St. Lucia, St. Vincent, Surinam, and Trinidad Tobago. The distribution and importance of *E. postfasciatus* in the Caribbean appears to be more than *C. formicarius elegantulus* (Suah, 1981). Further field surveys are needed to confirm the above reports. Despite the taxonomic differences between the two species, the mode of infestation and nature of damage by these pests are quite similar. Hence control measures devised to combat them are also practically identical. Details on the biology of these two weevil species has been reviewed by Talekar (1988). Adults feed externally on the vines or roots, mostly on roots. Damaged roots have a few small pits and numerous holes in which several weevil adults feed. The larvae bore down into
the roots or stems from the oviposition site. The insect gnaws winding tunnels which are packed behind solidy with frass. A characteristic terpene odor is found in damaged tissues. Damaged main stems become swollen, malformed and eventually crack.

3.0 STRATEGIES FOR INTEGRATED PEST MANAGEMENT (IPM)

CIP has taken up a leadership role in motivating national programs to develop collaborative research projects for managing the sweet potato weevil complex. As a first strategy, CIP organized the first workshop on sweet potato weevil control, Nov. 14-16, 1988 in Santo Domingo, Dominican Republic. National scientists from Dominican Republic, Cuba, Mexico, Venezuela, Uruguay, Argentina, Peru, and Puerto Rico, participated in this important event. At this workshop, details on strategies for IPM of sweet

potato weevils were developed. A brief overview of these projects are discussed below :

3.1 EVALUATION OF SWEET POTATO GERMPLASM FOR RESISTANCE

The objectives of this project are a) to develop a standardized method to screen for resistance, b) evaluate and maintain promising genotypes in each participating country, c) evaluate progenies from identified resistant clones, d) determine quarantine facilities in participating countries for moving germplasm.

To accomplish these objectives training was considered very essential. National scientists, one from Dominican Republic and another from St. Vincent, have now been trained to use a standardized technique to identify resistance to these weevils. The material identified as resistant in this project would be distributed to interested national programs. Information on existing clones reported resistant under field conditions is now being compiled by Breeding and Genetics department of CIP. When complete this list would be made available to all interested personnel.

3.2 UTILIZATION OF SEX PHEROMONES

Recently a sex pheromone, (Z)-3-dodecen-1-ol (E)-2- butenoate, has been identified as highly attractive to males. CIP and researchers from University of Florida are cooperating to develop a pheromone trap monitoring program for the sweet potato weevil in Mexico, Venezuela, Dominican Republic and Cuba. Protocols for testing trap designs and pheromone dose have been developed. The pheromone will be provided by CIP and Agrisense, the company that recently acquired the patent for the sweet potato weevil pheromone. In the proposed study at least three trap designs will be compared. Trap type selection will be based on costs for construction and/ or purchase and local availability of materials. Trap efficiency and weevil escape for all the trap designs would also be assessed. The work in the southern U.S. indicates that a common system can be developed for the U.S.. It is therefore important to test this technology in key countries in the Caribbean to see if the system is applicable to most of the Caribbean.

3.3 BIOLOGICAL CONTROL

Entomophilic nematodes, *Neoaplectana carpocapsae* and Heterorhabditis heliothisdis have been effective in controlling *C. formicarius elegantulus* in southern U.S.. In Peru, the entomopathogenic fungus *Beauveria bassiana* has been found promising for *E. postfasciatus* control. A research program

on the use of indigenous and exotic pathogens and nematodes for control of these tuber feeding weevils has been developed. Dominican Republic and Puerto Rico will be the lead countries to develop this technology. In Cuba, studies of sweet potato fields at risk of attack by *C. formicarius elegantulus* showed that yields were higher from fields protected by a predacious ant Pheidole megacepala either occuring naturally or introduced, than those in which recommended chemical treatments were applied. The chemical treatment cost was US$ 63.82/ha and the cost of introducing the ant was US$ 1.72/ha. The net profit was $1,100/ha where the ant had been introduced and $ 628.97/ha where it occured naturally, as compared with no profit from fields without the ant (Castineiras et. al. 1985). Recently researchers from Dominican Republic visited Cuba to study the potential of introducing *P. megacephala* to control sweet potato weevil. Both CIP and University of Florida are involved in assisting the national research programs in the design and implementation of studies related to biological control.

3.4 AGRONOMIC PRACTICES / USE OF CLEAN PLANTING MATERIALS

Countries, Haiti and Dominican Republic placed emphasis on a) producing and distributing clean planting materials, b) conducting adaptive on-farm trials to diffuse proper agronomic practices, and c) developing post harvest practices to reduce weevil damage. Emphasis is on transferring local experience through on-farm trials with strong involment by farmers. Through this experience a technological package would be eventually developed for testing in other countries of Caribbean.

3.5 ON-FARM INTERVIEWS

Caribbean Agricultural Research Development Institute (CARDI), through its representative in Jamaica, is taking a lead on conducting on-farm interviews on sweet potato weevil problem and its control in several of the islands. CIP will interact with CARDI in this survey. The results of these surveys would be extremely useful in identifying promising control measures which could be incorparated in the final development of a total IPM program for sweet potato weevil management in Caribbean.

3.6 MANPOWER DEVELOPMENT AND TRAINING

Both, training and manpower development are an important component of this project. CIP has taken up a leadership role to accomplish this objective. Recently CIP in collaboration with the University of Florida organized the first international conference on sweet potato pest management in Miami, Florida, U.S.A.

The conference assessed the status of current knowledge worldwide and identified research needs and gaps in knowledge
and technology base related to sweet potato pest management in Miami, Florida, U.S.A. Particular attention was given to the sweet potato weevil complex attacking sweet potato worldwide. Information on biology, population, and chemical ecology, biological control, host plant resistance and chemical and cultural control of insects attacking sweet potato were dealt in details. The conference also enabled an opportunity for researchers extension personnel, and private industry personnel to exchange information and develop collaborative research projects on sweet potato pest management, particularly those developed for the Caribbean basin in cooperation with the International Potato Center. More on-site training, training courses and workshops have been planned by CIP in cooperation with several countries in Caribbean to implement the IPM strategy for use by farmers.

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