RESEARCH NOTES—NOTAS DE INVESTIGACION

A NOTE ON NEMATODE CONTROL PRACTICES ON BANANAS IN CENTRAL AMERICA

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RESUMEN

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Se presenta información actualizada sobre las prácticas de control de nematodos en las regiones productoras de banano más importantes de Centroamérica. El amarre junto con al apuntalamiento son las prácticas agronómicas mas utilizadas para evitar las pérdidas por volcamiento. Medidas de control químico están menos difundidas. La falta de continuidad en el uso de nematicidas en los últimos años se han debido a factores económicos y circunstanciales. Se comenta acerca de las pérdidas por volcados causados por otros factores diferentes a nematodos que han conllevado en muchos casos a la adopción de medidas de control erróneas.

Palabras claves adicionales: banano, nematodo barrenador, manejo de plagas, pérdidas.

Banana production in Central America for export is a technically developed operation that traditionally has been in the hands of banana companies and large independent growers. It is also one of the few tropical fruit crops that has benefitted from nematode management practices in the last 20 years.

The nematode of major concern in banana production in the region is the burrowing nematode, *Radopholus similis* (Cobb) Thorne (11,15). Other nematode species that frequently cohabit in mixed populations with *R. similis,* such as *Pratylenchus coffeae* (Zimmermann) Filipjev & Schuurmans Stekhoven, *Helicotylenchus multicinctus* (Cobb) Golden, and *Meloidogyne* spp., are normally found in lower populations than the burrowing nematode and should be regarded as a contributing factor to overall nematode losses. In the absence of *R. similis* these nematode cause little economic damage to bananas (12).

Nematode damage in Central America is expressed mainly in the form of uprooting or toppling. The two main banana clones cultivated for export market in this region are Valery and Grande Naine. Both are characterized by a growth inclination of the plant ranging between 70 and 75 degrees (10). This growth habit together with a large fruit

weight and a poor root anchorage, mainly due to the destructive effects of nematodes, create a tendency of the plant to uproot, especially plants bearing bunches. Other forms of nematode damage, such as reduced longevity of the plantation, growth retardation, and reduced bunch weights, that prevail in other banana growing areas of the world (1,3,5,9,14), are uncommon in Central America. Nevertheless, nematode losses in the region vary considerably in the different banana-producing centers. In Belize, where nematode infestation is similar to that of the banana farms of the Sula Valley in Honduras, uproot losses are rare (7). In contrast, in Guápile, Costa Rica, uproot losses can reach up to 20% in some farms, perhaps the highest in Central America. In general, losses caused by nematodes tend to be lower in the northern portion of the Central American Isthmus (Belize, Guatemala, and Honduras) and higher in Costa Rica and Panama (Fig. 1). Some of the reasons accounting for the differences in losses could be the variability in pathogenicity of *R. similis,* which seems to be associated with the higher reproduction rate of populations that predominated in Costa Rica and Panama and also in Ecuador in South America (8,12,13); favorable environmental conditions, especially precipitation favoring nematode increase (4,6); and bad drainage. This last factor should be

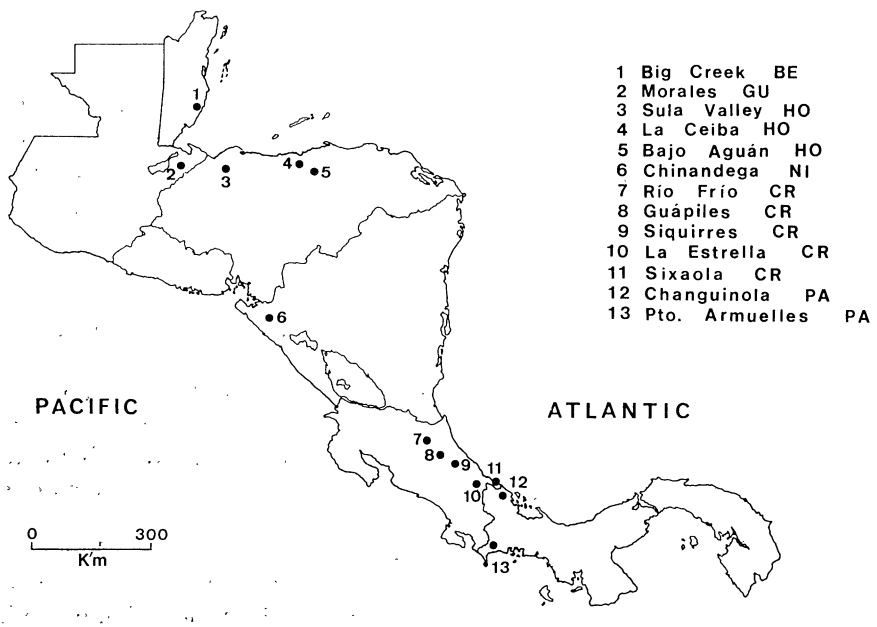

Fig. 1. Location of the most important banana production centers in Central America for export market.

considered an important predisposing factor to nematode damage. Nematode control practices vary accordingly (Table 1).

Propping and guying are the two most widespread agronomic practices currently established in Central America to avoid uproot losses, whether they are of nematode origin or from other causes. Propping consists in sustaining the banana plant with two poles, generally bamboo (*Bambusa vulgaris*) and to a lesser extent, caña brava (*Chusquea* sp.) or eucalyptus (*Eucalyptus* sp.), that cross themselves near the base of the bunch. Propping can also be done with one pole, of which there are several versions, some more efficient than others, depending on whether or not the pole is fastened to the plant or buried 30-50 cm into the ground. In Honduras and Panama use of propping is restricted because of the scarcity of bamboo stalks and the labor costs involved in this practice, whereas in Costa Rica and Nicaragua, propping tends to be more common. Guying consists in fastening the plant to adjacent plants with strings, always on the opposite side of the bunch, with the purpose of counteracting the excess weight. There are 3 forms of guying: simple, double, and triple, the last one being the most efficient, but also the highest in labor costs. Double guying is the most commonly used. An inconvenience of this practice is that when a plant falls, it may drag along other plants to which it is anchored, a situation that is frequent under conditions of strong wind. An improved practice called double-row planting with aerial guying was developed in the mid-1970's and implemented on a small scale in some farms in Honduras and Costa Rica. In this case, plants are tied to a cable 5-6 m in height, passing through the middle of each row and sustained over two strong posts at each end. Although uproot losses are reduced more with aerial guying than with conventional guying or propping, high investment costs and change in position of the banana plant after subsequent harvests have limited its use.

Chemical control is the other most common practice used to reduce losses caused by nematodes. Several insecticide-nematicides in various formulations are available. The use of nematicides in areas with high uproot problems have reduced losses in the majority of the cases, whereas in other banana-growing areas with low uproot losses, response has been little or nonexistant (2,11,12). It is of general opinion that two cycles of application per year are sufficient to achieve reasonable control. In spite of a recognized nematode problem in many banana production centers of Central America, the adoption of chemical control practices has been erratic in the last decade, depending mainly on costs of application, fluctuations in banana price on the world market, high investment on Black Sigatoka (*Mycosphaerella fijiensis* var. *difformis* Mulder & Stover) control and drainage, which generally receive priority

Table 1. Current nematode control measures on bananas in Central America.

Country (locality)	Ha[z]	Control measures	Comments
Belize			
(Big Creek)	900	None.	Nematode losses low, although infestation is high. Attempts to establish nematode-free plantations with thermotherapy of rhizome have been unsuccessful.
Guatemala			
(Morales)	7600	Guying and chemical control.	Little response to nematicides.
Honduras			
(Sula Valley)	11,400	Single and double guying. Chemical control occasional in the Sula Valley and common in La Ceiba. Double row planting with aerial guying practiced in a few farms.	Little or no response to nematicides in the Sula Valley. Double row planting expensive and good for only two years. High losses and few control measures in Bajo Aguán.
(La Ceiba)	5800		
(Bajo Aguán)	2000		
Nicaragua			
(Chinandega)	2600	Propping and chemical control.	
Costa Rica			
(Río Frío)	1900	Guying, single and double propping, chemical control and thermotherapy of rhizome. A few farms in Guápiles and Siquirres practice double row planting with aerial guying.	Uproot losses in Guápiles seem to be the highest in Central America. Good response to nematicides. Bad drainage is a contributing factor to nematode losses. Occasional chemical control in Siquirres and Sixaola.
(Guápiles)	9700		
(Siquirres)	5400		
(La Estrella)	2800		
(Sixaola)	1100		

Panama			
(Changuinola)	6400	Guying and occasional chemical control.	Nematode losses higher in Changuinola on the Atlantic coast than in Puerto Armuelles on the Pacific. Chemical control has been irregular depending on losses.
(P. Armuelles)	6600		

[z]Source: UPEB, Unión de Países Exportadores de Banano, 1986.

over nematode control practices, and ultimately, on management decision.

In general terms, guying is much more widespread and cheaper than propping. Best results are achieved by integrating both of these agronomic practices with chemical control (12).

It is important to point out that not all uproot losses are caused by nematodes. In Palmar, Costa Rica, on the Pacific coast, the use of Bordeaux mixture for many years to control Yellow Sigatoka, *Mycosphaerella musicola* Leach, originated a hard pan formed by an accumulation of copper compounds below the first 30 cm, where bananas roots cease growth, creating a condition for poor root development and anchorage. This condition, together with low nematode populations, was sufficient to cause significant uproot losses. Because of copper toxicity problems, bananas have been replaced in Palmar by African Oil Palm, *Elaeis guineensis* Jacq. Similar situations occur with bad drainage. Bananas that grow under these conditions develop shallow root systems and thus, have a tendency to uproot. Basal rot of the rhizome caused by the bacterium *Erwinia carotovora* (Jones) Holland, is another condition that can cause the plant to collapse. It is suspected that the banana root borer, *Cosmopolites sordidus* Germar, is contributing to the dispersal of the bacterium.

In all these situations nematodes are generally present and probably contributing to additional losses. However, the cause of these uproot losses are mainly of other origins that have misled banana specialists on many occasions to the adoption of unnecessary and expensive nematode control measures involving nematicides. The agronomic practices of propping and guying are usually less expensive and are applicable in reducing uprooting, regardless of the cause.

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