RESEARCH NOTE

PANGOLA GRASS AS A ROTATION CROP FOR PINEAPPLE NEMATODE CONTROL

Since 1954 when Alvarez-García and López-Matos[1] demonstrated the importance of plant parasitic nematodes in pineapple in Puerto Rico, growers have employed soil fumigation as a means to obtain a better crop. Mostly through soil fumigation, pineapple production was increased from an average of 10 tons per acre in 1954 to 15 tons in 1964. However, the nematocides generally used are expensive and hazardous, and their application is difficult and time-consuming. Although continued efforts are made to discover a chemical which may be cheaper and easier to apply than the conventional nematocides now in use, other nonchemical methods of control, particularly crop rotation, have been of great interest to the authors.

Crop rotation has been practiced for centuries to improve plant production, even when growers were not aware of nematode damage. This practice is used commercially to control the sugar beet cyst nematode *Heterodera schachtii* Schmidt, 1871, in sugar beets and the stem nematode *Ditylenchus dipsaci* Kühn, 1857, Filipjev, 1936, in alfalfa, in California. Research conducted in Florida[2, 3, 4] has demonstrated that Pangola grass, *Digitaria decumbens*, is immune to the peanut root-knot nematode, *Meloidogyne incognita acrita*, and that the nematode disappears from the soil in a period of 4 to 8 weeks in Pangola grass fields, thus resulting in a subsequent good tomato crop.

The root-knot nematode has never been found in Puerto Rico in association with Pangola grass. In greenhouse tests, it was found that Pangola grass, among other plants, reduced populations of the reniform nematode, *Rotylenchulus reniformis* Linford and Oliveira, 1940[5] the most common phytoparasitic nematode in pineapple fields.

[1] Alvarez-García, L. A., and López-Matos, L., Influence of root-knot nematodes on the decline in vigor of the Red Spanish variety of pineapple in Puerto Rico, *J. Agr. Univ. P.R. 38*(1): 61–72, 1954.

[2] Winchester, J. A., and Hayslip, N. C., The effect of land management practices on the root-knot nematode, *Meloidogyne incognita acrita*, in south Florida, *Proc. Fla. State Hort. Soc. 73:* 100–4, 1960.

[3] Winchester, J. A., Hayslip, N. C., and Kretschmer, A. E., Jr., Plant nematode distribution as affected by crop history of sandy soils in south Florida, *Proc. Fla. State Hort. Soc. 75:* 139–43.

[4] Hayslip, N. C., *et al.*, Tomato and Pangola grass rotation for sandy soils of south Florida, Agr. Exp. Sta. Circular S-153, pp. 1–24, 1964.

[5] Román, J., Immunity of sugarcane to the reniform nematode, *J. Agr. Univ. P.R. 48*(2): 265–99, 1964.

Two field experiments were conducted to evaluate the effect of crop rotation in the control of pineapple nematodes. In the first, pineapple was planted after the following treatments: 1, Untreated soil grown to pineapple for 3 previous years; 2, D-D-treated soil 40 gallons/acre after 3 years in pineapple; 3, untreated soil grown to Pangola grass for 1 year; 4, as for 3, but Pangola grass grown for 2 years; 5, as for 3 and 4, but Pangola grass grown for 3 previous years; and 6, untreated soil in sugarcane for the 3 previous years. Sugarcane, *Saccharum officinarum*, was included in this test because it is a nonhost for the reniform nematode. Samples were taken from each plot every 3 to 4 months and aliquots of 300 c.c. of soil processed, using a combination of the sieving and Baermann-funnel methods for nematode population fluctuation studies.

After applications of D-D, nematode populations almost disappeared, but increased gradually until the ninth month when populations were higher than in nonfumigated plots. On the other hand, nematode populations decreased after 1 year in Pangola grass. *Meloidogyne incognita* could not be recovered after the first year; *Criconemoides* and *Helicotylenchus* could not be detected in soil samples after 1½ years. Nematodes of the latter genus reappeared after substituting Pangola grass for pineapple, presumably from reinfestation from adjacent plots. Populations of *R. reniformis* decreased to very low levels while *Pratylenchus* was still numerous after 3 years. In sugarcane plots, only *R. reniformis* and *Pratylenchus* were reduced in numbers, but a residue remained in some plots and increased shortly after substituting for pineapple; populations of the other three genera increased in sugarcane.

Healthier and stronger pineapple plants grew in plots planted to Pangola grass for 3 years, followed by those treated with D-D and those planted to sugarcane for 3 years, in comparison to those grown in the check plots. Based on a limited number of fruits harvested, the average weight per fruit was as follows: Fumigated soil, 3.7 pounds; nonfumigated soil, 3.0; sugarcane, 3.9; and Pangola grass for 3 years, 4.0 pounds.

In a second experiment, a field that was in Pangola grass for 3 years was divided into 10 plots, half of which were fumigated with 25 gallons of D-D per acre, while the other 5 were left untreated. Ten months after planting no differences in growth and appearance could be detected and weights of 10 D-leaves taken at random from each plot failed to show any significant differences (1.8 pounds from D-D-treated soil and 1.7 pounds from nontreated plots). This experiment has not yet been harvested.

Pangola grass, therefore, seems to be an effective rotation crop for pineapple, because it shows complete resistance for three of the most common pineapple nematodes, *e.g. Meloidogyne incognita*, *Criconemoides*, and *Helicotylenchus*, and partial resistance to *Rotylenchulus reniformis*. It appears that soil fumigations would not be necessary for soils previously planted to this grass.

Further studies are underway to determine the effectiveness of Pangola grass as a rotation crop, not only for pineapple, but also for sugarcane and other crops of economic importance. The grass has been found to possess two additional characteristics qualifying it as useful in a rotation program or biological control: Young roots apparently produce a secretion that stimulates the emergence of root-knot larvae from the eggs, and larvae are then killed by a toxin produced by the older roots[6] if no other host is available. Besides, the plant is immune to the root-knot nematode, and presumably to others. Experiments will be conducted in an effort to identify both the stimulating secretion and the toxin produced by the grass roots.

Final results on the beneficial effects of crop rotation with Pangola grass in relation to nematode control and improvement in the physical characteristics of the pineapple plants (growth and yields) will be included in a future publication in this JOURNAL.

Alejandro Ayala, J. Román, and E. González Tejera
Department of Entomology

[6] Winchester, J. A., Preliminary investigations on the mode of action of Pangola grass roots in reducing cotton root-knot nematode (*Meloidogyne incognita acrita*) populations, *Proc. Soil and Crop Sci. Soc. Fla. 20:* 178–82, 1960.