Development of ecological practices to manage *Phytophthora* root rot of cassava (*Manihot esculenta*)

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INTRODUCTION

Cassava (*Manihot esculenta*), a starchy root crop, is the fourth most important source of dietary carbohydrate in developing countries. Root rots caused by *Phytophthora* fungi are widespread and cause losses of 20% in world production.

Phytophthora tropicalis, *P. melonis*, *P. nicotianae*, *P. cryptogea,* and *P. erythroseptica* have been reported as causal agents (E. Alvarez; Fassi 1957). Disease symptoms include a sudden wilting that kills or severely reduces the quality of cassava planting materials in many countries.

Several control practices were evaluated in the field for the management of root rot in cassava. Cassava genotypes and two thermotherapy systems were evaluated in the laboratory.

MATERIALS AND METHODS

On-farm field trials were established in three departments of Colombia to evaluate the effect of three different treatments on the incidence and severity of root rots in harvested roots. Stakes were grouped and submitted to three types of control as follows:

Thermotherapy: Stakes were immersed for 49 min in water heated to 49 °C over a wood fire **(Figure 1)**.

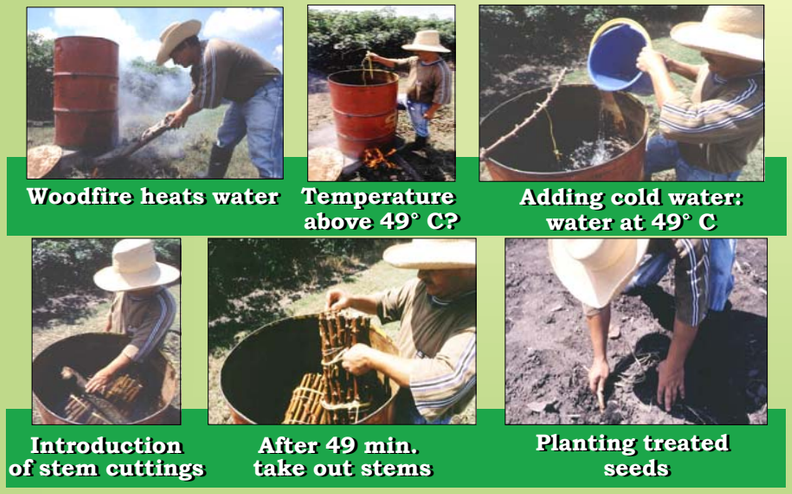

Figure 1. Cassava stakes were rustically treated in hot water by farmers to control diseases and pests.

Biological control: Three strains of *Trichoderma* sp. were used to prepare suspensions of 10^6 conidia/mL. Stakes were then inoculated by immersing them in the suspensions for 10 min. The suspensions were also applied periodically to the soil near the base of each plant.

No treatment: Traditional farmers' practice.

Stakes of regional cassava varieties were used for all treatments. The experiment design was randomized complete block. Cassava genotypes that had previously produced high yields in field trials were planted.

Two thermotherapy systems were evaluated in the greenhouse: immersion of stakes in water at 49°C for 49 minutes and immersion at 49°C for 5 hours. The day before all stakes had received a pretreatment in water at 49°C for 10 min.

Selection for resistance. A total of 120 genotypes were inoculated with *P. tropicalis* by perforating the roots and introducing the fungus. Once inoculated, treated cassava roots were deposited in bags and left for 6 days at 22°C. The height and width of the area affected were measured on each cassava root.

RESULTS

The highest yields were obtained with CIAT recommended crop management practices (**Figure 2**).

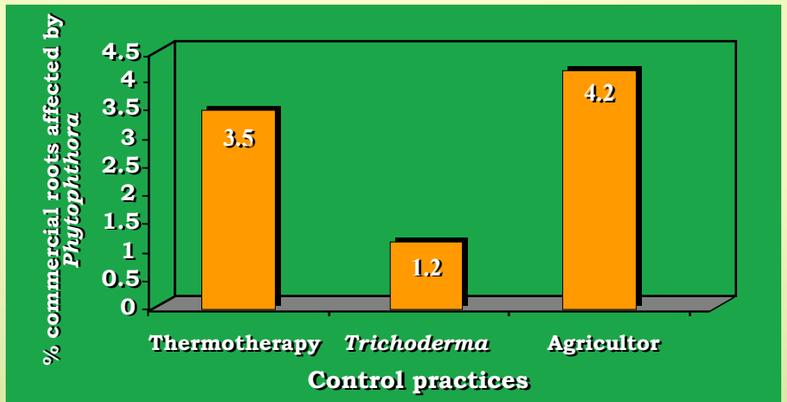

Figure 2. Effective practices for managing cassava root and stem rot. Averages correspond to seven harvests.

Stake immersion and periodic applications of suspensions of different strains of the biological agent *Trichoderma* increased yields by 11%. *Trichoderma* reduced by 71% the percentage roots affected. A high correlation was observed between production and soil concentrations of *Trichoderma.*

Trial results indicate that heat treatments did not affect germination (data not shown). Temperature is more likely to affect old and/or very thin stakes most. The pretreatment proved beneficial. Germination was 82% higher compared with that obtained with thermotherapy alone.

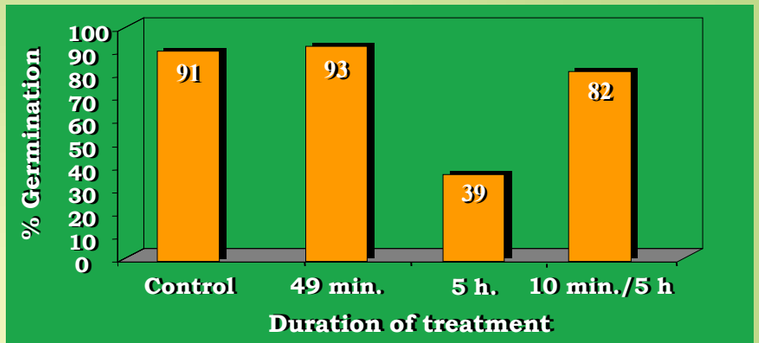

Figure 3. Effect of thermotherapy (49°C) on cassava stakes, averages of three genotypes: HMC-1, M Per 183, and Manzana.

The varieties affected by root rot in the field were Chiroza, Algodona, ICA Catumare, and M Per 183. The variety presenting lower incidence of root rot was HMC-1. Of the 120 cassava genotypes evaluated, 8% presented resistance to *P. tropicalis*. These materials will be tested in the field for resistance.

CONCLUSIONS

The treatments with heat, *Trichoderma,* and varietal resistance are effective alternatives for controlling Phytophthora root rot and are currently being validated through technology packages, with the active participation of farmers.

Hot water (49°C) heated in oil drums, without a thermostat, to disinfect infected cassava stakes is effective in controlling *Phytophthora* (also tested in vitro), *Xanthomonas axonopodis* pv. *manihotis* (cassava bacterial blight), *Diplodia manihotis* (stem rot), and insects (data not presented). Resource-poor farmers in Colombia are interested in applying this system. A short pretreatment (10 min) one day before the long treatment (5 hours) prevents undesired losses in germination. This system will allow seed to be distributed at a national level.

REFERENCES

Alvarez E; Llano G; Loke JB. 2002. CIAT Annual Report. Integrated Pest and Disease Management.
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