The status of fungal tuber rots as a constraint to cassava production in the Pouma district of Cameroon

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This paper appears in the proceedings of the 9th Triennial Symposium of the International Society for Tropical Root Crops - Africa Branch, held from 31st October – 5th November 2004, at Whitesands Hotel, Mombasa, KENYA.

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Abstract

Fungal rots have been reported as a limiting factor to cassava production in the humid forests of Central and West Africa. Starting April 2003 tuber rots were studied for one year as part of a diagnostic survey designed to investigate biophysical and crop management factors limiting cassava production in Pouma district, located halfway between Douala and Yaoundé in Cameroon. This paper reports the extent of root rot occurrence in the study area comprising of 62 farmer-managed trials. Root rot data was recorded at 6, 9, and 12 months after planting (MAP). At each sampling time samples of rotten tissue were collected for isolation and identification of the fungi. At 6 MAP, 41% of the field plots were free from rot symptoms and only little rotting was observed in 55% of the field plots. However, at this early stage of tuber development, more than 50% of root volume was rotted in nearly 2% fields. At 9 MAP rotting incidence and severity had

substantially increased as compared to 6 MAP, but still only about 2% of the fields had up to 50% of the root volume rotted. At 12 MAP rot incidence was less than at 9 MAP, but severity had substantially increased with tubers in 11% of the fields having up to 25% of their total volume rotted. Pathogens isolated from rot specimens include *Botryodiplodia theobromae*, *Macrophomina phaseolina*, *Fusarium* sp., A*rmillaria* sp., *Aspergillus* sp., *Sclerotium rolfsii* and *Trichoderma* sp. Data obtained indicate that fungal rots could cause substantial loss to cassava production in the Pouma area. However, the loss is less if cassava harvesting is done at 12 months.

Introduction

Cassava plays an important role as a source of food, employment and income for many people in Cameroon (Ngeve, 2001). The country was ranked the 10th largest producer of cassava in Africa with an annual production of 2.62 million t in 2003 (FAO, 2004). In some areas of Cameroon cassava has been tried as a replacement for cocoyam, *Xanthosoma sagittifolium*, which has been found to be highly susceptible to rot pathogens. Much of the cassava is produced in the forest areas that largely fall within the southern part of the country. As in many African countries, cassava tuber yields are typically low in Cameroon, where the productivity averages 13.8 metric t ha^{-1}. The causes for these low yields are diverse but diseases and numerous pests are known to partially contribute. Among the diseases that attack cassava the incidence of root rots has been reported to be higher in the forest areas than in other ecologies (Chalwe et al., 1999; Onyeka, 2002). In a previous research done in a few villages in Cameroon, 36% of cassava farmers ranked root rots as the second most important constraint after the African

root and tuber scale (Gockowski, J., unpblished)[1]. The extent of yield loss and the pathogens responsible for these rots have not been well determined. Recently, a factory set up in 1993 to produce starch from cassava in the Pouma area (halfway between Douala and Yaoundé) reported performance below full capacity due to inadequate supply of cassava tubers. IITA was approached to provide assistance in determining the factors responsible for the low cassava production, and recommend suitable solutions to increase production. A diagnostic survey was organized to investigate the major biophysical problems of cassava in this region. The occurrence of root rots was studied as one of the possible production constraints. The results obtained are presented in this paper.

Methodology

The study was carried out in Pouma district which lies 10.5° E and 3.85° N, located 141 km south-west of Yaounde. The study was initiated in March/April 2003 and continued for 12 months. Sixty-two farmers selected from eight villages were involved. The villages were selected based on discussions with representatives of the farmer organization AID Cameroun and area agricultural extension agents. Fields that were planted during similar period were selected to minimize variation caused by planting date. Generally, planting took place between 10 March and 16 April 2003. In each farmer's field, a 10m x 10m plot area was demarcated in which observations were recorded. During the first 3 months of the trials, information about cassava planting density, number of varieties and crops accompanying cassava was recorded.

[1] Gockowski, J., IITA Humid Forest Centre, Yaounde, Cameroun. Personal communication.

Observations for stem, root and tuber rots were recorded at 6, 9 and 12 months after planting (MAP). For the sampling at 6 and 9 MAP, five plants were uprooted in each field and inspected for superficial presence of fungi and actual rotting of the tuberous roots. At 12 MAP when the trial was terminated, 10 plants were evaluated for yield and for rotting. At each sampling, the number of roots rotted were recorded and used to calculate the % rot incidence (I) as follows:

$I = [\sum\{(\text{total rotted tubers}*100)/\text{total tubers}\}]/$ number of plants sampled.

The volume of roots rotted was estimated for each plant and was recorded as rot severity. For each field plot the average incidence was placed in one of five categories defined as no rot (0); 1-10% tuberous roots rotted; 11-25% tuberous roots rotted; 26-50% tuberous roots rotted; and >50% tuberous roots rotted.

For each field plot the average severity (S) was calculated as:

$S = [\sum\{\%\ \text{rot incidence}*(\%\text{rot severity}/100)\}] /$ number of plants sampled.

The average severity was placed in one of five categories defined as no rot (0); 1-10% root volume rotted; 11-25% root volume rotted; 26-50% root volume rotted; and >50% root volume rotted. Samples of rotted root tissue were collected for isolation and identification of the fungi in the laboratory.

Results

At 6 MAP, 41% fields were free from root rot symptoms (Figure 1). Low level (less than 10% roots rotted) of root rot was observed in 55% of the fields (Figure 2). About 2% fields had between 11-25% of their roots rotted while more than 50% of root volume was rotted in nearly 2% fields. In such severely infected plants, superficial sign of fungal

presence was high on the mother cuttings from where mycelia were seen extending to the base of the stems and to the young tuberous roots.

At 9 MAP, 24% fields were free from root rot symptoms (Figure 1). In nearly 64% of the fields the rotted roots had less than 10% of their volume spoilt while in 10% of the fields rotted roots had up to 25% of their volume spoilt (Figure 2). Only about 2% of the fields had an average of up to 50% of the root volume rotted. Complete rotting of tubers in a few plants was observed in only two villages.

At 12 MAP, when 10 plants were evaluated 44% of the field plots were free of rot symptoms (Figure 1). Nearly 46% of the field plots had less than 10% of their total volume rotted, while 11 % of the fields had up to 25% of their total volume rotted (Figure 2). Pathogens most frequently isolated from rot specimens were *Botryodiplodia theobromae*, *Macrophomina phaseolina*, *Fusarium* sp., *Sclerotium rolfsii*, A*rmillaria* sp., *Aspergillus* sp. and *Trichoderma* sp.

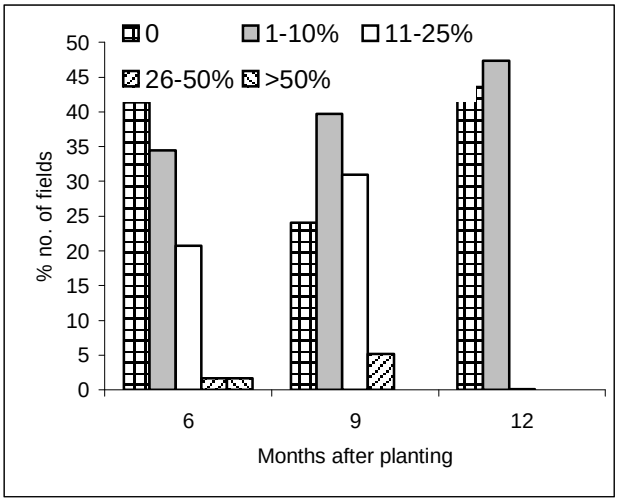

Figure 1: Percent cassava fields showing different levels of tuberous root rot incidence at 6, 9 and 12 months after planting (MAP) in Pouma district of Cameroon. At each sampling time, the percentage of fields with the following five incidence levels were plotted: no rot (0); 1-10% tuberous roots rotted; 11-25% tuberous roots rotted; 26-50% tuberous roots rotted; and >50% tuberous roots rotted. n = 58 at 6 and 9 MAP, and n = 55 at 12 MAP.

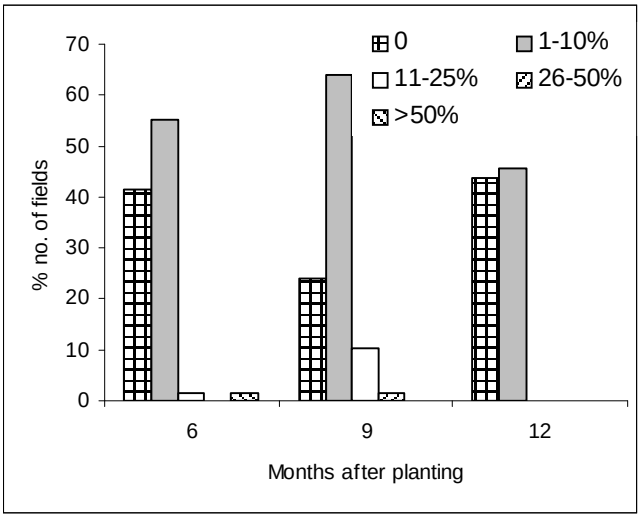

Figure 2: Percent cassava fields showing different levels of tuberous root rot severity at 6, 9 and 12 months after planting (MAP) in Pouma district of Cameroon. At each sampling time, the percentage of fields with the following five severity levels were plotted: no rot (0); 1-10% root volume rotted; 11-25% root volume rotted; 26-50% root volume rotted; and >50% root volume rotted. n = 58 at 6 and 9 MAP, and n = 55 at 12 MAP.

Discussion

Sampling at three-month intervals was expected to provide sufficient time for any changes in disease dynamics to be clearly expressed. The observation of tubers with more than 50% of their volume rotted at six months after planting was significant in that root rots have been assumed to be of importance only in the later stages of cassava plant growth. While evaluating several genotypes for resistance to *Botryodiplodia theobromae*, Onyeka (2002) reported observing only very little rot at six months. The observation in this study of significant rotting at 6 MAP seems to indicate that rot pathogens can attack plants early, which can potentially cause significant yield reduction

It is generally thought that rot severity increases substantially if harvesting is delayed. In Cameroon many farmers start harvesting cassava after one year of growth. Although some farmers may harvest their entire crop at one go, especially if it is meant for sale, a substantial number of farmers harvest their crop gradually depending on their needs for domestic consumption. Those who retain their crop in the field for a prolonged period may incur substantial loss from rots. Onyeka (2002) reported very significant increases in rot intensity when cassava plants were left in the field for up to 15 months after planting in Nigeria.

At harvest time (12 MAP) tubers in about 11% fields had up to 25% of their volume rotted. When added to a similar number which had been rotted at 9 MAP it is clear that substantial loss could result from rot damage to cassava in the Pouma area. However, the extent of loss incurred also depends on how the tubers are utilized. In Pouma much of the cassava is processed into *baton manioc* for sale or is consumed at home. When utilized

this way the part of the tuber that is damaged by rot can be chopped off and discarded and the rest utilized.

A total of six local varieties were observed in the area, with each farmer growing on average 1 to 3 varieties. The varieties did not seem to have differences in maturity dates, neither did they appear to differ in susceptibility to rot pathogens. Growing different varieties may be a tactic to minimize losses from disease or pest attacks. As observed, the fungi isolated from rotted tubers were quite diverse in identity and there may be differences in the cultivars each pathogen prefers. On the overall, data obtained from this study indicate that root rots could cause substantial loss to cassava production in the Pouma area. However, the loss realized could be minimal if cassava is harvested at 12 months. It is recommended that future studies of root rots be extended beyond 12 MAP so as to get more complete information.

Acknowledgements

The authors acknowledge technical assistance given by Mr. I. Langwa of IITA, Yaounde.

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