The status of cassava mosaic disease, bacterial blight and anthracnose as constraints to cassava production in the Pouma region of South Cameroon

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Abstract

The three foliar diseases that threaten cassava production most are the mosaic disease (CMD), bacterial blight (CBB) and anthracnose disease (CAD). Deployment of resistant varieties has brought the diseases under control, but continuous monitoring remains necessary to forestall unforeseen outbreaks. Starting April 2003, the three diseases were monitored for one year as part of a diagnostic survey designed to investigate biophysical and crop management factors limiting cassava production in Pouma district, Cameroon. The study was carried out in 62 farmer-managed fields within which 10m x 10m areas were demarcated for data collection. Observations for disease was done at 3, 6, 9 and 12 months after planting (MAP). Disease data, evaluated on a scale of 1 to 5, were recorded from five randomly selected plants at each observation time.

CMD: At 3 MAP, 39% of the field plots were moderately infected while 61% of the plots had severe infection. At 6 MAP, field plots with moderate infection increased to 72% while those with severe infection reduced to 26%. At 9 MAP, plots with moderate infection increased to 93% while plots with severe infection reduced to 7%. There was no significant change in the level of infection between 9 and 12 MAP. **CBB:** The slight infection at 3 MAP increased with severe infection observed in 67% of the field plots at 6 MAP. At 9 MAP, the number of field plots with severe infection reduced to 55% and remained at about that same level even at 12 MAP. **CAD:** There was no infection at 3 MAP. At 6 MAP 65% of the field plots showed moderate infection while 20% had severe infection. The number of field plots with moderate infection increased to 71 % at 9 MAP and then reduced to 44% at 12 MAP. Data show that CMD severity generally decreased as plants aged and the disease is not a serious concern in Pouma. The increase in CBB and CAD infection between 3 and 6 MAP was most likely due to favorable wet weather and could make these diseases a concern, but only when prolonged wet weather prevails.

Introduction

Cassava anthracnose disease, bacterial blight and mosaic disease are the three key diseases that pose a major challenge to cassava production in the rainforest zones of tropical Africa (Hahn et al., 1989; Thresh et al., 1994). The African cassava mosaic virus (ACMV), which causes mosaic disease (CMD) can reduce cassava yields by over 50% (Ariyo et al., 2001). Although the virus is distributed through all cassava producing areas in Africa it has been kept in check through breeding and distribution of resistant germplasm (Thresh et al., 1994). However, in many areas farmers still grow local varieties that may be highly susceptible. Even in areas where improved varieties are grown, new variants of virus have been reported resulting from combination of ACMV and the EACMV which could break the resistance currently existing (Otim-Nape et al., 2001). Cassava bacterial blight (CBB), caused by *Xanthomonas campestris* pv. *manihotis* affects yields significantly because stems with cankers and blighted leaves wilt ending up in shoot die back. Symptom severity is known to be highest in the humid forest and the forest savanna transition zone (Wydra et al., 2001). Varietal resistance has been found to vary in different environments. In many areas farmers do not practice integrated management measures for this important disease and therefore losses could be potentially high (Hillocks and Wydra, 2002). Cassava anthracnose disease (CAD) is caused by *Colletotrichum gloeosporioides* f.sp. *manihotis* and attacks mainly the stems. It is characterized by stem, twig and fruit cankers, leaf spotting and dieback (Theberge, 1985). Planting materials from infected stems are usually of poor quality and result in weak plants with low yield. Although in many areas the disease has been kept under control through deployment of resistant germplasm (Hahn et al., 1989), continuous monitoring is essential because new strains of the pathogen remain potential threats.

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 aim of this study was to determine whether CMD, CBB and CAD are part of the factors causing low cassava productivity in the Pouma district of South Cameroun.

Materials and Methods

The study was located in Pouma district, which lies 141 km southwest 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. Planting dates of cassava were considered for field selection to minimize variation caused by variable plant growth stages. Generally, planting took place between 10 March and 16 April 2003. In each farmer's field, a plot measuring 10m × 10m was demarcated in which observations were made. Information about cassava planting density, number of varieties and crops accompanying cassava was recorded early during the growing season.

Plants were evaluated for CMD, CBB and CAD severity at 3, 6, 9 and 12 months after planting (MAP). In each field five plants were visually examined for presence of different disease symptoms. The severity scores for each disease were taken using a scale of 1-5 as used by Fokunang *et al*., (2000).

CMD: 1 = no symptoms observed; 2 = mild chlorotic pattern over entire leaflets or mild distortion only at base of leaflets with the rest of the leaflets appearing green and healthy; 3 = strong mosaic pattern throughout leaf, narrowing and distortion of lower one-third of leaflets; 4 = severe mosaic, distortion of two-thirds of leaflets and general reduction of leaf size; 5 = severe mosaic, distortion of four-fifths or more leaflets, twisted and misshapen leaves.

CBB: 1 = no symptoms; 2 = only angular leaf spots; 3 = extensive leaf blight and leaf wilt, defoliation, gum exudation of stem and petioles; 4 = extensive leaf blight, wilt, defoliation and stem dieback; 5 = complete defoliation and stem tip dieback of lateral shoots.

CAD: 1= no symptom; 2 = shallow cankers on stems, lower down the plants; 3 = successive cankers higher up the plant with cankers on older stems becoming larger and deeper; 4 = dark-brown lesions on green shoots, petioles and leaves, young shoots collapsed and distorted; 5 = wilting, drying up of shoots and young leaves, and death of part or whole plant.

Results

Cassava Mosaic Disease: At 3 MAP, CMD symptoms were observed in all fields. Plants in 39% fields were moderately infected (level 2.1 to 3) with mild chlorotic to strong mosaic patterns observed on the leaves (Figure 1). Plants in 51% fields had severe infection (level 3.1 to 4) with initial signs of leaf distortion and leaf sizes being reduced in some cases. Plants in 10% fields had severe mosaic with many leaflets distorted. At 6 MAP, plants in 72% fields were moderately infected with only mild chlorosis. At this time plants in 26% fields were severely infected (level 3.1 to 4), which was a reduction when compared to 3 MAP. At 9 MAP, plants in 93% fields were moderately infected (level 2.1 to 3) while plants in the other 7% fields had severe infection. In general CMD, severity decreased as the plant age increased. At 12 MAP plants in 80% of the fields were moderately infected while only plants in 7% of the fields were severely infected.

Bacterial blight: At 3 MAP, plants in 93% fields were slightly infected (level 1.1 to 2), showing only angular leaf spots (Figure 2). At 6 MAP, infection in 67% fields was severe (level 3.1 to 4) with blighting of leaves, defoliation and initiation of wilting. Plants in the other 33% fields had moderate infection (level 2.1 to 3). At 9 MAP plants in 55% fields had severe infection (level 3.1 to 4) while 43% were moderately infected. At 12 MAP, the disease level were about the same as observed at 9 MAP, with plants in 53% fields being severely infected while plants in 46% fields had moderate infection.

Anthracnose: At 3 MAP, plants in 82% were not infected. The other 18% fields had only slight infection with cankers mostly on the lower part of the stem (Figure 3). At 6 MAP, anthracnose symptoms were observed in all fields but the severity of infection varied between fields. Plants in 65% fields had moderate infection (level 2.1 to 3) meaning cankers were just beginning to spread from the lower to the middle part of the stem. Plants in about 20% fields had severe infection (above level 3) with cankers having completely spread to the green part of stem. At 9 MAP, plants in 71% fields had a moderate level of infection (level 2.1 to 3) while 15% fields had severe infection (level 3.1 – 4). At 12 MAP, anthracnose was observed in all fields but the number of fields with moderately infected plants had reduced to 44%.

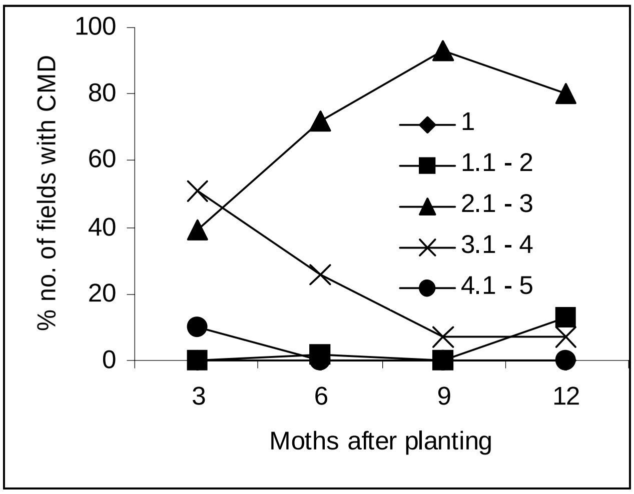

Figure 1: Severity level of cassava mosaic disease at 3, 6, 9 and 12 months after planting in Pouma area of Cameroon. Average severity of disease in each field was placed in one of five categories between 1 (no disease) to 5 (most severely infected). At 3 MAP 61 fields were evaluated; at 6 and 9 MAP= 58 fields; at 12 MAP= 55 fields.

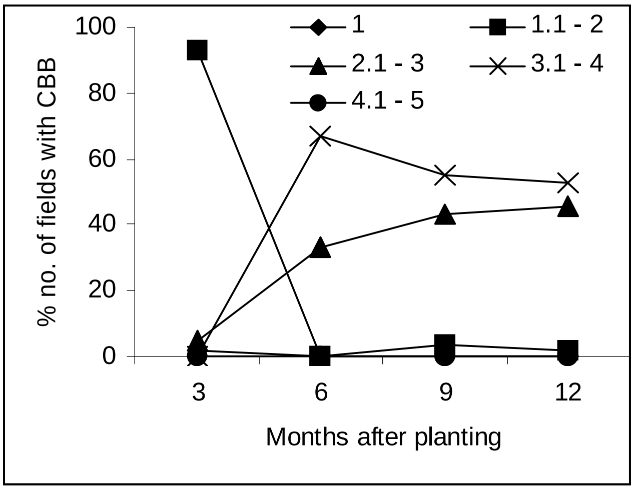

Figure 2: Severity level of cassava bacterial blight at 3, 6, 9 and 12 months after planting in Pouma area of Cameroon. Average severity of disease in each field was placed in one of five categories between 1 (no disease) to 5 (most severely infected). At 3 MAP 61 fields were evaluated; at 6 and 9 MAP= 58 fields; at 12 MAP= 55 fields.

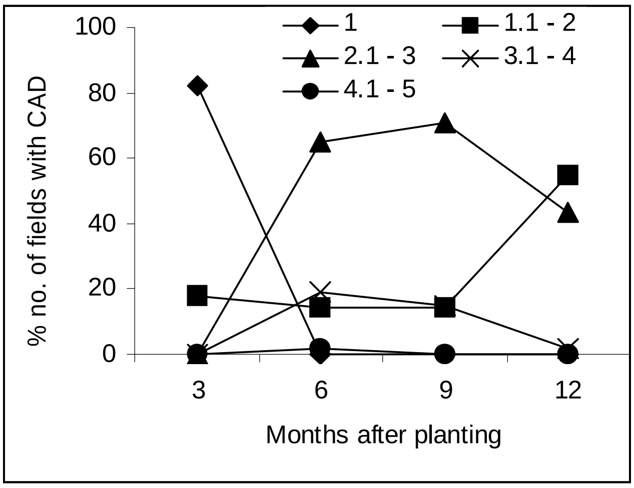

Figure 3: Severity level of cassava anthracnose disease at 3, 6, 9 and 12 months after planting in Pouma area of Cameroon. Average severity of disease in each field was placed in one of five categories between 1 (no disease) to 5 (most severely infected). At 3 MAP 61 fields were evaluated; at 6 and 9 MAP= 58 fields; at 12 MAP= 55 fields.

Discussion

Data for CMD showed a relatively high number of plants having a severe level of infection at 3 MAP, followed by a steady decrease in the number of plants with severe infection as plants aged. It could be that as plants grew older and bigger they became more tolerant to virus infection. One type of resistance to the virus is characterized by reduced spread of the virus within the plant (Hahn et al., 1980; Ariyo et al., 2001). Although six different varieties were observed in different farmers' fields, there were no apparent differences in susceptibility between varieties. The moderate level of infection observed on most plants between 6 and 12 MAP is not thought to reduce plant growth significantly.

For CBB, the observation that more plants were more severely infected at 6 MAP than at 9 MAP could be due to the fact that data for 6 MAP were recorded in October when the weather was very wet and therefore favorable for bacterial infection (Therberge 1985; IITA 1990). After 6 MAP, disease severity was either reducing or remained constant, probably because the weather was generally dry and unfavorable for spread of bacteria between leaves.

As for CBB, the severity of CAD increased significantly between 3 and 6 MAP which could have been caused by the wet weather prevailing in this period. It is known that conidia of *C. gloeosporioides* f.sp. *manihotis* spreads through rain splashes (Hillocks and Wydra, 2002). For CAD and CBB new leaves appearing with initial rains are affected but the diseases reduce as the dry season approaches (Fokunang et al., 2000), although they may continue to persist in the humid forest areas even during the dry season. With CAD, the reduced severity observed between 9 and 12 MAP could be because as plants grew in size, the portion of the stem occupied by anthracnose lesions decreased proportionately thus appearing less severe. For both CBB and CAD it is concluded that they could be of concern in Pouma if wet weather continues for extended periods of time.

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