The status of fungal rot diseases as constraints to cassava production and utilization in eastern Democratic Republic of Congo

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Abstract

Tuberous root rots are known to be a constraint to cassava production in the humid forest and forest transition agro-ecologies of Central and West Africa. In early 2004, rots were studied as part of a diagnostic survey carried out to determine the occurrence and distribution of major pests and diseases limiting cassava production in the eastern area of DR Congo. A total of 61 fields were visited. In each area, the fields were selected at random along the main road routes. Data were collected by interviewing owners of the selected fields on their perception of the occurrence of cassava tuber rots in their fields. In addition, where fields with mature plants were available, ten plants were selected randomly, uprooted and examined for rotting. Of the farmers visited, 53% in Kivu provinces, 68% in Oriental and 100% in Maniema identified tuber rot as a major constraint. Yield loss was said to vary between 20 - 100%, and was higher in the forest

areas of Oriental and Maniema provinces. According to farmers, harvesting immediately after the tubers mature is an effective management strategy especially where firewood is available for drying of the cassava chips. More than 80% of farmers interviewed in the forest areas leave mature plants in the ground to harvest gradually but in Kivu areas, 47% of farmers preferred to harvest immediately after the plants are mature Only 53% of farmers visited in Kivu provinces practice fallowing or rotation to manage rots, as compared to over 90% of farmers in the forest areas. All the varieties grown are susceptible, but the bitter varieties are more tolerant to rots. It is concluded that rots are a constraint to cassava production in eastern DR Congo but the disease could be managed by combining appropriate cultural practices and tolerant varieties.

Introduction

Cassava is a leading source of food and income in the humid forest areas of West and Central Africa. After Nigeria, the Democratic Republic of Congo (DRC) is ranked the second highest producer in Africa and the fifth highest worldwide with almost 15 million ton (FAO, 2004). In 2000 production was estimated to be 15.5 million ton, but in the past few years production is known to have reduced significantly especially due to cassava mosaic disease. In many African countries production is usually done under subsistence systems with the largest portion produced being for home consumption. Some of the extra harvest is sold and can fetch good prices especially where farms are located near urban centers. In DRC some large and small-scale farmers grow cassava entirely for sale (Nweke, 1995).

The occurrence of rots is suspected to be one of the main constraints to cassava production in many areas. However, rot diseases have not been well studied as compared to other key cassava diseases. A few studies have shown cassava tuberous root rots are an important constraint to production in the humid forest areas (ESCaPP, 1991; Chalwe et al., 1999; Onyeka, 2002). Although the extent of loss caused has not been accurately documented, losses can be high when conditions are favorable (Booth, 1978). For effective management of these diseases it is necessary to know how important they are in each region and also to determine the pathogens involved. The aim of the study reported in this paper was to determine the importance of tuberous root rots as a constraint to cassava production in the eastern part of DRC and to determine if there are opportunities for intervention with focused research.

Methodology

This study was part of a larger mission, carried out between January and February 2004, whose overall objective was to determine the distribution, incidence and severity of cassava diseases and pests in the Eastern and Northern provinces of the DRC. The provinces targeted were North and South Kivu, Maniema and Oriental. The rest of the country had been covered in an earlier survey (IITA, 2003). The survey was carried out by staff of the Institut National pour l'Etude et la Recherche Agronomiques (INERA) in collaboration with International institute of Tropical Agriculture (IITA)

Sites were selected based on accessibility, importance of cassava production and the security situation prevailing in the area. In South Kivu, sites visited were along the Kalehe axis, while in North Kivu sites were selected along Masisi in the West and

Rutshuru in the North. More sites were surveyed along the 400 km route from Goma to Butembo/Beni. In Oriental province the survey used Kisangani town as the focal point and selected sites along the routes to Lubutu, Ituri and Buta. Fields were selected along the main roads with minimum intervals of 10 km between. Where fields with mature plants (>10 months) were available, ten plants were selected randomly, uprooted and examined for rotting. A questionnaire was used to collect more data by interviewing owners of the selected fields on their perception of the occurrence of cassava tuber rots in their fields.

Results

Thirty-two fields were visited in North and South Kivu provinces, 22 fields in the Oriental province and seven fields in Maniema province. In all areas visited it was difficult to find cassava fields with mature tuberous roots because plants were in the early to medium growth stages. However, the data obtained from farmers through the questionnaire, which are summarized in Table 1, were useful as an indicator of the importance of rots.

More than 80% of farmers in North and South Kivu, 95% farmers in Oriental and all the farmers in Maniema provinces reported having observed rots in their fields. However, only 53% farmers in the Kivu areas and 68% farmers in Oriental province consider rots to be a major constraint in cassava production. In all areas, 30-50% of farmers reported occurrence of rots even before cassava has reached harvesting age. There was agreement among farmers that rotting increases if harvesting is delayed, especially in Oriental and Maniema provinces which are forest areas.

In North and South Kivu provinces, where population density is very high, 84% of farmers reported they do not have sufficient land. On the other hand, almost all the farmers in Oriental and Maniema provinces had sufficient land except some 14% living in the outskirts of Kisangani town. Due to land shortage only 53% of farmers in Kivu practice any kind of crop rotation or fallowing as compared to over 90% of farmers in Oriental and Maniema who subject their lands to prolonged periods of fallowing (>5 years). About 40% of the farmers in Kivu had grown cassava in the same plot for three or more consecutive seasons. Even where rotation was practiced in the Kivu areas, the period between rotations was generally very short, ranging between 6 months to one year before returning cassava to the same field. Due to this intensive utilization of land, 87% of farmers in North and South Kivu also reported poor soil fertility to be a major constraint.

There were key differences in the way farmers prefer to consume and/or store their cassava produce. In the Kivu provinces, 53% of farmers indicated they would like to leave the tubers unharvested in the soil as a form of storage. However, in practice this was not possible due to the need to clear and use the same land for the next season. The consequence was that farmers have to dry their harvest and store it in the form of chips in their houses. An overwhelming majority of the residents in the Kivu provinces also prefer consuming cassava in the form of fermented flour, which is processed from the dried chips. When the chips were not sufficiently dried, fungal contaminants easily established themselves, spoiling the chips and reducing their value when sold.

In the Oriental and Maniema provinces a majority of the residents prefer to consume cassava processed from freshly harvested tubers. Over 80% of the residents there actually

leave mature plants unharvested so that they can harvest gradually as needed. The few who prefer consuming flour from dried chips reported no problem with fungal contaminants because they can obtain firewood easily, which they utilize to ensure the cassava chips are well dried before storage. Generally, farmers in the forest areas prefer sweet varieties for fresh consumption. The sweet varieties have been noted to rot faster than the bitter varieties.

Discussion

From the results obtained one possible cause of the rot problems experienced in the Kivu provinces may be the intensive use of land without sufficient fallow period to reduce pathogen pressure. Since land available will remain fixed, a possible solution could be to utilize resistant varieties. Low soil fertility could also be contributing to the problem because weakened plants cannot withstand pathogen attacks well. Since the farmers are willing to intercrop cassava with other crops so as to maximize returns per unit land, the intercrops, such as legumes, could be deliberately selected so as to enhance soil fertility. Intercrops such as cocoyam which can act as hosts of the same pathogens causing rots to cassava tubers should also be avoided.

Although over 90% of farmers in Oriental and Maniema provinces fallow their land for periods of 5 - 10 years, over 68% said rotting is a major constraint. The most likely cause of the observed rotting could be the continued storage of the tubers in the soil for prolonged periods. Rotting is known to increase significantly if mature plants are left in the soil for extended periods of time (Onyeka, 2002). An important observation was that about 40% of the farmers in these areas observe rot damage even before plants have

reached harvesting age, which indicates that not all the rotting is due to delayed harvesting.

The observation that the sweet varieties preferred by farmers in the forest areas rot faster is important in that increasingly breeders and farmers in many areas are selecting for low cyanide content in improved varieties, which could be related to sweetness and probably also to increased rot occurrence. Another aspect that could contribute to the increased rots in Oriental and Maniema provinces is the prolonged wetness and the higher rainfall that is received there as compared to the Kivu provinces. In many areas e.g. Nigeria, Zambia and Togo cassava tuber rots have been reported to be more prevalent where rainfall is higher and soils do not drain rapidly (Nilmanee, 1986; Chalwe et al., 1999; Onyeka, 2002).

Early harvesting appeared to reduce rot incidence in the Kivu provinces, but it was apparent that after several months of storage insufficiently dried cassava chips were very badly contaminated rendering them unsuitable for human consumption. Although consumers did not seem to be very concerned about eating them, the contaminated chips would generally fetch a lower price in the market. Considering that some of the organisms inducing post-harvest deterioration are soil borne pathogens that enter the tubers before or during harvesting (Msikita et al., 1998), the importance of rots in the Kivu areas could be much more.

Another disadvantage of rapid harvesting as practiced in the Kivu areas is that the supply of cassava outstrips the demand in the market during the harvesting season, which exerts a downward pressure on prices. Many farmers also expressed concern that harvested cassava was more likely to be sold to generate cash for household needs than if the

mature tubers were left in the field and harvested gradually as needed for home consumption. This threatens food security and safety since rotting will reduce harvestable tuber yields.

In many of the areas, field management was observed to be inadequate. Plants with rot symptoms were left standing so as to continue harvesting the leaves to use as vegetables. In some fields rotted tubers were left scattered in the field and this could provide primary inoculum for the next crop. Proper field management could contribute to reducing soil borne diseases, but the farmers may need training on the measures they can take.

It has been reported that root rots can increase substantially if cassava is planted after a woody crop (Chalwe et al., 1999). Rotting stumps, logs and roots are commonly encountered within fields in the humid forest areas where trees are felled to create new lands. This could be another factor contributing to the high rot incidence in the forest areas, although no clear relationship has been established.

Conclusion

Data obtained from this study show that root rots are an important constraint to cassava production in the eastern parts of DRC and can impact negatively on food security of millions inhabiting the region. Our study shows that ecological, socio-economic and demographic factors strongly influenced root rot problem and these factors should be considered while designing intervention strategies for root rot management. It is recommended that focused research be conducted to search for resistant varieties that can be grown especially in the Kivu areas where opportunities to fallow or rotate are few due to land scarcity. In the forest areas where land is available farmers could be trained to use varieties of different maturities or stagger planting so that cassava matures at different

times in the year rather than all in one season. This will reduce the need to leave mature plants in the soil as a form of storage for prolonged periods thereby making fresh good quality tuberous roots available for extended peiods. Training in cultural measures for disease management could contribute substantially.

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Table 1: Farmers' perception of the occurrence of cassava root rots in North Kivu, South Kivu, Oriental and Maniema provinces in the Democratic Republic of Congo, 2004.

	South + North Kivu (n = 32)	**Maniema (n = 7)**	**Oriental (n = 22)**
Farmers who have observed rots in their fields	81[a]	100	95
Farmers who consider rots a major problem	53	100	68
Farmers who prefer to leave/store cassava in soil	53	100	82
Farmers who see rots even if harvesting is timely	50	43	36
Farmers without enough land	84	0	14
Farmers practicing crop rotation or fallowing	53	100	91
Farmers who have noted low soil fertility	87	0	14

[a] Figure is percentage.