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Cassava Transformation in Southern Africa (CATISA) Project
Zambia Draft Report – 2007/08

Submitted to

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Introduction

Southern Africa is very heterogeneous in terms of climate, natural resources, labour skills, economic prosperity and growth potential. However, for the most part, agriculture is the dominant sector of economic activity and employment in most countries of the region with rural communities depending upon agriculture for their livelihoods. Much of the agricultural production is based on the surpluses of millions of small-scale farmers using low input, rain-fed farming systems.

Success in the agricultural sector has to date been mixed. Despite the high agricultural potential of the region, considerable funds are routinely required to address the chronic food relief situation which has dogged the region for the past 20 years. This relief syndrome has been caused by a combination of poor governance, crop failure through severe droughts, poorly managed food reserves and civil unrest.

Agriculture in Zambia

Maize and cassava are the two main staples in Zambia. Maize serves as the principal food staple in central, southern and eastern Zambia and supplies about 60% of national calories, while cassava is important in northern and western Zambia (FAO, 2002). Small-scale farmers produce almost all cassava in Zambia.

Materials and methods

Zambia national crop production data was obtained from FAO data. In order to verify the production estimates for the current year, cassava yield estimates were conducted in farmers' fields from twelve (12) districts in Zambia in December 2007 and January, 2008. The survey team included scientists and research technicians from of the Zambian Root and Tuber Research Team and the International Institute of Tropical Agriculture (IITA/SARRNET). A one day field training workshop was conducted at Msekera Agricultural Research Station in Chipata, Zambia to harmonize the survey protocols and data collection. Cassava yield was assessed using the FAO guidelines on cassava field assessment (Appendix 1). CMD severity was assessed using the standard CMD scoring scale of 1 to 5 where 1= no visible symptom; 2 = a mild chlorotic pattern over the entire leaf while the latter appears green and healthy; 3 = a moderate mosaic pattern throughout the leaf, narrowing and distortion in the lower one-third of the leaflets; 4 = severe mosaic, distortion in two-thirds of the leaflets and general reduction in leaf size; and 5= very severe symptoms - severe mosaic and distortion in the entire leaf (Hahn et al., 1989; Njock, 1994). A similar scoring scale was used for CGM. Disease/pest incidence was based on the percentage of infected plants in each field.

Survey findings

Cassava production trends

Cassava production in Zambia has steadily been increasing over the years (Figure 1). Root yields have increased by 21% during the past decade (1995 to 2005). The increase

in cassava productivity may largely be attributed to the increase in area grown to cassava (Figure 2) since yield per unit area (Figure 3) has basically been constant and since 2000, it has reduced. Area under cassava cultivation has increased by 50% during the same period (1995-2005), while, cassava yields per unit area has decreased by 19%.

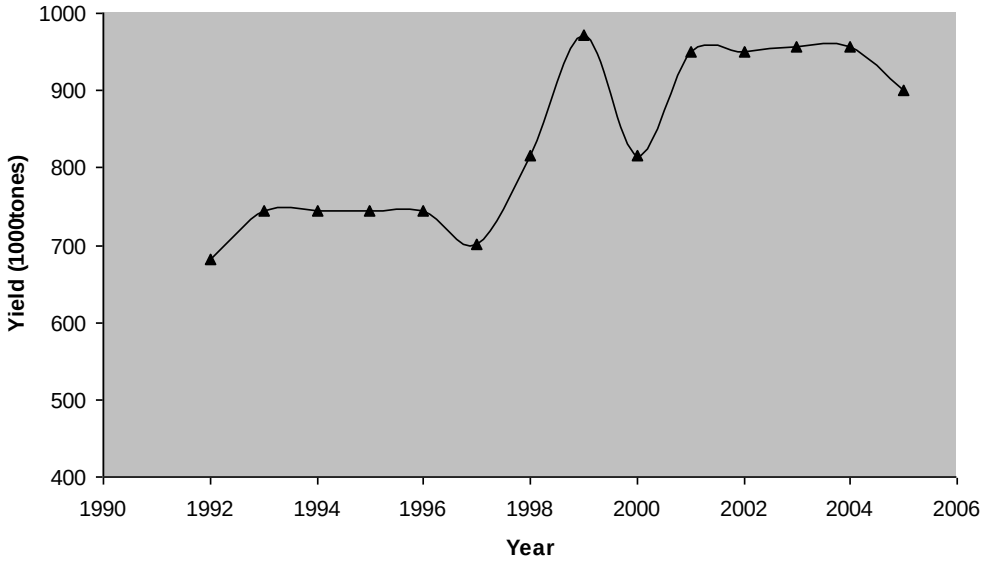


Figure 1 Cassava root yield production trends (1000 tones) in Zambia
Source: FAOSTAT

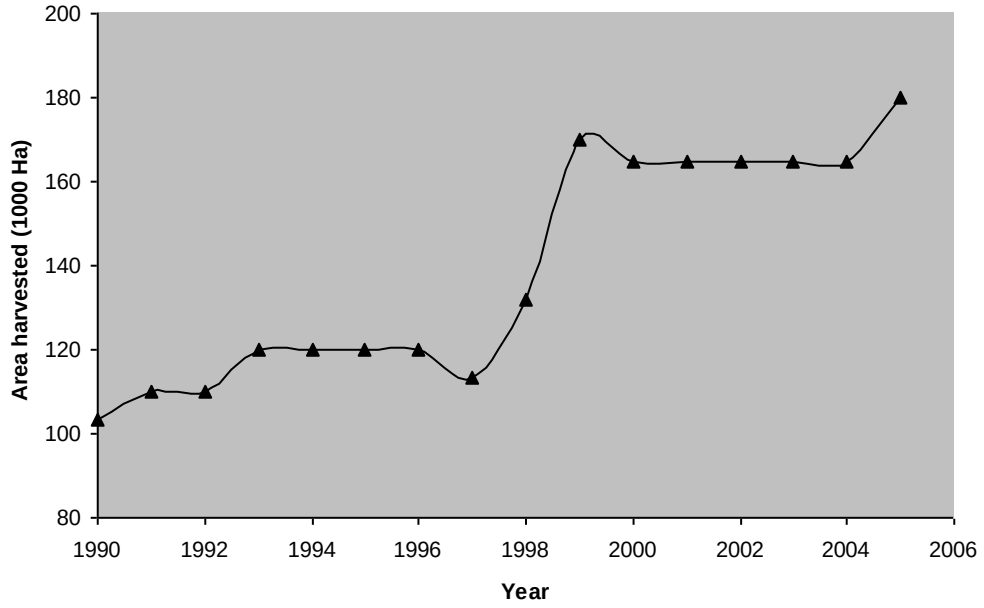


Figure 2 Area where cassava was harvested (1000 Ha) in Zambia
Source: FAOSTAT

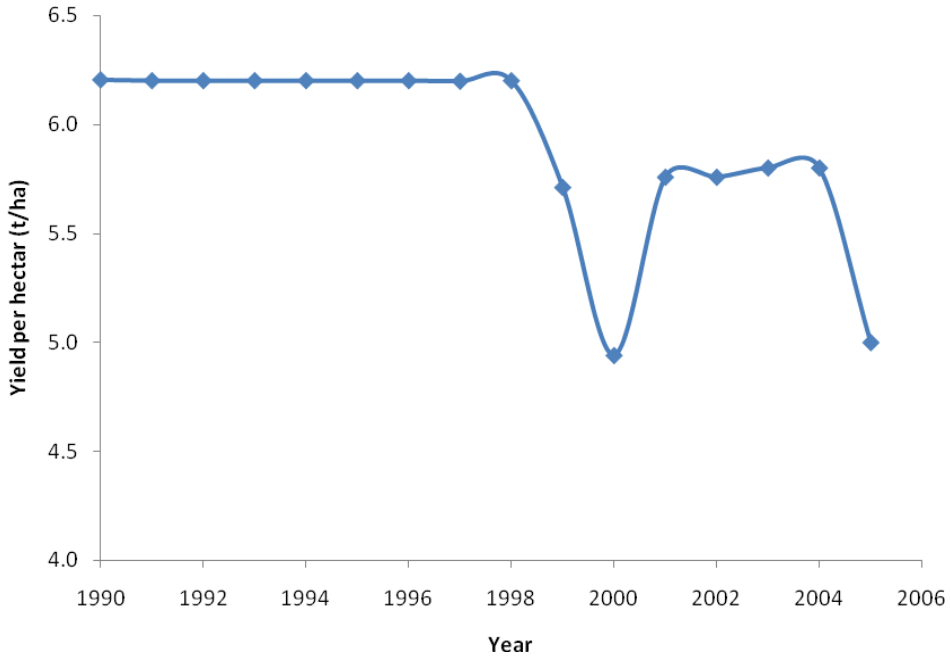


Figure 3 Cassava root yield per hectare (t/ha) in Zambia
Source: FAOSTAT

Cassava yield assessment for 2007& 2008

The cassava yield assessment results obtained from farmers' fields from the ten (10) districts surveyed in Zambia are presented in figure 4 below. The overall mean cassava root yield per unit area (tons/ha) in farmers' fields in Zambia was 18 tons per hectare, with a minimum of 2 and a maximum of 56 tons per hectare. Highest cassava yields were obtained from Mwinilunga followed by Kabompo districts while the lowest yields were from Lukulu and Luwingu districts.

The national average cassava yield computed from the 2005 figures obtained from FAO (Figure 3) is 5 tons per hectare. This is a gross underestimate of the cassava productivity in Zambia as revealed by the cassava yield assessment exercise conducted in 2007/2008. The FAO national average for Zambia is even lower than the average yield in Lukulu district which had the least average yield.

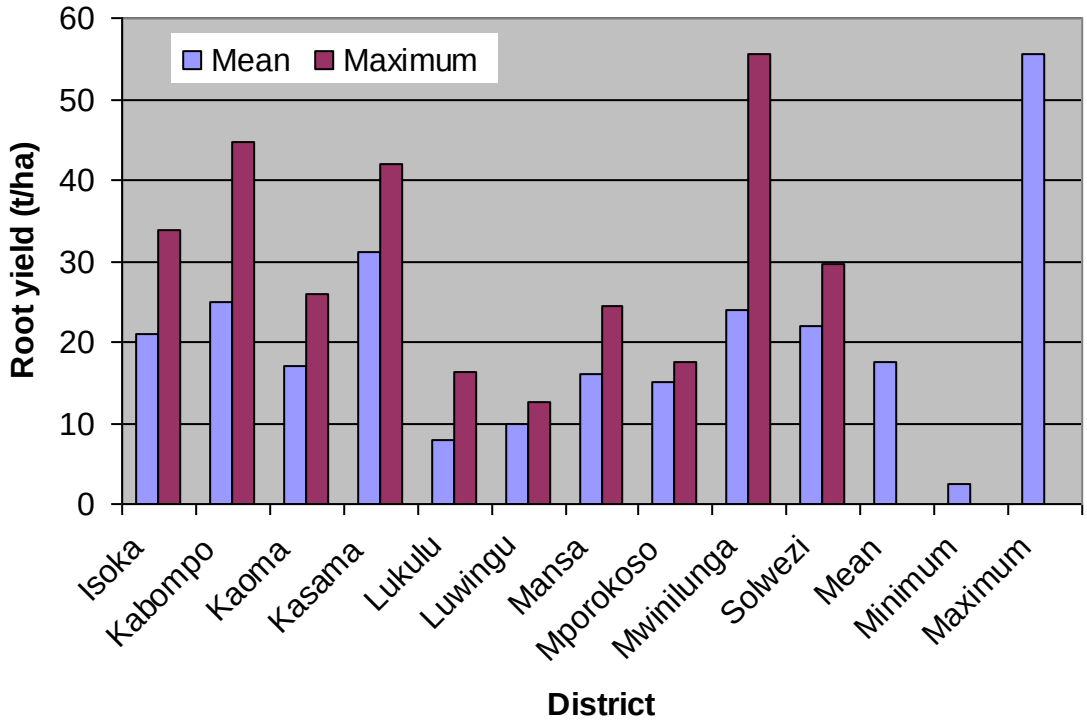


Figure 4 Average and maximum cassava root yield per hectare (t/ha) by district obtained from a cassava yield assessment survey conducted in farmers' fields from ten (10) districts in December 2007 & January, 2008 in Zambia

Major production constraints - Cassava diseases and pests

The outcome of the survey indicates that both cassava mosaic virus disease (CMD) and cassava green mites (CGM) are widely distributed in the main cassava growing areas in Zambia (Figure 5). The disease and pest incidence and severity were observed to be moderate to high in farmers' fields in the districts surveyed (Figures 6 & 7) in the main cassava growing areas in Zambia. Disease/pest incidence was assessed as the percentage of the number of CGM/CMD infected plants in the field; and severity was assessed using the scoring scale of 1 to 5 where 1= no visible symptoms and 5= very severe symptoms.

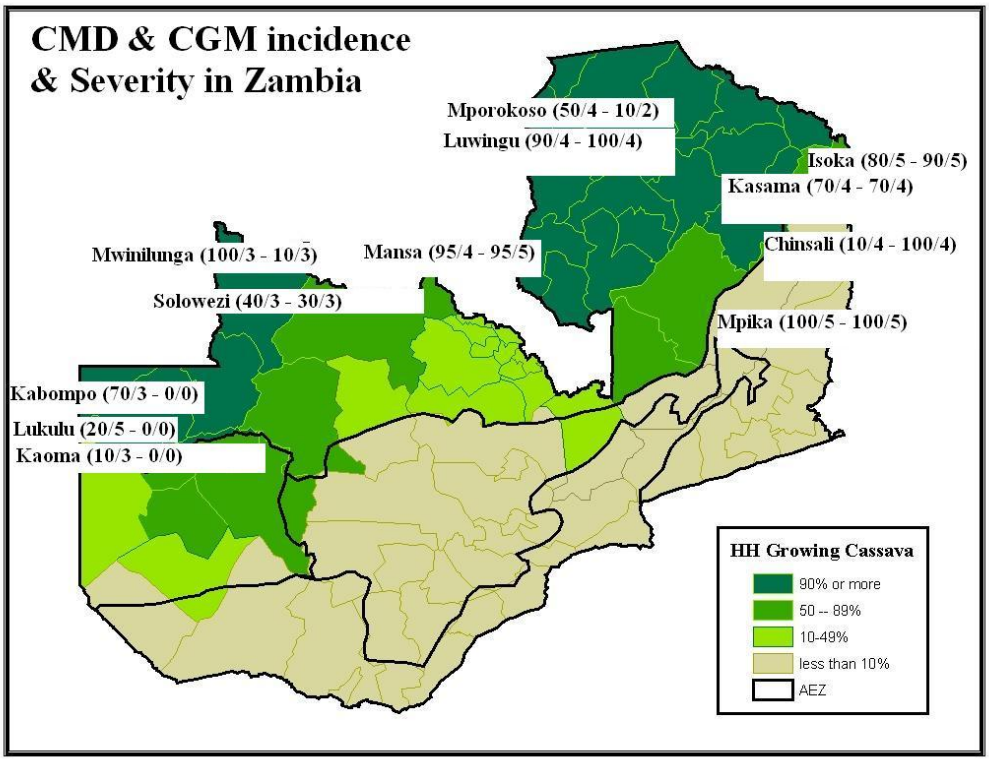


Figure 5: Distribution of CMD & CGM by district obtained from a survey conducted in farmers' fields from twelve (12) districts in December 2007 & January, 2008 in Zambia
Source of map: Steven Haggblade

Cassava mosaic virus disease

Cassava mosaic virus disease (CMD) is caused by cassava mosaic geminiviruses (CMGs), in the family Geminiviridae and genus Begomovirus. CMD symptoms are variable according to season and variety, but always include a chlorotic mosaic on infected leaves. The colour of chlorosis varies from pale green to whitish yellow and the extent of chlorosis varies from almost 100% of the leaf surface to less than 5%. In moderate to severe infections, leaves also exhibit crumpling, the laminae are distorted, and the size is reduced. These effects lead to the stunting of the growth of the plant. There are no symptoms on the stem or roots. Whilst symptoms produced by different CMGs or CMG strains may differ in severity, the general characteristics cannot be readily distinguished. Mixed CMG infections occur commonly and typically give rise to the most severe symptoms (*Figure 3*). Reduced photosynthetic activity resulting from chlorosis caused by CMD leads to reduced tuberization and lower or no yield at all. Africa-wide losses to CMD have been estimated at between 12 and 23 million tonnes, representing 15-24% of total production.

CMGs are transmitted either through planting infected stem cuttings or by the whitefly vector Bemisia tabaci (Genn.). Epidemic conditions may result where there is a high incidence of severe CMD coupled with high whitefly populations.

Cassava green mite

The cassava green mite (CGM), *Mononychellus tanajoa* (Bondar) is a cassava insect pest that feed on the bottom surface of leaves by sucking fluids from cells. This causes yellow spotting of leaves (chlorosis), which can increase from a few spots to complete loss of chlorophyll (green pigments in leaves). Generally, most green mites are found on the top upper one-third of the cassava plant. Severely damaged young leaves fail to expand and may dry out and fall off, which can cause a characteristic candle stick appearance. Because of reduced plant growth, accumulation of starch in the storage roots is slowed, sometimes even reversed, and root yield losses in the absence of any control measures can reach 50%. Where leaves are eaten as vegetables by farmers, a corresponding loss ensues. Reduced growth and stunting of the tips is also responsible for contorted and thin stems, thus affecting the planting material to be used for the next season. The size of CGM populations, and hence yield losses, is generally influenced by several factors including: (1) age of the host plant – young plants are more exposed and susceptible to CGM attacks than older plants; (2) season - damage severity is greater during dry than wet season, and heavy rainfall can reduce CGM populations, and (3) temperature– populations increase with increasing temperature leading at times to very rapid increase in populations and damage.

Figure 6: Cassava mosaic virus incidence and severity scores in farmers' cassava fields in some districts in Zambia obtained from a survey conducted in farmers' fields from twelve (12) districts in December 2007 & January, 2008

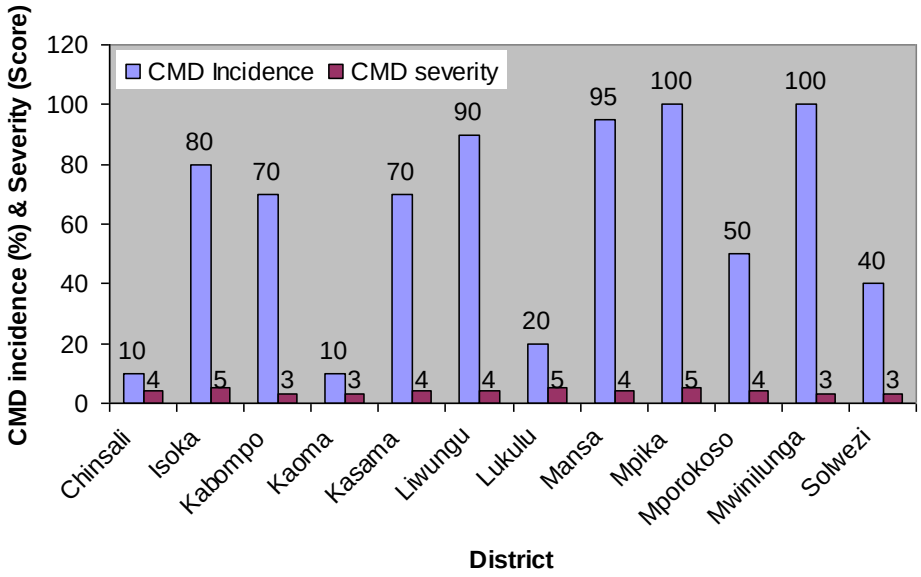
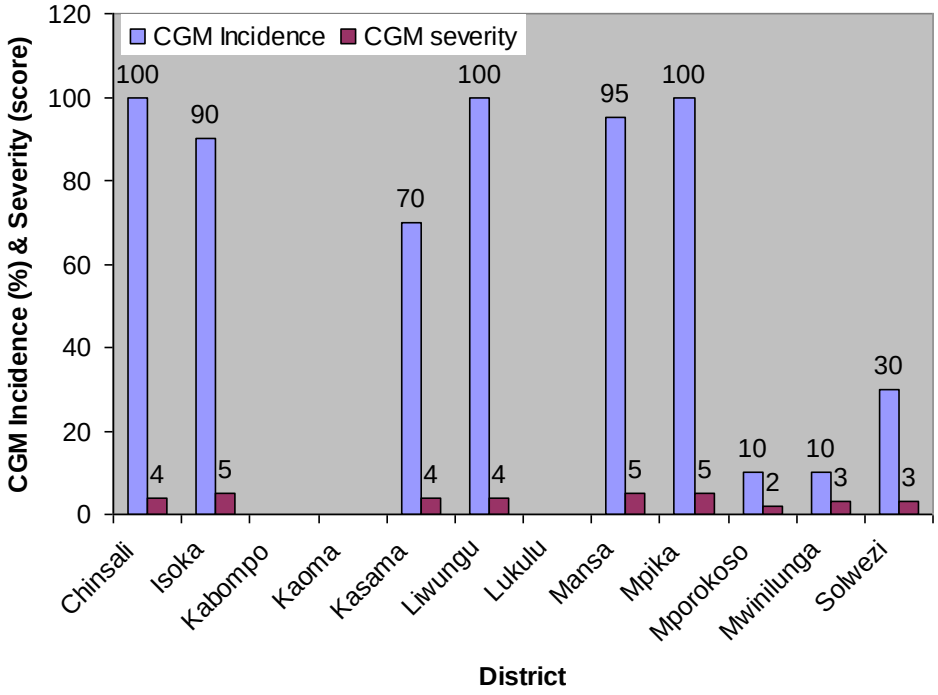


Figure 7: Cassava green mite incidence and severity score in farmers' cassava fields in some districts in Zambia obtained from a survey conducted in farmers' fields from twelve (12) districts in December 2007 & January, 2008



Collection of local cassava varieties

Local cassava varieties grown by farmers in the various districts visited during the survey were also collected (Figure 8). A total of 101 cassava accessions were collected and planted at Mansa and Solowezi Research Stations. Characterization using morphological and molecular markers will be done so as to identify and eliminate duplicates and also identify the predominant and most preferred genotypes in Zambia.

The cassava breeding program in Zambia released two waves of improved cassava varieties. Local best varieties (Bangweulu, Kapumba and Nalumino) were released in 1993, and locally bred varieties (Mweru, Chila, Tanganyika and Kampolombo) were released in 2000. Among these, three (Nalumino, Chila and Bangweulu) were collected from fourteen (14) different farmers. Nalumino was collected from ten (10) different farmers, while Bangweulu and Chila were each collected from two (2) different farmers.

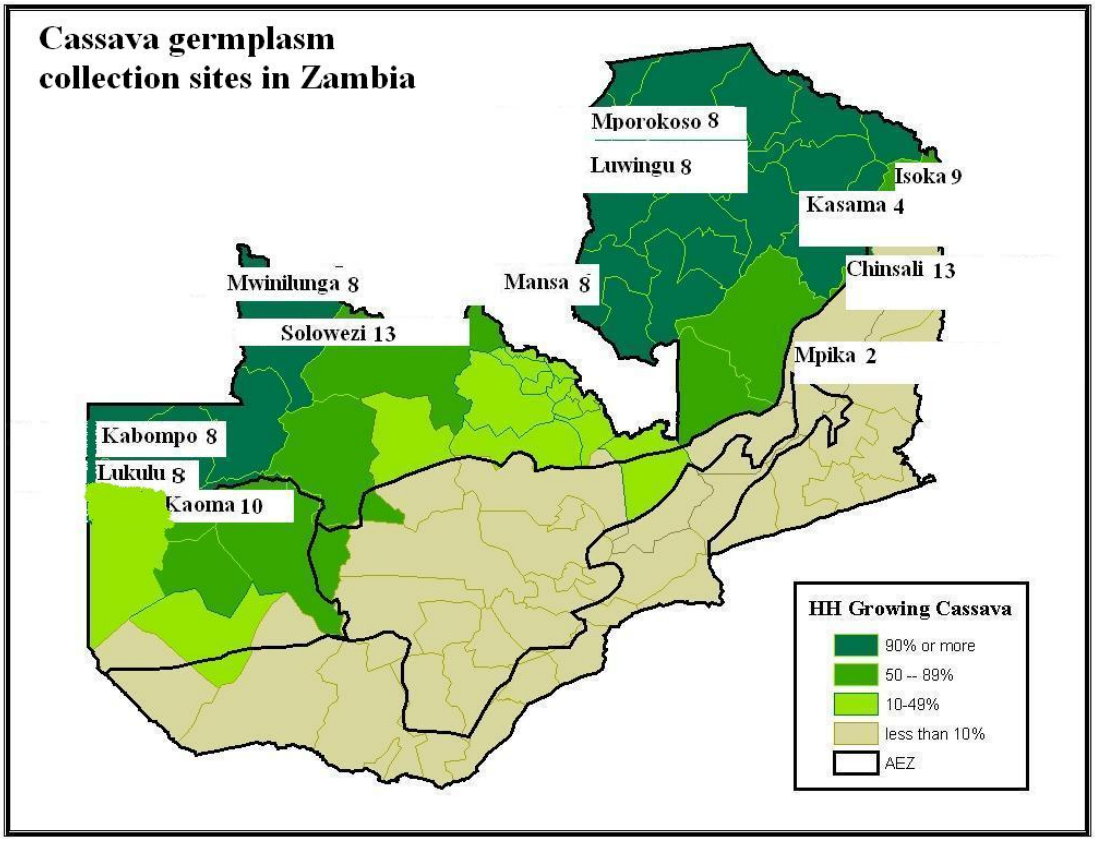


Figure 8: Number of farmer cassava varieties collected in December 2007 & January, 2008 from each district in the major growing areas in Zambia
Source of map: Steven Haggblade

Appendix 1

FAO Cassava yield assessment guidelines
(PDF doc attached)