

Farmer's Perception of Cassava Mosaic Disease, Preferences and Constraints in Lupaula Province of Zambia

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Abstract

Cassava is the principal staple root crop, providing a major source of calories for rural and urban households in Luapula province of Zambia. However, the yields on smallholder farms are relatively low largely due to disease infections. The study was therefore conducted to establish farmers' perceptions, knowledge and management of cassava mosaic disease (CMD), which is one of the major diseases of cassava, and to establish farmers' preferred traits, constraints and assess sources of cassava cuttings for planting. Focus group discussions (FGD) and structured interviews involving 156 farmers in Mwense, Mansa and Samfya districts were conducted from December 2008 to March 2009. Knowledge of CMD was limited among the respondents. Only 2.4% of the respondents were aware of the disease despite high CMD incidence in farmers' fields. The majority of the farmers were aware of the importance of insect pests; however, they could not differentiate between damages due to diseases or insect pests. High yield and early bulking traits were highly ranked. Most of the farmers planted local landraces on small-fields (<1 ha). It was evident that a local breeding programme aimed at developing locally adapted disease and pest resistant cassava cultivars was a pressing requirement.

Keywords

Cassava Mosaic Disease, Farmer, Knowledge

1. Introduction

Cassava is one of the major staple and most highly valued root crops in Zambia. It is mostly grown in Northern,

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Luapula, North-Western and Western provinces (often referred to as cassava belt) which accounts for 95% of total production [1]. Thirty percent of the population in Zambia is directly or indirectly dependent on cassava for their livelihood, with the majority from the cassava belt region [2]. In the last few years, cassava promotion and production has spread to other parts of the country such as Central, Eastern and Southern provinces.

Cassava mosaic disease has been reported to be one of the most limiting constraints to cassava production in Africa [3]. The disease in Zambia is prevalent in most of the farmers' fields [4], affecting both local and improved cultivars. Although improved cassava cultivars have been developed by the Zambia Agriculture Research Institute (ZARI) and have been promoted by public and private extension services, including non-governmental organisations (NGOs), adoption has been slow and consequently overall production is still low, with an average yield of 5.8 t·ha⁻¹ [5]. The adoption of a cultivar depends on the presence of farmer preferred traits among the available cultivars and the availability of information upon which decisions are based.

To assess the usefulness of any given cultivar, there is a need to determine the attributes and constraints that are responsible for farmers' choices through participatory approaches. Farmers have local knowledge on the attributes of their cultivars. Studies by Agwu and Anyaeche [6] indicated that a farmer's decision to use a particular cassava cultivar was influenced by a number of factors, some of which are trait based (high yield, low cyanide, early maturity, and colour of roots).

Improving cassava production among smallholder producers through the introduction of improved cultivars requires farmer involvement in the early stages of breeding. In many national breeding programmes where the farmers have been involved in the breeding process, improvements have been observed in the adoption and release of new cultivars. For instance, in Ghana, scientists working in collaboration with farmers identified 129 superior accessions from a total of 1350 seedlings [7]. The participatory approach improves the adoption rates through integrating local knowledge into research through dialogue between farmers and scientists. Furthermore, it is necessary for evaluating traits most preferred by the farmers. Therefore, a participatory rural appraisal (PRA) was conducted to gather information on farmers' preferences, perception, and knowledge of CMD and other production constraints and to lay the foundation for the development of CMD resistant cultivars in Zambia. The objectives of this study were: 1) to assess farmers' knowledge and perceptions of CMD; 2) to evaluate farmers' knowledge on the management of CMD; 3) to establish farmers' preferred traits and various constraints to cassava production; and 4) to assess sources of cassava cuttings for planting.

2. Method

2.1. Description of Study Area

The study was carried out in Mansa, Mwense and Samfya districts of Luapula province, located between latitude 8° to 12° south of the equator and longitude 28° to 30° east of Greenwich Mean Time [8]. The districts within the province are located in the high rainfall agroecological zone (AEZ III) (Figure 1) and receive above 1000 mm of rainfall per year. The rainfall pattern is monomodal and lasts from November to April. The mean annual minimum temperature is 10°C and the mean annual maximum is 31°C. The length of growing season is approximately 160 to 170 days (November to April) for rain grown crops.

2.2. Selection of Participants

The study was conducted between December 2008 and March 2009 in collaboration with the Department of Agriculture which falls under the Ministry of Agriculture and Cooperatives (MACO). A list of cassava farmers was drawn up and 20 to 25 farmers were randomly selected for the focus group discussion (FGD). In each district, 6 to 8 villages were targeted for the FGD. Adult men (56.1%) and women (43.9%) farmers were involved in the study (Table 1).

In the second stage, 90 randomly selected farmers (30 per district) were involved in the semi-structured interview (Table 2). The farmers were asked similar questions as in the FGD on their perceptions of pests and diseases, production and marketing constraints, control strategies and cropping system using a semi-structured questionnaire.

2.3. Data Collection

Prior to data collection a multi-disciplinary team was constituted comprising the principal investigator, three

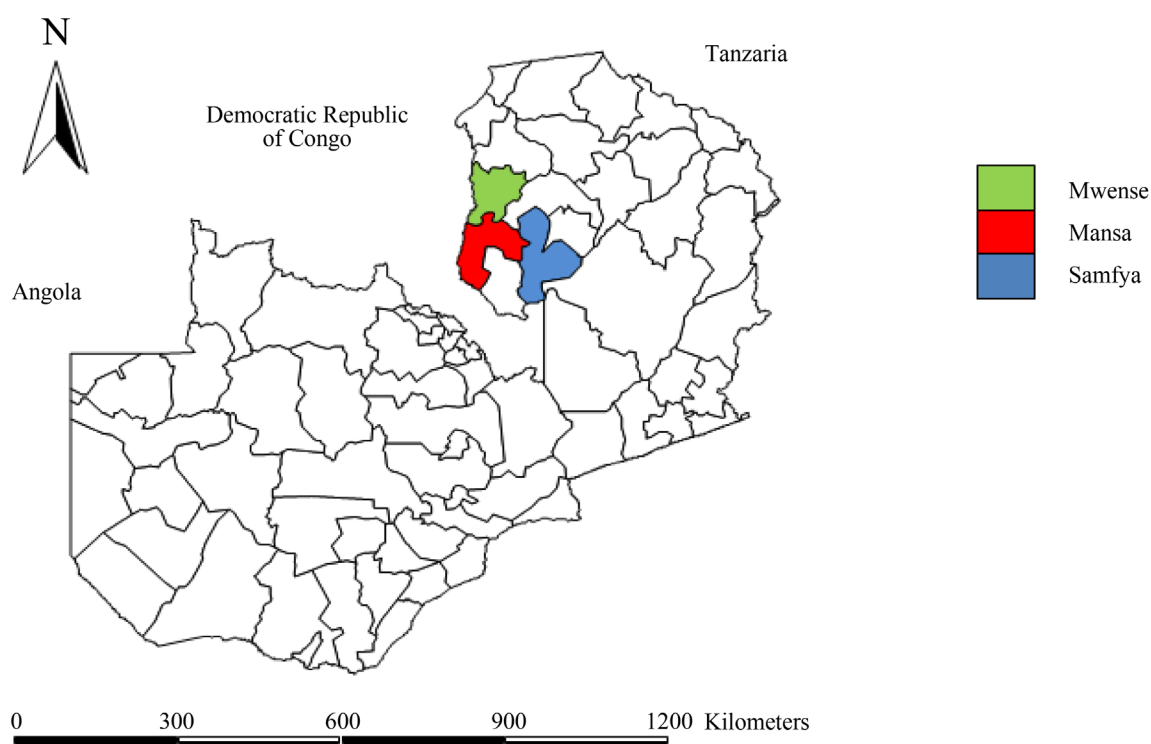


Figure 1. Districts in Zambia surveyed for the participatory rural appraisal study.

Table 1. Number of farmers by gender participating in focus group discussions held in three districts of Luapala province, Zambia.

District	Number of villages	Male	Female	Total
Mwense	6	12	10	22
Mansa	6	17	7	24
Samfya	8	8	12	20
Total	20	37 (56.1%)	29 (43.9%)	66

Table 2. Total number of farmers by gender participating in the structured questionnaire in three districts of Luapala province, Zambia.

District	Male	Female	Total
Mwense	21	9	30
Mansa	23	7	30
Samfya	23	7	30
Total	67 (74.4%)	23 (25.6%)	90

assistants, an extension officer (from District Agriculture Coordinators' office), and a camp officer from each study area. All the team members underwent training on administering questionnaires and handling of FGD. In addition, the participatory appraisal team reviewed interviewing techniques and questions in the questionnaire. Furthermore, the team also discussed various options to use in order to extract maximum information from the farmers. The open-ended questions that were formulated allowed farmers to give their opinions freely. The interviews and discussions were conducted in the local language (Bemba) as most of the farmers were conversant in it and this encouraged wide participation.

To assess farmers' reaction and knowledge of diseases and insect pests they were presented with plants having CMD symptoms or infested with insect pests. In addition, probing and iterative techniques were used during FGD discussion and structured interviews. Some of the questions asked were repeated and rephrased to enable farmers to better understand and respond as fully as possible. Repeating and rephrasing of questions is often necessary when the study group comprises semi-literate respondents. Other techniques used were listing and ranking of constraints, observations of cultivars in the field, listing of traits, and ranking.

Data on farmers' knowledge and perception of insect pests and diseases were collected from the FGD and structured interviews. The questions centred on farmers' awareness of insect pests and diseases, cultivars grown, production and marketing constraints, cropping system used and cropping calendar. Farmers were asked to list cultivars and provide their attributes. Comparisons between the factors considered e.g. constraints, insects and diseases, were done using the ranking method. The factor with the highest number of points was ranked as first and that with lowest points last. In Mwense and Samfya districts, farmer training centres (FTCs) were used for the FGD as the study was done during the rainy season.

2.4. Data Analysis

Statistical analysis for quantitative data was analysed using the statistical package for social sciences (SPSS) [9]. Descriptive statistics, analysis of variance and mean comparisons for each district were generated.

3. Results

3.1. Land Size

The average area planted with cassava by most of the farmers (46.3%) in the three districts was less than 1 ha. The rest of the cassava fields were between 1.0 to 1.5 ha (22.5%) and 1.5 to 2.0 ha (31.2%). In Samfya district (Figure 2) 38.8% of the respondents had cassava fields of less than 1 ha. In Mansa, 44.4% of the respondents had fields measuring between 1.0 - 1.5 ha.

3.2. Knowledge and Perception of Cassava Mosaic Disease

In all the three districts, the majority of the respondents (97.6%) were not familiar with the symptoms of CMD and could therefore not identify the disease. Only a few respondents (2.4%) were familiar with CMD and its symptoms by virtue of working at, and being within the vicinity of, Mansa Research station. A number of reasons were given by the respondents as to the probable cause of CMD. The majority of the respondents (73.6%) thought the symptoms were as a result of harvesting of cassava leaves. On the other hand, 12.6% were of the view that CMD was caused by mealybug infestation. Other respondents were of the view that CMD was caused

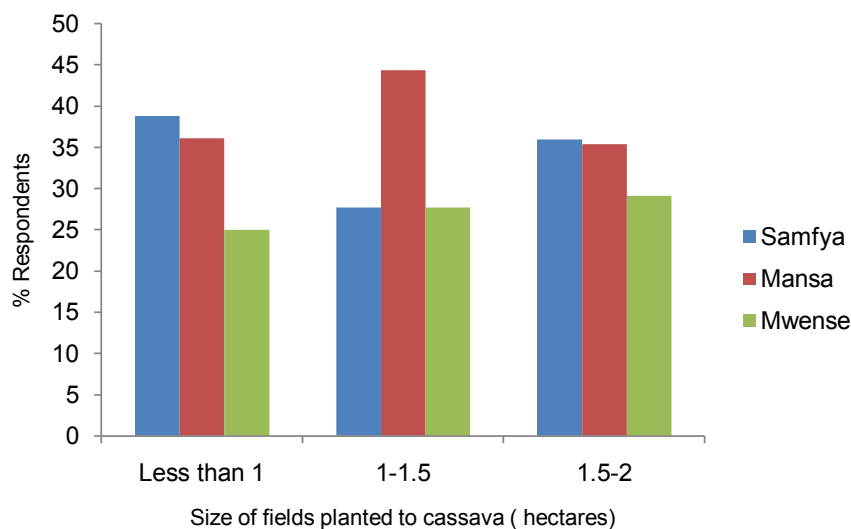


Figure 2. Size of cassava fields in Samfya, Mansa and Mwense districts.

by old age of the plants (4.6%), cold (3.4%), and lack of rain (3.4%). The rest of the respondents attributed the cause of CMD to lack of hygiene (non-removal of affected plants). In Samfya district some farmers were able to differentiate between symptoms of mealybug (*Phenacoccus manihoti* Matile-Ferrero) infestation and CMD. However, the farmers did not have a name for the condition in plants that exhibited CMD symptoms.

3.3. Incidence and Severity of Cassava Mosaic Disease in Farmers' Fields

Although the farmers were not aware of CMD, symptoms of the disease were present in most of the fields. There were no significant differences in CMD incidence in Samfya, Mansa and Mwense districts. The average incidence of CMD across the three districts was 61.2%. Samfya (68.6%) and Mwense (62.6%) districts had high CMD incidence. Mansa had the least incidence (57.8%). The CMD severity was moderate in Samfya (2.4), Mansa (2.5) and Mwense (2.5) with an overall mean of 2.5.

3.4. Insect Pests of Cassava

All the fields visited had mealybug, whitefly (*Bemisia tabaci* Gennadius, a vector of CMD) and cassava green mite (*Mononychellus tanajoa* Bondar). In all three districts farmers revealed that no cultivar was resistant to these pests and that all the cassava cultivars were equally affected. When asked about pests in general, the farmers could not differentiate between damage due to diseases versus insects. The majority (91.1%) of the respondents recognised insect pests and diseases as important in their cassava fields. On the other hand, a few farmers (8.9%) thought that insect pests and diseases were not that important. Across the three districts, cassava mealybug was regarded as the most important pest by 71.0% of the farmers, whereas 15.0% of the respondents considered termites (observed by the farmers to occur during the dry season (April-October)) to be the least important. Though termites were not considered to be the major pest, they were regarded as important by 57.1% and 35.7% of the respondents in Samfya and Mansa districts, respectively. However, 7.1% of respondents in Mwense district regarded termites to be least important. Other pests that farmers mentioned were moles (*Fukomys anelli*) (6.5%), grasshoppers (4.3%) and cutworms (3.2%). Mealybugs were also mentioned as important pests in Mansa (32.3%), Mwense (30.8%) and Samfya districts (36.9%).

3.5. Sources of Cassava Cuttings for Planting

In Mansa district 40.0% of the farmers obtained cuttings for planting from MACO, while 36.1% of the respondents from the same district accessed cuttings for planting from their own fields. In Mwense district 41.5% of the farmers accessed cuttings for planting from fellow farmers and 26.7% of the farmers obtained cuttings for planting from MACO. In Samfya district, 39.0% of the farmers obtained cuttings for planting from their colleagues, while the rest obtained cuttings for planting from MACO (33.3%) and own fields (34.7%) [10] [11].

3.6. Management of Cassava Mosaic Disease

From the FGD and structured interview it was evident that not a single farmer had a control or management strategy for CMD. Since the disease was poorly understood by most of the farmers, corresponding management options were not mentioned. Some farmers practised field sanitation through the removal of affected leaves, although this was intended for the control of cassava mealybug.

3.7. Cassava Cultivars Grown

The cultivars were mostly (>90%) local landraces. Across the three districts, 58.1% of the respondents grew local cultivars, 19.8% grew improved ones, while 22.1% grew both local and improved cultivars. On average four to five different cultivars were grown on each farm. The most popular cultivars included Bangweulu (20.1%), Katobamputa (19.1%), and Kabala (11.1%) (Figure 3). Farmers indicated that the improved cultivars (Mweru, Chila, Kapumpa, Kampolombo and Tanganyika) were not readily available in their localities.

3.8. Farmers' Preferred Characteristics

Across the three districts, 37% of the respondents preferred cultivars that were high yielding, while 36% preferred early bulking cultivars (Figure 4) (early bulking according to the farmers was cultivars that were ready

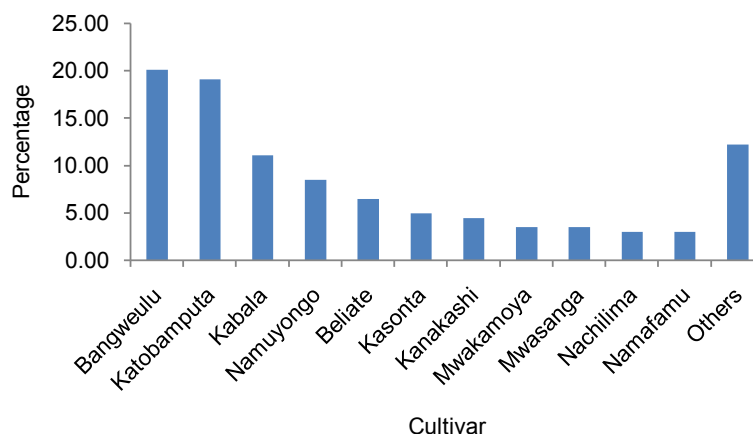


Figure 3. Cassava cultivars grown by the farmers.

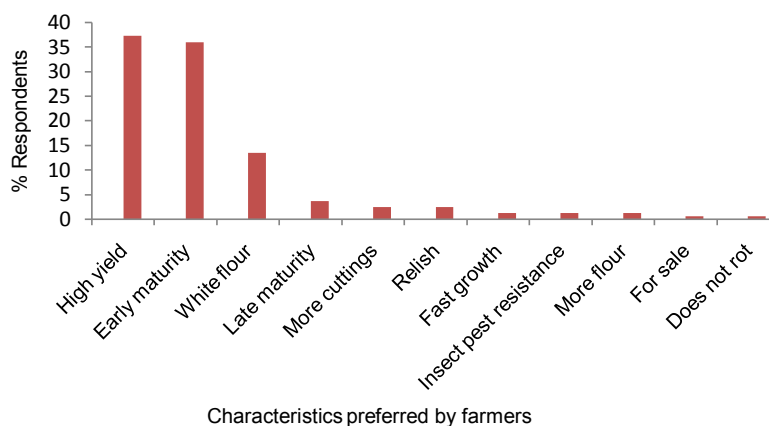


Figure 4. Characteristics of cassava preferred by the farmers.

for harvesting between 2 to 3 years after planting). Few respondents (13.4%) based their preference on the colour of cassava flour. Some respondents preferred local cultivars to improved ones as they produce better flour in terms of colour. A minority (2.4%) grew specific cultivars because the plants gave them more cuttings for planting and leaves for relish. Few respondents (1.2%) preferred cultivars with insect pest resistance.

3.9. Production and Marketing Constraints

During the FGD in each district, farmers highlighted a number of production and marketing constraints. The constraints included insect pests, lack of capital, late bulking genotypes, and lack of a market for cassava. In Mwense and Mansa districts, lack of capital was considered most important (Table 3), while in Samfya lack of planting material was ranked as the major constraint. However, for the structured survey 16% in Mansa district viewed lack of capital as a hindrance to cassava production as did 52% of the respondents in Mwense district. In contrast, 75% of the respondents in Samfya district regarded drought as an important production constraint.

For the marketing constraints, 41% of the respondents across all three districts considered distance to the market as a major constraint. About 32% of the respondents felt that lack of transport to move cassava produce to the market was a problem. Poor roads were considered by 21.7% of the respondents as being one of the marketing constraints. Very few famers (4.3%) regarded lack of a market for cassava produce as a problem.

3.10. Cropping System

In most of the farmers’ fields, cassava was intercropped with maize (*Zeamaydis*), groundnut (*Arachis hypogaea*) or common bean (*Phaseolus vulgaris*). Field observations showed that most of the farmers grew maize for food

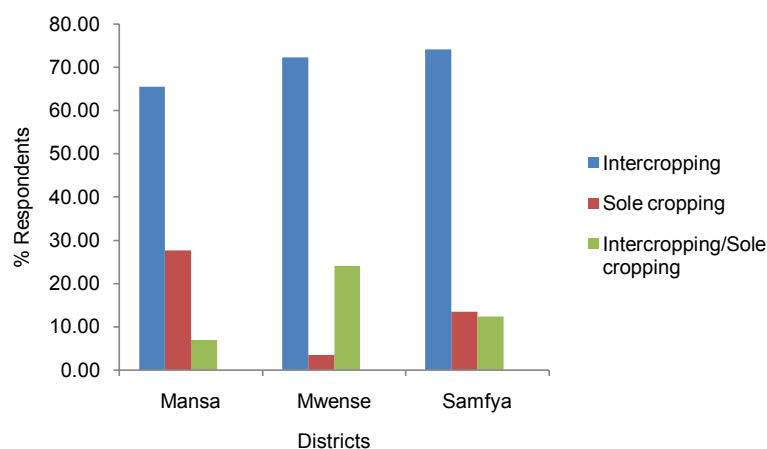
Table 3. Ranking of cassava production constraints identified during the focus group discussions held in three districts of Luapula province, Zambia (2009).

Constraint	Farmers' score* per district		
	Mwense	Mansa	Samfya
Capital	1	1	7
Late maturing	-	4	-
Market	6	3	-
Insect pests and diseases	3	5	3
Cassava cuttings	4	-	1
Shortage of labour	-	2	6
New varieties	-	-	4
Extension information	-	-	2
Transport to market	5	6	-
Drying of cassava	2	8	-
Low soil fertility	-	-	5
Implements	-	7	-

* = denotes rank of constraint; 1 = most pressing constraint; 8 = least pressing constraint.

security. Since the local cassava cultivars took long (2 to 3 years) to give appreciable yield, maize and other crops served as the immediate food source. A large proportion of the farmers (65.5%) in Mansa district intercropped cassava with either maize, common bean or sweet potato (*Ipomoea batatas*). About 27.6% cultivated sweet potato alone, while 6.9% practised both systems (intercropping and mono-cropping) (Figure 5).

In Mwense district there were more farmers (72.4%) intercropping cassava than in Mansa district. However, few farmers (3.4%) grew cassava alone. In Samfya district, intercropping (83.9%) was the most practiced system followed by mono-cropping (9.7%). For farmers practicing cassava mono-cropping the reason given was that intercropping affected root development of cassava especially when harvesting sweet potato or groundnut.

**Figure 5.** Cropping system practised by farmers in samfya, Mansa and mwense districts.

4. Discussion

The findings of the study revealed that the farmers did not know CMD as a disease in spite of its presence in most of the fields. Farmers associated CMD with mealybug infestation. The lack of knowledge of CMD by the farmers could be attributed to perceived damage to cassava plants. The susceptibility of improved varieties and

landraces to CMD and other pests could be because the cultivars were not specifically bred for pest and disease resistance. The four officially released varieties (Mweru, Tanganyika, Kampolombo and Chila) were specifically bred for high yield although some are tolerant to pests and diseases. In addition, the failure by the majority of the farmers to recognise CMD as a disease necessitates effort on the part of researchers and extension officers to educate the farmers on diseases of cassava.

Technical support from the MACO and extension was almost non-existent in the three study areas. The few extension officers that participated in the group discussions were also ignorant of the disease. For the farmers to recognise CMD symptoms on leaves or differentiate between diseased or healthy cassava plants, requires properly trained extension officers both public and private. The level of education may have contributed to the poor understanding of the disease as most of the respondents were semi-literate. Although high CMD incidence (61.2%) was recorded, the disease was not recognised by the majority of farmers. This is contrary to studies in Kenya where 88% of the farmers recognised CMD as a disease of their crop [12]. Studies by Muimba-Kankolongo *et al.* [4] estimated 50% to 70% yield loss per year in Zambia. As it has long been observed [2], the high levels of CMD incidence in the three districts surveyed require intervention by plant breeders to develop cassava varieties that are resistant to the disease.

Cassava mealybug (CMB) was regarded by all the farmers in the three districts as the major insect pest of cassava. However, no mention of whitefly (a vector of CMD) and cassava green mite was made. This could be due to the relatively small size of the insects. These observations are similar to findings reported by Poubom *et al.* [13] where farmers only mentioned large sized insects as the major constraints affecting cassava in West Africa. Similarly in Nigeria cassava green mite and CMB were considered to be diseases along cassava bacterial blight and Africa cassava mosaic virus disease while rodents, monkeys, and grasshoppers as pests [14]. The farmers indicated that termites and mealybugs caused the most damage to cassava plants. The importance of the mealybugs was recognised in all three districts as they are more easily noticed unlike whitefly.

There was no specific management of CMD by the minority of farmers who were aware of the disease. Although the farmers removed the affected top leaves (not specifically for CMD control), this clearly did not constitute effective management of CMD as detopping has been known to enhance symptom expression [15].

The majority of the farmers obtained cassava planting materials from either their own fields or from fellow farmers. The exchange of cassava cuttings is not restricted to within farming communities but also occurs across districts. Consequently planting materials are often infected with viruses, a situation which contributes to the high incidence of CMD. This practice of exchanging or getting cassava cuttings for planting is one of the ways in which CMD is spread [16]. In Mansa district, few farmers obtained cuttings from each other, probably because they farm in close proximity to Mansa Regional Research Station, which has a cassava multiplication programme.

The potential for viruses to spread through the planting materials is exacerbated by the fact that none of the farmers was aware that planting materials may act as sources of further virus infection in the field.

Farmers grew a number of cultivars in their fields, most of them low yielding and susceptible to pests and diseases. Though the cultivars were susceptible, farmers, often unknowingly, protected the crop against diseases and pests with very little outside technical assistance. However, the crop protection methods applied were based on “trial and error” with little impact on addressing the CMD problem.

Growing of more than one crop and at different times of the year assured the farmers of food security. This is the underlying reason why intercropping is practised in the three districts. Most of the farmers intercropped cassava with annual crops e.g. bean, maize, groundnut, sweet potato and bambara nut (*Vigna subterranea*). Intercropping of maize and cassava has been demonstrated to improve productivity per unit land area [17].

None of the farmers applied fertiliser although some of them acknowledged the low fertility levels of the cassava fields. This is similar to the practice of growing of cassava without fertiliser application among smallholder farmers in Democratic Republic of the Congo [18].

Although most of the farmers acknowledged the presence of insect pests, not a single farmer used pesticides. This has implications on the management of pests especially where cultural practice cannot contain pest problem. The high cost of pesticides in Zambia and lack of technical know-how, probably restricted smallholder cassava farmers from using chemical control methods. A similar observation was made in Côte d’Ivoire [19].

5. Conclusion

The study established that the farmers had little, if any, knowledge of CMD. High yield and early bulking were

some of the traits preferred by the farmers. Most of the farmers prefer growing landraces because they have the desired attributes and are adapted to low-input conditions. Farmers' preferred traits need to be included in the selection criteria of cassava breeding programmes to meet the farmers' needs and expectations. The farmers identified a number of constraints with regard to cassava production, namely capital, labour and drought. Therefore, farmers' preferences, such as high yielding and early bulking traits which were widely mentioned by the farmers, have to be given attention in breeding programmes. The participation of farmers in breeding programmes, from early to advanced stages, will facilitate the adoption of new improved cultivars.

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