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Cassava Farmer Field Schools

Resource material for facilitators in sub-Saharan Africa

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Cassava Farmer Field Schools

Resource materials for facilitators in sub-Saharan Africa

Prepared by:

Martin Ameu[a], Jennifer Hire[a], Daniel Kamalandua[c], Godrick Khisa[d], Celestin Koko Nzeza[b], Cyprien Ndambi Ndoki[bc] and Wilson Oduori Abangi[d]

[a] FAO consultant, Uganda
[b] FAO consultant, Democratic Republic of the Congo
[c] FAO consultant, Angola
[d] FAO consultant, Kenya

Coordinated by:

Marjon Fredrix and NeBambi Lutaladio
FAO, Plant Production and Protection Division
Rome, Italy

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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This field manual is the result of a cooperative effort of a team of scientists, technicians and farmers involved as facilitators in the FAO-assisted cassava farmers field schools in sub-Saharan Africa. It was prepared using information and experiences from Angola, the Democratic Republic of the Congo, Kenya and Uganda. The genuine contribution of each of the authors and co-authors of the country reports is gratefully acknowledged. The reports have drawn heavily on the practical experience of the existing networks of facilitators and farmers in each of the above countries. Their efforts and experiences which underpin this document are highly valued.

The manual was compiled by Ms Marjon Fredrix of FAO's Plant Production and Protection Division. It was reviewed by Kevin Gallagher and Manuela Allara of FAO and by Braima James (PhD) of the International Institute of Tropical Agriculture (IITA). Their feedback is most appreciated and has enriched the final version of the document.

Final editing and layout was done by Ruth Duffy.

Foreword

Most cassava farmers have years of practical experience and understand local conditions better than anyone else. However, there may be gaps in their knowledge of ecosystem processes, especially with regard to pests and their natural enemies, organisms causing diseases, and creatures that are small or not visible to the human eye. Managing pests and incorporating sustainable natural resource management into smallholder cassava production systems require a shift in extension from "teaching" to "learning"; this is particularly true for the many smallholder farmers that have little access to formal education, to government or private extension services, or to other information sources.

Providing support to farmers to improve their ecological literacy has been an area of attention and activity for many organizations, including the Food and Agriculture Organization of the United Nations (FAO). In the late 1980s, an education approach – the farmer field school (FFS) – was developed as part of an FAO IPM programme on rice in Asia, for farmers to learn about IPM (integrated pest management) for rice. At field schools, farmers are able to deepen their knowledge of agro-ecosystem processes, and test and validate practices that control pests and diseases and improve the sustainability of crop yields.

FFS is best suited for problems and opportunities requiring site-specific decisions or management practices. It is appropriate for issues that entail articulation of changes in behaviour within the farm enterprise, household and community, or among institutions at varying scales of interaction and for situations that can be improved only through development of location-dependent knowledge. The FFS process builds self-confidence (particularly for women), encourages group control of the process, and builds group and management skills. Thereby the FFS is a means to enable vulnerable farmers to create their own cohesive economic empowerment groups capable of venturing into collective, commercially-oriented endeavours and of interacting with service providers and market intermediaries. A good farmer field school process ensures the response to a concrete, immediate problem.

The application of FFS to cassava began in Africa in the late 1990s. The spread of new strains of the viruses causing cassava mosaic virus disease and, more recently, cassava brown streak disease, served as an entry point for promoting IPM and eco-friendly production. Field schools link up with programmes that distribute disease-tolerant cassava varieties and test them in multiplication fields. This learning-by-doing approach provides the opportunity for farmers to develop strategies to manage disease problems more effectively, while improving their cassava production practices.

FFS concepts have been found to be relevant across a number of sub-Saharan African countries – including Angola, the Democratic Republic of the Congo, Kenya, Sierra Leone and Uganda – in which the cassava FFS approach has been used and has empowered farmers with knowledge and skills, making them experts in their own fields, sharpening their ability to make critical and informed decisions, sensitizing them in new ways of thinking and problem solving and helping them learn how to organize themselves and their communities.

However, the skills – technical, methodological and organizational – of a facilitator are central to the delivery of a quality FFS. Investing in facilitator training is essential. This FFS manual is intended for extension or research staff involved in field-level farmer training, and for farmers or technical staff trained as FFS facilitators. The objective is to equip facilitators with the basic principles of FFS methodology and principles in order to enhance their capacity to provide training in a range of topics that include pre-FFS activities and the FFS itself. The facilitators are expected to follow a harmonized approach, considering that the FFS concept is based on an innovative, participatory, learning-by-doing approach, whereby the field is the primary learning stage: the farmer is the expert, the extensionist acts as facilitator and catalyst.

This manual is part of FAO's effort to promote sustainable intensification of smallholder crop production. It has been developed from experiences with farmer field schools in four African countries. It provides background information on the FFS approach and a compilation of field exercises as they are used in cassava farmer field schools. The guide is intended for use by farmer field facilitators during training of facilitators or during the farmer field school itself. We trust that capacity-building of small-scale cassava producers through FFS will help to realize cassava's full potential as a "21st century crop".

Why this guide?

Cassava is an important crop in the African region, contributing to the food security of many households in rural areas and cities. Cassava can be used in a wide array of industries, including food manufacturing, pharmaceuticals, textiles, plywood, paper and adhesives, and as feedstock for the production of ethanol biofuel.

Cassava is perceived as a poor man's crop, requiring few external inputs. In recent years, new strains of two viral diseases (cassava mosaic disease [CMD] and cassava brown streak disease [CBSD]) have affected production at field level in sub-Saharan Africa. They continue to spread into new areas in Eastern and Central Africa and strategies have been implemented to manage them. Two key recommendations for control of both CMD and CBSD are strict enforcement of quarantine procedures during international exchange of cassava germplasm, and adoption of appropriate cultural practices, especially the use of resistant or tolerant cultivars and virus-free planting material.

These strategies are dependent on: ongoing research efforts to generate new varieties that better resist the new strains; efforts to multiply and distribute healthy cassava planting materials, educating farmers on diseases and other aspects of cassava production and post-harvest handling; and raising awareness to develop appropriate actions at policy level.

This guide brings together experiences of four countries: Angola, the Democratic Republic of the Congo, Kenya and Uganda, with a focus on cassava farmer field schools. Farmer field schools provide a platform for farmers to learn and exchange information, increasing their knowledge and strengthening their decision-making skills. Farmer field schools are used in a range of fields; this guide brings together experiences and examples specific to cassava. Country reports were prepared by: Jennifer Hire and Martin Ameu (Uganda); Celestin Koko Nzeza (Democratic Republic of the Congo); Cyprien Ndambi Ndoki (Democratic Republic of the Congo/Angola); Daniel Kamalandua (Angola); Wilson Oduori Abangi and Godrick Khisa (Kenya).

The country reports form the basis for this document, which comprises two parts. The first part summarizes relevant background information on cassava and experiences with farmer field schools in the four countries; the second is a compilation of farmer field school exercises with a focus on cassava. The document is intended for use both during FFS-facilitator training and during the farmer field schools themselves. Facilitator skills need to be developed in training sessions specifically dedicated to farmer field schools. The exercises are intended to provide inspiration and background information; they can – indeed, should – be adapted to suit the local context. They are in addition to other exercises and activities that are part of farmer field schools but which are not detailed herein.

List of acronyms and abbreviations

AESA	Agro-ecosystem analysis
BBW	Banana bacterial wilt
CBSD	Cassava brown streak disease
CMD	Cassava mosaic disease
DAP	Days after planting
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer field school
FP	Farmer practice
GBV	Gender-based violence
GDP	Gross domestic product
H/H	Household
HIV	Human immunodeficiency virus
IITA	International Institute of Tropical Agriculture
IPM	Integrated pest management
IPPM	Integrated production and pest management
LP	Local practice
M&E	Monitoring and evaluation
NGO	Non-governmental Organization
PHAST	Particiaptory hygiene and sanitation transformation
PLWHA	People living with HIV/AIDS
Q&A	Questions and answers
SWASH	Safe water and sanitation hygiene
ToF	Training of facilitators
ToT	Training of trainers

PART 1

BACKGROUND INFORMATION ON CASSAVA AND FARMER FIELD SCHOOLS

1. Importance of cassava

Agriculture continues to be important in the economies of most sub-Saharan countries, contributing significantly to the gross domestic product (GDP) and providing food and employment to the majority of the population. Cassava was introduced into Africa in the 1800s. It rapidly spread throughout the African region and today plays an important role in both household and national food security. The ability of cassava to grow well in marginal environments and to resist periods of drought, as well as its flexibility in the cropping and food system, make it an attractive crop for many farmers in Africa.

Cassava production does not always meet demand, and increases in production will help improve food security, especially in areas where cassava is the preferred staple food. If the cassava value chain is developed, the demand for cassava will increase. Cassava can then help families to generate cash income.

The world's biggest producer of cassava (in 2010) was Nigeria, followed by Brazil, Indonesia, Thailand, the Democratic Republic of the Congo and Angola. Uganda was in 11th place. In Angola and the Democratic Republic of the Congo, cassava is ranked first among all agricultural crops in terms of quantity produced and value represented. In Uganda, cassava is second (after banana/plantain). Cassava is less important in Kenya, where in terms of quantity produced it is ranked 16th. Table 1 summarizes 2010 cassava production in the four countries (FAOSTAT).

TABLE 1
Production, yields and area harvested for cassava in Angola, the Democratic Republic of the Congo, Kenya and Uganda

Country	Production (tonnes)	Yield (kg/ha)	Area harvested (ha)
Angola	13 858 700	13 241	1 046 610
Democratic Republic of the Congo	15 049 500	8 114	1 854 750
Kenya	323 389	5 252	61 573
Uganda	5 282 000	12 727	415 000

Within each country, the importance of cassava varies by region:

- **Angola.** Each farming family has a cassava plot. Compared with the average for sub-Saharan Africa, yields are generally high (around 12.8 tonnes/ha). Uigi and Malange provinces have the biggest areas cultivated with cassava.
- **Democratic Republic of the Congo.** Cassava is the staple food for most of the population. Production levels decreased in the 1990s by about 20 percent for several reasons, for example, the upsurge in pests and diseases, lower-performing agricultural practices, the reduction in soil fertility, the decline of the agricultural extension and education system, and the prevalence of socio-economic and political conflict.
- **Kenya.** Cassava is grown virtually throughout the country. The western, coastal and semi-arid (eastern) regions have the highest production in that order.
- **Uganda.** The east and the north are the leading cassava-producing regions, and for most households in these two regions, cassava is the principal crop. However, production of cassava is also expanding rapidly in the central region.

CASSAVA AND FOOD SECURITY

Cassava plays an important role in household food security, especially in rural communities. It is usually a subsistence crop grown for food and only the surplus is sold to generate cash income. The growing cycle of cassava is long, from 12 to 18 months for many varieties, while some local varieties can take 24 months to mature. Cassava can develop and grow under marginal conditions with low soil fertility and can tolerate periods of drought. In some places it is the preferred staple, while in others it is planted as a crop providing food to supplement other (preferred) staples, such as cereals. The tuberous roots are harvested as needed, as they cannot be stored at length; if processed into chips or flour they can be stored for longer. However, they can be kept for considerable periods in the field after maturity, particularly in the case of local varieties.

In several African countries, notably the Democratic Republic of the Congo, Cameroon, Liberia and the United Republic of Tanzania, young cassava leaves are popular as vegetables. Selling cassava leaves provides additional household income, especially for people living around urban centres. In many cases, cassava is perceived as a poor man's crop, a famine-reserve crop; it has the advantage of requiring few external inputs.

Cassava roots and leaves are used for human consumption, following procedures to remove the cyanide in the plant. Cassava can also be used as animal feed, as well as in industrial processes (starch and glue). However, these uses are still limited in most African countries.

- **Fresh cassava.** Fresh roots are consumed by both urban and rural consumers. Cassava roots are perishable, which limits the markets for the fresh product. Leaves of cassava are also eaten in some areas.
- **Cassava flour.** Cassava roots can be processed into dry chips to allow for longer storage. These chips can later be reduced into flour for human consumption (e.g. *foufou*). Also *gari*, a food produced from cassava, is popular, especially in West Africa. *Chikwangue*, made from fermented cassava flour is popular in the Democratic Republic of the Congo. Most cassava flour is used as human food, but it can also be used for industrial purposes (starch and glue). However this use is limited so far. Commercial processing of cassava roots is limited.
- **Cassava for animal feed.** Cassava is widely used for feeding pigs, cattle, sheep and poultry. Dried peels of cassava roots are fed to livestock and raw or boiled roots are mixed with protein concentrates, such as maize, sorghum, palm kennel and mineral salt, to feed livestock. Cassava can also be processed into chips and then used as animal feed.

Traditional uses of cassava – examples from Kenya

Fresh roots are roasted and boiled for consumption in all the growing areas. In Nyanza and the Western provinces of Kenya, roots are also peeled, chopped into small pieces, dried and milled into flour for *ugali*, usually combined with a cereal (maize, finger millet or sorghum). In the Coast Province, cassava leaves are used as vegetables, while in Machakos and Kitui, cassava roots are used as a snack.

Nyanza Province produces most of the cassava consumed in the country and the crop is culturally accepted by the local population. The communities living in this area utilize the crop for various traditional dishes. The Central Province, on the other hand, produces the least, mainly because the local communities consider it a non-prestigious crop. What little is produced in this area is used as cattle feed.

Kenya report on cassava FFS

POTENTIAL TO DEVELOP CASSAVA VALUE CHAINS

Cassava has the potential to become a crop that not only has an important role in providing food security to rural households, but which generates income by developing value chains. The development of cassava value chains would help create markets, making it more attractive for farmers to invest in growing and marketing the crop. Table 2 summarizes the products and uses of cassava in Uganda, their current importance and potential for the future.

TABLE 2
Uses, status and potential of cassava production in Uganda

Product and uses	Current importance	Potential growth – low investment	Potential growth – high investment	Domestic potential	Export potential
Fresh roots	Very high	Low	Low	Very high	Very low, mainly due to its bulkiness and perishability
Chips as a raw material for various flour grades	High	High growth potential	High growth potential	High growth potential	Moderate
Cassava flour for human consumption (sole or composite flour)	Very high	High growth potential	High growth potential	Very high growth potential	Moderate growth potential, already exported to neighbouring countries (Sudan, Kenya and Democratic Republic of the Congo)
Industrial uses in bread making and confectionery	Low	High growth potential	High growth potential	High	Low
Industrial uses as ingredient in animal feed (pigs/ chicken)	Low	High growth potential	High growth potential	High	Low
Industrial use as raw materials for alcohol production	High for both traditional and industrial brewing	Very high growth potential	Very high growth potential	High	Moderate
Industrial uses as starch	Low	Low growth potential	Low growth potential	Moderate	Moderate

Uganda report on cassava FFS

FACTORS INFLUENCING CASSAVA VALUE CHAIN DEVELOPMENT

Several constraints have been identified and need to be addressed to realize the potential for further development of cassava production and value chains:

- Production level constraints:
  - Use of inferior and low-yielding varieties
  - Lack of good quality planting materials
  - Pests
  - Diseases (see p. 8)
  - Lack of healthy planting materials of disease-tolerant/resistant varieties
  - Diminishing access to land and declining soil fertility
  - Lack of credit facilities and farm inputs
  - Labour bottlenecks (shortages and/or high costs depending on locality)
  - Poor cultural practices

- Processing and utilization constraints:
  - Poor processing equipment, technologies and methods
  - Lack of incentives for entrepreneurship and investments in processing
  - Poor quality and limited range of processed products
  - Bulkiness and perishability of roots
  - Narrow range of processed products
- Market constraints:
  - Lack of market information
  - Poor linkages between market and producers
  - High cost of bulking and transportation
  - Spoilage, especially for fresh roots and dried chips
  - Competition from grain in the food and animal industry
  - Lack of incentives and institutional support for market development
  - Poor quality products
  - Underexploited market opportunities in the industrial sector
  - Poor price incentives
  - Poor infrastructure (roads and storage facilities)
  - High transportation costs
- Policy and institutional constraints:
  - Lack of incentives for investment in the cassava industry
  - Lack of enabling policy environment for development and investment
  - Lack of standards and regulations on cassava products
  - Limited national resources allocation for development of the subsector
  - Lack of credit facilities for commercialization activities

Cassava mosaic disease and cassava brown streak disease

CMD: cassava mosaic disease

A new strain of cassava mosaic disease (CMD) appeared in the 1990s in Uganda and existing varieties had no resistance. The strain spread rapidly in the Eastern and Central African region, and continues to affect new areas with cassava yields seriously affected. Research programmes have developed new varieties with resistance or tolerance to the new strain of CMD, and efforts continue to multiply planting materials and make them available to farmers.

In Kenya, CMD had been observed for over a century without being considered a major problem. In the mid-1990s, the situation changed dramatically when an unusually severe form of CMD caused yield losses of 80–100 percent in farmers' fields. Between 1995 and 1998, annual yield losses totalled approximately 150 000 tonnes to a value of USD 10 million. In Nyanza Province alone, yields dropped from 7–10 tonnes/ha to under 3 tonnes/ha, while the area under production decreased from 25 000 to 17 000 ha. The disease initially spread from Uganda to the neighbouring Kenyan districts of Teso and Busia, and has since spread to other districts in Western and Nyanza provinces, forcing farmers to abandon cassava cultivation. The local varieties have all been devastated, resulting in markedly reduced incomes for affected farmers and general food insecurity at household level.

CBSD: cassava brown streak disease

More recently, a new strain of cassava brown streak disease (CBSD) occurred in the United Republic of Tanzania, and started to spread to areas where the disease had not previously posed problems. CBSD has mostly occurred in coastal areas in Eastern Africa, but is now spreading inland as well. It affects the root tubers and can result in serious production losses. Some new varieties with resistance/tolerance have been identified and more are under development in research centres.

Responses to these diseases require efforts from the research community to develop new and increasingly resistant materials. Efforts are being made by a large range of organizations and national systems to multiply healthy cassava material and to provide farmers with the new material. Systems with primary, secondary and tertiary sites for multiplication have been set up in countries where the problems are most urgent. Farmers also need additional knowledge and skills to better recognize the diseases, understand basic biology and identify the spread of the diseases in order to be able to better manage them at field level.

Uganda and Kenya country reports on casava FFS

2. Experiences with farmer field schools on cassava

Farmer field schools (FFSs) were first developed in 1989 in Indonesia, focusing on integrated pest management (IPM) in rice. They bring together groups of farmers to strengthen their knowledge of and skills in agro-ecosystems, in order that they may make informed decisions on field management. They provide a space for hands-on practical learning in the field for the duration of a cropping season. Following the early experiences in Indonesia, the FFS approach spread to other countries and a broader range of topics were covered. FFSs came to Africa in the mid-1990s and are used in an increasing number of countries.

FFSs help farmers to validate and test local knowledge, as well as scientific knowledge generated outside the community. A process of sharing and critical analysis helps farmers to adapt new information and technologies to their local situation. The FFS approach places emphasis on group work and aims to strengthen collaboration within and between groups; it focuses on interaction with

Basics of a farmer field school

A farmer field school (FFS) is a season-long non-formal education programme conducted on a crop in farmers' fields. The activities follow the different developmental stages of the crop and their related management practices. The process is learner-centred and participatory, and relies on an experiential learning approach, entailing the following:

- Involvement of a group of farmers (20–30 persons)
- Field-based experience
- Duration of one cropping season (from seeding/transplanting to harvest and possibly through to post-harvest and marketing in annual crops)
- Regular meetings between FFS participants during the cropping season
- Agro-ecosystem analysis (AESA) activity conducted in the field
- A study (by participants) comparing improved and conventional practices
- Other field studies, based on local field problems
- Special topics (topic of the day) dealing with specific issues selected by participants
- Group dynamics and team-building exercises to enhance cooperation and collaboration
- Experiential, participatory and learner-centred methods based on non-formal education
- Guidance from at least one facilitator offering experiential learning opportunities (not delivering top-down instructions)

FFSs in Uganda

The farmer field school approach in Uganda was introduced in 1999 and to date just over 4 000 FFS have been implemented in a variety of contexts, such as:

- integrated production and pest management (IPPM) for different crops (e.g. cotton, sweet potato, tomato and cabbage);
- land and water management;
- disease control (e.g. banana bacterial wilt [BBW] and late blight in potatoes);
- food security (farmer innovation, livestock management, self-reliance of refugees); and
- rehabilitation of agriculture in post-conflict communities.

extension services and research. Since FFSs began over 20 years ago, more than a million farmers worldwide have joined FFSs covering an increasing range of topics. Many organizations have embraced the FFS as an effective participatory learning approach. Impacts include policy change, better and more cost-effective production, improved livelihoods, and stronger farmer organizations and networks.

FFSs in Africa cover a broad range of topics, including cassava and cassava-based farming systems. Overcoming production constraints at farmer and community level is a major entry point for these FFSs.

Kenya and Uganda began FFS activities in the 1990s, while the Democratic Republic of the Congo and Angola followed in the 2000s. Each country now has the capacity to implement FFSs on a range of topics, and has substantial experience in FFS implementation. The number of FFSs organized in each country ranges from hundreds to several thousands, involving a range of stakeholders with support from organizations, governments and local communities. Policy support for FFSs and institutionalization vary from country to country.

CREATING CAPACITY FOR FFS

The skills – technical, methodological and organizational – of a facilitator are crucial to delivery of a quality FFS. It is necessary to invest in training facilitators and each country has made efforts to this end, although models differ slightly. Training covers a range of topics encompassing pre-FFS activities and the FFS itself. The Democratic Republic of the Congo developed cassava-focused FFSs in Kisantu (Province of Bas Congo) and Bateke Plateau (Province of Kinshasa).

GRANTS FOR FFS IMPLEMENTATION

In the four countries, FFS groups receive a grant to directly manage FFS activities (this is not the case in all FFS programmes). The grant covers the cost of learning materials for the FFS, support preparation of the FFS study field and other field inputs, exchange visits, innovation funding and support for external facilitators. In the Democratic Republic of the Congo, support for innovations was intended to help set up a multiplication field for healthy cassava planting materials, but evolved to include other income-generating activities that can help sustain the group after the FFS.

Cassava FFSs in the Democratic Republic of the Congo – training model

In 2002, the Democratic Republic of the Congo initiated cassava FFSs in Kisantu and on the Bateke Plateau. The impact of CMD was strong, and farmers were experiencing problems with cassava production. Cassava multiplication programmes were ongoing and aimed to provide farmers with more resistant cassava varieties. FFSs were set up to strengthen farmer groups and to increase knowledge and understanding of the various production problems encountered; they brought together a range of stakeholders.

Two sites were selected (Kisantu and Bateke Plateau) and in each site, around 20 FFS groups were organized at local level. Each FFS group identified two farmer-facilitators, and resource persons (master facilitators) were selected to train the farmer-facilitators and to support FFS implementation.

Training was field-based, from soil preparation through to harvest and processing. Non-formal adult education methods were adopted and organized on four levels:

- Intensive workshops for the resource persons (before the start of activities, and then at regular intervals)
- Monthly training of farmer-facilitators (3 days/month)
- Weekly meetings of FFS groups
- Training for the larger associations

A range of topics were covered:

- Participatory rural appraisal
- Participatory research
- Curriculum development
- Design of FFS field studies
- Agro-ecosystem analysis
- Group dynamics exercises
- Special topics
- Facilitation skills
- Non-formal adult education principles
- Monitoring and evaluation of field activities

Uganda – FFS grants

Initially a grant of USD 500–600 is provided to an FFS to cover running costs, including the logistics of training. At the end of the season, the beneficiary FFS remits half of the grant to the FFS network, constituting a revolving fund. The revolving fund is used to establish and operate other semi-self-financed FFSs. The FFS is thus placed in the hands of the farmers, leading to sustainability and farmer ownership of the approach. The revolving fund is accessed by the FFS through applications made to the FFS network. Facilitators provide support – on the basis of the network guidelines – to ensure that the correct procedures are followed throughout the application process and approval of funds. The facilitator is responsible for reviewing the proposals before funds are granted.

TABLE 3
Results of cassava FFSs in the Democratic Republic of the Congo, 2004

Site	Soil preparation	Cassava root yields (kg/ha)	
		Local practice	*IPPM*
Kisantu	By hand, ridges	8 700	15 050
Mbankana	Animal traction	2 720	9 600
Mbankana	Tractor	2 220	7 600

RESULTS OF CASSAVA FARMER FIELD SCHOOLS

FFSs help farmers to improve their knowledge of and skills in field management, leading to improved production of cassava. They also help farmers to become better organized and to network with other groups.

In the Democratic Republic of the Congo, cassava FFS groups set up studies to compare the local practice of cassava growing with integrated production and pest management (IPPM) of cassava. In the IPPM plots, farmers tried out new varieties and cultural practices that differed from the local practices, including: spacing of plants, incorporation of vegetative material (e.g. weeds) into the soil during land preparation and pest and disease management (e.g. uprooting of plants affected by CMD). They also compared different soil preparation methods. Table 3 summarizes the differences in yield between different sites with different types of soil preparation. While soil preparation techniques differed, there were also other factors which varied between plots. The differences in yield cannot, therefore, be attributed soley to soil preparation.

The FFS study fields are not research plots, rather a space to try out different field management practices and observe the differences. For example: cassava plants develop better on ridges (preparation by hand) than in soil prepared by animal traction; but animal traction goes deeper than a tractor and, consequently, produces better results.

Angola – gains of the FFS (cassava and other crops)

- **Farmer level.** Farmers increase production thanks to improved knowledge and skills, diversification of the cropping system, integrated land management, increased yields and improved benefits when applying knowledge gained. They gain access to microcredit, improve their living standards, develop relations with other farmers and gain self-confidence.
- **Municipal level.** Decentralized programmes can be implemented to combat poverty and hunger. Groups are organized and information is disseminated.
- **Provincial level.** The gains are such that provinces with direct FFS experience advocate that they should be expanded to all provinces.
- **National level.** The value of the FFS is recognized and it is to be integrated into the national extension programme in an effort to address poverty and hunger.

KEY LESSONS LEARNED

Some lessons learned may be applied to the four countries and are also useful for future activities elsewhere:

- Quality facilitators are fundamental for sustainable cassava FFS/IPPM groups and for creating networks with a vision for the future linking FFS groups and farmer graduates.
- Networking and sharing between FFS groups is necessary – farmers can learn from each other.
- Learning must be hands-on and practical, giving farmers the opportunity to see and experiment with different land preparation methods, planting, weeding, harvesting, utilization and value-added options.
- Understanding diseases and recognizing the importance of healthy planting materials is essential, as the phenomenon of cassava virus diseases (CMD, CBSD) rises. Phytosanitation – the uprooting of diseased materials – is something that farmers are often reluctant to do. The FFS can address this in different ways: setting up a multiplication plot and practising phytosanitation; and being active in the community to ensure that phytosanitation is practised; and making healthy cuttings available. This is key to obtaining sustainable cassava production.
- Farmer networks must be widened to link with other areas and regions for exchanges, workshops and meetings.
- Linkages with research are needed to continue to address problems at farm level – FFS groups, in collaboration with extension, are potential partners for research.
- Awareness raising and information dissemination on alternative uses for cassava are required to change current perceptions of cassava as a poor man's crop.
- The creation of enabling policy frameworks on cassava is important to tap the crop's potential.

POTENTIAL TO FURTHER DEVELOP FFSs ON CASSAVA

FFSs on cassava provide an opportunity for increasing production and productivity and enhancing the processing, utilization and marketing of cassava, especially among the rural households that rely on cassava for food and income. Especially in areas where cassava is the preferred staple food, increasing production can contribute to better household food security. If the cassava value chain is developed, the potential to grow cassava will increase, permitting households to generate cash income.

The FFS approach uses hands-on learning methodologies that allow farmers to improve knowledge, test and validate new technologies and improve decision-making skills. Effects can be observed after an FFS, as farmers apply new skills in

their fields. Women are well represented in many cassava FFSs – a reflection of their importance in agriculture, particularly in cassava. The FFS provides a space for women to improve their knowledge. Having two distinct cropping seasons per year allows FFS groups to follow the crop under different conditions. FFSs also encourage group cohesion, collaboration and networking at farmer level.

In the four countries, there are already well-trained facilitators, farmer-facilitators and FFS farmers ready and available to continue and expand FFSs on cassava.

There are also constraints. For farmer-facilitators, finding the time to join in regular training sessions (up to three days a month) is a potential problem, especially when they are women with numerous other responsibilities in the family. Coordination of FFS activities and programmes sometimes poses problems, especially when institutionalization processes are absent or in the early stages. Successful pilot activities are not always scaled up due to lack of funding from external donors or the government.

To realize the potential and overcome some of the constraints, appropriate policies and support are needed:

- Applied research must be continuous to ensure that, for example, varieties tolerant/resistant to CMD and CBSD are developed and made available to farmers. FFS groups can work in partnership with research to validate and adapt the materials and technologies proposed. Research activities should look at the improvement of cassava's entire value chain, not just the production aspects.
- FFS approaches must be integrated into (government) programmes and funds made available. In some countries, FFSs are integrated into extension services, facilitating expansion of the approach; cassava can be a focus of the FFS in areas where it is a priority crop. Various organizations that support cassava development programmes can incorporate the FFS approach into their programmes where appropriate.
- FFS groups, farmer-facilitators and FFS networks have a lead role to play in defining priorities and activities related to cassava (and other major issues), and in implementing them in partnership with local NGOs, government structures, international and national research organizations and institutions. Organizations need to be aware of and willing to work with FFS networks.

An enabling policy framework could address these issues, while promoting development of the cassava value chain and acknowledging the communities' role in furthering agricultural development. In the four countries, some elements to enable policies are in place, but others require further work.

Uganda – Cassava development policy

The cassava development policy is intended to facilitate increased commercialization of cassava and cassava-based products in domestic and export markets. Moreover, it should advance awareness of fair trade, consumer health safety protection and regulations for the cassava subsector.

Specific objectives:

- Promote production and multiplication of high quality and certified cassava planting materials
- Provide advisory/extension services to all stakeholders involved in cassava production and the value chain
- Support environmentally friendly and sustainable methods for management of cassava pests and diseases
- Support and promote the use of appropriate post-harvest processing and handling technologies by all stakeholders in the cassava chain
- Generate information and establish database information flow among stakeholders in the cassava subsector
- Facilitate industrial use of cassava and cassava-based products to expand and diversify incomes
- Promote educational campaigns on the nutritional value of cassava and cassava-based products aimed at increased consumption of these products
- Enhance sustainable production of cassava to meet both domestic and export market demands
- Support and facilitate the development of market systems and infrastructure for the cassava subsector

The policy framework at international and macroeconomic levels is based on the need to guide the development of the cassava subsector, and the policy is based on the following principles:

- Support research to generate high-yielding cassava varieties and technologies for the value chain
- Put in place suitable systems and infrastructure for improved delivery of services
- Emphasize improvement and capacity-building of all stakeholders for increased supply of improved quality of cassava and cassava products
- Establish systems for developing cassava standards and quality assurance and safety enforcement
- Support gender equality for access to resources and benefits from investments made in the subsector
- Promote educational campaigns to increase domestic utilization and consumption of cassava products that substitute imported ones
- Support public and private sector investment to develop the value chain
- Create databases and information systems to guide investments and trade in the subsector
- Facilitate competitive and fair trade practices
- Regulate all stakeholders in the cassava value chain to realize a profitable subsector

PART 2

CASSAVA FARMER FIELD SCHOOLS

Facilitator resource materials

1. Introduction

Part 2 provides background information on the FFS approach and a compilation of field exercises as they are used in cassava field schools. The exercises are drawn primarily from experiences in Angola, the Democratic Republic of the Congo, Kenya and Uganda, but also build on the larger field school experiences of other programmes. The annexes provide additional background information on facilitation, as well as examples of curricula in use for cassava FFSs.

The exercises are practical and mostly focused on cassava, although more general exercises are also included. Cassava is a long-duration crop with a growing cycle of 12–18 months or more. This means in practice that cassava FFSs often set up several field studies, including a basic comparison of local farmer practices with integrated approaches, plus an additional set of studies elaborating specific themes identified with FFS participants during the preparation phase.

The field study designs and exercises in the guide are intended as a source of inspiration, to be used by facilitators and adapted to local conditions. New exercises may be added as deemed necessary. The exercises can be used both by FFS facilitators with basic FFS skills and who are starting work on cassava and by experienced facilitators for Training of Facilitators (ToF). They may be applied to different models in use, from season-long, full-time training to zigzag ToF with associated FFSs.

The background information is presented as follows:

2. FFS approach:	Background
3. FFS preparation:	Exercises
4. FFS implementation:	4.1 Field studies
	4.2 IPPM exercises
5. Farming as a business	Exercises
6. Group dynamics	Exercises
7. Evaluation	General information
8. Post-FFS activities	General information

2. FFS approach: Background

CONCEPT

The farmer field school is a participatory approach for learning, building on principles of non-formal adult education. The FFS is a school without walls that takes place in a field where a crop is grown and where farmers meet regularly to develop their capacities to analyse and solve their individual and shared problems. The following elements are prerequisites for an FFS:

- FFS field for learning and comparison
- Group of farmers (learners)
- Individual and shared learning objectives identified and defined
- Programme for FFS meetings, curriculum
- Organization of the FFS group
- Trained facilitator with technical skills to guide farmers' learning experience

HISTORY

The farmer field school approach was first developed in Indonesia in 1989. The first FFSs focused on educating farmers in integrated pest management in rice. Misuse of pesticides had disrupted natural biological control in rice ecosystems, leading to increasing problems with pest outbreaks and negative effects on the environment and human health. FFSs helped farmers to strengthen their knowledge of the rice ecosystem and to make improved field management decisions in a context of mutual learning and community participation. The FFS approach for rice was soon after introduced in other Asian countries. An increasing number of countries have since adopted the FFS approach for a broad range of topics and in a variety of contexts.

MAIN OBJECTIVES OF THE FFS

- Strengthening of farmer capacity to identify and resolve field problems occurring in specific conditions
- Strengthening of communities' organizational capacity with consolidation of social cohesion
- Development of techniques adapted and appropriate to farmers' local conditions (adaptive management)
- Creation of a critical mass capable of taking leadership and initiating sustainable community development

Basic principles of FFS

- The field is the first resource for learning.
- Experimentation is the basis for learning.
- Decision-making guides the learning process.
- Learning occurs during a full cropping season (complete cycle).
- The content of the training (curriculum) is based on the local conditions of the FFS supported by innovations and inputs from outside.

The FFS is a space for educating farmers, and learning is central to the FFS. The above principles must guide this learning. The content of the training depends on the problems arising and can thus evolve over time and space in line with the local ecology. Farmers' knowledge and experiences are valued and essential inputs for learning in the FFS.

IPM, IPPM AND FFS

In Asian rice systems, integrated pest management (IPM) was the entry point for the FFS. As the FFS spread to other regions, IPM broadened to integrated production and pest management (IPPM). The FFS enhances understanding of complex agro-ecosystems and strengthens farmer knowledge. Farmers understand different elements in the agro-ecosystem, the relations between those elements and how they influence each other; they appreciate the ecosystem services that are being delivered, and learn how to make informed decisions to manage systems in an optimal way.

The four principles of IPPM in the context of FFS

1. **Grow a healthy crop.** This covers a wide range of cultural practices: soil preparation, variety selection, planting, weeding and harvesting. A healthy crop is better able to withstand pests and diseases and can compensate for damage without leading to crop losses.
2. **Observe crops regularly.** This is the basis for informed crop management decisions: the farmer takes into account the different elements of the agro-ecosystem, understands the relations between the different elements and analyses the situation
3. **Conserve natural enemies.** Insects that may feed on plants, but natural enemies that feed on these insects, providing a free ecosystem service: natural biological control. Understanding the importance of and conserving natural biological control is a key element of IPM.
4. **Farmers are experts in their own field.** Farmers are the key decision-makers and they need knowledge and understanding of the whole agro-ecosystem to make informed decisions. Farmers become experts in their fields by exchanging information, testing and comparing different approaches.

FFSs are knowledge intensive – they merge science-generated information with farmer know-how. The FFS is a space to test and validate new ideas, and to debate, analyse and understand underlying knowledge to enhance decision-making skills.

IPPM and FFS contribute to sustainable crop production intensification, promoted by FAO in its "Save and Grow" strategy (http://www.fao.org/ag/save-and-grow/).

STEPS IN DEVELOPING AN FFS PROGRAMME

Farmer field schools work at community level with groups of farmers. Programmes are developed in consultation with local communities and specific steps must be followed to ensure interaction between farmers and other relevant stakeholders:

- Needs assessment
- Curriculum development
- Training of facilitators
- Farmer field school implementation
- Follow-up activities

Prior to actual implementation of the FFS, preparatory work is required. Facilitators need to be trained and to acquire the necessary skills – technical, methodological, facilitation and organizational. Training of facilitators (ToF) must reinforce these skills and impart knowledge of the process of preparing and implementing FFSs. Different programmes may have different ToF models.

FFS preparation (pre-FFS), FFS implementation and follow-up activities (post-FFS) are described in detail in the sections that follow. Groundwork is required during preparation of the FFS. Once the FFS starts to have regular sessions at the beginning of the cropping season, the (weekly) field meeting programme typically includes the following:

- Recap of the previous session/field meeting
- Agro-ecosystem analysis (AESA)
- Group dynamics exercise
- Special topic (or topic of the day)
- Planning for the next session
- Short evaluation of the day

This guide provides examples of field studies and exercises that can be done in the FFS. Special topics include exercises on technical issues, such as better understanding of biology and ecology of insects and diseases. FFS meetings may also address social issues.

3. FFS preparation: Exercises

The numerous pre-FFS activities include the following:

- Awareness-raising about the FFS
- Selection of a group of farmers to join the FFS – locally set criteria are followed, taking into consideration crop-growing responsibilities, analysis of gender roles, labour division etc.
- Identification of field problems and potential solutions
- Selection of a field for the FFS
- Development of an initial curriculum
- Establishment of frequency of meetings

The field exercises collected herein provide just some examples of what can be done during the pre-FFS phase. Ideally a facilitator will have sufficient time before the actual FFS starts (the cropping season) to have several meetings with the community to inform them about the FFS and prepare for the activity (2–3 months are ideal, but often less time is available).

DEVELOPING A CROPPING CALENDAR[1]

Background

Farmers have a lot of experience growing cassava. They are familiar with the different practices at different times of the growing season, and the problems encountered at different times. They also have ideas for possible solutions and opportunities to address certain problems. This exercise takes place before planting and allows the FFS group and the facilitator to analyse the cassava value chain, not only from an agronomic point of view, but also in a broader socio-economic context. It helps the group establish priorities about which issues to address during the FFS, and it helps decide what field study or studies would be of interest.

[1] After the session, the facilitator can use the outputs of this session to help elaborate a location-specific curriculum for the FFS.

Objectives

- To analyse and discuss practices, problems of and opportunities for cassava production
- To set priorities for topics and studies in the FFS

Time needed: 2 hours (before the start of the FFS)

Materials: Flip chart, marker pens

Procedure

- Work in small groups of 5–6 persons.
- Ask each group to discuss and fill out a matrix (see Table 4).
- Specify whether cassava is grown alone or mixed with other crops. Identify issues associated with this.
- Discuss how the plot for cassava is chosen. Is the field cleared for cassava? Is cassava grown after another crop? Will cassava be followed by another crop?
- Ask each group to present their findings, and discuss with the whole group.
- Mark which topics to be dealt with and which are difficult to address.
- Set priorities with the group on what can be done in the time available.

Questions for discussion (for each stage of the season)

- What are the main issues?
- What are the potential solutions?
- How can it be included in the FFS?
- What are the priority issues?

TABLE 4
Example of matrix from Busia District, Uganda

Time of the season	Activity	Problems	Opportunities possible solutions
November	Harvesting	Low demand for cassava	Process and store cassava
December	Land preparation	High labour costs	Savings
February (end)	Planting	Lack of clean planting material	Establishment of group mother garden

CHOICE OF FIELD

Introduction

Choosing the field is very important in integrated management. As cassava is a very sturdy plant, farmers tend to think it can be planted in all kinds of conditions and still produce. However, to achieve good, profitable production with efficient integrated management of diseases and pests, cassava prefers a loose soil, deep and sufficiently rich in nutrients. Practices to be avoided include:

- cultivating cassava in fields that are flooded or which will flood;
- rotating cassava after a root or tuber crop; and
- using fields where bacterial blight has occurred in the last 5 years.

For mixed cropping, selection criteria for the other crops should also be taken into account. The FFS group can perform this exercise during discussion of field site selection. It helps farmers when they choose their own production fields for cassava.

Objective: To improve farmer capacity to choose a field that is suitable for profitable production of cassava

Time needed: 2–3 hours

Materials: Flip chart, marker pens, cord, measuring tape, machete, notebook, pencil, pen

Procedure

- Make a social map of the village indicating all fields (draw in the sand or on a flip chart).
- Discuss and analyse the potential of the different types of soil.
- Visit the fields.
- Make transects during field visits, if possible. Decide on the route for visiting different fields, and ask the group to observe the contours of the terrain. Make a list of the interesting things observed in the fields and discussed during the walk (e.g. plants observed, land use, problems). Draw the contours of the different areas observed, list issues of interest and make additional observations. Discuss what resources are available and where, how they change and any problems arising.
- Ask farmers why they select a particular field; discuss their selection criteria.

- Reflect on and take note of poorly informed criteria.
- Encourage and congratulate for well-reasoned criteria.
- Complement selection criteria with additional guidelines.
- Once the field selection criteria are established, proceed with demarcation of the selected site for the FFS.

Questions for discussion

- How do you choose a field? Why?
- What were the yields in fields of different soil types? Which were best? Why?
- What is a good depth to prepare the soil for a field that will be used for cassava?
- After which crop do you prefer to grow cassava?
- How often did you grow cassava in the same field? And what happened?
- For the FFS, what is a suitable field? What other criteria do we need to think about for the FFS?

ACCESS TO LAND: NEGOTIATING ACCESS

Introduction

Land in Africa generally belongs to a clan or extended family, but in most cases each clan member has some agricultural land of their own. The village or clan chief manages the land, but in a collegial way involving all members of the clan. People not from the area or members of families that are new in a village go through well-known procedures to gain access to land.

Lack of ownership of land does not favour long-term investments to improve soil fertility, because the benefits generated often do not last more than two successive years. Furthermore, farmer associations cannot be counted on for continuity, as their efforts can easily be disturbed or disrupted if problems arise with the land tenure arrangements. It is, therefore, important to negotiate access to land and obtain a provisory land title.

Objective: To improve negotiation skills and secure land for better use now and in the future

Time needed: 2–3 hours

Materials: Notebooks, crayon, pens, flip chart, markers

Procedure

- Make a social map of the village indicating all the available land.
- Reflect together with farmers on:
  - how land is accessed and transmitted from one generation to another within the same clan and to non-members of the clan;
  - the availability of land in the village;
  - the fertility of land in the village and the level of degradation;
  - the demography of the village;
  - land-related problems and conflict that are known in the village or that could occur;
  - how to resolve above conflicts;
  - opportunities to guarantee individual or community ownership for better utilization of land, for example a provisory land title; and
  - the creation of the FFS.

Questions for discussion

- How do you access land?
- Who are the owners (in percentage) and who are not?
- What land in the village is unused? How does this compare with 10 years ago?
- What is the evolution of soil fertility in the village? What might happen with the village lands in 5, 10, 15 or 20 years?
- How will the population evolve in the next 5, 10, 15 or 20 years, and what will be the consequences for land properties? What land-related problems or conflicts do you know of or might happen in 5, 10, 15 or 20 years' time?
- What possibilities exist for guaranteeing land property to individuals, families or the community for rational and sustainable exploitation of the land? What do you think of written documents (provisory land title) to guarantee ownership?
- Where can you set up the field school and what conditions need to be met?

4. FFS implementation
4.1 Field studies

Each FFS sets up a "study field" – a field that is used for learning during the FFS. The FFS will normally set up a comparison between local farmer practices and IPPM practices. Additional studies may be established to address specific problems identified during the preparation phase. Since cassava is a long-duration crop, it may be feasible and of interest to set up additional study fields. If pressure from viral diseases is high, a study on the multiplication of healthy planting materials would be useful. As mentioned earlier, field studies are meant to be learning media, not academic research activities.

Introduction

Farmers are researchers who manage their environment on the basis of their own experience which goes back for centuries and therefore instils in them confidence in the results achieved. Their reactions are based on their experiences. They are not keen to modify their habits. They will only change if faced with a new experience that guarantees results based on new knowledge. For these reasons, FFS studies should meet farmers' needs and expectations.

When there is collaboration between farmers, extension workers and researchers, it is possible to adapt developing technologies to the agronomic and socio-economic conditions of farmers. Research in research stations can be reoriented to incorporate farmer knowledge and experiences, validating them on the basis of scientific principles, and to integrate socio-economic aspects in the themes and technologies developed.

Defining possible studies for the FFS

In reality, learning in the FFS is based on non-formal adult education principles and on integrated crop management. Agricultural experimentation allows farmers to confront their personal and collective experiences with a new experience of integrated management in order to find solutions to their problems. The aim is to develop or improve farmers' capacities to observe, analyse and make informed decisions to improve their farming practices and living conditions.

It can be useful to develop a knowledge matrix with farmers and resource persons, both on familiar issues and on topics yet to be well understood. The cropping calendar is an effective tool for pinpointing important local issues. The knowledge matrix helps identify what studies to set up and who can provide

Knowledge matrix

Knowledge levels		Farmers	
		Yes	No
Extension and research	Yes	Yes – Yes IPPM/FP comparison	Yes – No Special study
	No	No – Yes Special study	No – No Research

inputs, and provides ideas for the specific topics selected. For each topic, the knowledge matrix elaborates what is known and by whom (farmers, extension officers and researchers).

- Top left: both farmers and extension/research have awareness and understanding.
- Bottom left: farmers have knowledge and experience; extension/research lack awareness.
- Top right: extension/research have understanding and knowledge; farmers lack knowledge.
- Bottom right: the "unknown" – both farmers and research/extension lack knowledge or information.

The matrix helps to elaborate topics for study, and to identify what knowledge can be contributed by whom when trying to find better management practices for the location.

This section provides examples of field studies that can be set up in an FFS for cassava. These examples are provided by active FFS programmes and have been tried out in FFSs and/or ToF. An FFS has at least one basic study, comparing local farmer practices with IPPM practices. Examples are also given of special studies with an in-depth focus on a specific issue of local importance. Cassava's long growing season is suitable for the inclusion of special studies, as there is time for follow-up. Healthy planting material for cassava is important, particularly in areas where CMD and CBSD are spreading and causing problems – in such cases, the FFS would benefit from setting up a multiplication study.

The section begins with two general exercises: the first to determine the field layout, the second to decide on plot size and planting of the fields. Detailed study designs are provided for a range of topics.

The study designs provided below are a source of inspiration and should be adapted to local conditions. They are not a blueprint to be set up in each and every FFS. Nor are they exhaustive: other field studies can be developed to address other topics of relevance for an FFS group in a particular location. Some studies may already provide results after one season, while others (e.g. studies on soil fertility) require a longer experimentation period (in such cases, a post-FFS group activity might be appropriate).

Overview of the field study designs in this section

Field study	Layout
	Establishing the studies in the field
Basic comparison	Different management approaches for cassava: IPPM vs FP
Multiplication and planting material	Multiplication of healthy cassava cuttings
	Variety comparison
	Transmission of mosaic virus
Soil fertility management	Management of vegetative residues during soil preparation
	Organic fertilization using cow manure
	Short fallow to improve soil fertility using legume crops
Other special studies	Planting dates
	Weeding
	Harvesting cassava leaves
	Management of moles

FIELD STUDY (1): LAYOUT

Introduction

The learning process in the FFS must suit the adult learning cycle. Farmers have accumulated experience which is a great resource for learning. But changing attitudes and behaviour can only be influenced by conclusions drawn from practical experiences which provide solutions to real problems. Field studies merge facilitator and farmer knowledge to obtain improved production and profitability. The general field study compares different management practices between a field under integrated production and protection management (IPPM) and a field that is following the local farmer practice (FP). At the outset, the FP is documented in detail to avoid it changing in the course of the season.

Topics which are unfamiliar to either the facilitators or the farmers are included in special studies (if a season-long study is not required, it can be dealt with as a special topic during an FFS session). The general and special studies constitute the field layout for the FFS. The objectives of the studies should be well understood by all participants in the FFS. Thus, this exercise has to be given adequate time and attention as it forms the foundation and basis for motivation for farmers to commit themselves to attend FFS sessions throughout the cropping cycle.

Objectives

- To guide farmers to define and develop the studies to be set up by the FFS, and the relative objectives and treatments
- To teach farmers how to find solutions to major field problems through experimentation

Time needed: 3–4 hours

Materials: Machetes, pegs for plot demarcation, notebooks, pens, pencils, flip chart, markers

Procedure

- Make a list for group examination and classify all problems encountered in cassava production. Discuss importance of the different problems. Refer to the cropping calendar exercise if done earlier.
- Discuss how to translate certain problems into FFS studies, using questions such as: What do farmers think about a specific problem? What have farmers done about it and why? How can the problem/question be solved? What are the constraints? Which topics should be addressed in the study or studies?

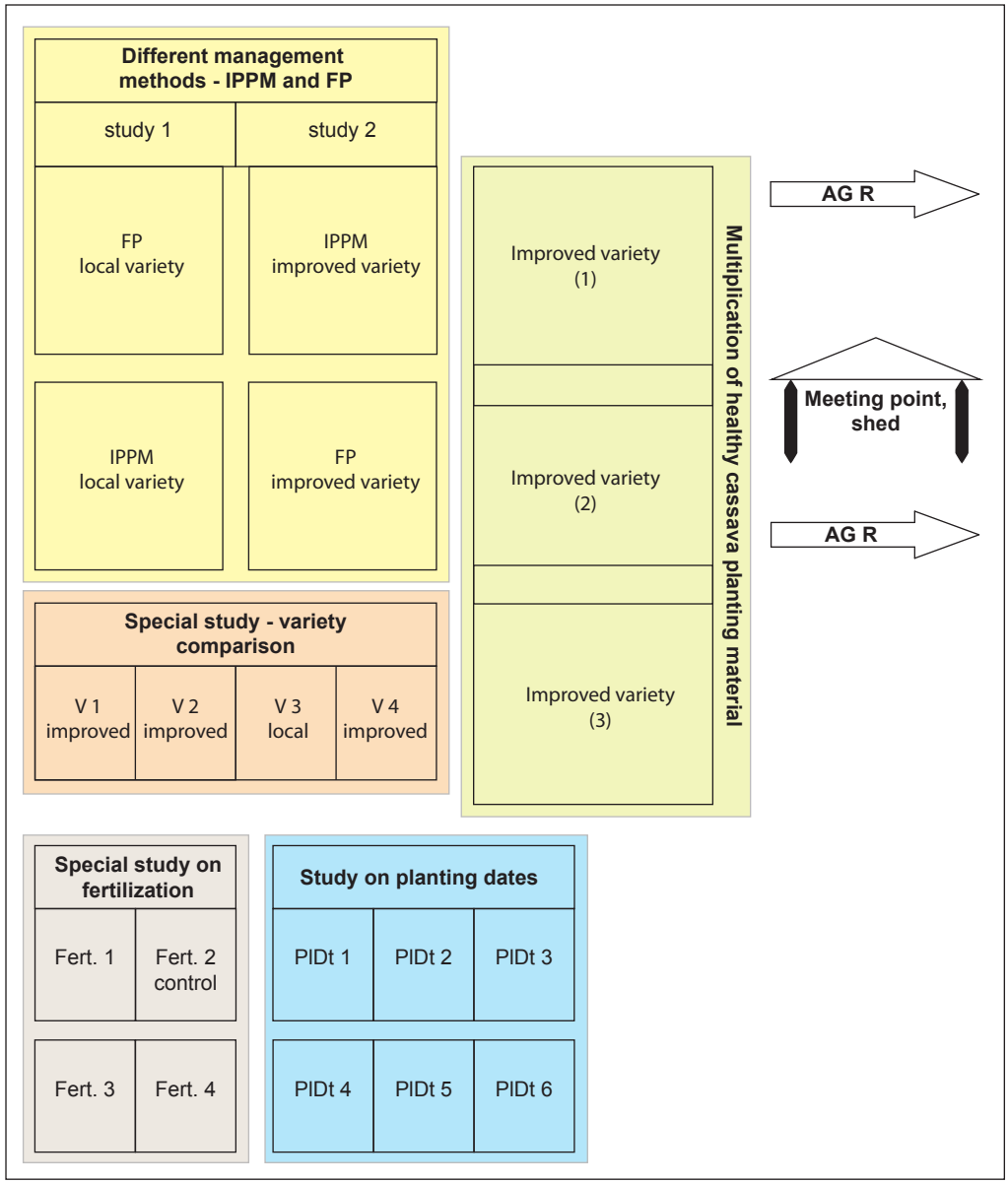
- Consider treatments for the various studies.
- Contemplate elementary principles of comparison between treatments and the indicators to be followed to assess differences.
- Reflect on farmer management methods for cassava.
- Examine together the timing and period as well as the way the different studies are set up.
- Consider the field layout in space and time for each study, taking into account the dimensions, orientation of planting lines and fields, topography and fertility gradient.
- Make a sketch on a flip chart for all the studies, indicating the different fields.
- Mark the boundaries of the different fields and relative treatments using demarcation pegs.
- Put up signs to mark the different fields.
- Reflect with farmers on the difficulties encountered in defining the studies, objectives and treatments, and in marking the boundaries.

Questions for discussion[2]

- How do farmers experiment with new technologies such as new varieties?
- What are the major problems arising? What are possible solutions (know-how)? Which solutions are known only to the farmers or only to the facilitators? How can the different solutions be tested (know-how)?
- What are the different treatments for each study? What do you think of each treatment? Why are there different treatments in a study? How do they compare?
- Who will plant and when? Why? How did you select your field? Where will you plant?
- How can you make the overview sketch for all the studies and treatments? How can you lay out the studies and treatments in the field taking into account field dimension and orientation, planting lines, topography and fertility gradient? How can you mark or label the different studies and treatments?
- What difficulties are encountered during the exercise?

[2] The facilitator should guide the farmers to discover the answers by asking questions and giving examples.

Example of layout for different studies in an FFS



FIELD STUDY (2): ESTABLISHING THE STUDIES IN THE FIELD – DIMENSION OF PLOTS AND ORIENTATION OF PLANTING ROWS OR RIDGES

Introduction

The dimension of a plot depends on several factors including crop type, the outcome of the study, availability of planting material and planting density. The availability of cassava cuttings is crucial and can cause a reduction or an increase in study plot size. For an optimal density of 10 000 plants per hectare, cassava is planted at a distance of 1 × 1 m. Plot sizes of 10 × 15 m (or 20 m) for IPPM and LP (local practice), and 5 × 10 m for special studies (minimum size) have given satisfactory results. The orientation of the planting rows varies depending on the topography of the land:

- **Flat fields:** plots can be rectangular or square and the orientation of planting rows east–west, to allow for efficient use of light for photosynthesis.
- **Sloping land:** plots can be rectangular, and planting rows follow contour lines to reduce the speed of water runoff and to avoid erosion (with all its consequences).

Ridges are laid out with a spacing of 1 m between the tops of the ridges. However, if the field contains a lot of vegetative residue, the distance can be increased to 1.5 m between the tops of the ridges.

Objective: To assist participants to better lay out and orient the study plots and planting rows for efficient utilization of light and judicious use of rainwater

Time needed: 1.5–2 hours

Materials: Measuring tape, machetes, hoes, pegs for demarcation, markers, notebooks, pencils, pens, flip chart

Procedure

- Remind participants of the number and types of studies to be carried out.
- Reflect on the availability of cuttings, the shape or topography of the field, and the planting distances that will be used to determine the shape and dimensions of the plots.
- For the orientation of the planting rows, carry out exercises on shade and lines:
  - divide the participants into four groups and ask them to form four lines north–south
  - ask participants to observe the presence of shade between the lines
  - change the orientation of the four lines to east–west

  - ask participants to observe the absence of shade between the lines
  - reflect on the effects of shade on cassava plants
  - lead a discussion to decide on east–west orientation
- Reflect on the causes and effects of erosion.
- Consider the advantages of making rows that follow contour lines.
- Think about the need to plant following contour lines on sloping land.
- Practise the layout of the plots based on the dimensions decided, making rows (ridges) on flat land and following contour lines.

Questions for discussion

- What are the studies to be set up by the FFS?
- How many plots does each study require? How will the plots be laid out in the field?
- What will be the dimensions of each plot? What space should be foreseen between plots and between studies?
- What will be the shape and orientation of the plots?
- What happens when planting rows are oriented north–south?
- What happens when planting rows are oriented east–west?
- What is a good orientation for all plants to optimize the benefits of light?
- What are the reasons for the high fertility of low-lying land compared to sloping land and higher land?
- What do you know about the causes and effects of erosion?
- Is it necessary to control erosion?
- What techniques or practices can be applied to reduce erosion?
- What are the advantages of making ridges and planting lines following contour lines?
- How can you establish (lay out and mark) planting rows of cassava?

BASIC COMPARISON:[3] DIFFERENT MANAGEMENT APPROACHES FOR CASSAVA: IPPM VS FP

Introduction

Cassava is a staple food for more than 70 percent of the Congolese population and it is the principle source of income for producers. However, cassava production has dropped dramatically since the mid-1990s for a variety of reasons, including diseases and pests (e.g. CMD), lack of improved varieties and poor cultural practices, creating food insecurity and income deficiency. Farmer households continue to grow cassava without obtaining satisfactory production levels. Furthermore, although cultural practices and improved varieties have been developed by research and disseminated, they remain unknown to women farmers. In order to help farmers improve their practices, it is necessary to set up a study to compare different crop management approaches in order that they may adapt demonstrated new and improved practices to their own fields.

Objectives

- To allow farmers to choose cultural practices adapted to their own conditions, in order that they may obtain sustainable and profitable production and protection of cassava
- To evaluate the economic benefits of different management approaches of cassava (IPPM/FP)

Time needed: Complete cropping cycle up to processing and marketing

Materials: Field, implements for ploughing, cord, measuring tape, planting materials, magnifying glasses, insect net, pegs for plot demarcation

Procedure

- Ask participants to explain how they grow cassava in their fields at the various crop stages (refer to the exercise on cropping calendars if applicable). Compare the local farmer practice with a practice integrating all disease and pest management knowledge in order to achieve improved production (including practices recommended by researchers and farmers' best practices)
- Establish two FP plots with two varieties: improved and local.
- Establish two IPPM plots with two varieties: improved and local.

[3] Example from the Democratic Republic of the Congo – must be adapted to local conditions.

Technical itinerary for IPPM practices:
Starting points in the Democratic Republic of the Congo

Field selection criteria

- Area accessible, visible, close to village
- Land ownership undisputed (document of provisionary land title available)
- History known (previous season without cassava, former vegetation indicating fertility)
- Soil loose and deep
- Area representative of local environment

Field preparation

- Plough deeply (30 cm) with incorporation of vegetative mass (weeds, straw and crop residues) where termites are not a problem using adapted tools/equipment
- Practise ridging with incorporation of weeds and other plant residues between the ridges
- Take into consideration contour lines
- Do not practise total burning – only partial incineration

Preparation of planting materials

- Select improved high-performing variety (mosaic-resistant, high-yielding, suitable for local use)
- Choose healthy planting material from a known source (field)
- Use woody part of stem for planting
- Cut planting material (at least 4–5 eyes or nodes, 15–25 cm long) using a sharp machete

Planting

- Timed to coincide with seasonal rainfall (e.g. after 35 mm rainfall)
- Planting distances:
  - monoculture: 1 × 1 m
  - mixed cropping (associated crops are seeded/planted at the same time), e.g. groundnut: cassava at 1 × 1m and 2 rows of groundnut at 40 × 20 cm or 30 × 30 cm with 3 grains per hill between 2 rows of cassava

Crop maintenance, field management

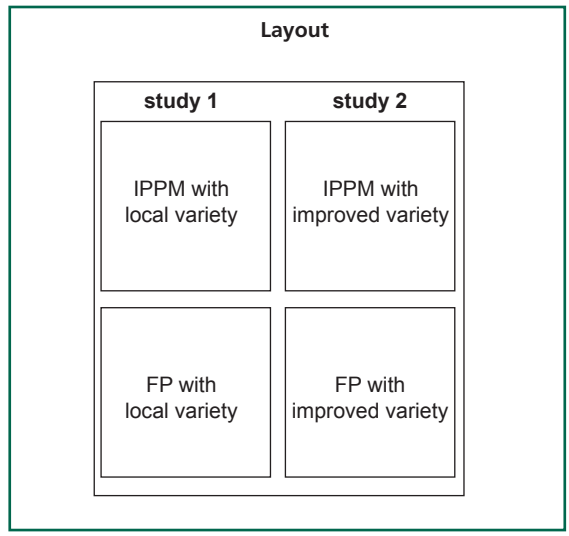
On the basis of the AESA, keep field very clean in first 3 months by, for example:

- replanting in gaps;
- practising phytosanitation or replanting in gaps 3–4 weeks after planting; and
- hoeing and ridging up.

Harvest

- Leaves: number of harvests and intervals to be discussed beforehand
- Roots: 12–18 months after planting (depending on vegetative cycle of variety planted) by uprooting whole plant
- Planting material: beginning 10 months after planting using selection, or after harvest of roots (conservation of planting material on the ground, with stump, as sticks)

- During the FFS sessions, carry out an AESA in both fields, note and implement management decisions, compare differences as they occur and discuss why they occur.
- Make a final comparison at the end of the season, taking into account parameters observed as indicated in the box opposite, and discuss differences between the practices and why they occur. Identify additional issues for further work, and discuss what could be applied in farmers' fields in the coming season.



Observations

- Planting date; percentage of viable plants; replanting
- Growth and development: height, circumference of base, diameter of plant, number of stems per plant
- Diseases and pests: incidence and severity; natural enemies
- Productions: associated crop(s), leaves, planting materials, roots
- Number of plants harvested, average number of roots per plant, total weight of roots marketed and rejected (small dimensions)
- Production of planting material: metres of planting material obtained
- Value roots and planting materials harvested
- Inputs used (costs, labour)

Questions for discussion

- How do IPPM and FP compare?
- How do the development and growth of the cassava crop compare in the two treatments? Which was best? Why?
- What about diseases? Did you find any differences? What is the proportion of healthy cassava plants compared with diseased ones – in IPPM? in FP?
- What about pests and natural enemies? Are there any differences? Why?
- What was the yield in the IPPM and the FP plots? Why are there differences?
- What are the respective benefits of the IPPM and FP plots? Why?
- Do you plan to apply some of the things you learned in the FFS? If yes, what and why? Do you foresee any difficulties? How can they be overcome?

MULTIPLICATION AND PLANTING MATERIAL (1): MULTIPLICATION OF HEALTHY CASSAVA CUTTINGS

Introduction

Multiplication of healthy planting materials is very important when growing cassava. It has become even more important in recent years with the occurrence and spread of new strains of cassava mosaic virus and cassava brown streak disease, which are causing serious production problems for farmers in several countries. These diseases are principally transmitted by planting material or by whiteflies as vectors and they continue to spread rapidly in the region. Understanding the multiplication and selection of good cuttings can make a crucial difference in cassava production. Establishing a special study on multiplication is practically essential in conditions where virus diseases pose problems.

In agriculture, the quality of the planting material (seeds, cuttings, shoots) is crucial for obtaining a healthy crop and good results. The source and quality of cassava cuttings are significant in integrated management of diseases and pests – indeed, with cassava the biggest source of field infection is the planting material: the cutting. Use of diseased cuttings leads to immediate contamination of a newly planted field.

Farmers are used to mixing several varieties of cassava in the same field. Mosaic virus and brown streak virus disseminate mostly through infected or diseased cuttings. Almost all local varieties are susceptible to the viruses and their yields are very low. It is necessary to produce a sufficient quantity of planting materials of better-performing varieties (i.e. with resistance/tolerance to mosaic and/or brown streak virus, high yield potential and adaptability to local uses). Numerous varieties that meet the above criteria have been developed and disseminated; but they are not always available or correctly managed at farmer level (following multiplication standards), and therefore do not reach their production potential. Participants should become familiar with the technical schedule that will allow them to produce quality planting material starting in their own farms.

Farmers normally choose new varieties that they consider better or which have certain desirable characteristics. However, when introducing new varieties it is also possible that diseases are spread. What is more, new varieties are often provided in small quantities. Therefore, the farmer field school sets up a small multiplication programme for farmers to learn how to multiply healthy planting material and obtain healthy cassava cuttings that can be distributed to the FFS members once they have been produced.

A multiplication field also provides an opportunity for self-financing of the group – healthy cassava cuttings produced for the local setting can be sold commercially.

A multiplication field to produce healthy cuttings encourages participants to be more motivated and to apply the techniques learned during training, especially in areas where virus diseases such as CMD and CBSD are important.

For the multiplication of healthy planting material, small cuttings are used: 3 eyes (or nodes), 10–15 cm long (microcuttings). This will help get a high number of plants per mother plant (increasing the multiplication level). The cuttings can be longer if terminal parts of the plant are used. They are planted directly in the field once the soil is sufficiently humid. Diseased plants are regularly eliminated from the field up to harvest (phytosanitation).

Objectives

- To help farmers distinguish and produce a healthy, good quality cutting
- To produce healthy cassava cuttings for use by families of FFS members
- To self-finance the FFS

Time needed: Complete cropping cycle up to harvest and marketing of the cassava cuttings

Materials: Healthy cuttings of two or three new varieties resistant to mosaic virus, hoe, machetes, notebooks, pens, study field, cord

Procedure

- Carry out multiplication following the locally-used protocol.[4]

Cassava Multiplication Protocol:
An example from the Democratic Republic of the Congo

Field selection

- Area isolated, ≥ 200 m from any cassava field and/or field with solanaceous crops in a savannah setting (where there is a natural barrier, isolation can be 100 m)
- Soil fertile with sandy clay texture
- Field flat or slightly sloping
- Not fields where cassava or solanaceous crops have been cultivated in recent past (< 5 years)

Selection of varieties and cuttings

- Resistant varieties known to and accepted by FFS members
- Healthy cuttings from a field followed by specialists (research station, specialized NGOs etc.)
- Cuttings from median and hard parts of healthy stems, aged 7–18 months

[4] Example from the Democratic Republic of the Congo – please verify local protocols.

Cassava Multiplication Protocol (cont'd)

Preparation of cuttings
Cut with sharp machete to a length of 10–15 cm (a 1-ha field requires ≥ 2 500–3 000 m of cuttings)

Planting
- Timing: from the start of the rainy season
- Depth: 5–10 cm
- Distance: 1 × 0.5 m
- Density: 1 cutting per placement, 20 000 plants per ha
- Position of cutting: plant flat for microcuttings

Maintenance/management
- Replanting: immediately after establishment, 3–4 weeks after planting
- Weeding: as soon as weeds threaten to compete with cassava, especially during first 3 months
- Fertilization (important to obtain good quantity of cuttings per unit of land): mineral or organic; incorporation of weeds at soil preparation (to help increase production)
- Phytosanitation: inspect whole field walking line by line; localize, uproot and destroy all plants with symptoms of diseases or other atypical characteristics; inspections – very intensive at the beginning of the planting (2–3 times/week), after 2 months reduced to once a week, once sanitary situation under control less frequent (but regular)
- Border areas of multiplication field: check frequently and destroy all unwanted wild growth

Harvest of cassava cuttings (recepage)
At 20–25 cm from the soil level from the eighth month of planting

Conditioning
- Cuttings grouped in bunches of 50 or 10 1-m stems (i.e. 50 or 100 m for each bunch)
- Avoid disturbing or damaging the cuttings and eyes during manipulation (cutting, conditioning, loading, transportation)

Conservation
- Stacked in vertical position and covered with humid soil
- Covered storage, vertical position
- Close to a stream in the dry season
- Not stored for more than 2 weeks

Planting distances of 0.5 × 1 m give many more cuttings that those of 1 × 1 m. Farmers prefer to plant at 1 × 1 m since this will also give good root production. A second cutting can be organized after an interval of 9 months, if the roots are not yet harvested and plants are still in the field.

- After establishing the field, make regular visits during the FFS, observe for diseased plants and apply phytosanitation.
- Collect data as suggested below.
- Evaluate the quality of cuttings at the end of the season and discuss how to ensure good quality cuttings for the community.

Observations

- Planting dates, percentage of establishment, replanting date
- Starting dates and frequency of phytosanitary inspections
- Measurements of growth: plant height, circumference of base
- Number of stems per plant
- Incidence of mosaic over time by variety, comparison between varieties
- Number of plants periodically eliminated during phytosanitation
- Diseases and pests
- Harvest dates of cuttings; total number of bunches of cuttings harvested by variety, and market value of cuttings

Questions for discussion

- How did the different varieties develop in the multiplication field? What do you think about the quality of the cuttings in the multiplication field? Are they different from what you would normally use to plant your cassava field? Why or why not? Would you be willing to use them for your own field? Would you be willing to pay for such cassava cuttings?
- What was the disease incidence in the field? What were the main diseases? Were there differences between varieties? Why or why not?
- How often did you do phytosanitation in the field? How many plants did you remove in the different fields? Where did you put the infected plants that you removed? What did you do with them? Were there differences between varieties? Can you do phytosanitation in your own field?
- Will you set up a multiplication field for yourself, or with a group of farmers? Why or why not? Would you consider applying phytosanitation to local varieties as well?

MULTIPLICATION AND PLANTING MATERIAL (2): VARIETY COMPARISON[5]

Introduction

Almost all local cassava varieties are susceptible to mosaic virus (cassava mosaic disease, CMD) and yields are very low. It is necessary to have better-performing varieties, with resistance or tolerance to mosaic virus, high yields and suitability for local uses. Many varieties satisfying these criteria have been developed and disseminated. Since farmers are not willing to adopt them before experimentation, a study comparing varieties can help them learn about the new varieties and choose what is best for their own needs and requirements.

Objectives

- To allow farmers to know and be able to choose the varieties best adapted for their own uses
- To evaluate the economic benefits of the different varieties studied

Time needed: Full cropping cycle until processing and marketing

Materials: Planting materials of 4 varieties (1 local, 3 new), hoe, machetes, notebooks, pens, prepared study fields

Procedure

- Select varieties and planting materials following discussion with farmers.
- Make sure planting materials are available when setting up the study.
- Prepare soil in all fields following IPPM approaches.
- Randomly assign varieties to treatments (each plot 5 × 10 m).
- Follow similar crop management activities (IPPM approach) in all 4 fields.
- Use AESA as a basis for crop management.
- Follow the study closely and collect information regularly using AESA.
- Carry out an evaluation of the production from an agronomic point of view and from the farmers' point of view.
- Carry out an economic analysis comparing the varieties.

[5] This study can be also implemented with the emphasis on CBSD.

Observations

- Planting date
- Percentage of plants that establish, date of replanting
- Dates of hoeing
- Measurements of growth: plant height, circumference of the main stem at base of plant
- Number of stems per plant
- Incidence and severity of diseases and pests, natural enemies
- Harvesting dates
- Costs and incomes (economic analysis)

Questions for discussion

- Which variety do you like most? Which do you like least? Why? Which variety is most preferred by other people? Which is least preferred? Why?
- What did you observe about the growth and development of each variety?
- What diseases were observed in the varieties? Was there any difference between the varieties? Why?
- Which pests and natural enemies did you find? Was there any difference between the varieties?
- Were there any differences in yields or economic benefits?
- If you select one or two varieties for your own fields, where will you find planting material? Can you set up a multiplication field for the near future?
- Would you like to try more varieties in the coming season?

MULTIPLICATION AND PLANTING MATERIAL (3): TRANSMISSION OF MOSAIC VIRUS[6]

Introduction

Farmers only become aware of CMD when the symptoms are already very severe. The principal source of transmission of the mosaic virus is the planting material: infected planting material leads to an infected plant. In general, the severity of the disease increases from one generation (cycle) to the next.

By experimenting disease transmission through use of planting materials with different levels of infection, farmers can understand the danger of using infected planting material and begin to envisage solutions.

Objective: To help farmers understand how to manage primary infection of mosaic virus

Time needed: Complete cropping cycle

Materials: Healthy cassava planting material, planting material with a moderate mosaic virus infection, planting material with heavy infection with deformed leaves, machetes, hoes, flip chart, markers, magnifying glass, pencils, notebooks, pens

Procedure

- Find and observe healthy planting material and material with different levels of mosaic virus in the field (remove 3–4 stems from each category).
- Cut 30 small parts of planting material for each level of infection (healthy, moderately infected and heavily infected).
- Mark 3 fields, each 3 × 10 m.
- Plant each category of planting material in 3 lines and conserve the remaining planting materials, separated by category.
- Following establishment, count the diseased plants in each category, make a drawing of the plants observed and make a comparison between the fields/ treatments on the severity of attack.
- Reflect with farmers on the contamination in the fields – during the season at regular intervals and at the end of the season.
- Discuss what can be done to reduce virus transmission in cassava.
- Complete information on primary infection.

[6] A similar study can be done for cassava brown streak virus causing CBSD.

Observations

- Planting date
- Percentage of plants that establish; date of replanting (use the planting material put aside earlier)
- Incidence and severity of CMD after establishment of the crop
- Dates of hoeing
- Measurements for growth: plant height, circumference of base of main stem of cassava plant, diameter of crown
- Number of stems per plant
- Incidence and severity of other diseases and pests
- Harvest dates
- Expenditures and incomes (economic analysis)

Questions for discussion

- How many plants were infected in each treatment/field? Why is there a difference in the number of infected plants for each treatment?
- Are there any differences in production between the different treatments? Why?
- What happens if you use cuttings that are already infected with diseases? How can you avoid this happening? What sources do you use for taking cassava cuttings? What are the main observations made on the cuttings of the local varieties?
- What are the farmers' criteria for selecting planting material?
- What are other criteria need to be considered when selecting a cassava cutting? Why?
- What do you think of this study? What decisions will you make about planting materials? What do you think of the transmission of mosaic through plant cuttings? How can you reduce the risk of virus transmission when you select cuttings? What can you do to get healthy cassava cuttings?
- Would you be willing to spend money to get good quality planting materials? Why or why not?

SOIL FERTILITY MANAGEMENT (1): MANAGEMENT OF VEGETATIVE RESIDUES DURING SOIL PREPARATION

Introduction

During soil preparation, the vegetative residues of the land being cleared (that should serve to enrich the soil) are usually burned and the ashes are blown and washed away by the wind and rain. The practice results in soil degradation and reduced soil fertility, leading to low soil productivity and diminished capacity of plants to resist diseases and pests. Guidance on the basis of research on the management of vegetative residues during soil preparation is available, but is ignored by farmers. It is important to test certain options locally to find solutions to the problems mentioned.

Objectives

- To help farmers develop techniques for rational use of vegetative residues to improve and maintain soil fertility
- To reduce the use of wild fires and complete burning that reduce soil productivity and have a negative impact on the environment
- To evaluate economic benefits of different ways of managing vegetative residues during soil preparation when growing cassava

Time needed: Complete cropping cycle through processing and marketing

Materials: Study fields, healthy cassava planting material, measuring tape, cord, pegs for demarcation, hoes, machetes, bamboo, markers, flip chart, weighing scale

Procedure

- Define three treatments with the farmers:
  - control field with complete burning
  - field with partial burning followed by incorporation of residues
  - field with vegetative residues used as mulch
- Mark the 3 fields with pegs, each 5 × 10 m, and prepare the soil following the treatments defined
- Select one variety to be used in all fields
- Carry out the different management operations at the same time, one in each field
- Apply management practices based on decisions made during the AESA
- Follow up regularly and collect weekly data using the AESA

Observations

- Planting date
- Percentage of plant establishment; date of replanting
- Dates of hoeing
- Measures of growth: plant height, circumference of base of the main stem, diameter of the crown of the plant (soil coverage)
- Number of stems per plant
- Incidence of diseases and pests
- Cover – development of weeds
- Micro-organisms/soil insects
- Soil humidity
- Harvesting dates
- Number of roots per field
- Total weight of roots per field
- Number of roots that are marketable
- Market value of the productions
- Expenditures and incomes (economic analysis)

Questions for discussion:

- What do you notice about plant development in the 3 fields?
- What happens with diseases and pests and natural enemies?
- What happens with weeds?
- What are the soil characteristics (aspect, humidity, colour)?
- What differences in production did you record in the different fields?
- Which field has the most advantages and benefits?
- Which field is most difficult to manage? Why?
- How will you prepare your new production fields? Will you try to incorporate vegetative residues? Why or why not?
- What other things can be done to improve soil fertility in the longer term?

SOIL FERTILITY MANAGEMENT (2): ORGANIC FERTILIZATION USING COW MANURE

Introduction

Soils that are being used for cassava have an increasingly low fertility level leading to mediocre growth and development and as a consequence to low yields and productivity. The duration of the fallow period has become very short. Farmer solutions to date have not proved completely satisfactory. New fertilization techniques exist but are not accessible to many farmers. The integration of other activities has potentially positive effects: farmers who keep big animals can enrich their savannah fields with cow manure to obtain profitable and sustainable cassava production.

Objectives

- To assist farmers to choose a level of organic fertilizer to increase cassava production
- To evaluate the economic benefits of the various fertilization methods

Time needed: Complete cropping cycle through to marketing

Materials: Prepared fields, healthy cassava cuttings, flip chart, markers, notebooks, pencils, pens, labels, machetes, hoes, measuring tape, pegs, cow manure, weighing scale

Procedure[7]

- Define 3 treatments, proposed by farmers and facilitators:
  - control (without fertilization)
  - 1 kg of cow manure per plant
  - 2 kg of cow manure per plant
- Mark 3 fields with pegs and indicate the planting rows.
- Prepare the soil according to IPPM practices. Leave a gap of at least 1.5 m between fields to avoid seepage.
- Weigh 1 kg and 2 kg of cow manure, and mark respective levels on containers to make weighing fast and easy.
- Make a localized application of cow manure (planting hole) as basic fertilizer before planting. Mix the cow manure well with the soil before planting.

[7] Grow another crop in the same field during the following season to evaluate profitability.

- Use one variety only, preferably using healthy planting material.
- Establish and manage the field following IPPM practices.
- Evaluate and compare regularly growth and development.
- Evaluate and compare the incidence of diseases and pests, and weed presence.
- Evaluate and compare the different productions.
- Carry out economic analysis.

Observations

- Date of fertilizer application
- Planting date, date of plant establishment, percentage of established plants, date of replanting
- Dates of hoeing
- Growth and development (height, circumference of stem at base of the plant, diameter of crown)
- Number of stems per plant
- Incidence and severity of diseases and pests
- Harvesting date
- Number of roots per plant
- Total weight of roots for each field
- Number of metres of planting material/cuttings
- Market value of each production (leaves, planting material and roots) per treatment/field
- Expenditure and income (economic analysis)

Questions for discussion

- What treatment had the highest yield? Why?
- How did plants develop in the 3 treatments? What were the differences? Which treatment was best?
- What about diseases and pests? Do you notice any differences between the treatments?
- Is it easy to find manure in your own farm, or somewhere else? Is it being used for other purposes? Can you apply manure in your own field in the next season? Why or why not? How much can you use?
- Will the cow manure still influence soil fertility in the field for the coming season? How can you find out?

SOIL FERTILITY MANAGEMENT (3): SHORT FALLOW TO IMPROVE SOIL FERTILITY USING LEGUME CROPS

Introduction

Slash and burn agriculture (normal practice in the Democratic Republic of the Congo) is creating increasing problems (reduced yields), especially close to centres of habitation, as the population increases and fallow period shortens. In addition, many fields are invaded by weeds that are very difficult to eradicate (e.g. *Digitaria* sp., *Imperata cylindrica* and *Cynodon dactylon*). Furthermore, cassava is often planted in marginal soils.

Legume crops can cover and enrich the soil with organic matter and nitrogen, and they can be used to interrupt the cycle of continuous cassava cultivation in a particular field. They, therefore, provide a solution to the problem of finding suitable fields for cassava cultivation.

Objectives

- Develop techniques to increase the effectiveness and reduce the time of the fallow period
- Develop farmer capacity to use legume crops to improve soil fertility after cassava
- Develop integrated management techniques to manage and recover fields that are degraded and invaded by weeds that are difficult to eradicate
- Evaluate the economic benefits of an improved short-duration fallow period compared with a natural fallow period

Time needed: Three consecutive cropping seasons (A, B and B)

Materials: Field with cassava (20 × 40 m and close to harvest), hoes, machetes, measuring tapes, pegs, cord, cover legume crop seeds (preferably *Mucana pruriens* var. *utilis*)

Procedure

- Select a field of cassava close to maturity, with low fertility and with a dominance of obnoxious weeds (e.g. *Digitaria*, *Imperata*).
- Mark 2 plots (20 × 20 m) in the cassava field.
- After or just before the harvest of the cassava, sow *Mucuna* in one of the 2 plots at a spacing of 1 × 0.5 m, using 2 seeds per planting hole. Leave the other field under natural fallow.
- Protect the 2 fields against animals and bush fires during the dry season.
- After 4 months of improved fallow, go back to the same field, cut down the *Mucuna* cover crop, and prepare the soil while incorporating the vegetative

residues in the plot with improved fallow, 3–4 weeks before planting or seeding.

- Prepare at the same time a plot with natural fallow according to farmer practices.
- Plant cassava with planting distances of 1 × 1 m using the same management methods in the 2 plots.
- Evaluate and compare growth and development of the first crop and the following crop in each field.
- Evaluate and compare the different productions at the end of each cropping season.
- Carry out an economic analysis.

Observations

- Dimensions of the plots marked for the fallow
- Date of seeding the legume crop (start of fallow)
- Growth of the legume crop during the fallow period (season B)
- Evaluation of the cover of the soil
- Evaluation of the vegetative mass accumulated on the soil
- Relative importance of activities of micro-organisms and soil insects
- Development of weeds
- Agronomic observations on the next crop grown after the fallow in the 2 plots

Questions for discussion

- What do you notice about the growth of the legume crop and the weeds?
- How do you evaluate the cover of the weeds compared with the legume crop?
- Which weed species are most prominent in each of the 2 plots?
- What micro-organism and insect activity did you observe in the soil?
- What did you notice about the humus level in the soil?
- What did you observe in the growth and development of the crop in the 2 fields? Why?
- What did you notice about the development of weeds in the following crop? Why?
- What can you do to improve sustainable soil management for cassava growing? Will you grow a legume crop yourself? Why or why not? Could you find seeds of the legume crop?

OTHER SPECIAL STUDIES (1): PLANTING DATES

Introduction

Farmers tend to plant cassava throughout the year with little consideration for the different cropping seasons. Often the establishment of the cassava crop is fine, but growth and development are limited by a range of factors, including lack of water during critical periods. Plants that lack vigour are more susceptible to effects caused by bad weather, diseases and pests. It is very important for farmers to experiment with different planting dates for cassava and determine which periods are favourable for profitable production of roots under local conditions.

Objectives

- To assist farmers to know and choose the favourable periods for planting cassava in the different seasons for a profitable production of roots
- To evaluate the economic benefits of the different planting dates of cassava for each season

Time needed: Complete cropping cycle up to marketing, to be done in the different seasons

Materials: Prepared fields, healthy cassava cuttings, flip chart, markers, notebook, pencils, pens, labels, machetes, hoes, measuring tape, sticks

Procedure

- Determine the starting of the planting of cassava for each season, either by asking the farmers, or by using a cropping calendar that was developed earlier.
- Define an interval between the planting dates, from a minimum of 2 weeks to up to a month, depending on the local context.
- Define the number of planting dates to be tried out (treatments) per season and mark the number of fields needed (one field per planting date).
- Follow IPPM practices for preparation, planting and field management.
- Use only one resistant or tolerant variety; plant at the selected interval and label well the different plots.
- Monitor the fields regularly using AESA; harvest with intervals corresponding to the treatments; compare results at harvest and marketing for the different planting dates.
- Evaluate the different productions using farmers' criteria.
- Carry out an economic analysis.

Observations

- Planting date, date of establishment of plants, percentage of established plants, date of replanting
- Dates of hoeing
- Growth and development (height, circumference, diameter of crown)
- Number of stems per plant
- Incidence and severity of diseases and pests
- Harvesting date
- Number of roots per plant
- Total weight of roots for each field
- Number of metres of planting material/cuttings per plot
- Market value of each production (leaves, planting material and roots) for each planting date
- Expenditures and incomes (economic analysis)

Questions for discussion

- What differences did you observe between the fields with different planting dates? In which field did the crop develop best? Why?
- What about diseases and pests in the different treatments? Could you find any differences between the planting dates?
- What is the preferred time for planting? What conditions are favourable then? Are there any constraints to planting during the most favourable period? How could you overcome them?
- When do you plan to plant your own production fields? What planting time would be most suitable if you are practising intercropping?

OTHER SPECIAL STUDIES (2): WEEDING

Introduction

The cassava crop must be weeded well and in a timely manner. However, when planning their time, farmers put more effort into establishing new fields and think that hoeing can be done at a later stage. Late weeding is then done during the short dry season from mid-January to mid-February or during the long dry season from the end of May to mid-September,[8] which will allow the uprooted weeds to dry completely. During these periods, the weeds have already developed their reproductive organs (rhizomes, stolons, seeds) and become difficult to control. Competition between weeds and cassava has a negative impact and can reduce the yield. A special study on this topic allows farmers to understand the various phenomena and to learn the mechanisms for weed control.

Objectives

- To help farmers better understand the effects of weeds on production
- To develop techniques and different attitudes for weed management
- To evaluate the economic benefits of the various weeding techniques

Time needed: Complete cropping cycle

Materials: Study fields, planting materials of one variety of cassava, hoes, machetes, flip chart, measuring tape, planting cord, markers, notebooks, pencils, marking pegs, weighing scale

Procedure

- Define 4 treatments proposed by farmers and the facilitator:
  - field to be weeded following farmer practices
  - field to be weeded following decisions made during the AESA
  - field to be weeded at 30, 60 and 105 days
  - field with neglected weeding (once every 3 months after planting)
- Select the field, preferably covered by *Digitaria* sp. or other invasive and obnoxious weeds.

[8] This reflects the seasons in the Democratic Republic of the Congo. Seasons may differ elsewhere, therefore adapt to local conditions.

- Prepare the soil following IPPM practices.
- Plant all the fields at the same time, with a planting distance of 1 × 1 m.
- Follow up regularly the field using AESA, but for weeding follow what is determined in the treatments.
- Evaluate cover and incidence of weeds in the different fields.
- Evaluate incidence and severity of diseases and pests.
- Harvest 12–18 months after planting.
- Evaluate different productions (leaves, planting material and roots).
- Carry out an economic analysis.

Observations

- Planting date, date of establishment of plants, percentage of established plants, date of replanting
- Growth and development (height, circumference of main stem at the base of the plant, diameter of crown)
- Cover by weeds
- Incidence and severity of diseases and pests
- Number of plants harvested in each field/treatment
- Total weight of roots per field/treatment
- Number and weight of marketable roots
- Production of planting materials (in metres of planting materials)
- Expenditure and income (economic analysis)

Questions for discussion

- What differences did you observe between the different plots? What happens if weeding is done late? What happens if weeding is not done at all?
- Were there any differences in the cassava yields in the different plots? Why or why not?
- How can you reduce the weed problem for the next season?
- What do you plan to do for weeding in your own field?

OTHER SPECIAL STUDIES (3): HARVESTING CASSAVA LEAVES

Introduction

Young cassava leaves are one of the most popular vegetables in the Democratic Republic of the Congo. Farmers close to cities and centres with large populations focus on production of both roots and leaves. The leaves are a certain and regular source of cash income and bring in more cash than the roots. However, too frequent harvesting of leaves can reduce root production and contribute to food insecurity. Many farmers believe that harvesting leaves will give good root production while in reality each harvest may result in reduced root yield. How can the harvesting of cassava leaves and the production of roots be balanced to achieve economic profitability in the farm?

Applied research advises 2–3 harvests of leaves at 2-month intervals, starting at least 4 months after planting. Some good results have been obtained in certain conditions. It is necessary for farmers to convince themselves of how to manage the harvesting of leaves while guaranteeing the production of roots.

Objectives

- To teach farmers about the effect of harvesting leaves on root production
- To help farmers achieve a profitable leaf harvest
- To evaluate the economic benefits of harvesting cassava leaves

Time needed: Complete cropping cycle up to marketing

Materials: Study field prepared following IPPM, planting material of the 2 best varieties of cassava preferred for the production of leaves (local and improved), machetes, hoes, flip chart, measuring tape, planting cord, markers, notebooks, pencils, pegs, weighing scale

Procedure

- Include 4 treatments in the study (proposed by farmers and facilitator).
- Mark the field in 2 blocks of 4 subfields each; each subfield measures 5 × 10 m. Each variety will be planted in a block of 4 subfields.
- Define the 4 treatments:
  - harvest for household consumption (short cuts)
  - harvest for sales in the market (very long cuts)
  - harvest 2–3 times beginning 4 months after planting
  - no harvest of leaves
- Prepare, plant and manage the fields following IPPM practices.

- Besides the treatments (harvesting leaves), base all other practices on decisions during the AESA.
- Harvest leaves following the predefined treatments, weigh each harvest and assign its market value. Discuss how leaves should be prepared to avoid possible problems with cyanide poisoning if not done well.
- Harvest roots in all fields at the same time by uprooting the whole plant starting from 12–18 months after planting.
- Evaluate the different parameters of the yield with reference to root yields.
- Evaluate the production of planting materials in metres.
- Compare the 4 practices for each variety and between the 2 varieties.
- Make an economic analysis of the 4 treatments per variety and of the 2 varieties.

Observations

- Planting date, date of establishment of plants, percentage of established plants, date of replanting
- Growth and development (height, circumference of the main stem at the base of the plant, diameter of crown)
- Frequency (total number) of harvests of leaves for each treatment
- Weights and values of each harvest of leaves
- Incidence and severity of diseases and pests
- Number of plants harvested in each field/treatment
- Total weight of roots per field/treatment
- Number and weight of marketable roots
- Market value of each production (leaves, planting material and roots) per treatment/field
- Expenditures and incomes (economic analysis)

Questions for discussion

- What were the yields of the leaves in the different treatments and the respective incomes? What were the root yields in the different treatments and their respective values? How do the economic benefits of the different treatments compare? How important is it to harvest leaves without waiting until the end of the season to obtain food or income for the family?
- How does the frequency of harvesting cassava leaves influence the yield of the roots? Why?
- How would you plan to harvest leaves in your own fields next season? Why?

OTHER SPECIAL STUDIES (4): MANAGEMENT OF MOLES

Mole rats can cause problems in cassava growing. Below are two examples of field studies on managing moles, using different methods.

MANAGEMENT OF MOLES – DEMOCRATIC REPUBLIC OF THE CONGO

Introduction

In certain areas in Katanga, moles cause economic damage to the roots of cassava, especially when grown on ridges. The experience of the Tshokwe tribe with hills to ridge up cassava plants gives satisfactory results in mole control. To validate this practice and to promote a widespread uptake and adaptation by farmers, solutions should be tested in a field study.

Objectives

- To help farmers adapt a soil preparation method to reduce damage by moles
- To evaluate the economic benefits of different methods of mole control

Time needed: Complete cropping cycle

Materials: Prepared plots, healthy cassava cuttings, flip chart, markers, notebooks, pencils, pens, labels, machetes, hoes, measuring tape, pegs

Procedure[9]

- Define 3 treatments in a participatory way:
  - soil preparation with ridges (local control)
  - soil preparation with hills
  - soil preparation for direct planting
- Mark 2 blocks with 3 plots in each with a dimension of 5 × 10 m per plot, and keep a distance of 1.5 m between the plots.
- Select two varieties: one sweet and one bitter
- Plant and manage all plots following IPPM practices
- Apply cultural practices based on decisions made while doing the AESA
- Evaluate and compare regularly the damage caused by moles
- Evaluate the different productions from both an agronomic point of view and the farmers' point of view
- Carry out an economic analysis

[9] In areas where moles are a major problem, it may be useful also to experiment with different planting dates.

Observations

- Planting date, date of establishment of plants, percentage of established plants, date of replanting
- Growth and development (height, circumference, diameter of crown)
- Incidence of mole attacks in each treatment
- Dates and frequency of weeding
- Incidence and severity of diseases and pests
- Harvesting date
- Number of roots harvested per plot
- Number of roots per plant
- Total weight of roots for each plot
- Number of metres of planting material/cuttings per plot
- Market value of each production (leaves, planting material and roots) for each treatment
- Expenditure and income (economic analysis)

Questions for discussion

- Did you find differences in the mole damage on cassava plants in the different treatments? Which seemed best? Why (or why not) did you find differences?
- Were there any differences in yield between the different treatments? Why or why not? What are the labour requirements for each treatment? Would labour be a constraint?
- How would you try to manage moles in your field next season? Do you think that one farmer alone can deal with the problem, or is community action necessary? What could be done if the problem is serious? What action can the community take together?

THE MOLE RAT AND OMULUHU (*TEPHROSIA*) – UGANDA

Background

This study shows the kinds of activity that can be done with FFS groups to follow and understand how to control the mole rat. *Tephrosia* is a legume in the *Fabaceae* family. Many species in the *Tephrosia* genus are poisonous, particularly for fish, because of their high concentration of rotenone. *Tephrosia* has been used historically by indigenous cultures as a fish poison.

The roots of *Tephrosia* are poisonous to the mole rat. In Busia District, IPPM-FFS farmers use it to control the mole rat, a pest of cassava. Geoffrey Ouma, an FFS graduate, says "I have used *Tephrosia* to control the mole rats in my garden for over five years. Currently I use this knowledge to train other farmers and I have also made money through selling the *Tephrosia* seed."

Objective: To enhance participant understanding of how *Tephrosia* can be used to control mole rats in cassava fields

Materials: Flip chart, marker pens, hoe, cassava cuttings, *Tephrosia* seed

Procedure

Using the cassava fields neighbouring the FFS study plot as your control, conduct the following steps:

- Ask participants to plant cassava with spacing of 1 × 1m.
- In between the rows, plant *Tephrosia* with spacing of 1.5 × 1.5 m.
- Plant *Tephrosia* around the garden to form of a hedge/fence.
- Ask participants to continue monitoring the mole rat up to harvest time.

Questions for discussion

- What do you think about using *Tephrosia* to manage mole rats? How do the fields compare with fields without this management strategy? Can you use it in your own fields?
- Are there any differences in yield between the different treatments? Why or why not?
- How would you try to manage moles in your field next season? Do you think that one farmer alone can deal with the problem, or is community action necessary? What could be done if the problem is serious? What action can be taken by the community together?

4.2 FFS exercises on IPPM

Overview of the technical, IPPM-related exercises included herein

Decision-making for IPPM	Agro-ecosystem analysis
	IPPM principles in local languages of Uganda and Kenya
Soil preparation	Clearing the field
	Soil preparation
Varieties	Variety identification and names
	Criteria for selection of a variety
Planting materials	Source of cassava cuttings: where to get planting material
	Preparation of cassava cuttings
	Storage and preservation of planting material
	Rapid multiplication techniques
Growing cassava in association with other crops	Intercropping
	Selection and preparation of seeds of crops grown in association with cassava
	Germination test
Planting the fields	Time of planting
	Planting of cassava (and seeding associated crops)
Crop physiology	Planting methods and plant development
	Plant development
Maintenance of the crop	Filling gaps
	Weeding the cassava field
Soil fertility and fertilization	Water-holding capacity of the soil
	Legume crops and their role in soil fertility management
Diseases and pests of cassava	Symptoms of diseases and pests
	Diseases and photosynthesis
	Disease groups
	Disease triangle to explain disease management
	Identification of cassava mosaic disease
	Identification of cassava brown streak disease
	Spread and management of CMD and CBSD
	Phytosanitation of cassava
	Identification of bacterial blight
	Spread and management of bacterial blight
	Identification of anthracnose disease
	Identification of leaf spots
	Identification of cassava mealy bug
	Spread and management of cassava mealy bug
	Identification of cassava root scale
	Spread and management of root scale
	Identification of green spider mite
	Spread and management of green spidermite
	Controlling the mole rat
	Insect zoo
	Insect box
	Cassava growth stages, pests and natural enemies

DECISION-MAKING FOR IPPM (1): AGRO-ECOSYSTEM ANALYSIS (AESA)

Agro-ecsosystem analysis is a very important exercise in FFS. AESA is done weekly (every FFS meeting) in the different study fields. It is a tool for observation, analysis, exchange and discussion to help reach informed decisions for integrated production and pest management. It helps FFS participants to look at all the elements in the agro-ecosystem and to understand how they are linked and influence each other. It also helps the FFS group to compare IPPM and FP throughout the season and understand why there might be differences occurring. AESA is a useful tool in other studies that the group may have set up.

Field observations

- **Why?** To have information on the different organisms and elements of the agroecosystem, to analyse them and to make decisions as and when needed
- **When?** Once the crop is established (i.e. 2 weeks after planting), continuing throughout the cropping cycle
- **How?** The facilitator should guide participants to:
  - **observe** (listen, see, touch, feel and taste)
  - **analyse** (reflect on what is observed, establish relations, interactions between different things observed, the consequences and their influence on the crop)
  - **conclude (**according to the perception of each member of the group, reach a common decision)
  - **practise the knowledge obtained (**everybody can adapt the new experience to their environment, everybody can develop their skills)

Steps in agro-ecosystem analysis

1. Organization of groups:
   - Divide the big group in small groups of 5 to 8 people.
   - Each group selects a facilitator and a person who takes notes.
   - Each group moves to a plot or study field.
2. Observation and collection of information in small groups:
   - Collect and count all different specimens of insects and natural enemies.
   - Collect specimens of diseases and count degree of infection.
   - Collect specimens of weeds.

- Collect agronomic data of selected sample plant following an X pattern in the field, avoid border areas. Agronomic data: height, diameter of the main stem at the base of plant, number of normal leaves, number of abnormal leaves, crown of the plant, number of stems, number of fruits.
- Take notes on: season, crop, variety, planting date, number of days after planting, soil conditions, climate.

3. Analysis and discussion in small groups of the elements observed and summarize conclusions on posters (see the example of a poster presentation on p. 68).
4. Presentation of the findings of each small group and plenary discussion:
   - Each group presents conclusions summarized in poster.
   - Group discusses.
   - Ask questions about why and how things happen in the field, how different elements influence each other. (The facilitator plays an important role in ensuring lively and technically well informed discussions leading to good decisions. "What if...?" questions are an effective tool for reflection.)
5. Decision-making by the FFS group about problems and field observations in the different study fields and on the basis of the above steps.
6. Implementation of decisions:
   - activities (field work)
   - themes for further training (e.g. special topics or a small study/ experiment, such as an insect zoo).

Time needed

In the first few sessions of the FFS, AESA is time consuming. The participants have to understand the process and have to get used to making and recording observations. It can take 2–3 hours to complete. However, after a few weeks, all know what to do and an AESA takes less time, about 1.5 hours.

AESA is used to compare IPPM and FP (comparison study) and to discuss what differences occur and why. AESA can also be used in special studies; the frequency depends on the aim of the study and the time available.

Note: If time allows, do not limit observations to the study fields. Look at what is happening in the surrounding fields to gain an idea of the situation, what differences there might be and why.

Sample AESA poster

AESA No.

FFS: Date:

Group: Session:

Field observations

Field/plot:

Crop:

Variety:

Planting data:

Cropping cycle:

DAP:

Plant observations

Length:

Diameter:

No. stems:

No. leaves:

diseased:

normal:

No. branches

No. stems:

Shadow:

Enemies of the crop

Insects

Diseases

Weeds

Friends of the crop

Beneficial organisms

Natural enemies

Scientific names / Local names

Observations (*What did you see/observe?*)	**Conclusions** (*What does that mean? What could it lead to?*)	**Decisions** (*What can be done to find a solution or gain knowledge?*)
Soil humidity Diseases Insects Weeds Natural enemies		

DECISION-MAKING FOR IPPM (2): IPPM PRINCIPLES IN LOCAL LANGUAGES OF UGANDA AND KENYA

Background

IPPM principles underpin learning and decision-making in an FFS study field. They build on knowledge that is local and scientific to find the best possible solutions in the local context.

It is important to find joy in any activity. Farmers need to feel they "own" the IPPM principles, which must be repeatedly referred to in the AESA process. Farmers like to sing: when they sing about the IPPM principles, they think about them and improve their understanding.

Objective: To enhance participant understanding of the four IPPM principles

Time needed: 1.5 hours

Materials: Flip chart, marker pens

Procedure

- Ask participants to explain what they understand by the term "principle".
- Explain the principle of the law of gravity by throwing a stone up and watching it fall!
- Explain how the four principles of IPPM operate.
- Ask participants to recite the four IPPM principles during FFS sessions, in order to have a strong grasp of the principles and internalize them for everyday life.
- Ask participants to translate the IPPM principles into their local language and to sing them with a tune of their choice (see p. 70).

Questions for discussion

- What do you understand about each principle?
- How is each principle translated in your mother tongue?
- Do you know the role each principle plays in achieving high yields for cassava production?
- How do the IPPM principles relate to what is being done in the FFS study plot?

IPPM principles song:	**Kiluhya (language used in Busia Kenya):**
IPPM has got four principles and we know them (×2)	Amalako ka IPPM kari kane khwakamanya (×2)
Growing a healthy crop in a healthy soil	Okhuba nebitake nende ebiayo bilayi
Conserving natural enemies	Okhulinda ebibukha omwicha wo murimi
Regular observation of the field	Okenderanga endalo yawo buri sikha
The farmer becomes an expert	Olunyuma omurimi abe omanyire ebindu bingi
Samia (language used in Busia Uganda):	**Kiswahili:**
Amalako ka IPPM kali kane kwakamanya (×2)	Kanuni Za IIPM ziko nne tuazijua (×2)
Ohutaka emwe ndayi mwiloba elayi	Kusitawisia mimea na mifugo wenye afya
Ohulinda ebiwuha omwicha wo mulimi	Kuwatunza wadudu marafiki wa mkulima
Olambula endalo yawo buli siha	Kutembelea shamba lako mara kwa mara
Olunyuma omulimi afuha omukugu	Hatimaye mkulima ndiye mtalaam

SOIL (1): CLEARING THE FIELD

Introduction

Clearing the field is an operation which requires both time and labour. It must be done well and at the right time, preferably during the dry season to allow good use of vegetative residues (decomposition). For fields invaded by weeds propagated by rhizomes (e.g. some grasses and *Imperata cylindrica*), it is necessary to work to a good depth with a hoe to uproot and destroy all rhizomes.

Objective: To help farmers improve their practices to clear the land

Time needed: 1.5–2 hours

Materials: Field selected for study plots, hoe, machete

Procedure

- Discuss with farmers the practices they adopt to clear the land.
- Discuss the strong and weak points.
- Reflect on the possibilities for improvement of these practices.
- Reflect on the organization of this operation in the FFS, including the appropriate time to start the work, the time needed and the distribution of the tasks.

Questions for discussion

- When do you clear the land to grow cassava?
- How do you clear the land for growing cassava?
- What are the strong points? Why?
- What are the weak points that can be improved? Why?
- How can you modify the weak points to achieve a good result?
- How do you think you can organize this work for good field management, taking into account the area to be cultivated, the cultural season, additional daily tasks and other seasonal activities?

SOIL (2): SOIL PREPARATION

Introduction

Good soil preparation involves:

- loosening of the soil – to allow infiltration/circulation of air and water; and
- decomposition of organic matter in the soil.

Well-prepared soil promotes living micro-organisms and the development of roots, including cassava roots, which can reach a depth of up to 20 cm (and soil for the cassava crop, therefore, needs to be prepared to a depth of at least 30 cm).

Appropriate techniques and materials (hoes) must be adopted, depending on local practices and whether or not cassava is grown directly in the field, on ridges or on hills.

Objective: To improve techniques for better soil preparation and good weed management

Time needed: 1.5 hours

Materials: Hoes, machetes, planting cord, measuring tape, flip chart, markers, notebooks, crayons

Procedure

- Reflect on the importance of deep soil preparation.
- Reflect on local techniques of soil preparation as used by farmers and discuss the advantages and disadvantages.
- Reflect on possible improvements.
- Practise soil preparation, directly and on ridges (hills), while incorporating vegetative residues.

Questions for discussion

- Why is soil preparation important?
- What kinds of soil preparation do you practise? How?
- What are the advantages and disadvantages of each type of preparation? Why?
- How can you improve soil preparation techniques?
- What are appropriate tools and instruments to use?
- How can you prepare soil to a depth of more than 30 cm in a simple way or incorporate vegetative materials?

VARIETIES

The selection of a variety is an important step in growing a crop. Each variety has its own characteristics and farmers select varieties which meet their needs. The exercises below focus on how to select varieties, and the criteria to consider.

VARIETIES (1): VARIETY IDENTIFICATION AND NAMES

Background

With numerous varieties of cassava provided to farmers over the past 5–10 years, correct identification is a challenge not only for farmers but also for service providers in the government extension system and NGOs. Some varieties are known by names that are no longer correct having changed when the varieties were disseminated to more farmers. This inconsistency has led to doubt and unnecessary rejection by some farmers because specific varieties have specific attributes which need to be recognized. For instance, 'TME 204' is mistakenly known by some farmers as 'Akena', and some farmers have an unjustified negative opinion of 'Akena' because of CBSD damage to the real 'TME 204'.

Objective: To help participants correctly identify cassava varieties

Time needed: 1.5 hours

Materials: Leaves, stems and roots of the different varieties of cassava cultivated by the farmers, flip chart, marker pens

Procedure

- Ask each participant in the previous FFS session to bring a sample of cassava stems with leaves and roots of different varieties they have grown.
- Ask participants to group the plant samples based on the characteristics of their leaves, stems and roots. Samples with common features are grouped together, each group constituting a variety.
- Ask participants to name the varieties known to them. Compare and discuss the names and identify characteristics documented for the given variety.

Questions for discussion

- How many varieties did you bring? Do you think they are all different, or are some the same? Why does this happen? Is it important?
- What qualities do you prefer in the varieties you grow?
- Are you using the same name for the same variety, or are there different names for the same variety? Does this cause confusion?
- How can you make sure you have the variety you really want to grow?

VARIETIES (2): CRITERIA FOR SELECTION OF A VARIETY[10]

Background

Farmers are always on the lookout for new varieties with improved characteristics, such as higher yield potential, good root characteristics (determined by dry matter content, nutritional value etc.), appropriate tolerance, improved taste, higher market price, the ability to produce more planting material and long ground storability. However, the (new) short-duration varieties have a relatively low yield potential, and high-yielding varieties are often poor in taste. Furthermore, each variety performs differently in different situations, depending on specific location and seasonal conditions. This highlights the importance of varieties being tested in a variety of agro-ecological zones, in order that farmers can select those most likely to perform well in their specific location. Farmers must bear these issues in mind when choosing varieties that fit and perform best under the prevailing farming conditions.

The variety determines the plant quality, which, in turn, influences the development of diseases. The use of improved varieties with resistance to the principal diseases is a management method recommended for integrated production and pest management. The majority of farmers do not have access to performing varieties developed by national and international research institutes. The FFS provides an opportunity for farmers to learn the different characteristics of the improved (new) varieties that have been tested and distributed and which are available. Farmers can see how they compare with local varieties and make an informed decision about whether or not to use the new varieties. Varieties not only need to respond to the requirements of the farmers, but must have resistance to diseases of economic importance (one of the main reasons for production losses in cassava).

Objectives

- To enhance farmers' understanding of the factors to consider when choosing a variety to plant.
- To help farmers become familiar with the characteristics of new varieties, especially their advantages compared with local varieties, in order that they can select varieties with resistance to mosaic and other major diseases.

Time needed: 1.5–2 hours

[10] The FFS provides an opportunity to test several varieties. If the FFS group expresses interest, set up a special study on variety comparison. An example is given in the section on field studies.

Materials: Leaves, stems and roots of the different varieties of cassava cultivated by the farmers, improved varieties distributed by research institutions or other centres, flip chart, marker pens

Procedure

- Identify and name the local varieties and ask the participants to rank them according to their popularity in their community.
- Observe the improved varieties and compare the vegetative parts (especially roots and leaves) with the other varieties.
- Examine the possible reasons for differences in the production of roots.
- Analyse the different ways mosaic virus (CMD) spreads.
- Ask participants to list the strengths and weaknesses of each of the varieties, according to the following criteria:
  - production
  - processing and marketing
  - utilization
  - access to planting materials
  - resistance to virus diseases

Questions for discussion

- What factors should be taken into consideration in variety selection?
  - desired characteristics of the crop and produce
  - availability of planting material
  - market demand for produce/planting material
- What differences do you notice between the varieties?
- What do you think of the development of each variety?
- What do you think of the development of diseases in the different varieties?
- What are the qualities and imperfections of each variety?
- What new variety would you consider integrating in your fields? Why?
- What are the selection criteria for a good quality variety that is also resistant to mosaic virus?
- How do you think you can manage the imperfections of the new variety? Why?

PLANTING MATERIALS

After deciding which are the preferred varieties for cultivation in the field, a farmer needs to identify where to get the planting material – from a production field or a multiplication plot. Once the source is determined, the planting material needs to be cut, then stored until planting. There follow some exercises for the FFS on finding good planting material and preparing and storing the cuttings.

PLANTING MATERIALS (1): SOURCE OF CASSAVA CUTTINGS: WHERE TO GET PLANTING MATERIAL

Background

Farmers usually use cuttings taken indiscriminately from a range of sources for planting the chosen varieties. Each source of cuttings has advantages and disadvantages. Identifying and discussing these advantages and disadvantages can help the farmer make better decisions about where to obtain cassava cuttings.

In principle, cuttings should come from a multiplication field with healthy planting material. The cuttings selected must meet several criteria, for example, an age of 9–15 months and an absence of mosaic symptoms (indeed, the most efficient way to manage cassava mosaic virus is to use healthy planting material). Planting material should be hard (otherwise it can rot) and it must have sufficient nutrient supply to easily establish and make roots.

Objectives

- To enhance farmers' understanding of the different sources of cassava planting materials and their associated advantages and disadvantages
- To assist farmers in improving their selection criteria for planting material
- To integrate the management of cassava mosaic virus building from healthy cassava planting material

Time needed: 1.5–2 hours

Materials: Learning field, cassava field that is mature with one or several local varieties and a field of similar age that has one or more improved varieties coming from research, flip chart, marker pens, machetes, string, measuring tape, pegs

Procedure

- Ask participants to list and rank the sources of planting material for cassava.
- Ask participants to state the advantages and disadvantages of each source. This could be captured in tabular form (see p. 77).
- Go to the fields: one with a local variety and one with an improved variety and collect cuttings.

- Divide the group of farmers into two subgroups and ask one subgroup to collect some cuttings from the field with the local variety.
- Reflect with the farmers on their selection criteria for the planting material.
- Reflect on the planting material's role in the transmission of mosaic virus.
- Complement the farmers' selection criteria with any criteria they might have missed.
- Ask the other subgroup to collect healthy cuttings from the field with improved varieties, taking into consideration all the selection criteria.
- Look at the cuttings, discuss and compare.

If there is no field with improved varieties available, follow these steps:

- Go with the farmers to a field to collect cassava cuttings.
- Reflect with the farmers on their criteria for selecting planting material.
- Reflect on the role of planting material in transmitting diseases.
- Set up an experiment using healthy and diseased planting materials.
- Complement the farmers' selection criteria with any not mentioned.
- Plant only healthy cuttings in the IPPM field, or cuttings that look healthy (local variety).

Questions for discussion

- What sources do you use for taking cassava cuttings? What are the main observations made on the cuttings of the local varieties?
- What are the farmers' criteria for selecting planting material?
- What do you think of the transmission of CMD via plant cuttings? How can you reduce the risk of virus transmission when you select cuttings?
- What can you do to get healthy cassava cuttings?
- What are the main observations concerning cuttings of improved varieties?
- Can you compare the cuttings of local and improved varieties?
- What other criteria need to be considered when selecting a cassava cutting? Why?
- Would you be willing to spend money to obtain good quality planting materials? Why or why not?

Source of planting material	Advantages	Disadvantages

PLANTING MATERIALS (2): PREPARATION OF CASSAVA CUTTINGS

Introduction

Farmers use the whole stem, from the top to the bottom, as planting material for cassava, with sections 40–60 cm long. Ideally, the sufficiently hardened median parts of the stem should be used, taking cuttings 15–25 cm long with a minimum of 4–5 eyes. The parts at the top and bottom are eliminated. So a cutting 1 m long can provide four smaller 25-cm cuttings; 1 ha (10 000 m^2) is planted with 2 500 m of cuttings. In other words, the number of square metres of surface area divided by 4 will give the number of metres of cassava cuttings needed for the field to be planted. But it is recommended to keep 5–10 percent of additional cuttings in appropriate conditions to fill any gaps after planting.

The quality of the cuttings affects establishment, growth performance and, ultimately, yield. Attention needs to be paid to:

- the length of the cuttings;
- any bruising of or damage to the epidermis and buds; and
- damage caused by termites.

Pre-sprouting cuttings before planting can result in high growth vigour, full crop stand, reduced weed pressure and higher yield.

Objectives

- To enable farmers to better manage and use cuttings to guarantee good establishment and avoid losses of planting material of cassava
- To teach farmers to evaluate the planting material required to plant a specific surface area
- To provide participants with the necessary knowledge and skills to prepare stem cuttings

Time needed: 1.5–2 hours

Materials: Field with a variety selected for planting, cuttings, machetes, flip chart, markers, piece of wood with marks for cutting the stems, measuring tape, cassava stems, tools for cutting (e.g. pangas)

Procedure

- Gather the participants next to a field which has the variety selected for planting.
- Allow the farmers to cut the stems in their habitual manner (FP).
- Cut the stems according to research recommendations (IPPM).
- Ask farmers to compare the FP cuttings with the IPPM cuttings.
- Provide exercises for calculating how many cuttings are needed to cover a given surface.
- Ask participants to obtain stem cuttings and to cut them into short (< 20 cm) and long (> 30 cm) cuttings.
- Organize participants in smaller groups to discuss and present the advantages and disadvantages of short and long cuttings, the effects of bruised or damaged nodes.
- Discuss how to protect cuttings against termites.
- Demonstrate the pre-sprouting technique.

Questions for discussion

- How do you prepare planting materials?
- What do you think of the bottom and top parts compared with the centre parts of the stem?
- What factors influence good crop establishment?
- What differences do you observe between FP and IPPM cuttings?
- What measures should be taken when preparing cuttings to guarantee good crop establishment?
- What quantity of stems is required for 1 ha, 0.75 ha, 0.50 ha and 0.25 ha, respectively?
- How many cuttings are needed for 1 m^2?
- What is a good cassava cutting in your opinion? Why?
- Do you use pre-sprouting in your own fields?
- What is your experience with termites damaging the cuttings?

PLANTING MATERIALS (3): STORAGE AND PRESERVATION OF PLANTING MATERIAL

Background

Long-term storage of cassava stems is not possible because stems dehydrate. However, cassava stems can be stored for several weeks if kept under the right conditions. Understanding correct storage is important in a cassava FFS, because farmers often lose planting material when they harvest cassava during the dry period and the stems end up drying up.

Objective: To provide participants with knowledge and skills for the correct storage and preservation of cassava stems

Time needed: 1.5 hours

Materials: Cassava stems, tree shades, marker pens, flip chart

Procedure

- Ask participants to identify good tree shade and collect cassava stems.
- Explain and demonstrate the procedures for preparing the stems for storage.
- Ask participants to observe, take notes and report periodically to the larger group on the condition of the cuttings in the shade.
- Determine how long the cuttings can stay fresh enough for planting.

Questions for discussion

- How long is it possible to keep cassava cuttings in the shade?
- How long can they remain exposed to sunlight?
- How long do you normally keep cuttings before planting?
- In what conditions do you normally keep cuttings?
- What scope is there for improvement in the practices?

PLANTING MATERIALS (4): RAPID MULTIPLICATION TECHNIQUES

Background

Sometimes it is difficult to obtain sufficient quantities of good quality planting material to plant a production field of cassava. Rapid multiplication techniques help to provide planting material in a relatively short period.

Objective: To provide participants with the knowledge and skills required for rapidly multiplying cassava planting materials during periods of limited supply

Time needed: 1.5–2 hours

Materials: Flip chart, marker pens, knives, compost, cassava cuttings, materials for shading the nursery bed

Procedure

- Explain that rapid multiplication is a technique used to overcome the problem of low multiplication rates of vegetatively propagated crops, such as cassava, in order to ensure that there is adequate planting material available at the right time of the season.
- Demonstrate how to prepare cassava cuttings for rapid multiplication.
- Ask the participants to plan the site and experiment with rapid multiplication techniques.
- Observe the development of the young plants during the rest of the season and compare with the growth of plants from normal cuttings.

Questions for discussion

- How does this method compare with farmers' experience of planting material multiplication?
- What are the problems FFS members face with rapid multiplication techniques?
- How might they overcome these problems?

GROWING CASSAVA IN ASSOCIATION WITH OTHER CROPS (1): INTERCROPPING[11]

Introduction

In many cases cassava is not planted as a single crop, but in association with other field crops, such as maize, groundnut and cowpea. There are disadvantages, but also advantages – for example, while crops might compete for resources, they can also increase the nutrient-use efficiency. Having several crops in the field is an attractive option for the farmer, as they provide a source of food and income for the family, while the cassava crop remains in the field for a long period.

Objectives

- To enhance understanding of crops suitable for intercropping with cassava
- To explain the advantages and disadvantages of intercropping with cassava

Time needed: 1.5–2 hours

Materials: Flip chart, marker pens

Procedure

- In small groups, ask participants to list the various cassava intercrops and to rank them according to their popularity.
- Ask participants to state the advantages and disadvantages of each of the intercrops.

Questions for discussion

- Do crops planted together with cassava affect cassava growth and yield?
- What are the positive effects of intercropping on cassava growth and yield?
- What are the negative effects of intercropping on cassava growth and yield?

[11] If intercropping is very common, it should be included in the field study to compare local practices and IPPM.

GROWING CASSAVA IN ASSOCIATION WITH OTHER CROPS (2): SELECTION AND PREPARATION OF SEEDS OF CROPS GROWN IN ASSOCIATION WITH CASSAVA

Introduction

The choice of seeds of crops to be grown in association with cassava (mixed crops) influences the economic benefits of the field. Good seed allows for good germination, which produces:

- vigorous plants; and
- plants with better resistance to pests and diseases.

Poor germination, on the other hand, leads to:

- economic losses due to loss of seeds and additional work; and
- production losses due to poor establishment and subsequent gap filling.

Many diseases are transmitted by seeds. Seeds from a field that has been well managed increase the chances of a good crop.

Objective: To improve the capacity of farmers to choose seeds and recognize good quality seed

Time needed: 1.5–2 hours

Materials: Seeds, hoes, machetes

Procedure

- Reflect with the farmers on the issues to consider when choosing and preparing seeds.
- Help farmers discover additional criteria, keeping in mind the origin of the seeds.
- Stimulate farmers' interest in seeking a guarantee when buying seeds.

Questions for discussion

- How do you prepare your seeds?
- Do you buy seeds?
- What guarantee do you have when you buy seeds from another party?
- What are the consequences when a seed does not germinate?
- How can you improve the availability of good quality seeds?
- What quantity of seeds is required for a surface of 0.10 ha?

GROWING CASSAVA IN ASSOCIATION WITH OTHER CROPS (3): GERMINATION TEST

Introduction

If the germination percentage is known, losses (both money and time) can be avoided in a farm. A seed lot should not have a germination percentage below 95 percent. However, there are farmers that use seeds with a germination rate of less than 50 percent. The timing of the germination test is important, in order to have sufficient time to obtain other seeds if necessary.

Objective: To explain to farmers the importance of a germination test and the techniques involved

Time needed: 1 hour to start the exercise, and 1 hour once the seeds have germinated

Materials: Seeds, hoes, flip chart, markers

Procedure

- Using a hoe, prepare well a surface of 1 m^2; alternatively, prepare a basin or container with some topsoil.
- Mark 10 lines with 10 cm between the lines.
- Take a sample of approx. 200 g of seeds.
- Select and weigh the good seeds within the sample and calculate the loss.
- Take 100 seeds randomly and seed them in the 10 lines with a spacing of 10 cm between the seeds.
- Make sure that the plot is watered.
- Once sufficient time has passed for germination, count the number of seeds that have germinated and monitor the quality of the plants. Determine the percentage of germination and discuss the results.
- Try to calculate the losses incurred since the beginning of the selection process.

Questions for discussion

- What do you think of the germination?
- What do you think of the quality of the seeds?
- What are the advantages of doing a germination test?
- Can you estimate the potential losses?
- Is the germination capacity of your seeds weak?
- What measures can you take to ensure good quality seeds?

PLANTING THE FIELDS (1): TIME OF PLANTING[12]

Background

In northern and eastern Uganda, cassava is planted mainly in the second, shorter rainy season, which precedes the long dry season lasting 3–5 months. For early-maturing varieties (10–12 months), this means that for nearly half its growth period, the crop grows in moisture-stressed conditions, with a high incidence of mealy bugs and green mite. Furthermore, the crop is often destroyed by livestock left to wander during the dry season. The long dry season sets in when the second season crop is young, which means that crop growth is slowed down and root formation and development is delayed and poor. As a result, low on-farm cassava yields are experienced, in particular for early-maturing varieties (whose uptake by farmers has been high in the past few years).

Planting in the first season would help avoid or reduce the impact of the production challenges associated with the long dry seasons, because the first season crop will, at the onset of the long dry season, be at an advanced stage of its growth period and thus experience less stress in growth and yield.

Objective: To provide participants with knowledge about the best season/time for planting of cassava

Time needed: 1–1.5 hours

Materials: Flip chart, marker pens, fields of cassava planted in second season and first season

Procedure

- Explain the relationship between the time of planting and growth and yield performance of cassava.
- Allow participants to experiment with the time of planting.
- Observe the crop throughout its growth period and compare yields.

Questions for discussion

- What differences do you observe between the fields planted at different times? Why?
- Which fields perform best?

[12] This exercise can be done comparing fields planted at different times around the FFS. If planting dates are an issue, a special study on planting dates can be set up.

PLANTING THE FIELDS (2): PLANTING OF CASSAVA (AND SEEDING ASSOCIATED CROPS)

Introduction

Farmers plant cassava throughout the year, in the rainy and the dry season, as a monoculture, but more often together with other crops (mixed cropping). The planting density and seeding of crops vary a lot. To obtain good field results, it is recommended to plant the cassava and seed the associated crop at the same time. Plants, therefore, have the opportunity to reap the maximum benefit from the rains and develop vigorously and rapidly in order to resist bad weather and difficult periods. It is important to seed the associated crop at the beginning of the cropping season, so that it can mature during a period that is sufficiently humid, to then become fully mature and harvested during a relatively dry period. Cassava is planted either at the same time as, or one or two weeks after, the associated crop.

The planting density for cassava is 1 × 1 m, with one cutting per planting place.

- In clay soils, the cuttings are planted in an inclined direction to a depth of 10 cm, and are covered up to two-thirds or three-quarters.
- In sandy soils, the cuttings are planted in a horizontal position or flat at a depth of 10 cm.

It is advised to have no more than one crop associated to cassava. Rows are oriented from east to west in flat fields, and follow the contour lines on sloping lands.

- Maize is seeded in the same lines as the cassava or in staggered rows with a planting density of 1 × 1 m, using 2 seeds per planting hole.
- Groundnut is seeded in two lines between 2 lines of cassava with planting densities of 40 × 20 cm or 30 × 30 cm, using 2 seeds per planting hole.

Objective: To help farmers improve cassava planting methods in order to achieve a crop growth and development that will give good production

Time needed: 1.5–2 hours

Materials: Cuttings of a local variety and improved variety, flip chart, markers, hoes, machetes, field prepared for FP and IPPM, string, measuring tape

Procedure

- Allow farmers to plant (and seed) in the FP field.
- With the assistance of the facilitator, mark the planting rows in the IPPM field, and let farmers plant (and seed) with technical guidance.
- Reflect with the farmers on the spatial occupation, the number of cuttings and planting holes, the planting distances, the orientation and the advantages of planting in lines.
- Conserve the remaining cuttings for replanting in the gaps.

Questions for discussion

- How do you plant and seed your field?
- What do you think about how the plant occupies the space?
- What happens when plants are very densely planted?
- How can you set out the planting rows? Why do you need to mark them?
- What do you think about the planting distances in the IPPM and FP fields?
- What are the advantages and disadvantages of planting without making rows?
- What do you think about improving cassava planting methods in the future?
- How and why should you keep the remaining cuttings?

CROP PHYSIOLOGY (1): PLANTING METHODS AND PLANT DEVELOPMENT

Background

Cassava cuttings can be planted vertically, at an angle or horizontally. The orientation of the cutting at planting influences growth characteristics and therefore should be decided on the basis of a range of criteria:

- soil type
- reduction of damage to roots by rodents
- whether the purpose of planting is for production of several stems (stem multiplication)

Objective: To enable participants to appreciate the relationship between the orientation of cutting at planting and root formation and stem production

Time needed: 1 hour when starting the exercise, plus 1 more hour after root setting

Materials: Cassava cuttings, hand hoe, flip chart, marker pens

Procedure

- Ask participants to plant some cuttings vertically with two-thirds of the cutting buried into the soil, and others horizontally with the entire cutting buried at a depth of about 10 cm.
- Ask participants to later on take count of the number of stems produced and the depth and closeness of the roots in the soil.
- Discuss the depth and closeness of the roots in relation to vulnerability to or damage by rodents, as well as to ease of harvest.

Questions for discussion

- What differences do you observe between the different ways of planting?
- What do you prefer? Why?
- How does soil type influence the planting method?
- If you plant the crop for production purposes, what is your preferred planting method?
- If you plant the crop for multiplication of cassava cuttings, what is your preferred planting method?

CROP PHYSIOLOGY (2): PLANT DEVELOPMENT[13]

Background

This exercise is an example of the kind of activity that can be done with FFS groups to follow and understand the development of the crop. Recognizing the different stages of crop development and understanding the plant's needs at each stage are important for ensuring that plants will be managed in the best possible way.

Objectives

- To explain the formation and development of root, stem and leaf at the seedling and other growth stages of cassava
- To describe the physiological characteristics and nutrient requirements at the seedling and other growth stages of cassava
- To teach the agronomic practices necessary at the seedling and other growth stages of cassava

Time needed: 2 hours

Materials: Cassava plants at 14 days after planting (DAP), and at 30, 60, 90, 120 and 160 DAP, plus hoe, cuttings, marker pens, flip chart, paper, pen, ruler, scissors

Procedure

- Ask participants to prepare planting material and plant several cuttings in the study plot.
- Ask participants to dig up one plant per month and to draw the root and shoot system.
- Observe and describe the morphological characteristics, and draw the growth stages of cassava.
- Measure, count and describe the growth criteria: height of plant, length of roots, number of leaves.

[13] If cassava plants in the different stages of development are available at the same time, the exercise can be done in one session. If materials at the different stages are not available at the same time, the exercise can be repeated during the season, linked to an AESA. Farmers can correlate the crop growth and development above ground with the development of the roots and other parts underground. Keep flip charts and record observations for comparison at a later stage.

Questions for discussion

- Describe and discuss the morphology of the cassava plant. How many roots are there at each stage? What is their importance? How many leaves should there be at each stage? How does the stem develop at the different stages?
- Reflect on how the plants are changing.
- Discuss the cultivation practices used in the nursery:
  - soil preparation techniques
  - nutrient usage (types of nutrient, amounts and methods of application)
  - planting techniques
  - management of herbivores and natural enemies in the nursery
- Discuss what cultivation methods should to be applied in the nursery garden and why.
- For each stage, observe farmer practices and discuss with the farmers the practices adopted and why.

MAINTENANCE OF THE CROP (1): FILLING GAPS

Introduction

After planting, there are some cuttings (and seeds) that do not establish. It is useful to check establishment with a view to filling gaps in the field 3–4 weeks after planting. A good practice is to use cuttings that have been kept in the right storage conditions. While gaps are being filled, it is also good practice to uproot diseased plants in the field and replace them with other cuttings. This helps to eliminate sources of contamination from the field – but note that it is important to dispose properly of diseased plants. This operation is done only once in the production field, when refilling gaps. In a multiplication field, regular phytosanitation takes place throughout the season.

Objective

To assist farmers to better manage the timing of and method for replanting gaps

Time needed: 1.5–2 hours

Materials

Machete, hoe, cuttings, flip chart, markers, notebook, pens

Procedure

- Divide participants into subgroups of 5–6 members.
- Spread the subgroups over different plots to observe the empty spaces in each separate row and then estimate the percentage of crop establishment.
- Root up all those plants carrying signs or symptoms of mosaic disease.
- Use correctly stored cassava cuttings for replanting.
- List the advantages of using well-conserved cuttings rather than newly harvested cuttings for replanting.

Questions for discussion

- Why should replanting be done and why is timing important?
- What are the possible reasons for cuttings dying or not establishing?
- How do you replant?
- Why is it important to use cuttings that are well conserved for replanting?
- Why should diseased plants be eliminated (phytosanitation) at this point in time?
- How can this operation be improved in your field?
- How do you dispose of the diseased plants?

MAINTENANCE OF THE CROP (2): WEEDING THE CASSAVA FIELD[14]

Introduction

Crop losses caused by late or insufficient weeding can exceed 60 percent of the potential production. Invasive and noxious weed species, such as *Digitaria* sp, *Cynodon dactylon* and *Imperata cylindrica*, have forced many farmers to abandon their fields. A plant that has to deal with strong competition from weeds is not able to feed itself well and becomes sensitive to diseases and pests. This sensitivity is greatest when the plant is still young.

The aim is to create good conditions so that the plant becomes vigorous and resistant to diseases and pests, because a healthy plant gives an optimal production. It is also necessary to keep a cassava field free from competition from other plants during the first 3 months so that roots can start to develop.

Local practices traditionally dictate that the timing of the first weeding is determined by the needs of the associated crop. However, in the FFS, the decision to weed is made on the basis of decisions made during the agro-ecosystem analysis (AESA).

Weed management depends on the species: for species that make rhizomes (e.g. *Imperata*) and stolons (e.g. *Digitaria*), efficient weeding consists of completely uprooting the rhizomes and stolons and putting them in a place where they have no direct contact with the soil so that they cannot re-establish. For species that multiply by seed (e.g. *Chromolaena*), weeding should be done before flowering so as to cut the cycle of spreading of the weeds.

Objective: To help participants improve weeding in their fields

Time needed: 1.5–2 hours

Materials: Cassava fields, hoes for weeding, machetes, flip chart, markers, notebooks, pens

[14] If the FFS has set up a special study on weed management, then this exercise is not needed. However, it can be a special topic in FFSs that do not have a study on weed management, but which want to discuss further weed management.

Procedure

- Go to the field and observe.
- Reflect on the influence of weeds on the cassava crop.
- Ask the participants when (period, frequency) and how (method) they weed their fields (FP).
- Reflect on the fragility of young plants compared to sufficiently grown plants when competing with other plants.
- Reflect on what needs to be done when plants are still young.
- Make comparisons with small human children and the special care they need.
- Reflect on the methods by which weeds spread and difficulty of controlling them.
- Reflect on the management of species with rhizomes and stolons.

Questions for discussion

- When and how do you weed your cassava?
- What are the effects of weeds on crops?
- What is the age of a living being (plant, animal, human) in its most sensitive stage, in your experience?
- When are plants most sensitive to competition with other plants, compared to a human being? Why?
- What measures should be taken when plants are still young to ensure that they feed well and better resist diseases during the cropping cycle?
- How are weeds spread? Which weeds are most difficult to control? Why? How are these weeds managed?
- What practices and techniques for weeding should be adopted to eliminate invasive weeds from the field and its borders in an efficient way?

SOIL FERTILITY AND FERTILIZATION (1): WATER-HOLDING CAPACITY OF THE SOIL

Introduction

Organic matter has an important role to play in the soil. It helps to improve the soil structure, provides nutrients to micro-organisms, retains water and nutrients in the soil, helps certain mineral elements become assimilated by the plant, and reduces erosion by allowing infiltration and seepage and enhancing the formation of soil aggregates. Integrated production and pest management of cassava starts with good soil fertility management.

Objective: To help farmers understand the water retention capacity of soils and how it can be improved

Time needed: 2 hours

Materials: Samples of different soils (sandy, clay and sandy-clay), compost or decomposed organic matter, plastic bottles of approx. 1–1.5 litres (two per subgroup), pieces of mosquito netting, markers, flip charts, cups, watch, water

Procedure

- Reflect on the importance of organic matter in the soil.
- Reflect on the water-holding capacity of organic matter in different soil types and the consequences on soil fertility levels.
- Reflect on the rate of water infiltration in the presence and absence of organic matter.
- Draw conclusions about the absence or presence of organic matter when selecting a field and when managing vegetative residues.

Procedure

- Divide the big group into subgroups of 5–7 persons.
- Have each subgroup take two treatments for comparison and analysis. Examples of treatments:
  - Clay soil
  - Clay soil + decomposed organic matter
  - Sandy soil
  - Sandy soil + decomposed organic matter

  - Sandy-clay soil
  - Sandy-clay soil + decomposed organic matter
  - Eroded soil
  - Eroded soil + decomposed organic matter
- Take the used plastic bottles (approx. 1.5 litres each).
- Distribute the bottles, two bottles per subgroup for the two treatments.
- Cut the bottles in two (the upper part will be used for the soil, while the lower part will be used to capture infiltration water).
- Turn over the upper part of the bottles and cover the openings (now at the bottom) with a piece of mosquito netting that will serve as a filter for the water to pass through.
- Mark the treatments on each of the bottles that have been prepared.
- Fill carefully each bottle with 1 kg of dry soil, following the treatment labels (the column should be straight up and the lower part of the bottles placed under the column to collect the water that seeps out).
- Observe the colours of the soil for each treatment.
- Give 2 litres of water to each subgroup, so they can simultaneously pour 1 litre of water into each of the two treatments.
- Pour the entire 1 litre slowly onto the surface of the soil that has been put in the bottle until all the water is finished.
- Write down the exact times for:
  - starting to pour the water;
  - the first drops of water to infiltrate and seep out; and
  - the infiltrated water ceasing to seep out.
- Measure the quantity of water that has filtrated into the bottom of the bottles and do the substraction to calculate the amount of water held by the soil (water retention capacity).
- Determine the difference in time between the start and end of water infiltration in the different treatments.
- Observe the colour of the humid soil and of the water that leaked out.
- Make comparisons between treatments for:
  - the duration of the infiltration; and
  - the quantity of water that infiltrated and was retained in the soil.
- Use the above comparisons to estimate the water-holding capacity of the different soil types (treatments).

Questions for discussion

- What are the predominant soil types that you use for growing cassava? Can you take some samples? What are their characteristics with regard to colour and water retention?
- What enhances water retention capacity in a certain soil?
- Why is water-holding capacity important for the growth and development of the plant?
- How can the water-holding capacity of a soil be improved?
- What do you think of the colour of the water in each bottle/treatment?
- What can the colour tell us about the soil fertility?
- What differences can you see between the treatments with regard to the duration of infiltration and the volumes of water infiltrated/retained (water-holding capacity)?
- What is the relationship between the volumes of water retained and the growth and development of the plants?
- How can soil fertility be improved?

SOIL FERTILITY AND FERTILIZATION (2): LEGUME CROPS AND THEIR ROLE IN SOIL FERTILITY MANAGEMENT[15]

Knowledge of legume crops is very important for the management and natural fertilization of soils. Legumes have the capacity to capture atmospheric nitrogen with the help of micro-organisms associated with bacterial nodules on the roots of legumes. *Rhizobium* captures aerial nitrogen that becomes available for the plant, and the plant provides nutrients to micro-organisms. This symbiosis results in soils enriched with nitrogen – a very important nutrient, which is unstable and easily lost during bush fires, and becomes washed out of soils during rains or destroyed by exposure to sunlight. Vegetative residues of legume crops provide organic matter which is rich in nitrogen. Also, legumes are a preferred crop in rotation, in mixed cropping and in improving fallow.

Identification and knowledge of legumes

The rural environment contains numerous species of weedy legumes that are adapted to local conditions. These include *Pueraria javanica*, *Mucuna pruriens* var. *utililis*, *Calopogonium* sp and *Centrosema pubescens*. Their judicious use can improve soil fertility levels and increase soil productivity, but such practices are not always widely known.

Objectives

- To provide farmers with the capacity to identify legume species occurring in their environments
- To assist in identifying usages for legumes that are adapted to the environment

Time needed: 2 hours

Materials: Flip chart, markers, pens, pencils, notebooks

Procedure

- Visit a field that has some wild legume plants.
- Ask participants whether they observe and know any similar species in savannah or forest areas.
- Ask participants to observe the form of the leaves (trifoliate) and fruits (pods).

[15] Some FFS groups might have set up a study on legumes, other groups might be interested. This exercise can be done as a special topic or topic of the day to learn more about the role of legumes, and to discuss whether it could be interesting to set up a specific experiment.

- Uproot one of the plants observed while making sure that the nodules remain attached to the roots.
- Ask participants to observe the roots and pay attention to the nodules.
- Discuss which field crops have characteristics similar to the observed plants.
- Make a transversal cut through the nodules and expose them to the air to observe the colour.
- Explain how the red colour is able to enrich the soil with nitrogen.
- Reflect on the potential benefits of using legumes for cassava.

Questions for discussion

- Do you know these kinds of weeds? Where do you find them? What are their names?
- What criteria are adopted to identify legume crops?
- Which field crops are legumes?
- What other legumes can you find in your environment?
- What change in colour did you observe after cutting open the nodules?
- How can you use legumes to improve the productivity of cassava?

DISEASES AND PESTS OF CASSAVA (1): SYMPTOMS OF DISEASES AND PESTS

Introduction

Cassava plants can be affected by a range of diseases and pests that attack leaves, stems or roots. Pests can eat leaves and create other problems. Diseases are caused by a pathogen invading a plant and attacking from the inside, resulting in malformations, wilts or rots.

Pests and diseases are influenced by the plant itself and by the environment. Recognizing symptoms in the field and understanding what organism causes a problem is the first step towards better management of the problem. Once it is understood what is affecting a crop, and how the plant and environment may influence the pest or disease, it is easier to decide what management approach should be adopted. This exercise is designed to identify symptoms and causal agents. It can be done linked to an AESA and carried out at different times in the season so as to cover the various problems arising during the entire cropping cycle.

Objectives

- To teach farmers to distinguish between diseased and damaged and healthy cassava plants
- To discuss the possible causes of disease or damage

Time needed: 2 hours

Materials: Plants showing symptoms collected in the field, healthy plants, collected by the participants (preferably of the same variety and grown under the same conditions as the diseased plants), flip chart, paper, notebook, markers, crayon

Procedure

- Ask each subgroup to observe what they found in the field.
- Ask participants to discuss the questions listed below.
- Have each subgroup present briefly what symptoms they have found, and what might be causing the problem.
- Examine the sanitary status of each plant.
- Reflect on what farmers most frequently observe in their field as abnormal.
- Reflect on the presence of symptoms on one of the plants.
- Reflect on whether those symptoms (malformations) can have effects on the cassava crop.

- Reflect on the possible causes of the symptoms, including malformations, noting the presence or absence of insects.
- Differentiate between "parasites" (living inside the plant) and "pests".
- Make comparisons with how human beings are affected by diseases and pests.

Questions for discussion

- What differences do you observe between the healthy and diseased/damaged plants? Why?
- What are the possible reasons for the differences? Do you know what is causing the problem? Is it a pest? Or a disease? Can you find it on the plant?
- How does a plant without any problems develop?
- What are the disease symptoms that you often find in cassava fields?
- What could be the effects of such anomalies on the crop?
- What do you often observe on plants that have these anomalies?
- What differences do you notice between anomalies caused by different pests or diseases?

DISEASES AND PESTS OF CASSAVA (2): DISEASES AND PHOTOSYNTHESIS

Introduction

The leaves of the plant are where water and nutrients are transformed into sugars that feed the plants. Sunlight is needed to make this happen. The process takes place in the chlorophyll of green leaves and is called photosynthesis. The sugars made in the plant are transported by the sap to feed all the different parts of the plant, and to make reserves in the form of roots or grains that people then eat.

Most plant damage affecting the leaf surface or the circulation of sap also affects photosynthesis. Conveying the basic principles of photosynthesis by using an illustration that is easily understood allows farmers to better understand the effects of diseases on crops and enables them to take appropriate management measures.

Objectives

- To help participants understand the principles of photosynthesis
- To show how leaves damaged by disease influence photosynthesis, affecting crop growth and development, as well as production

Time needed: 1 hour

Materials: Flip chart, markers, pencils, notebooks, plants affected by mosaic virus, cassava brown streak disease and bacterial blight, healthy plants (plants without symptoms)

Procedure

- Go to a field that has healthy and diseased plants.
- Ask participants to observe the difference in colour between the healthy and diseased plants.
- Reflect on what happens to a plant in the shade. Underline the importance of sun in the life of plants, in particular the effects of lack of sun on leaves and on vegetative growth.
- Reflect on the plants' production, noting the differences between plants grown in the shade and plants exposed to the sun in either rich or poor soils.
- Discuss how plants draw nutrients from the soil and how they reach the leaves.
- Reflect on the effects of the reduction of leaf surface on the nutrition of plants and on the production of roots of cassava.
- Identify the importance of leaves being exposed to the sun for efficient nutrition.

Questions for discussion

- What differences do you observe in the colour of healthy and diseased plants?
- What happens when a plant is in the shade?
- What difference in production do you observe in poor and rich soils?
- What is a good colour of leaves to feed the plant? Why?
- How does the plant feed itself?
- How does the plant draw the nutrients from the soil towards leaves?
- What is the relationship between plant and sun?
- What is the relationship between production and the plant leaves?

DISEASES AND PESTS OF CASSAVA (3): DISEASE GROUPS

Introduction

In order to learn about and understand disease management, it is important to appreciate information that is already available on the life cycles of diseases. This exercise taps the information already known by the members of the group and links it up to practical field school situations. The exercise is not designed to "test" participants' knowledge of diseases; rather it summarizes the knowledge available and triggers creative thinking about how to find out about and manage diseases.

Objective: To list all available information on disease ecology and management (rather than control) of diseases

Time needed: 1.5–2 hours

Materials: Drawing paper and markers

Procedure

- Make a list of diseases of cassava using the guide questions listed below. Remind trainees that "I don't know" is a truly valid answer and always a better answer than "I guess. . .".
  - What diseases of this crop do you know? (Use local names)
  - What are the symptoms?
  - When do the diseases occur?
- Complete the list and classify the diseases in groups using the question, "What is the causal organism of the disease: fungus, bacterium, virus or nematode?" (Some participants may know about causal organisms. Some may not. Ask participants to recall earlier discussions on symptoms of the disease. Remember that the exercise is not designed to "test" participants' knowledge of diseases but summarizes the knowledge available and triggers creative thinking about how to find out about and manage diseases.)

- Focus on how the disease is spread. Ask participants to recall their observations of diseases in the field and how they spread. Use the following questions:
  - Does the disease spread through water?
  - Does the disease spread through infected seeds?
  - Can it survive and multiply on weeds?
  - Can it survive on plant residues?
  - Can insects spread the disease?
  - Can humans spread the disease?
- If participants are not sure, follow up each question with:
  - What experiments can be designed and conducted to find out about this?
- List information about disease groups per crop on poster paper and put them up on the walls. These posters may be used as reference during future sessions.

DISEASES AND PESTS OF CASSAVA (4): DISEASE TRIANGLE TO EXPLAIN DISEASE MANAGEMENT

Introduction

The results of earlier exercises may form the basis for a discussion on disease management. Diseases only become problematic when the interaction between pathogen, crop and environment is optimal for the pathogen. This exercise calls attention to the fact that disease management basically involves orchestrating the pathogen, crop and environment.

Objectives

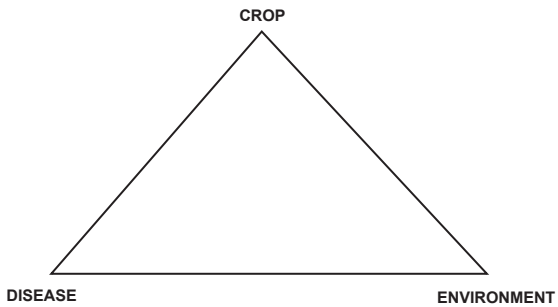
- To reinforce discussions on disease management
- To list management practices for each component of the disease triangle to "inactivate" the spread of disease

Time needed: 2 hours

Materials: Big paper, pens, markers

Procedure

- Ask participants to recall the earlier discussion on disease management, i.e. that it is possible to effect changes on the environment, plant or pathogen in order to prevent disease, and that for the disease to develop, these three factors must be present or favourable
- Ask for volunteers to give examples, for example:
  - a fungal disease surviving on crop residues in soil (Is the disease present? –> Yes) ...
  - ... will definitely show when a susceptible crop (Is a susceptible crop present? –> Yes) ...
  - ... is planted in a rainy season (Is a suitable environment present? –> Yes).
- Draw the triangle:



Discussions

Discussions may focus on the fact that the disease triangle helps us understand management practices that may be tried out or avoided to "inactivate" at least one of the corners in the triangle. The examples below may be used to start a discussion on the practical implementation of disease management strategies.

Disease corner (Is the disease present?)

- To avoid a soil-borne disease, test the use of subsoil in the nursery. (Is the disease present? –> No? –> How would you apply this method in the field?)
- To avoid an insect-transmitted virus disease, try to cover a nursery with screen-netting. (Is the disease present? –> No? –> How would you apply this method in the field?)
- A season with paddy rice can be considered a season of inundation of soil with water. Certain soil-borne diseases are killed when soil is flooded for a period of time. (Is the disease present? –> No? –> How would you apply this method in the field?)
- By implementing sanitation measures, such as removal of infected crop residues or diseased plant material in the field, test whether removal of sources of infection reduces disease. (Is the disease present? –> No? –> How would you apply this method in the field?)

Crop corner (Is a susceptible crop present?)

- Search for resistant cultivars by planting a portion of the field with other cultivars from neighbouring areas and/or imported cultivars. (Is the crop present? –> No? –> How would you apply this method in the field?)
- Crop rotation by avoiding planting susceptible crops for several cropping seasons. (Is the crop present? –> No? –> How would you apply this method in the field?)
- Weeding of susceptible weeds. (Is the crop present? –> No? –> How would you apply this method in the field?)

Environment corner (Is a suitable environment present?)

- Choose a season that is not favourable for disease, e.g. the dry season. (Is the environment favourable? –> No? –> How would you apply this method in the field?)
- Change from overhead irrigation to flooding in order to reduce leaf wetness. (Is the environment favourable? –> No? –> How would you apply this method in the field?)
- Test mixed cropping so that the disease cannot spread easily. (Is the environment favourable? –> No? –> How would you apply this method in the field?)

After the discussion, divide the group into four. Refer to the session on disease/symptom groups. Assign one disease group to each group of participants. Ask each group to select one disease for a crop and to design a management measure that can be tested in the ToT (training of trainers) field. Ask groups to make a presentation once they have completed the task. Discuss which corner of the disease triangle is avoided or inactivated. Try to implement the management measures that the groups present.

DISEASES AND PESTS OF CASSAVA (5): IDENTIFICATION OF CASSAVA MOSAIC DISEASE

Introduction

Cassava mosaic disease (CMD) has been a documented disease for a long time. In recent years, with the development of a new strain of CMD, the disease has become of greater economic importance and it continues to spread. It can cause production losses of between 50 and 90 percent. It is transmitted mainly through primary infection when planting already infected cassava cuttings. In a small percentage of cases, the disease is transmitted from one plant to another by a vector, the whitefly. Some operations carried out by farmers, in particular harvesting leaves and cassava cuttings, can increase the severity of the disease.

The symptoms of mosaic are chlorotic spots (clear green and yellow) evolving to bigger spots. Then they shrink and shrivel up. In the most advanced phase of mosaic, the leaf surface may become reduced by over 90 percent.

Time needed: 1.5–2 hours

Materials: Healthy plants and plants infected with CMD at different degrees of attack, flip chart, markers, crayons, papers, notebooks

Procedure

- Start with a visit to the field, possibly linked to an AESA.
- Observe and identify all plants showing symptoms of mosaic.
- Analyse with the group, asking those that already know the disease to allow the others to find the answer and to not give the name unless asked.
- With the farmers, reflect on and analyse the differences between the various plants observed.
- Reflect with the participants on the potential effects of the symptoms on the production of leaves (used as vegetables) and roots, building from the concept of photosynthesis.
- Find at least one plant that has a much reduced number of leaves.
- Reflect with farmers on the presence of these symptoms in their own fields.
- Discover the local names of the disease before providing participants with its official scientific name.

Questions for discussion

- What differences exist between different plants of the same variety and between diseased plants of different varieties?
- Which plants are most affected? How do you notice them?
- Can you indicate how the symptoms evolve?
- What are the possible effects of the symptoms once they evolve?
- How may they affect production of the leaves and roots?
- Do you have these symptoms in your fields? What percentage of plants do you estimate are infected?
- What names do you give these phenomena in your local language?
- Who knows the name of this disease in a different language? Where and when did you learn this?
- Does anyone have additional information to share with other farmers?

DISEASES AND PESTS OF CASSAVA (6): IDENTIFICATION OF CASSAVA BROWN STREAK DISEASE

Introduction

Cassava brown streak disease (CBSD) has, in the last few years, spread in the African region. The virus disease used to be limited to coastal areas in eastern Africa, but it can now be found in an increasing number of countries. The virus affects the roots, which are characterized by brown spots and streaks, and yields are reduced. The roots can still be used if the infection is not too severe, but it takes a lot of time to clean the roots before they can be processed. Symptoms can also be detected on the leaves, but they are not very clear and often go undetected until harvest. The virus is spread – as with mosaic virus – by cuttings or whiteflies. Research is underway to develop varieties with tolerance or resistance to CBSD, but they are not necessarily available everywhere.

In some regions, CBSD has discouraged farmers from growing cassava, and they have shifted to other crops. Access to more resistant varieties can encourage farmers to return to growing cassava.

Time needed: 1.5–2 hours

Materials: Healthy plants and plants that are infected with CBSD at different levels of attack, including roots that have been attacked, flip chart, markers, crayons, papers, notebooks

Procedure

- Begin with a visit to the field, possibly linked to an AESA.
- Observe and identify all plants showing symptoms of brown streak disease (leaves and roots).
- Give instructions for analysis and ask those that already know the disease to allow the others to find the answers and to not give the name unless asked.
- Reflect on and analyse the differences between the different plants observed.
- Reflect with participants on the potential effects of symptoms on the production of leaves (used as vegetables) and roots.
- Find at least one plant that has symptoms on leaves and roots.
- Reflect with farmers on the presence of these symptoms in their own fields.
- Ask the local names of the disease before providing its official scientific name.

Questions for discussion

- What differences exist between different plants of the same variety and between diseased plants of different varieties?
- Which plants are most affected? How do you notice them?
- Can you indicate how the symptoms evolve?
- What effects may those symptoms have once they evolve?
- What is the effect on production of the leaves and of roots?
- Do you have such symptoms in your fields? What percentage of plants do you estimate to be infected?
- What names do you give these phenomena in your local language?
- Who knows the name of this disease in a different language? Where and when did you learn this?
- Does anyone have additional information to share with other farmers?

DISEASES AND PESTS OF CASSAVA (7): SPREAD AND MANAGEMENT OF CMD AND CBSD

Introduction

Mosaic virus and brown streak disease are principally transmitted by cassava cuttings (primary infection). The use of cuttings from healthy plants limits the spread of these diseases. However, contamination can also occur from one plant to another by means of a vector: the whitefly. This kind of infection is called a secondary infection. In the case of CMD, it is found on new leaves or on the top part of the plant. The development of the disease within the plant varies from one plant to another and from one variety to another. A vigorous plant has greater resistance. The diseases do not pose problems for human health.

The principal ways of managing these diseases are:

- use of healthy planting materials;
- use of high-yielding resistant varieties;
- elimination of the sources of infection; and
- improvement of cultural practices.

Materials: Plants that have a new infection of mosaic virus and/or brown streak virus (secondary infection), plants with a primary infection and healthy plants or plants that appear to be healthy, flip chart, markers, crayons, paper, notebook

Time needed: 1.5–2 hours

Procedure

- Make a specific visit to the field – or go there when doing an AESA – early in the morning.
- Observe and identify plants that have symptoms of mosaic and/or brown streak virus
- Select plants with secondary infection and plants with primary infection.
- Observe and identify all the symptoms of selected plants.
- Reflect on and analyse with the farmers the differences between the plants, the infected leaves and healthy leaves.
- Reflect on the severity of the disease(s).
- Localize the position of the leaves on the different plants and reflect.
- Observe the presence of whiteflies and reflect on their actions.

- Reflect on the host plants of whitefly.
- Harvest leaves of some plants for domestic consumption and take some cuttings using a machete; observe how the disease is linked to these operations.
- Reflect on measures to take to manage the disease.
- Plant some lines of healthy and diseased plants for future observation.

Questions for discussion

- What observations did you make on the selected plants?
- What differences do you notice between the leaves of the selected plants?
- How severe is the attack? What leads you to this conclusion?
- Where can you observe most symptoms for CMD? Why?
- Where can you observe most symptoms for CBSD? Why?
- Can you observe the presence of whiteflies on the underside of the leaves? What colour are they? What are they doing? What is their impact on the plant?
- What are the host plants for whiteflies?
- What can you do to effectively manage cassava mosaic virus?
- What can you do to effectively manage cassava brown streak virus?
- Think about the disease triangle:
  - **Host plant:** Are there cassava varieties that have tolerance or resistance to CMD/CBSD? Are there other potential measures?
  - **Pathogen:** How can you make sure that the virus is not present in planting material? How can you limit it spreading?
  - **Environment:** Are there factors with a negative influence on the development of the virus? Can anything be done to manage this?

DISEASES AND PESTS OF CASSAVA (8): PHYTOSANITATION OF CASSAVA

Introduction

For both CMD and CBSD, it is very important to ensure that cassava planting material is healthy. Phytosanitation is a useful tool in this regard. If the FFS has set up a multiplication field, phytosanitation will already be carried out on a regular basis. If, on the other hand, there is no multiplication field, the exercise below may be done as soon as any symptoms are observed. It can be repeated as necessary in order to obtain good planting materials.

Phytosanitation involves the elimination and destruction of all diseased plants that occur in a field with the aim of removing all sources of contamination so that plants can produce healthy planting material and the farmer can have a healthy crop. During phytosanitation, it is necessary to check every single row and to systematically eliminate, without any hesitation, all plants showing symptoms of disease.

In the production field, an initial round of phytosanitation should be done to evaluate plant establishment and to replace eliminated plants as necessary. However, in the multiplication field, phytosanitation must be done regularly throughout the cropping cycle, and eliminated plants are not replaced to avoid competition and decline of the plants. The optimal frequency for phytosanitation is once a week for the first two months of the crop once the gaps have been filled, and every two weeks for the rest of the cropping cycle until harvesting of the cuttings.

It is important to bear in mind that after visiting a regular production field, one cannot go to the multiplication field to do phytosanitation. Farmers should avoid carrying diseased materials with them in the field. Eliminated materials should be removed immediately and properly disposed of, far away from the field. Farmers are often reluctant to accept phytosanitation, until they understand the danger created by these economically important diseases, and the ways in which they are transmitted.

Objective: To teach farmers how to grow a healthy crop and produce healthy planting material.

Time needed: 1.5–2 hours

Materials: Production field, multiplication field, machetes, hoes, notebook, pencil

Procedure

- Reflect with the participants on the multiplication of healthy cassava cuttings.
- Reflect with the participants on how plants become contaminated.
- Make comparisons with disease contamination among humans from, for example, malaria and AIDS.
- Reflect with the farmers on ways to eradicate sources of contamination.
- Divide the participants into subgroups of 5–6 people. Ask the subgroups to observe plants row by row, placing one subgroup in charge of verifying how the control is done.
- Uproot and destroy the whole plant and all plants that have symptoms of disease.

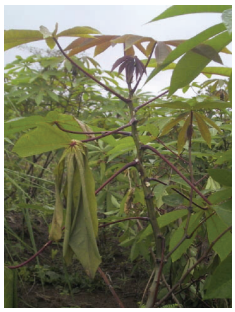
Questions for discussion

- Why is it a good practice to multiply healthy cassava cuttings?
- How can contamination spread from one plant to another and from one season to the next?
- What are the consequences of using diseased plants in the fields?
- How can healthy cuttings be obtained?
- What steps and precautions should be taken to reduce or eliminate diseased plants in the field?

DISEASES AND PESTS OF CASSAVA (9): IDENTIFICATION OF BACTERIAL BLIGHT

Introduction

Bacterial blight is one of the most important diseases of cassava. It spreads easily when climate conditions are favourable (humidity and heat) and can totally decimate a field if an attack occurs at an early stage. Some farmers believe thunder to be the cause of the disease.



Bacterial blight begins with jagged spots with a watery (oily) appearance on the leaves, which slowly wilt until they become dry and eventually fall. A gum is secreted on the petioles and young stems. In an advanced stage of the disease, the upper part of the plant dies back from high to low. When a tolerant variety is used, the plant reacts by growing new shoots from the base of the plant. In order to learn how to effectively manage the disease, it is necessary to understand the causes of the disease.

Objective: To improve the capacity of farmers to correctly identify bacterial blight.

Time needed: 1.5–2 hours

Materials: Plants attacked by bacterial blight with different degrees of severity, flip chart, markers, crayons, paper, notebook

Procedure

- Go to the field (for example, when carrying out an AESA) at a time when bacterial blight can be found in the field.
- Use the "what is this?" principle to observe plants with different levels of bacterial blight.
- During the analysis, ask those who are already familiar with the disease to let others reply and not to provide answers unless requested to do so.
- Reflect with the farmers on the differences that exist between plants observed.
- Reflect on the causes and evolution of the disease.
- Reflect on the effects of the climate on the development of bacterial blight.
- Reflect on damage caused by bacterial blight to photosynthesis and production.

Questions for discussion

- What differences do you see between the plants observed?
- Which plants are most affected? What observations bring you to this conclusion?
- Do you find these symptoms in your fields? What percentage of plants do you estimate is affected?
- In what ecological environment do you most see these symptoms?
- What are the effects of these symptoms when they evolve? Do they affect production of stem cuttings, leaves or roots?
- What is this disease called in the local language?
- Does anyone know what the disease is called in another language? Where and when did you learn this?
- Does anyone have additional information to share?

DISEASES AND PESTS OF CASSAVA (10): SPREAD AND MANAGEMENT OF BACTERIAL BLIGHT

Introduction

Bacterial blight develops well during periods of high temperature and high air humidity. Bacterial blight is a disease that is spread easily by bacteria (microbes) that can be found in the gums secreted by the plant. The bacteria are spread in a variety of ways, by:

- rain (splashing);
- tools (machete, hoe, clippers etc.);
- animals; and
- humans.

They live in the plant's interior and, for this reason, plant cuttings are the biggest source of contamination. The use of healthy cuttings significantly limits contamination.

The disease is worse in marginal conditions, where soil is poor or when competition from weeds is high. It develops well in the savannah ecology and during warm and humid periods (periods of strong rain result in high air humidity).

Sensitivity to the disease varies, depending on the variety. Demonstrating to farmers how contamination occurs allows them to become familiar with ways of managing the disease, including:

- use of healthy plant cuttings;
- use of resistant varieties; and
- adoption of improved techniques (planting when rains occur, good fertilization, avoidance of competition with weeds etc.).

Objectives

- To help farmers understand the causes of bacterial blight in their fields
- To help farmers understand how bacterial blight is propagated
- To apply the acquired knowledge to improved management of the disease

Time needed: 1.5–2 hours

Materials: Syringe, bowl, water, attacked plant, flip chart, markers, crayons, eraser, notebook

Procedure

- During a warm and humid period, following an AESA, observe closely the diseased plants.
- Take the leaves of diseased plants, and soak them in water for 48 hours.
- Inject the water in which the leaves were soaked into healthy plants.
- After one week (i.e. the following meeting), reflect on what has happened in the plants that were injected.
- Reflect on the relationship between the injection and the disease.
- Draw a parallel between the above experiment and flu or cold contamination between humans.
- Gather together all the available information on the spread of bacterial blight.
- Reflect on possible measures to avoid new contaminations.

Questions for discussion

- What do you observe on the plants (ask this question before and after injection)?
- Why did the disease attack after injection?
- What relationship can we see between the disease and the injection?
- How does the disease spread? What are the effects of the different ways of spreading bacterial blight in your fields?
- What measures should be taken to limit or avoid new contamination?
- What measures can be taken to limit damage to the crop in relation to the age of the plant and the crop stage?
- Are some varieties more resistant than others?
- What weather conditions favour disease development? How could you use this information to optimise management of the disease?

DISEASES AND PESTS OF CASSAVA (11): IDENTIFICATION OF ANTHRACNOSE DISEASE

Introduction

Anthracnose is a fungal disease. It can cause not only heavy losses of cuttings, but also losses of roots. The disease is characterized by the presence of cankers (lesions) on the stem and at the base of the petioles of the leaves. These cankers are caused by a fungus which begins with wounds caused by the stings of an insect named *Pseudotheraptus devastans*; indeed, the development of the secondary infection, anthracnose disease, is entirely dependent on the insect stings.

When cankers grow deeply, they reach the central part of the stem, causing it to break easily. This disease can disturb the circulation of plant sap, blocking the feeding of the upper part until the leaves fall off and the stem dries up. The result is that the plant tops look dead, leading the disease to be confused with bacterial blight.

Objective: To improve the capacity of farmers to correctly identify anthracnose disease

Time needed: 1.5–2 hours

Materials: Plants affected by anthracnosis to a varying degree of severity, flip chart, markers, crayons, papers, notebooks

Procedure[16]

- Implement AESA or "what is this?" to observe plants affected by anthracnosis under varying levels of attack.
- Ask those participants already familiar with the disease to allow others to answer and to only reply when specifically asked to do so.
- Reflect with the farmers on the differences that exist between different plants.
- Reflect on the evolution of the disease.
- Reflect on the effect of the climate on anthracnose disease.
- Reflect on the damage anthracnosis can cause to production (photosynthesis).

[16] Note that this exercise is to be done during a favourable period, when anthracnosis can be found in the field.

Questions for discussion

- What differences exist between the different plants?
- Which plants are most affected? How do you distinguish them from others?
- Do you know the symptoms?
- Can you indicate how the symptoms evolve?
- What effects can these symptoms have over time?
- Do you find these symptoms in your fields? What percentage of plants is affected?
- What do you call this disease in your local language?
- Who knows what this disease is called in another language? Where did you learn this?
- Does anyone have any additional information?

DISEASES AND PESTS OF CASSAVA (12): IDENTIFICATION OF LEAF SPOTS

Introduction

Leaf spots occur on old leaves and the economic impact of the disease is, therefore, limited. There are three types of leaf spots caused by *Cercosporiosis*. It is important that farmers are knowledgeable about this disease to avoid anxiety.

Objective: To strengthen the capacities of farmers to correctly identify the three different types of leaf spots

Time needed: 1.5–2 hours

Materials: Plant with leaves affected by *Cercosporiosis*, flip chart, markers, crayons, notebooks

Procedure

- Ask farmers to look at the plants with leaf spots.
- Reflect on the condition of the plants.
- Reflect on the age of the leaves that are affected and the role of the leaves.
- Reflect on whether this attack will have an effect on the crop.
- Gather together all the information.

Questions for discussion

- What differences do you observe on the leaves of the plants?
- What are the possible reasons for the differences?
- What is the level of attack on the leaves?
- What is the role of the leaves?
- What effects can this disease have on the life of the plant?

DISEASES AND PESTS OF CASSAVA (13): IDENTIFICATION OF CASSAVA MEALY BUG

Introduction

The cassava mealy bug is characterized by the presence of a white mass during the dry season. It is not very visible during the rainy season. These insects feed on the plant by sucking while injecting a toxin. The attacks can stop growth and are identifiable by the stunted and bushy development of the growing points of the plant. On close observation, it is possible to see that a white powdery mass covers the yellowish adult insects that are fixed on the plant and the young insects that can move easily. Strong infestations cause the leaves to dry up. After the dry season, even if the plant recovers, traces of mealy bug infestations are still visible in the form of the deformation of the stem, especially the stunting between the internodes of the plant.

The cassava mealy bug was introduced into Africa by accident, from South America in the 1970s. It caused serious problems in Africa in the 1970s and 1980s, but was brought under control following research to introduce and release a parasitic wasp (*Apoanagyris lopezi*) that lays its eggs in the mealy bug. Its larvae develop in the mealy bug and kill it. It is efficient at keeping populations of cassava mealy bug in check in most situations.

Objective: To assist farmers in identifying cassava mealy bug in their fields

Time needed: 1.5–2 hours

Materials: Plants with mealy bug, flip chart, crayons, markers, notebooks

Procedure

- Ask participants to look at the plant with the mealy bugs.
- Observe the plants and touch and take the insects and ask each farmer to have their own specimen.
- Observe the insect well and draw it.
- Look for natural enemies.
- Reflect on the condition of the plants.
- Reflect on the way the insect feeds.
- Reflect on the effects the insects can have on the crop.
- Reflect on why populations are normally low.
- Gather together all the information.

Questions for discussion

- What differences can you observe between the plants?
- What are the possible reasons for the differences?
- What is the level of attack?
- What are the insects doing on the plants?
- How are they feeding?
- What effects can the insects have on the growth and development of the plant?
- Are there natural enemies of the cassava mealy bug? Can you find them in the field? Can you see them?

DISEASES AND PESTS OF CASSAVA (14): SPREAD AND MANAGEMENT OF CASSAVA MEALY BUG

Introduction

The mealy bug lives on the plant and appears as a white mass that looks like white flour. This white mass covers the insect with its eggs inside. These eggs and young mealy bugs are easily transported by wind and rain, cassava cuttings, animals and humans, spreading to contaminate other plants and fields. The insects can slow down or even stop plant growth. The internodes become shorter and show stunting, and the growing points become bushy.

The mealy bug appears principally in the dry season and disappears during the rainy season, when it gets washed off by the rain. A range of appropriate mangement practices are available:

- Use of resistant varieties
- Planting at the beginning of the rainy season
- Good fertilization
- Adoption of improved cultural practices
- Use of biological control

Objectives

- To help farmers understand the mechanism of dissemination
- To teach techniques for the efficient management of cassava mealy bug

Time needed: 1.5–2 hours

Materials: Flip chart, crayons, markers, notebooks, healthy plants, plants with mealy bugs, paper

Procedure

- Ask participants to look at healthy plants and plants with mealy bugs.
- Observe the plants and touch the insects.
- Place the insects on a sheet of white paper.
- Ask each participant to take a specimen of the insect.
- Observe the insect closely and make a drawing of it.

- Reflect on the condition of the plant.
- Reflect on the effects of the insect on the crop.
- Reflect on the multiplication of the insect.
- Reflect on how and when an insect can move from one plant to another or from one field to another.
- Reflect on when the insects appear in the field.
- Gather together all the information.

Questions for discussion

- What differences do you notice between the plants?
- What are the possible reasons for these differences?
- After touching the insects, what do you notice?
- How can the insects move from one plant to another and from one field to another?
- What are the potential effects of such moves on other plants and other fields?
- How can these effects be avoided?
- Have you seen these insects in your cassava fields? During which periods do you see high numbers?
- What are the local solutions for managing the insect?
- How can the effects of mealy bug infestations on the plant be avoided or reduced?
- What natural enemies exist and how can they be used?
- If ants were observed in the field, what were they doing? What is the relationship between the ants and CMB?
- Where do farmers get their planting materials from? How is the source of planting materials important in the spread of CMB?

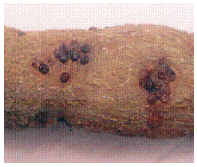
DISEASES AND PESTS OF CASSAVA (15): IDENTIFICATION OF CASSAVA ROOT SCALE

Introduction

The cassava root scale insect is small and neither the males nor the females have wings. In the young stage, the root scale insect is very mobile and has all appendages (legs, antennae and flagellate). When it grows, it becomes immobile and covers itself with a waxy layer that forms a protective shield for eggs at the moment of oviposition. It attaches itself to the plant on all subsoil parts, including the roots and the mother cutting (used when planting the crop).

The root scale insect is a pest found in secondary degraded forests, while it is absent from savannah and primary forest areas. It is abundant in light and loose soils and affects a large number of plant species, including taro and yams. It lives in association with a small red ant, which is a good indicator of the presence of the root scale insect.

The damage caused to the plant varies from malformation of the roots, in the case of a light infestation, to root formation actually stopping, in the case of a heavy attack. In addition, the holes made by the root scale insect when it is feeding can serve as entry points for pathogens that can cause root rot.



Objective: To increase farmers' knowledge of the pest

Time needed: 1.5–2 hours

Materials: Plants or parts of plants colonized by root scale, notebook, crayons, flip chart, markers, paper, pens

Procedure

- Ask farmers to examine healthy plants and plants affected by root scale.
- Observe and touch the plants.
- Collect the pests on white paper.
- Ask each farmer to have a specimen of the insect.
- Observe the pest well and draw it.
- Observe which parts of the plant are colonized by the pest.
- Reflect on how the insect feeds and multiplies.
- Reflect on the potential effects of the insect on the crop.
- Reflect on how and when the insect can move from one plant to another or from one field to another.
- Reflect on the period in which it can be found.
- Gather together all the information.

Questions for discussion

- What do you observe on the plants? What differences do you notice?
- What part or portions of the plant are affected? Can you draw the parts attacked by the insect?
- When you touch the plant, what do you notice?
- How can the insects move from one plant to another or from one field to another?
- What are the potential effects of such movements on other plants or fields? How can these effects be avoided?
- Have you already observed these insects in your fields? How did you notice their presence?
- What are the local solutions?
- How can attacks from root scale insects be avoided or reduced on cassava?

DISEASES AND PESTS OF CASSAVA (16): SPREAD AND MANAGEMENT OF ROOT SCALE

Introduction

The root scale adult is immobile. It is mobile only in the larval stage, when it can move from one plant to another. The ant associated with the root scale insect plays an important role in dispersing larvae. At present, there are no efficient management methods for controlling root scale insects. A moderately long fallow period (3–5 years) combined with deep soil preparation can help reduce the level of infestation.

Objectives:

- To help farmers understand the mechanism of dissemination
- To teach management methods for efficient control of the root scale insect

Time needed: 1.5–2 hours

Materials: Flip chart, crayons, markers, notebooks, healthy plants, plants with root scale, paper

Procedure

- Ask participants to look at both healthy plants and plants with root scale.
- Reflect on the period in which such phenomena can be observed.
- Observe and touch the affected roots.
- Place some insects on white paper.
- Ask each farmer to take a specimen.
- Observe the insect well, draw it and examine how the insects feed themselves.
- Reflect on the effects of the pests on the development of the roots of cassava.
- Reflect on how the insect multiplies.
- Examine the role or the activity of ants in relation to the root scale insects.
- Reflect on how insects move from one plant to another or from one field to another.
- Reflect on integrated management methods for root scale.

Questions for discussion

- What differences do you observe when looking at the roots of the collected plants?
- Have you already found these insects in your fields? During what period do you observe a strong presence?
- What are the possible reasons for differences?
- How do the insects feed?
- How do they multiply?
- What do you notice on the root scale insects? What are the ants doing?
- What is the role of the ants in relation to the root scale insects?
- How can the insects move from one plant to another and from one field to another?
- What are the potential effects of these movements on other plants and on other fields?
- What are local solutions for preventing root scale attacks?
- What are the most efficient ways to avoid or reduce root scale attacks?
- Where do farmers get their planting materials from? Why is the source of planting materials important in the spread of root scale?

DISEASES AND PESTS OF CASSAVA (17): IDENTIFICATION OF GREEN SPIDERMITE

Introduction

During the dry season, one can observe chlorosis in the form of small spots, as well as leaves curling – symptoms easily confused with those of mosaic virus. Upon closer examination with a magnifying glass, it is possible to observe small green spidermites on the underside of the leaves. During the rainy season, on the other hand, these pests are not very visible.

Spidermites feed on the plant by sucking and they inject a toxin when doing so. Attacks result in retarded growth, which is manifested in reduced internodes – an effect which remains even after the plant has recovered its health. Strong infestations can lead to the dropping of young leaves.

Objective: To assist farmers in identifying green spidermites in their fields

Time needed: 1.5–2 hours

Materials: Flip chart, crayons, markers, notebooks, healthy plants, plants with green spidermites, magnifying glass, white paper

Procedure

- Ask participants to examine healthy plants and plants with green spidermites.
- Observe the plants, touch them, remove the green spidermites and place them on white paper.
- Ask each farmer to have their own specimen.
- Observe the spidermite carefully with the magnifying glass and draw it.
- Reflect on the status of the plant.
- Reflect on the difference between green spidermite symptoms and those of mosaic virus.

- Reflect on the way spidermites feed.
- Reflect on the effects of the insects on the crop.
- Gather together all the information.

Questions for discussion

- What differences do you observe? Why?
- What can be the reasons for those differences?
- What differences do you notice between spidermite symptoms and mosaic virus?
- What is the level of infestation?
- After touching, what do you notice?
- What are the spidermites doing on the plant?
- How do they feed?
- What effects do the spidermites have on the growth and development of the plant?

DISEASES AND PESTS OF CASSAVA (18): SPREAD AND MANAGEMENT OF GREEN SPIDERMITE

Introduction

The green spidermite lives on the underside of the plant's leaves. It can only be seen easily with a magnifying glass. Spidermite attacks have an effect on the plant because the pest feeds on the leaves and destroys the plant's potential chlorophyll. Young spidermites are easily carried by animals, the wind and rain, and cuttings, as well as by humans; other plants and fields thus become contaminated. Spidermite attacks can slow down or even halt the plant's growth. Internodes become shorter at the terminal plant parts.

Spidermites appear during the dry season; they are less visible during the rainy season because they get washed off by the rain. A variety of approaches should be adopted to manage the spidermite:

- Use of resistant varieties
- Planting at the beginning of the rainy season
- Good fertilization
- Improved cultural practices
- Biological control using *T. aripo* as a predator (this natural enemy feeds on the green spidermite, keeping populations low)

Objective: To help farmers better understand how spidermites spread and how to manage them

Time needed: 1.5–2 hours

Materials: Healthy plants, plants with green spidermites, flip chart, crayons, markers, notebooks, magnifying glass, paper

Procedure

- Ask participants to look at healthy plants and plants with green spidermites.
- Observe the plants and point out differences in the leaves and the growth.
- Use a magnifying glass to observe and touch the spidermites.
- Ask each farmer to have a specimen.
- Reflect on the way spidermites multiply.
- Reflect on the period favourable for spidermites to appear.
- Reflect on when and how spidermites move from one plant to another and from one field to another.

- List the differences between the symptoms of mosaic virus and those of spidermites.
- Observe closely the spidermite predator, *T. aripo*; draw it and distinguish it from the green spidermite.
- Reflect on the effects of spidermites on the crop and on how to manage the green spidermite.

Questions for discussion

- What differences do you observe between the plants?
- What might be the reasons for the differences?
- After having touched the plants and observed them with the magnifying glass, what do you notice?
- How can the spidermites move from one plant to another and from one field to another?
- What effects can such movements have on other plants and fields? How can this be avoided?
- What do you notice about the presence of green spidermites in your own fields?
- How can you reduce or avoid the effects of infestations of green spidermites on the plant?

DISEASES AND PESTS OF CASSAVA (19): CONTROLLING THE MOLE RAT

Background

When the farmer finally wants to harvest his cassava, he discovers that the mole rat is also harvesting it! The mole rat can consume up to 50 percent of the cassava in the field, so everything possible must be done to control it. The smoke of hot pepper, dry cow dung and cotton wool is known to drive away the mole rat.

If mole rats are a big problem in the area, the FFS group might want to set up a special study on it. Some ideas are given in the Field Study section (p. 62).

Objective: To enhance participant understanding of how locally available materials can be used to control mole rats in a cassava field

Time needed: 1.5–2 hours

Materials: Flip chart, marker pens, hoe, hot pepper, dry cow dung, cotton wool

Procedure

- Let the participants locate the hole or route of the tunnel that has been excavated by the mole rat
- Ask participants to follow the following steps:
  - Place hot pepper, dry cow dung and cotton wool at the entrance to the tunnel.
  - Burn the hot pepper, dry cow dung and cotton wool.
  - Drive the smoke into the tunnel (as a blacksmith does).

Questions for discussion

- What do you think of the different methods?
- How do they catch and get rid of the mole rat?
- Do you put sacks on the other end of the tunnel to catch the rats?
- How do you dispose of those that were caught?
- Could you use the method in your fields?
- Would you need to collaborate with other farmers?

DISEASES AND PESTS OF CASSAVA (20): INSECT ZOO

During field work (e.g. AESA), farmers come across a range of insects. In some cases, farmers will have a good idea of what the insects do and how they develop, and they will have a local name. In other cases, what the insect does in the field may be unclear, its function unknown. Insects have life cycles with different stages: some start as an egg and become larva, pupa and adult; others start as an egg, developing into nymph and then adult. Some stages might feed on the plant, others not. It is important to know the functions of insects and to understand their life cycles in the field for optimum management. The insect zoo, where living insects and spiders are studied, provides information on functions (Does the insect eat plants? Does it eat other insects?) and life cycles.

Opportunities

- Get to know the relationship between an insect and a plant: put one species in a cage with the plant and observe what happens, what the insect does.
- Get to know the relationship between different insects: put insects of different species together and observe what eats what.
- Understand the biology of insects to better manage them: know the different stages of the life cycle.

When you find something in the field, set up an insect zoo using simple materials. Ask farmers to observe between sessions, and discuss findings during the next meeting. Try to link the information from the insect zoo to AESA for better decision-making.

Insect zoo experiments

- Cover a plant in the field with netting, release the insect (put several similar ones) and observe whether it eats the plant or not.
- Put a plant in a pot, cover it with netting, release the insect and observe what happens.
- Cut off the top of a plastic bottle, put the different insects together inside (to find out whether an insect is a predator and eats another insect). Put some leaves of the plant inside as well and cover with netting. Observe what happens and note what the insects do. If one eats the other, it is a predator. Try to observe how many insects it can eat per day.

Insects have life cycles, for example starting as an egg, turning into a larva, then into a pupa from which an adult emerges. The different stages do not always resemble each other. During some stages they might eat a plant, during others not. Other insects develop from egg to nymph to adult. Knowing the different stages, and understanding how long it will take for an insect to complete its life cycle is important when managing a crop. Life cycle studies can be set up in the insect zoo. Put a plant in a pot (or cover a plant in the field with netting), and cover it with netting. Put inside the stage that you find (adult or larva) and observe what happens. Try to find out how long it takes before an insect changes stage, and try to observe the different stages of the same insect.

DISEASES AND PESTS OF CASSAVA (21): INSECT BOX

Introduction

During the FFS, different insects will be observed. Insect zoos will be set up to learn more about insects, and information will be shared during the AESA and other FFS activities. It can be useful for farmers to make a reference collection of the insects for after the FFS. The insect box is an effective way to make a collection of all that farmers find in the field. Insects can be classified as "pests" and "natural enemies", and names can be added.

Objectives

- To be able to make the insect box
- To understand the use of the insect box

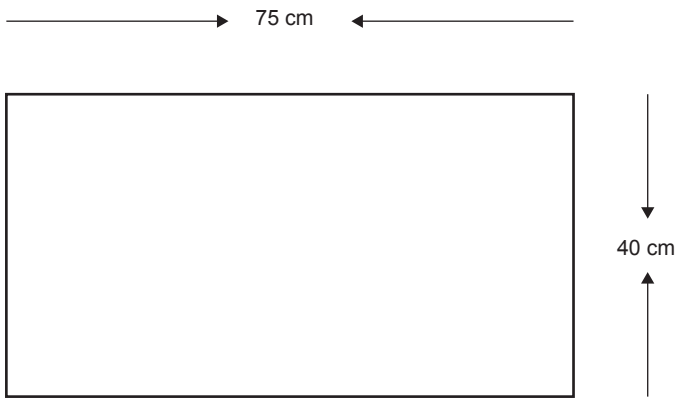
Materials: Manila sheet, markers, masking tape, ruler, stapling machine (optional), cardboard boxes, flip charts, pens, exercise books, scissors

Procedure

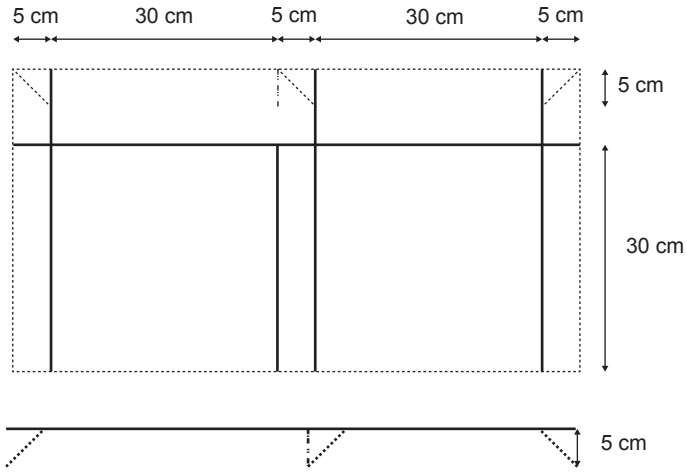
- Hold question and answer sessions.
- Carry out group discussions.
- Perform group work (the subgroup that finishes first assists the other subgroups).
- Instruct first subgroups, then individuals, to make their own insect box.

Making an insect box

1. Cut manila in measurements of 75 × 40 cm



2. Across the length, from the extreme edge mark into: 5 cm, 30 cm, 5 cm



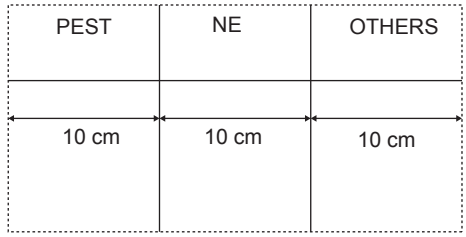
3. Cut along this line

4. Fold along these lines

5. Fold along these lines

Making an insect box (cont'd)

6. Hold the box in place first using the masking tape, later use the stapling machine
7. Cut out 30 × 30 cm piece of cardboard
8. Mark three sections on a cardboard
9. Label them as Pest, NE and Others using the masking tape and markers



10. Place it inside the box
11. Close the insect box
12. Label the insect box

DISEASES AND PESTS OF CASSAVA (22): CASSAVA GROWTH STAGES, PESTS AND NATURAL ENEMIES

Background

This exercise is an example of the kind of activity that can be done with FFS groups in order to follow and understand the various cassava growth stages and their related pests and natural enemies. It is probably best to do this exercise towards the end of the season, when the group has learned about the different insects during their different growth stages. It will help summarize what has been learned.

Objective: To enhance participant understanding of cassava growth stages and related pests and natural enemies

Timing and time needed

The exercise can be done at the beginning of the FFS, but it is particularly suitable towards the end for summarizing the information and knowledge gathered during the season, and for looking at the bigger picture. Time needed is 2 hours.

Materials: Flip chart, marker pens, cassava plant parts

Procedure

- Ask participants (working in small groups of 5–6 persons) to go to the cassava fields in the neighbourhood and pick representative samples of cassava plant parts in the different growth stages to assist you in the drawing.
- Draw a table:

1	**Days after planting**	DAP ----------	DAP ----------	DAP ----------	DAP ----------	DAP ----------	DAP 9–12 months
2	**Growth stage**	Seedling/ Emergency	Vegetative	Flowering	Fruiting	Dormancy	Maturity 270–360 days
3	**Drawing of cassava plant**	Drawing	Draw here	Draw here	Draw here	Draw here	Draw here
4	**Pests and diseases**	1. 2.	1. 2.				Mole rat
5	**Natural enemies**	1. 2.	1. 2.				

- In rows 1 and 2, fill in the main growth stages you know and the period (DAP).
- In row 3, draw the expected appearance of the cassava plant in the row below the growth stages in the spaces provided.
- In row 4, list the three most common pests and diseases that might be encountered during that growth period.
- In row 5, list the three most common natural enemies that might be encountered during that growth period.

Questions for discussion

- How do pests and natural enemies change with the cassava growth stages? Why?
- Select one disease or pest at a time: When does it occur? How is it managed during the crop cycle?

5. Farming as a business

The FFS provides an opportunity not only to address technical aspects of growing cassava, but also to discuss and reflect on farming as a business that generates income for the family. Farmers do not always keep records of what inputs are used for growing a crop, how much is spent and how much is generated. Labour, especially family labour, is not always valued as an economic input in the enterprise of growing cassava (and other crops). Efforts to add value to produce before selling it on the market are often limited. Farmers often lack information on where and when they could sell a crop in the most profitable way. They may not work together in marketing efforts (that could reduce costs). Also, they are not used to making a business plan nor to trying to get credit to implement it. Exercises are provided below that can be done in the FFS to get participants thinking about farming as a business. An economic analysis that compares IPPM and FP (local farmer practice) plots is a must. Activities can also be done on post-harvesting. There are also examples of exercises that look at selecting enterprises and group action to obtain access to credit.

ECONOMIC ANALYSIS OF THE CASSAVA ENTERPRISE (1): INTRODUCTION

This exercise can be started at the beginning of the FFS to introduce the importance of economic analysis and to explain what information is needed. It can be followed by the subsequent exercise on the matrix and how to collect all the information needed for economic analysis during the FFS.

Objective: To build farmers' ability to undertake an economic analysis of a cassava enterprise

Time: 2 hours

Procedure

- Explain the importance of an economic analysis of an enterprise.
- Ask participants in small groups to list all the activities they undertake to produce cassava.
- Ask participants to cost all the items.
- Ask participants to estimate yield per unit area obtained from the cassava fields. Include estimates of leaves that are consumed by the family, given away to others or sold.
- Ask participants to compute gross returns based on the lowest and highest prices or average price of specific cassava products – roots, chips, cuttings etc.
- Ask participants to compute net profit margins.
- Explain how various factors influence the net profit margins of cassava.

Questions for discussion

- Why is it important to make an economic analysis?
- What is the best way to collect all the information?
- Do you keep records?
- Why is it important in the FFS to keep records of all economic information for the study comparing local practices with integrated management?

ECONOMIC ANALYSIS OF THE CASSAVA ENTERPRISE (2): MATRIX TO COLLECT INFORMATION FROM STUDY FIELD

One of the objectives of the FFS is the improvement of farmers' livelihoods. These improvements are achieved by increasing the income that in turn depends on the increase in agricultural production (in terms of both quantity and quality). Therefore observations or comparative analyses are not limited to agronomic indicators; they also look at economics. The economic analysis is a comparison of benefits as well as other economic aspects between the study plots with different management methods.

All the activities and inputs for each plot are evaluated the day they are used and applied; they are then reported in a matrix on a big piece of paper. This matrix is brought along to each field meeting so that new information can be added as it occurs. At the end of the season, the total costs are calculated, the total revenue for each plot worked out and a comparison between the different plots made.

This activity helps learners to understand the necessity of record-keeping and helps them to make decisions based on parameters that will allow the activity to be profitable.

Procedure

- Develop a matrix for the kind of information that needs to be collected during the season and summarize the matrix on a flip chart (overleaf is an example of a table/matrix for economic analysis). The matrix can be developed with the FFS group (building from the introduction exercise) and reflect the local situation.
- Update the matrix during FFS meetings, so that information is recorded regularly whenever an input is bought, or when time has been spent working in the field.
- At the end of the season, complete the table, compare yield levels between the different treatments and discuss the questions below.

Questions for discussion

- What treatment had the highest yield? What treatment had the highest benefit? Why?
- Were you surprised about any of the results? Why or why not?
- Why is it important to make an economic analysis?
- What is the best way to collect all the information?
- Do you keep records?

FFS: ..... Season: .....

Study: IPPM and farmer practice

Economic analysis

Date	Activities/Inputs	IPPM		FP	
		Local variety	Improved variety	Local variety	Improved variety
	Costs (value/ha)				
	Yield (kg/ha)				
	Earnings (value/ha) (yield multiplied by price/kg)				
	Benefits (value/ha) (earnings minus costs)				

POST-HARVEST ACTIVITIES (1): PROCESSING OF CASSAVA

Background

Improved cassava processing methods increase productivity and improve on the quality and storability of cassava products. They also enhance the potential for cassava commercialization. Thus, undertaking this exercise in cassava FFS is very relevant.

Some cassava varieties (e.g. 'NASE III' in Uganda) must be fermented before consumption and must never be eaten fresh. The facilitator should remind participants of and ask them about this issue.

Objectives

- To enable participants to gain knowledge and skills on improved processing of cassava chips, flour and gari
- To develop other or secondary level products from cassava

Time needed: 1.5–2 hours

Materials: Flip chart and marker pens

Procedure

- Ask participants in small groups to share their experiences on methods used in the processing of cassava. This should relate to peeling, washing, chipping or grating, fermentation, drying, storage, packaging and or milling.
- Discuss the traditional and improved methods in the plenary.

Questions for discussion

- How do you process your cassava? Have you learned a new way of doing so?
- What works best for you? Why?
- How do you improve processing?
- What varieties need fermenting before they are ready for consumption?
- How do you ensure proper fermentation?

POST-HARVEST ACTIVITIES (2): MINGLING TEST

Background

It can occur that when one objective is achieved in a variety (for example, obtaining a high-yielding variety that is tolerant to pests and diseases), other attributes may be lost (for example, the ease with which cassava flour can be cooked). Traditionally, in some communities in Uganda, cassava is dried and mixed with sorghum, processed into flour, cooked and eaten as *Busima* or *Atapa* (cassava bread) – the main constituent of meals in eastern and northern parts of Uganda. Preparation of the meal involves an activity of "mingling", whereby specific proportions of cassava flour and hot water are mixed using a wooden mingling stick to make cassava bread. The women who do the cooking in households note that while some varieties are easy to mingle, others are not, and as such, ease of mingling is an issue of concern.

Objectives: To enhance participant understanding of how to use ease of mingling as a parameter for selecting the cassava variety to grow

Timing and time needed

This is a post-harvest exercise and is most appropriate towards the end of the FFS when the crop is at maturity stage. Time needed is 3 hours.

Materials: Flip chart, marker pens, cassava flour from different varieties, cooking utensils

Procedure

- Each group cooks the variety that was allocated to it during the variety set-up study.
- Explain and demonstrate specific known suitable mixtures of flour items.

Questions for discussion

- How easily do the different varieties mingle?
- How do you consider this factor when selecting varieties to be planted?

POST-HARVEST ACTIVITIES (3): PALATABILITY TEST

Background

The taste of a variety is an important consideration in variety acceptance, especially for fresh root consumers. Evaluation of a variety's taste is, therefore, a vital activity to be undertaken in cassava FFS.

Objective: To enhance participant understanding of how to use palatability as a parameter for selecting the variety of cassava to grow

Timing and time needed

This is a post-harvest exercise and is most appropriate towards the end of the FFS when the crop is at maturity stage. Time needed is 3 hours.

Materials: Flip chart, marker pens, cassava roots harvested from different varieties, cooking utensils

Procedure

- Ask participants in their group to do piecemeal harvest from the various varieties.
- Get each group to cook the variety that was allocated to it during the variety set-up study.
- Ask participants to taste the different varieties.

Questions for discussion

- Do the different varieties differ in taste?
- What are your preferences?

MARKET SURVEY

Background

One of the main goals of FFS is to improve farmers' livelihoods and increase incomes through the use of IPPM. This exercise is an example of the kinds of activities that can be done with FFS groups to follow and understand how cassava prices change during the season.

Objective: To enhance participant understanding of how cassava prices change during the season

Time needed: 1.5–2 hours

Materials: Flip chart, marker pens, notebook

Procedure

- Ask a mini-group on a weekly basis to visit the local market to find the price for cassava.
- Identify the different stakeholders in the market chain, and their roles and functions.
- Present the findings to the plenary.

Questions for discussion

- How do cassava prices change during the season?
- What coping mechanism can farmers put in place with regard to price changes?

SETTING THE OBJECTIVES AND SELECTION OF INCOME-GENERATING ACTIVITIES

Introduction

Farmers are highly dependent on their agricultural activities, especially for income-generating activities. Planning of activities is important to ensure a rational use of family resources in the fight against poverty. However, the majority of farmers do not have a good oversight of available resources and do not always make the best use of their time to meet the family's needs, following the cropping calendar.

Objective: To assist farmers to better define objectives and priority activities, planning them in order to enhance the possibilities of success.

Time needed: 1.5–2 hours

Materials: Flip chart, markers, paper, crayon, notebooks, pens

Procedure

- Create a case study that realistically reflects the activities and conditions of an average family in the village. Analyse the family situation by estimating:
  - food needed for the family by month and then by year;
  - monthly requirement for health;
  - monthly requirement for transportation;
  - what is needed to cover school fees for children;
  - what is needed to cover clothing; and
  - what is needed to cover housing.
- Add up all the needs for the family.
- Analyse the yearly production of the family by:
  - analysing the annual cultivated area per family;
  - analysing the production per land unit for all crops grown;
  - analysing the total field production and value in money; and
  - analysing all other activities that might bring in family income.
- Add up the total of family income.
- Compare the income and needs of the family.
- Analyse available resources, especially the individual production of family members.
- Develop a calendar of availability of the main agricultural products during the year.

Questions for discussion

- How do you determine your objectives?
- What do think about your family situation? Is it good? Can you meet your needs?
- Are you satisfied with your way of living? If not, what could you do?
- What is the minimum area of land that you need to cultivate in order to meet your needs?
- What causes periods of abundance, rarity and lack of agricultural produce for certain periods of the year?
- Are there other activities, other crops that you could grow to meet your needs?
- What resources are you not using or using poorly?
- How do you think you can improve your farms?

COLLECTING INFORMATION AND RECORD-KEEPING OF THE FARM ENTERPRISE

Introduction

Agricultural households often have difficulty estimating their expenditure during the cropping season, for example, evaluating family labour as well as estimating income from the development of different activities in order to assess the actual or approximate benefits. An important tool to meet this requirement is the progressive collection or registration of all information for all incomes (money coming in) and all expenses (outgoings) for each activity, beginning with the access to or selection of a field.

Objectives

- To strengthen the capacities of farmers to better estimate the profitability of the agricultural enterprise
- To teach farmers to keep all information which is useful for analysing different production factors (archives)

Materials: Notebook, pen, flip chart, markers

Procedure

- Think about the different crop operations and the resources needed to implement them.
- Reflect on the costs/value of family labour among other expenses and the value of social networks among income.
- Make a list of different crop operations starting with obtaining or selecting a field through marketing (sales) of the products.
- Make a table on a flip chart with the following columns: date, crop operation, description providing objective or reason, quantity and quality, outgoings (expenditure), incomings (income), balance.
- Use different colours for the table to make it more clear.

Questions for discussion

- What are the different crop operations that you perform from the beginning to the end of the season on your agricultural enterprise? What are the different costs you make during these operations?
- Who in the household is responsible for different sales and who keeps the money?
- What are the different types of labour used for the different operations? How can we give value to family labour?
- How do we give a value to presents and gifts in the form of agricultural products from the family to other family members, to friends and visitors?
- Is it necessary to record all the information for the agricultural enterprise?
- Do you have family members who are heads of the household, or children in the family who have studied?
- Who can be made responsible for recording in a notebook all information on the costs and incomes of the agricultural enterprise? How is the notebook to be used to write down all information for the enterprise during a cropping season? How is the information to be used?
- How can the economic analysis carried out in the FFS help improve the records? How is it helpful for evaluating family labour costs in growing cassava or other crops?

SAVINGS BY FFS MEMBERS – SAVINGS AND CREDIT

Introduction

Attitudes of members of rural associations have become more and more "wait-and-see". They hope to obtain support from different short-duration projects implemented in their locality, but support only covers some well-targeted needs. Often, after the project, communities are not capable of taking the lead in continuing actions started and in making them last. Therefore it is very important to raise awareness and encourage members of the FFS to make contributions to cover their different needs and to save to be able to continue activities after the end of the project.

This exercise can be done at the beginning of the FFS, as an introduction. However, it will be useful to come back to this topic during the FFS, as a special topic, to keep discussing and identifying ways forward, also for activities after the FFS finishes.

Objectives

- To raise awareness among FFS members and associations of the importance of sustaining themselves by building from their own means
- To teach FFS members about savings in order to access credit

Time needed: 1.5–2 hours

Materials: Notebook, pencil, pen, flip chart, markers, eraser

Procedure

- Think about the needs of the association of the FFS to accomplish the objectives that were defined for the ongoing cropping season, or the near future.
- Examine the nature and destination of support given by projects or other organizations.
- Do a group dynamics exercise on savings (local proverbs; story of the stork and the ant).
- Reflect on the possibilities to cover needs that are not included in the support given.
- Estimate the nature, the volume or the value of these needs.
- Introduce in a participatory manner the mechanism of obligatory individual contributions.
- Guide the members in defining the amount to be saved, the regularity and the responsibility.

- Remind everybody of the tasks of the board/committee of the FFS to better assign responsibilities.
- Determine the modalities of payments and loans of the fund.
- Underline the importance of saving to gain access to credit.

Questions for discussion

- What are the activities selected by the FFS for the current cropping season? What are the different needs of the association or FFS (inputs, organization, field and others) to realize the activities?
- What supports are already received or expected from partners that you work with? Can the support cover all the needs as defined above?
- What are the lessons to be learned from proverbs? And from the story of La Fontaine?
- What can we do to cover needs that are not covered by the different supports?
- Is it possible to have monthly contributions? What day or what moment is good for saving? In which form? In nature or in kind? What amount is to be contributed by each member? Who will be responsible for receiving the contributions?
- What are the different tasks of the committee?
- How will funds be taken out of the cash fund? How will the funds be managed?
- Is there a Savings and Credit Cooperative in the locality? Since when? Have you already opened an account with them for the FFS?
- What does credit mean to you? What relation can we establish between savings and credit?

LABOUR DIVISION OVER TIME AND BETWEEN FAMILY MEMBERS

Introduction

Planning activities helps to make better use of the resources that are available for a family. Available resources are not only financial or material, but also include human resources and time available. Human resources are mainly those in the family. Often human resources and available time are poorly used. Generally, division of tasks in the family is unequal. Men and boys leave the bulk of work to be done by women and children. Use of time is not optimal.

Objectives

- To assist farmers to better plan their activities, increasing their motivation and the probability of success
- To promote a better division of tasks in the family

Time needed: 1.5–2 hours

Materials: Flip chart, markers, paper, pencils, notebook, pens

Procedure

- Make an analysis of the division of tasks between family members to understand workloads and the divisions of tasks over time. In particular:
  - Analyse the work done by each category of family members (men, boys, women and girls) over a day, over a week, over a month and over a year.
  - Analyse the time needed for these tasks for a day, a week, a month and a year.
  - Summarize for the different categories of family members and for the whole year.
- Reflect together on the following questions:
  - How do you decide on the tasks of each family member?
  - What are tasks that certain family members cannot do? Why?
  - What do you think of this labour division? Is it good? Do you think it is fair? If no, what can you do? How can you help the people that have too much to do?
  - During which periods do you have too much free time and how would you better use it? What do you think of the use of your time? Could you improve it? How?

6. Group dynamics

Some examples of group dynamics exercises are given below for use in the FFS. Other group dynamics exercises are available, and are normally included in ToF sessions.

PAIRED INTERVIEWING (GETTING STARTED, INTRODUCTIONS AND ICE-BREAKING)

Objectives

- To discover what participants want to get from the session, workshop or training course and to learn a little about their personalities
- To help evaluate a course at the end of the training
- To help participants relax at the beginning of a course

Time: 20–45 minutes (depends on number of participants)

Materials: Paper, pens

Activities

- Participants split into pairs. The trainer asks each participant to interview their partner by focusing on questions such as:
  - What is your name? What is your background and experience?
  - What led you to attend this course? What do you hope to get from it?
  - Do you have any past experience of participatory methods in the field?
  - What are two good things that happened to you in the past year?
- After five minutes of interviewing each other, participants then report to the plenary about their partner, summarizing the main facts in one minute.

Hints

The key to the exercise is that participants do not report on themselves – in this way they do not become nervous while waiting for their turn. Moreover, the exercise is neutral to seniority as participants interview their "neighbour" – you as the trainer may discover only later that a junior officer is reporting on a director or vice versa. If expectations are discussed, the trainer can write these down on flip chart paper, which can then be stuck to the wall during the workshop. Participants are then able to use the list to monitor whether their expectations have been met or

have changed. With a large group (over 20), the principal problem lies in limiting the length of each response. If each person takes 2 or 3 minutes to report back, many people will be bored and you are wasting precious time. If you explain this to participants, then they will take more responsibility for sticking to time limits. You can also ask them to limit the reporting back to name, experience and two good things that happened last year. If you know or suspect that many participants have been told to attend the training, do not know what it is about and therefore are unlikely to have clear expectations, then talking about expectations will be irrelevant and difficult. Instead focus on other questions, such as the two good things that happened to them. You may find that this exercise is also valuable for evaluations. To use it for that purpose, change the questions that the pairs ask of each other to:

- To what extent did the course meet my (your) expectations?
- What did you find most valuable?
- What did you find least valuable?
- How would you like to see the course changed before it is run again?

FIRST NAME INTRODUCTIONS (GETTING STARTED – INTRODUCTIONS AND ICE-BREAKING)

Background

This session is very important at the beginning of a workshop. As a trainer, your task is to set an informal tone and to get the participants engaged right from the start. A first name introduction is one of several participatory exercises that serve this purpose well. By using this type of introduction, participants get the feeling that their expectations are taken seriously and that their commitment is welcomed.

Objectives

- To help participants learn each other's names quickly
- To create a relaxed atmosphere

Time: 20–30 minutes (depending on the size of the group and how much you laugh!)

Materials: None

Activities

The facilitator introduces himself by saying his first name and adds an adjective which starts with the same letter(s), e.g. "My name is Edward, edgy Edward". The facilitator then asks the person sitting next to him to introduces him to the other participants before introducing himself or herself, adding an adjective beginning with the same letter of his or her first name as well, e.g. "I am happy to introduce to you edgy Edward. May I introduce myself also? My name is groovy Gregory". Everyone introduces all the persons who were introduced before. Continue until everyone has had a turn.

Hints

It is good to start with this game during the first or second day of the FFS. It provides a lot of fun and really speeds up the process of becoming acquainted.

BOMAYE

Background

Adults, especially women, find it a problem to introduce themselves and to get to know each other better.

Objective: To establish rapport among participants and develop cohesive working groups

Procedure

- Place one participant (leader) in the centre.
- Give the song instructions.
- Allow sufficient time for all participants to give their names.

Chorus

Leader:	*Bomaye bo Bomaye bo*
The rest:	*Bomayeeeh*
Leader:	*Bomaye bo Bomaye bo*
The rest:	*Bomayeeeh*
Leader:	*Bomaye bo bomaye bo bomaye bo*
The rest:	*Bomayeeeh*

Next

Individual (1):	*Grace Bomaye bo*
The rest:	*Bomayeeeh*
Individual (2):	*Lydia Bomaye bo*
The rest:	*Bomayeeeh*
Individual (3):	*Betty Bomaye bo*
The rest:	*Bomayeeeh*

A GOOD FACILITATOR

Background

For effective bottom-up learning, the FFS facilitator is expected to act as a guide, do things differently, talk less and transform himself from facilitator to organizer.

Objectives: To enhance participant understanding while improving on their facilitation skills in an FFS

Timing and time needed

The exercise is most appropriate during the ToT, a day or two before participants go to facilitate the satellite FFS. Time needed is 2 hours.

Procedure

- Ask participants in their mini-groups to come up with the general qualities of a good facilitator.
- Ask participants to present their views to the plenary for sharing.
- Build on what the participants have presented by asking them to brainstorm on the parts found on the vehicle.
- Draw a vehicle, indicating:
  - key
  - gears 1, 2, 3, 4
  - seats
  - mirrors
  - fuel tank
  - lights
  - accelerator
  - breaking system
  - bumper

Discussion

Use an analogy to compare the different parts of the vehicle to the components of an FFS; for example a facilitator should:

- start with gear 1 and work upwards;
- apply reverse gear when not everyone has understood;
- be aware of pot holes and other road users;
- use mirrors to check for participants who are trailing behind;
- use the breaking system to allow all participants to catch up; and
- use the bumper every now and again to make things move.

FFS PRAYER

Background and objectives

The principle emphasis is on creating an environment in which individuals and groups feel free to experience, reflect and change. In particular, games, exercises and songs are valuable for:

- relaxing the participants;
- rejuvenating the group;
- stimulating the flow of communication between strangers; and
- establishing a learning climate that is enjoyable as well as fruitful.

Lord on this very hour I pray,
The strength to live my best today
Draw near to me and I shall see
The kind of person I shall be

In serving others I may see
That I am only serving Thee
Teach me Oh Lord thy great plan that I become a better man

In serving others I may see
That I am only serving Thee
Teach me Oh Lord thy great plan that I become a better man

AMEN!

FRUIT SALAD (PICKING UP THE TEMPO – ENERGIZING AND FORMING GROUPS)

Objectives

- To get the group active and awake
- To form subgroups, each with an easily remembered name, for further group work

Timing and time needed

This exercise is especially good after lunch or to break a long passive session. Time needed is 10 minutes.

Materials

Chairs arranged in a circle – one fewer than the total number of participants and trainers. If there are enough chairs, they could be set up ahead of time in another space, such as an adjoining room. Otherwise, ask participants to bring their chairs with them.

Procedure

Decide on the number of groups that are needed, as this will determine the number of fruits selected. Set up a closed circle of chairs, one fewer than the number of people who will join the exercise. Ask participants to sit in the chairs. The trainer begins the game by standing in the middle. Explain that this is an energizing exercise, which will require their (very!) active participation. Let the participants name as many fruits as you need subgroups, for example four fruits, if you need to form four subgroups. Ask one person to choose a fruit, their neighbour another fruit, the next neighbour another, and so on until the desired number of subgroups is reached. The next person in the circle takes the first fruit, the next the second, and so on until everyone including the trainer has a fruit name (such as apple, melon, orange, jackfruit, melon, orange). If necessary, you can then write the fruits on a large sheet of paper or on the board, especially if there are more than five fruits to remember. Before you start, ask all the oranges to put up their hands, then the melons etc. This will just remind everyone once again of their fruit. The person in the middle calls out the name of one fruit. All those participants who are that fruit must change chairs – no exceptions! The person in the middle will also try to get a seat, and should succeed as they have only half the distance to travel. One person will be left in the middle who then repeats the process by calling out another fruit. When "fruit salad" is called out, then everyone must change chairs.

Comments

This exercise can be a great deal of fun. Participants will be fully active in a couple of minutes of organized chaos. It does need someone to stop the game, and as the trainer, you should conclude by allowing yourself to be left in the middle. This is easiest after "fruit salad" has been called. Conclude the exercise and ask everyone to return to the workshop area. Assign fruit names to tables and ask everyone to sit in their new groups. There is no debriefing. If group work is required at a later stage these fruit names can be used again (e.g. "All pineapples will work together."). This game mixes hierarchies and relaxes participants. It also divides friends and colleagues into separate groups as they tend to sit together in the circle. There are endless variations to "Fruit Salad", including: "Jungle" or "Zoo" (with animals from the jungle or zoo); "Vegetable Soup" or "Meat Stew" (types of vegetables or meats); "Cocktail" (types of drink); "Agroforestry" (tree types); "Ocean" (fish); and "Rainbow" (colours). In order to double the number of groups from the game, adopt "Jungle" or "Zoo" and identify alternate males and females in blocks. All animals of a species move together, but when groups are formed, tigers and tigresses, lion and lionesses, form separate groups. In this way, eight groups can be formed from four animals. For very large numbers, have more than one circle playing the game simultaneously. Another easier variation which requires no memorizing is the "Mail Game". The person in the middle announces "I have a letter for those who [work for an NGO/live in the countryside/are wearing black shoes etc!" As in "Fruit Salad", all those who fulfill the criteria change places. The person left in the middle chooses another criterion to which he/she "delivers the letter".

THE STORY OF THE BOY, THE WISE OLD MAN AND THE BIRD

Objective
To keep the FFS flame that has been lit burning

Method: Storytelling

Timing and time needed
The exercise is most appropriate during the graduation of ToTs. The time required is 15 minutes.

The boy, the wise old man and the bird

Once upon a time there lived a young boy in a small village. Now in this same village there lived an old man who was known for being very wise. One day the young boy, having caught a bird, decides use it to test the old man's wisdom. So he goes to the old man, holding the bird in such a way that the old man cannot see it, and then asks the old man:

"Old man, tell me, is this bird alive or dead?"

The old man knew that if he said the bird was alive, the boy would squeeze the bird and kill it; on the other hand, if he said it was dead, the young boy would produce a live bird, so the old man in reply says:

"Young man, the life of the bird is in your hands: you can save it or kill it".

Conclusion
Likewise, after graduation, the life of the FFS is in the hands of the facilitators: they can kill the FFS or keep it alive.

JARANGA DAY

Background

This exercise is named after Mr Jaranga Ogen, an FFS facilitator from Uganda, who was minister for welfare and entertainment during an IPPM-FFS ToT in Soroti in 1999. It was based on the fact that farmers encounter a number of problems and tasks at different times, including during the Intensive ToT period. Farmers think about possible solutions continuously and seek opportunities to address certain problems; this causes additional stress. The exercise is based on the fact that it is not enough to merely analyse agronomic issues and address only set priorities and academic issues; it is also necessary to look at a broader social interaction. Jaranga Days have contributed to the cohesiveness of the group, to making the ToT and field study more interesting and, most importantly, to stress reduction.

Objectives

- To help reduce stress, tension and home feelings and to make the FFS flexible, enjoyable and entertaining.
- To make participants open up and to bridge the gap between participants and facilitators.

Timing and time needed

The exercise is most appropriate once a week during a ToT or during an FFS workshop when work is at its peak and everybody is exhausted after a hard day's work. It serves to break monotony and rejuvenate the participants. Time needed is 3 hours.

Materials: Snacks and music

Procedure

- Ask the host team in collaboration with the minister of welfare to draw up a programme for the day in such a way that each group and each participant comes up with energizers. As far as possible, avoid a high table and speeches.
- Create small working groups of 5–6 persons, and have each group entertain the rest.
- Hold a quiz covering all topics covered. All issues to do with FFS can be included, comprising those which are difficult to address in the FFS sessions.
- Set priorities with the group on what can be done in the time available during the period allocated for the day.

7. Evaluation of FFS

FFS programmes normally set up a system to monitor and evaluate FFS activities. The role of facilitators in evaluation is very important.

- The facilitator will normally ask for feedback at the end of the session, to improve subsequent sessions, and to see whether the group wants to learn more about specific topics in the coming weeks. The Itemized Response Technique (what went well, what can be improved) is an exercise that is commonly used for this purpose – participants share their thoughts with regard to what went well, what should be improved for the next session and how it can be improved.
- Quality matrices are in use in many programmes and are helpful for assessing the process and content of an FFS meeting. Facilitators can use this tool themselves. It can also be used by others that support activities in the field.
- Most programmes keep records of the FFS, storing data on the FFS location, duration, participation (male/female), number of meetings and technical data. The facilitator maintains the records and ensures that they are submitted to the programme management.
- An overall evaluation (and planning for the future) is often held towards the end of the FFS.

Check with your programme which monitoring and evaluation tools are being used. You can also check:

http://www.vegetableipmasia.org/docs/Field%20Guide/Resource%20Material.pdf
p. 106–118 for more information on FFS evaluation.

8. Post-FFS activities

In many cases farmers are interested in continuing activities after an FFS. It is useful to do a final evaluation with the FFS group towards the end of the season. This can be the starting point for planning post-FFS activities and can encourage farmers to continue activities after the FFS. Post-FFS activities may encompass a wide range of elements, including: more learning and sharing; training other farmers in the community; strengthening farmer groups and organizations; networking; and income-generating activities.

Find out from the FFS programme what experiences there are on post-FFS activities, and what kind of support might be available.

ANNEX 1

Being an FFS facilitator

Facilitators play a critical role in an FFS. They need technical, methodological and organizational skills to help learners in the FFS improve knowledge and decision-making skills. Below are some considerations and techniques that are frequently used by facilitators in an FFS. Additional skills training on facilitation is provided in ToF (training of facilitator) courses.

PARTICIPATORY APPROACHES

In the past, farmers and their communities were thought to have little to contribute to their own development. It was believed that knowledgeable outsiders with specific know-how could guide rural people and their communities to development by following these ideas. This is no longer the case: development calls for participatory approaches in all areas.

Participatory approaches assume that:

- agents of development behave, not as teachers, but as facilitators;
- agents of change work with communities and use community considerations (whether human or technical in nature) as a starting point;
- the facilitator is not prejudiced; and
- communities are the centre of action.

The farmer field school approach is a method that builds on principles of participatory approaches. It takes into account the local knowledge of farmers and leaves farmers free to decide after having assisted in discovering possible solutions through hands-on learning.

TRAINING APPROACHES OFTEN USED IN FARMER FIELD SCHOOLS

Introduction

The farmer field school is based on principles of participatory education, building on non-formal adult education principles. The facilitator should keep in mind that adult participants:

- will only learn when the content is interesting to them, i.e. when it will help solve problems in daily life;
- learn better when training focuses on their professional activities;
- have experience and can assist each other in a process of mutual learning;

- learn more efficiently from peers (exchange of experiences promotes efficient learning);
- learn better when they are actively involved and participating;
- need to learn at their own pace; and
- are conscious of their own and need to be treated with respect and humility.

The facilitator should not forget that repetition allows for appropriation of knowledge. In addition, the facilitator should encourage active participation by:

- stimulating interest;
- encouraging participants to talk and express their opinions;
- guiding participants to put their experiences to good use and to help each other;
- creating collective exercises to examine solutions for certain problems by tapping the experience and wisdom of group members (participants should be stimulated to contribute necessary experiences and knowledge on the topic that is discussed); and
- influencing attitudes and beliefs, and facilitating acceptance of new skills or information gained in the training.

A ToF course should include extensive reflection on facilitation; methods are applied throughout the training.

SOME TECHNIQUES AND METHODS USED IN FARMER FIELD SCHOOLS

Questions and answers

This technique fits with all other techniques and methods used in FFS training. The facilitator is not actually a teacher, but respects the principles of adult education. Lectures are not delivered but the facilitator probes to arouse reflection and observation among learners to allow them to go through the different steps of the adult experiential learning cycle.

Asking open-ended questions and avoiding questions that imply a "yes" or "no" answer stimulates dialogue and learning. Questions should aim to get concrete results/answers through reflection of participants. The facilitator should keep in mind the following questions: Why? Who? Where? When? How? It is important to adapt to different circumstances and take into account the experience acquired by the learners.

Discussions in the big group/plenary

The facilitator is the moderator, helping the group participants to discover or use all their skills and guiding them to find solutions to the problems discussed. Plenary discussions allow for an open exchange between all members of the FFS, where ideas and experiences can be shared, and a common decision can be reached.

The facilitator plays the following role:

- Create an environment in which participants feel at ease.
- Facilitate and guide discussions – introducing the session, structuring the discussion, making regular summaries.
- Recognize and acknowledge the different points of view and opinions of participants.
- Make sure that there is good communication in the group – encouraging listening and respecting the group's rules on who talks when.
- Use practical methods adapted to the local situation for everybody to participate from beginning to end.
- Help maintain a good atmosphere in the group by moderating reactions from one person to another.
- Provide scientific, technical, social and organizational information useful for developing skills.
- Assure that the identified solutions have a general consensus and are applicable.
- Develop knowledge and know-how, increase self-awareness and confidence, and put know-how into action where appropriate.

Small group discussions

To facilitate active discussion, the big group is divided into small subgroups. This technique allows efficient and harmonious discussions, and takes into account skills and interests. In general, people are more ready to speak in small groups and feel encouraged to present their results in a plenary session.

In a small group, it is easier to discuss opposing or complementary opinions and different experiences to better analyse the problem and develop attitudes to speak about it and provide feedback. It is possible to hold debates and learn about the democratic process.

Group dynamics

The objectives of the farmer field school are not only technical, but also include development of the self, which may be stimulated by group dynamics exercises. Group dynamics can take the shape of a game, a proverb, a story, a parable, or the sharing of a life experience. The activity underlines a moral lesson to be learned with the objective of resolving a problem, strengthening social cohesion of the group or community, or changing negative attitudes. This lesson is identified and discussed in the group. Group dynamics also prepare groups to take charge of participatory community activities and provide an opportunity to (re-)valorize the oral African literature traditions that are slowly disappearing.

Exchange visits

Exchange visits allow a group to confront itself with others. Relations between groups are improved and visits allow for exchange of experiences and information between participants of different FFSs and different environments.

Role plays

Role plays are used to transmit a message to members of the FFS. They can also be used to evaluate capacities that participants have developed.

The principle of: "What is that?"

- **Why?** This principle is used to draw out observations on what happens in the field.
- **When?** This is used each time a new phenomenon is found in the field or surroundings.
- **How?** Each new phenomenon in the field is for reflection.

The facilitator proceeds with questions to encourage FFS members to reflect, for example:

- What is it?
- Where did you find it?
- What was it doing?
- On which part of the plant?
- Is the damage serious?
- Do you see it often? During which periods?

Continue to reflect on all details to help learners understand the function of what they observed in the field. Note that it is important to avoid giving the name of the disease or insect immediately, as once the name is given, the learner will cease to make observations (this principle applies to all participatory training).

Transforming situations into lessons

As a facilitator, grasp all opportunities arising to help change the attitudes and capabilities of learners. Observe what is happening all around (agricultural, social, economic, political, cultural situation). Interesting cases can be analysed and lessons learnt from them.

ANNEX 2

Examples of learning objectives and curricula

RELEVANT EXERCISES RELATED TO CASSAVA FFS/IPM AND ON THE BROADER FFS AND IPM EXPERIENCES IN KENYA

Learning goals for cassava crop FFS/IPM

1. Record-keeping – types of records kept, advantages of record-keeping
2. Cassava site selection – type of field required for cassava production
3. Land preparation – methods, equipment, timing, ploughing depth, type of seed bed required for cassava establishment
4. Planting materials selection – appropriate varieties, cuttings (source, preparation for planting, size), selection of planting materials
5. Fertilizer application – types of fertilizer used for planting, rates and methods of application
6. Planting – methods, spacing, timing of planting and plant population, intercropping (which other crops and why?)
7. Weeding – methods, timing, frequency
8. Disease and pest control – types of diseases and pests experienced in cassava, identification, impact on yields, control and IPPM
9. Cassava maturity and harvesting – maturity period, methods and timing of harvesting, storage
10. Cassava utilization – uses, by-products
11. Marketing of cassava – traditional vs modern, reaping maximum benefits, gross margin analysis and its importance

Special topics

1. Soil conservation and farm management – why it is done and its importance
2. Farming as a business and its importance
3. Marketing and synergy in marketing
4. Visioning in farming and enterprise growth planning for sustainability of farming activities
5. HIV and its impact on agricultural development and the economy
6. Environmental management and its importance
7. Gender-based violence and how to deal with it
8. Importance of networking for sustainable development
9. Production of crops to go with cassava for increased production to achieve food security and higher income generation

Curriculum for FFS on cassava, Democratic Republic of the Congo (Note that the period must suit the site's cropping calendar)

No.	Period	Operation/ Activities	Topic	Learning objective	Content	Methods	Materials	Time	Responsible person	Evaluation indicators
1.	Jan.–Dec.	Economic analysis	Farm record-keeping and economic analysis	Know how to keep and analyse records for planning and management	Importance of record-keeping Types of records and their use Inventory Enterprise budgeting Sales records Profit and loss account	Brainstorming, discussion	Flip chart, markers, masking tape	1.5 h	Facilitator	Feedback Ability to keep and use farm records
2.	Feb.–Mar.	Site selection	Site identification	Be able to identify and select suitable land for production	Criteria for selecting land Characteristics of land suitable for cassava production History of the site (crops grown and their performance)	Brainstorming, field observation, soil identification, discussion	Fields, water, hoe, flip chart, markers, masking tape	1–2.5 h	Facilitator	Feedback Ability to list characteristics of good land for cassava
3.	Feb.–Mar.	Land preparation (land clearing, stump removal, ploughing, harrowing, ridging)	Land preparation for cultivation	Know the importance of good land preparation and how to do it	Importance of land clearing Methods of land clearing When and how to clear the land Types of equipment for different soil type and gradient Importance of land preparation Methods of land preparation	Brainstorming, discussion, field visits	Flip chart, markers, masking tape, field for field visit, examples of land preparation tools/ equipment	2 h	Facilitator	Feedback Ability to list methods of land clearing and land preparation
4.	Mar.–April	Input procurement: cassava planting materials, fertilizers	Planting material and fertilizers for procurement	Know the characteristics of desirable varieties and sources of their planting materials and fertilizers	Identification of varieties of cassava planting materials and fertilizer types. When, from where to collect planting materials and how to prepare for planting (Farmer) criteria for selecting planting materials Information on fertilizer package and label Cassava cutting and fertilizer rates, calculation of fertilizer rates Storage methods of planting materials	Brainstorming, observation, discussion, field practice	Samples of planting materials and fertilizers, flip chart, markers, masking tape, materials for preparing planting material	2 h	Facilitator	Feedback Ability to list characteristics of good planting materials and fertilizers

No.	Period	Operation/ Activities	Topic	Learning objective	Content	Methods	Materials	Time	Responsible person	Evaluation indicators
5.	Mar.–April	Planting operations	Planting	Know how to plant properly	Time of planting Methods of planting (advantages and disadvantages) Spacing and depth of planting (plant population)	Brainstorming, discussion, field practice	Flip chart, markers, masking tape, field, planting material and equipment	3 h	Facilitator	Feedback Planting know-how
6.	April–June	Fertilizer application	Fertility management	Be able to apply good fertilizer correctly	Types of organic and inorganic fertilizers and their characteristics Sources of fertilizers Methods and rates of application (use of organic and inorganic fertilizers as basal and top dressing)	Brainstorming, discussion, field practice	Flip chart, markers, masking tape, field for field practice, samples of fertilizers	3 h	Facilitator	Feedback Soil fertility management know-how
7.	May–Oct.	Weeding	Weed management	Be able to manage weeds	Importance of weeding Methods and timing of weeding Characteristics of different weeds Use of herbicides, ITK Safety precautions	Brainstorming, discussion, field practice	Flip chart, markers, masking tape, field for field practice	2 h	Facilitator	Feedback Weeding know-how
8.	April–Nov.	Pests and diseases	Pest and disease management	Understand pests and diseases	Importance of pest and disease management Types, symptoms and characteristics of pests and diseases Methods of pest and disease management Use of ITK Biocontrol and cultural control Types and use of pesticides Pests and diseases and storage	Brainstorming, group discussion, field practice	Flip chart, markers, masking tape, field for field practice, (bio-) pesticides, application equipment	2–3 h	Facilitator	Feedback Pest and disease management know-how
9.	Mar.–Dec.	Field monitoring	Crop management requirements	Be able to monitor and identify problems in the field/crop	Agro-ecosystem analysis Stage of growth/development Pest and disease infestations Weather effects Soil/water/plant conditions	Brainstorming, group discussion, field practice	Flip chart, markers, masking tape, field for field practice	2–3 h	Facilitator	Feedback Ability to manage main pests and diseases

No.	Period	Operation/ Activities	Topic	Learning objective	Content	Methods	Materials	Time	Responsible person	Evaluation indicators
10.	Nov.–Dec.	Harvesting	Determination of appropriate time of harvesting	Know when and how to harvest	Signs and characteristics of maturity When to harvest How to harvest	Group discussion, field pratice	Field with maturing crop, harvesting tools	3 h	Facilitator	Feedback Knowledge of when and how to harvest
11.	Nov.–Dec.	Post-harvesting/ processing	Post-harvest handling	Learn about proper methods of post-harvest handling and processing	Minimize post-harvest losses (quality and quantity) Different processing and package practices (advantages and disadvantages) How to process and package	Presentation, group discussion, visits to processing units, field practice	Flip chart, markers, masking tape, produce, processing equipment/ tools	2 h	Facilitator	Feedback Knowledge of proper methods of post-harvest handling and processing
12.	Nov.–Dec.	Storage	Minimum losses in storage	Be able to know how to minimize storage losses	Importance of good storage Storage methods and structures (advantages and disadvantages) Storage pests and their management Fumigation chemicals	Presentation, group discussion, visits to storage structures	Flip chart, markers, masking tape, storage structures, chemicals	2 h	Facilitator	Feedback Ability to store cassava and manage storage pests
13.	Nov.–Dec.	Marketing	Marketing strategies	Understand marketing intelligence	Demand and supply Sources of marketing information (market survey) Marketing intelligence	Presentation, discussion, group work	Flip chart, markers, masking tape	2 h	Facilitator	Feedback Knowledge of marketing strategies

Exercises in FFS setting – FFS-related methodology and process (Kenya)

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
1.	Background of FFS	• Origin and global spread • What is an FFS? • Objectives of FFS • Basic concepts, characteristics • Fundamental elements of FFS	Participants understand the FFS methodology and process	Presentation and plenary discussion through Q & A	Flip charts, masking tapes, marker pens and facilitator's notes	5 h
2.	Organization and management of FFS process	• Key programme activities • Subgroup and host team concept • FFS schedule	Participants understand how FFSs are organized and managed	Presentation, group discussions	Flip charts, masking tapes, marker pens and facilitator's notes	8 h
3.	Understanding the ecosystem, agro-ecosystem analysis (AESA)	• Ecological functions and relationships - Energy flows in and ecosystem - Life cycles, food chains, food webs • Ecosystems - Concept and components of an ecosystem • Agro-ecosystem analysis - What AESA is - Why (importance of AESA) - Process of AESA - Developing AESA parameters • Concept of "What is this and What is that?"	Participants are able to: • understand and appreciate the concept of ecosystem • appreciate AESA and HESA as key decision-making tools • conduct AESA	Presentation, practical observation, group work and presentation in plenary Field visit/work	Flip charts, masking tapes, marker pens, polythene bags, vials, alcohol, hand lenses and facilitator's notes	8 h
4.	Experimentation in FFS	• Participatory comparative experiments (PCEs) • Designing an FFS study field - Criteria and factors to consider while selecting an FFS study enterprise - Documentation of experimental process	Participants are able to: • understand the different stages of an experiment and the basic principles of systematic experimental design • have the skills to design, implement and evaluate a simple experiment • understand the aim of an experiment • identify the data parameters	Presentations, games, group work on PTEs options and presentations in plenary	Flip charts, masking tapes, marker pens, stones, buckets and facilitator's notes	8 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
5.	Principles of adult non-formal education		Participants are able to explain the principles of adult non-formal education	Presentation, Q & A	Flip charts, masking tapes, marker pens and facilitator's notes	2 h
6.	Concept of group dynamics and ice breakers	• What are group dynamics and icebreakers • Why and when group dynamics and icebreakers • Categories of group dynamics and icebreakers	Participants are able to explain and perform group dynamics and icebreakers	Presentations, Q & A, brainstorming	Flip charts, masking tapes, marker pens and facilitator's notes	2 h
7.	Participatory M & E	• Concept and frameworks • Baseline information • Monitoring • Evaluation • Reporting formats	Participants are able to: • reflect on what should be monitored and evaluated to measure success, and identify appropriate indicators to measure the identified parameters • decide monitoring parameters, who should do it, where, with what and when	Presentations and reactions in form of Q & A	Flip charts, masking tapes, marker pens, baseline data and facilitator's notes	8 h

Exercises in FFS setting – cassava-specific exercises (Kenya)

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
1.	Variety selection	• Budgeting • Varieties of cassava • Selection of clean cassava cuttings for planting • Reasons for planting cassava • Cultural aspects	Participants are able to: • make an informed decision on suitable varieties • select clean planting cuttings	Group discussion, plenary, analysis of key factors of cassava varieties	Flip charts Pens Books Marker pens Cassava farms Masking tape Facilitator's notes	1 h
2.	Site selection for planting	• Soil types • Security (wild animals, fencing etc.) • Location	Participants are able to understand factors to consider when choosing a site for establishing cassava	Group discussion, analysis, walk around possible site	Flip chart Pens Books Marker pens Masking tape Hands Facilitator's notes	1.5 h
3.	Land preparation	• Land clearing • Ploughing method (oxen, hand, mechanized) • Harrowing	Participants are able to understand the need/techniques for land preparation for cassava	Group discussion, participatory practical demonstration	Farm tools Flip charts Pens Books Markers Masking tape Facilitator's notes	1 h
4.	Planting	• Planting methods • Rapid multiplication	Participants are able to select the appropriate planting method for cassava and know how to rapidly multiply the clean materials that may be in short supply	Group discussion, participatory practical demonstration	Farm tools Flip charts Pens Books Markers Masking tape String line Farm inputs Tape measure Facilitator's notes	1 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
5.	Selection of clean planting materials	• Budgeting • Varieties • Reasons for planting (income, food etc.) • Cultural aspects	Participants are able to make an informed decision on how to select clean cassava planting cuttings	Group discussion, analysis of key factors considered in choosing clean cassava cuttings for planting	Flip charts Pens Books Marker pens Masking tape Facilitator's notes	1 h
6.	Weeding	• Why weed? • Common weeds • When to weed • Methods of weeding	Participants are able to: • understand the importance of weeding • identify weeds in the plot	• Group discussion, plenary, participatory practical participation in weeding • Role play • Build on findings, summarize	Farm tools Flip charts Pens Books Markers Masking tape Facilitator's notes	1 h
7.	Pest and disease control	• Create awareness of use of chemicals only when other alternatives have been exhausted • Identification of pests and diseases • Identification of appropriate action • Use of IPM • Performance of action	Participants are able to: • identify pests and diseases and take appropriate action • understand the relationship between natural enemies and pests • know the right time to use chemicals	• Group discussion, plenary, participatory practical participation • Build on findings, summarize • Group dynamics (songs and plays)	Farm tools Flip charts Pens Books Markers Masking tape Farm inputs Facilitator's notes	1 h
8.	Field day	• Field day timing	The community has exposure to cassava IPPM practices and farmer participants are able to demonstrate the skills acquired in FFS learning sessions	• Demonstration of AESA • Display of cassava products • Poster presentation by FFS • Conducting community around FFS plots • Speeches	Farm tools Flip charts Pens Books Markers Masking tape Farm inputs Facilitator's notes Cassava products	1 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
9.	Harvesting	• When to harvest • Harvesting methods • Post-harvest handling • Assessment of crop yield and value • By-products utilization	Participants know how to attain the highest quality product and minimize losses and are aware of the various alternatives in by-product use	Group discussion, plenary, participatory practical participation	Farm tools Flip charts Pens Books Markers Masking tape Bags/crates Weighing scales Facilitator's notes	1 h
10.	Preservation of cuttings harvested during dry spell	• When to preserve • Methods of preservation	Participants are versed in preservation methods and times	Group discussion, plenary, participatory practical participation	Flip charts Pens Books Markers Pangas Hoes Masking tape Storage vessel Facilitator's notes	3 h
11.	Processing, utilization and storage	• Processing methods • Storage methods • Product development	Participants are able to understand the need for processing for storage	Group discussion, participatory practical demonstration, various cassava products	Flip charts Pens Books Markers Masking tape Facilitator's notes	5 h
12.	Exchange visit		Participants are able to exchange and acquire new skills and experiences with the hosts	• Demonstration of AESA • Display of cassava products • Poster presentation by FFS • Touring of areas of interest • Experience sharing • Speeches • Lessons learnt	Farm tools Flip charts Pens Books Markers Masking tape Farm inputs Facilitator's notes Cassava products	1 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
13.	Methods of improving soil fertility	• Soil fertility testing • Composting • Fertilizers	Participants are able to understand the importance, composition, formation and maintenance of healthy soils	Group discussion, participatory practical demonstration (use of songs etc.)	Flip charts Pens Books Markers Masking tape Farm inputs Manure Compost Facilitator's notes	1 h
14.	Record-keeping		Participants are able to understand the importance of and keep records	Group discussion, participatory practical demonstration	Flip charts Pens Books Markers Masking tape Facilitator's notes	1 h
15.	Forming clean cassava production advocacy team	• What is advocacy? • Why is a cassava advocacy team needed?	Participants are able to understand the importance of having a cassava advocacy team and its quality control roles	Group discussion, plenary, participatory practical participation	Flip charts Pens Books Markers Masking tape Facilitator's notes	2 h

Exercises in FFS setting – other cross-cutting topics (Kenya)

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
	Gender					
1.	Gender and gender-based violence (GBV)	• Malaria • TB • Cholera • Diarrhoea	Participants know: • diseases • causes and symptoms • preventive and curative measures	• Group discussion, plenary, group dynamics • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts Pamphlets Facilitator notes	2 h
2.	Hygiene and sanitation	• Personal hygiene • Environmental hygiene • Waste disposal	Participants are aware of the importance of proper hygiene in health management for better production	• Practical development of participatory hygiene and sanitation transformation (PHAST) • Demonstration on safe water and sanitation hygiene (SWASH) • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts Pamphlets Facilitator notes Point of use product (water guard, filters, aqua guard, aqua tab)	1 h 30 min
3.	Personal development	• Building self-esteem • Decision-making and problem solving • Interpersonal relationships	Participants have knowledge to develop adaptive and positive behaviour to effectively deal with life's demands	• Group discussion, plenary, group dynamics • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts Pamphlets Facilitator notes	1 h 30 min
4.	Definition of terms	• Gender • Sex • GBV	Participants have a clear understanding of the concepts relating to gender	• Brainstorming • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts Pamphlets Facilitator notes	20 min
5.	Gender roles		Participants are able to identify the different gender roles within the community	• Activity calendar, group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	1 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
6.	Gender inequality		Participants understand the term gender inequality and identify gender inequalities in their community	• Brainstorming, group discussion, plenary • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	1 h
7.	Addressing gender inequality in the community		Participants are able to identify ways to address gender inequality in the community	• Role play • Group discussion, plenary • Experience sharing • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes Activity calendar	1 h
8.	Forms of GBV	• Physical • Sexual • Emotional/psychological • Socio-economic • FGM • Traditional practices	Participants are able to identify the various forms of GBV	• Group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	1 h
9.	Causes of GBV		Participants are able to identify the causes of GBV in their community	• Group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	1 h
10.	Impact of GBV	• On society • On family relationships • On health • On household Income	Participants are able to identify the impacts of GBV on households and the community	• Group discussion, plenary • Role play • Experience sharing • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	1 h
11.	Ways of addressing GBV in the community		Participants are able to identify practical ways of addressing GBV in the H/H and community	• Group discussion, plenary • Experience sharing • Build on findings and summarize	Flipchart Marker pen Masking tape Facilitator notes	1 h
12.	Labour- and energy-saving technologies		Participants: • are aware of labour- and energy-saving technologies and how they can be used to address gender inequality/ GBV issues at H/H and community level • know where to access labour and energy technologies	• Group discussion, plenary • Village map/resource mapping • Demonstrations • Build on findings and summarize	Flip chart Marker pen Masking tape Pamphlets Posters/flyers Facilitator notes Energy- and labour-saving devices/samples	1 h

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
	Human rights					
13.	Human rights	• What are human rights?	Participants understand what is meant by the term "human rights"	• Brainstorming	Facilitator notes Flip chart Marker pen Masking tape	20 min
14.	Types of human rights and legal empowerment	• Right to food • Right to health • Right to education • Property and land right • Legal empowerment	Participants are familiar with basic human rights and ways of seeking redress	• Group discussion, plenary • Build on findings and summarize	Facilitator notes Flip chart Marker pen Masking tape Constitution/Acts of Parliament/HRCharter	1 h
15.	Human rights violations		Participants are able to identify human rights violations at H/H and community level	• Group discussion, plenary • Experience sharing • Build on findings and summarize	Facilitator notes Flip chart Marker pen Masking tape	40 min
	HIV					
16.	Definition of HIV		Participants are able to understand the basic meaning of HIV	• Brainstorming • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	10 min
17.	Modes of transmission		Participants are able to identify the main modes of transmission	• Group discussion, plenary • Build on findings and summarize	Flip chart Marker pen Masking tape Pamphlets Handouts Posters/flyers Facilitator notes	20 min
18.	Factors that lead to spread/susceptibility		Participants are able to identify the factors that lead to the spread of HIV	• Group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	30 min
19.	Myths and facts on HIV					
20.	Impact	• On family and relationships • On household income and food security	Participants can identify the socio-economic, political impacts of HIV on their household and community	• Group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Facilitator notes	30 min

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
21.	Modes of prevention		Participants understand methods of preventing HIV infection	• Group discussion, plenary • Role play • Demonstration • Build on findings and summarize	Flip chart Marker pen Masking tape Pamphlets/handouts Posters/flyers Facilitator notes Male and female condoms Penile model Tissue paper	30 min
22.	Stakeholders identification and involvement		Participants have identified relevant stakeholders in their community for linkages	• Drawing of village map/chapati diagram • Group discussion	Flip chart/Manila paper Marker pen Pencils Masking tape Stones Facilitator notes	60 min
23.	Impact mitigation		Participants know methods of mitigating impact of HIV within their community and household	• Group discussion, plenary • Role play • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts Posters/flyers Facilitator notes	45 min
24.	Labour- and energy-saving technologies		Participants: • are aware of labour- and energy-saving technologies and the benefits of these technologies • know where to access labour and energy technologies	• Group discussion, plenary • Village map/resource mapping • Demonstrations	Flip chart Marker pen Masking tape Pamphlets Posters/flyers Facilitator notes Energy- and labour-saving devices/samples	1 h
25.	Care and support		Participants: • understand how to care for and support PLWHA • are able to identify support services and groups in the community	• Group discussion, plenary • Use of village map • Demonstration • Build on findings and summarize	Flip chart Marker pen Masking tape Handouts/pamphlets Posters/flyers Facilitator notes HBC Kit	1 h 20 min

No.	Topic	Subtopic	Objectives	Facilitation methods	Materials required	Estimated time
	Environment					
26.	What is environment?		Participants understand what is meant by environment	• Participatory discussion groups	Flip charts Pens/markers Books Facilitator notes Masking tape	30 min
27.	How does environment impact us?		Participants have a basic idea of how the environment impacts lives	• Participatory discussion groups, group dynamics (drama poems)	Flip charts Pens/markers Facilitator notes Books Masking tape	45 min
28.	How do we impact our environment?		Participants understand the links between human activity and damage to the environment	• Participatory discussion groups, group dynamics (drama, poems)	Flip charts Pens/markers Facilitator notes Books Masking tape	45 min
29.	Natural environment	• Pollution • Conservation • Land degradation • Climate change • Agroforestry • Conservation agriculture	Participants have a basic idea of the impacts humans make on the environment and how to mitigate them	• Participatory discussion groups, field visits, group dynamics (drama, poems)	Flip charts Pens/markers Books Masking tape Facilitator notes	2 h
30.	Personal environment		Participants have an understanding of how to maintain a healthy personal environment	• Participatory discussion groups, group dynamics (drama, poems)	Flip charts Pens/markers Books Facilitator notes Masking tape	45 min
31.	Graduation		At the end of exercise all participants receive certificates	• Demonstration of AESA • Display of cassava products • Poster presentation by FFS • Conducting community around the plots of the FFS • Speeches	Farm tools and inputs Flip charts Pens/markers Books Masking tape Facilitator notes Cassava products Certificates, prizes, gifts	

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Cassava Farmer Field Schools
Resource material for facilitators in sub-Saharan Africa

This manual is part of FAO's effort to promote sustainable intensification of smallholder crop production. It has been developed from experiences with farmer field schools in four African countries. It provides background information on the farmer field school approach and a compilation of field exercises as they are used in cassava farmer field schools. The guide is intended for use by farmer field facilitators during training of facilitators or during the farmer field school itself.

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