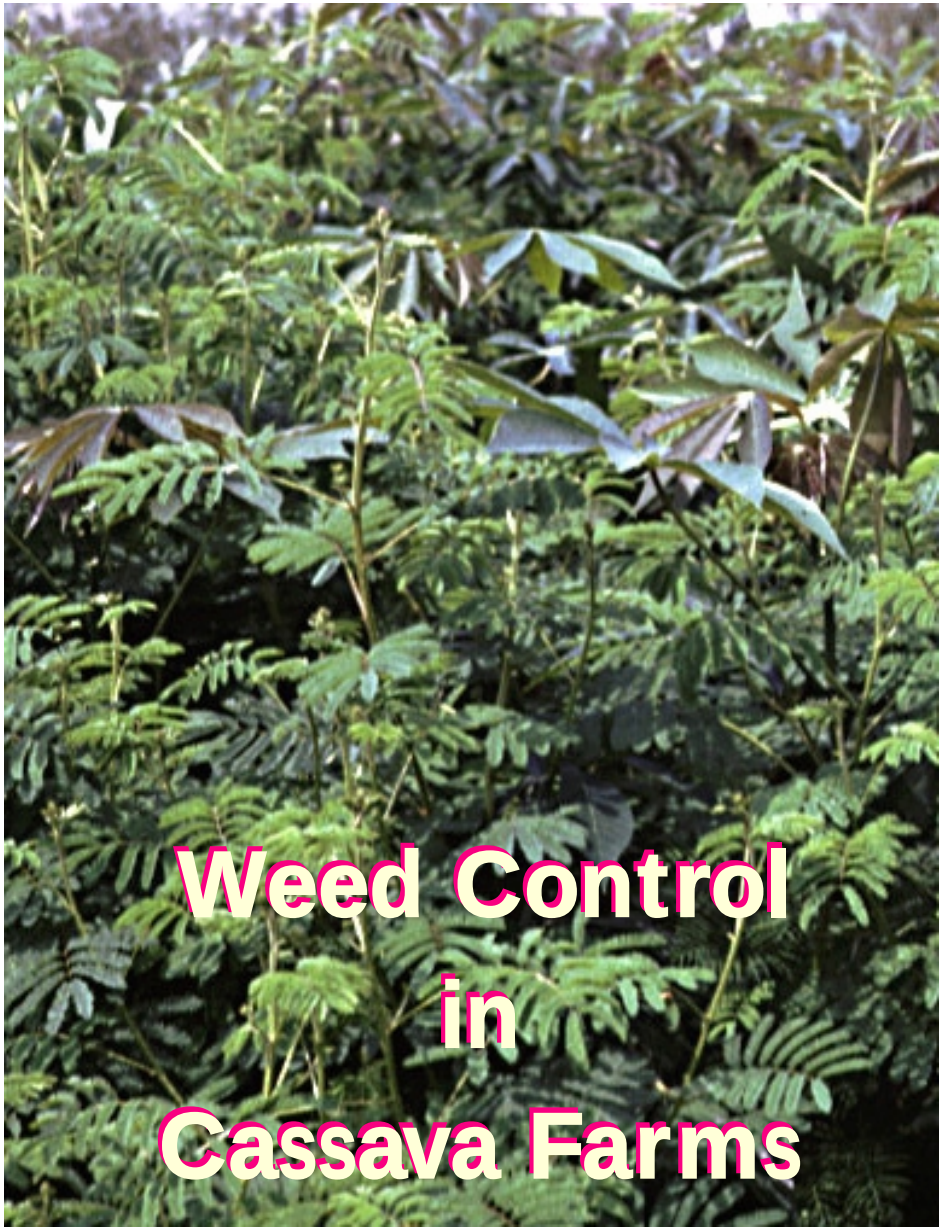

Weed Control in Cassava Farms

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About this booklet

This booklet is one in a set of field guides prepared by the International Institute of Tropical Agriculture (IITA) to increase the technical knowledge of extension agents and enhance the integration of plant protection and plant production practices in farmers' efforts to grow a healthy crop of cassava. The booklet is based largely on the extension and farmer training experience of the regional project "Ecologically Sustainable Cassava Plant Protection" (ESCaPP), 1993–1997. ESCaPP was executed by IITA's Plant Health Management Division (PHMD), in collaboration with national agricultural research and extension systems in Bénin, Cameroon, Ghana, and Nigeria, and funded by the Division of Global and Interregional Programmes of the United Nations Development Programme (UNDP).

IITA is one of 16 nonprofit international agricultural research and training centers supported by the Consultative Group on International Agricultural Research (CGIAR). Their shared mission is the alleviation of hunger and poverty in tropical developing countries by generating appropriate plant production and protection technologies which benefit the poor and enhance agricultural production while preserving the natural resource base. At IITA, PHMD is dedicated to sustainable plant protection of primary food crops in Africa. The division's research philosophy is to identify and correct the ecological imbalances in agricultural systems causing pest problems and to provide environmentally and economically appropriate options for integrated pest management. (IPM)

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International Institute of Tropical Agriculture

© IITA 2000
ISBN 978-131-175-4
Printed in Nigeria by Wordsmithes Printers, Lagos

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IPM Field Guide for Extension Agents

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What are the objectives of this guide?

This field guide has been prepared to help you to:

- identify common weeds in cassava farms,
- identify the structures with which the weeds reproduce and spread,
- specify how weed plants become problems in cassava farms, and
- combine the most appropriate cultural practices to control weeds in your cassava farm.

Introduction

Weeds are plants growing where they are not wanted. Many different types of weeds (for example, Figures 1, 2, and 3) occur in cassava farms and cause considerable losses to the farmer. This is because weeds compete with the cassava crop for nutrients, sunlight, and space. Weeds may harbor pests and diseases or physically injure cassava plants and storage roots. Weeds may also harbor natural enemies that control pests, so certain weeds can be left on cassava farms, provided they are not many enough to compete with the crop. For these reasons close attention should be paid to weed control in the farmer's effort to grow a healthy crop and obtain high yields of cassava.

Figure 1: Spear grass, *Imperata cylindrica*

Figure 2: The sedge, *Mariscus alternifolius*

Figure 3: Siam weed, *Chromolaena odorata*

What are the common weeds in cassava farms?

Weeds occurring in cassava farms can be put into three main groups, namely, grasses, sedges, and broadleaf weeds. Occasionally, cassava is also damaged by certain parasitic plants. Numerous kinds of weeds occur in particular places, the following is simply a selection of the most widespread species.

Grasses: Grasses are usually slender, erect, or creeping plants. Their stems can be oval or cylindrical in shape. The leaves of grasses are much longer than they are broad and are never subdivided into little leaves (leaflets). Grass weeds which are commonly found in cassava farms include spear grass, *Imperata cylindrica* (Figure 1); bermuda grass, *Cynodon dactylon* (Figure 4); guinea grass *Panicum maximum* (Figure 5); and the feathery pennisetum, *Pennisetum polystachion* (Figure 6).

Segdes: Sedges resemble grasses but are always erect and usually have solid and triangular shaped stems. The common sedges which cause problems in cassava farms are *Mariscus alternifolius* (Figure 2), and purple nutsedge, *Cyperus rotundus* (Figure 7).

Figure 4: Bermuda grass, *Cynodon dactylon*

Figure 5: Guinea grass, *Panicum maximum*

Figure 6: Feathery pennisetum, *Pennisetum polystachion*

Figure 7: Purple nutsedge, *Cyperus rotundus*

Broadleaf weeds: Broadleaf weeds are herbs, creepers, climbers, and shrubs whose stems are solid and irregular in shape. Their leaves are broad, expanded, and single or subdivided into leaflets to form compound leaves. Broadleaf weeds which are commonly found in cassava farms include Siam weed, *Chromolaena odorata* (Figure 3); wild poinsettia, *Euphorbia heterophylla* (Figure 8); giant sensitive weed, *Mimosa invisa* (Figure 9); tridax, *Tridax procumbens* (Figure 10); goat weed, *Ageratum conyzoides* (Figure 11); waterleaf, *Talinum triangulare* (Figure 12); and tropical spiderwort, *Commelina benghalensis* (Figure 13).

Figure 8: Wild poinsettia, *Euphorbia heterophylla*

Figure 9: Giant sensitive weed, *Mimosa invisa*

Figure 10: Tridax, *Tridax procumbens*

Figure 11: Goat weed, *Ageratum conyzoides*

Figure 12: Waterleaf, *Talinum triangulare*

Figure 13: Tropical spiderwort, *Commelina benghalensis*

How do weeds spread in cassava farms?

Whenever an area is cleared for farming, weeds are among the first plants you see growing on the land. Because they grow and reproduce very quickly, they are able to establish themselves on farms within a short time. Weeds reproduce and spread through seeds and vegetative structures, for example, rhizomes, stolons, tubers, and stem/root basal stocks. Table 1 lists the structures by which the common weeds in cassava farms reproduce and spread.

Spread by seeds: A number of weeds which live for only one year (annual weeds) reproduce and spread mainly by seeds. Examples of such weeds are Siam weed, *Chromolaena odorata* (Figure 3); wild poinsettia, *Euphorbia heterophylla* (Figure 8); tridax, *Tridax procumbens* (Figure 10); and goat weed, *Ageratum conyzoides* (Figure 11); These weeds shed their seeds mostly in the dry season and die soon afterwards. The seeds survive in the soil and germinate the following season, or can remain in the soil for many years until disturbed when the soil is tilled for planting. In order to effectively control annual weeds, you need to remove them early before they start flowering. This prevents the weeds from seeding and increasing the quantity of seeds in the soil.

Spread by rhizomes: Rhizomes are underground stems running horizontal to the soil surface. They have thin brown papery leaves wrapped around the stem. The rhizomes have roots. Spear grass, *Imperata cylindrica*, reproduces mainly by rhizomes (Figure 14). If rhizomes are cut up into pieces, each piece is capable of growing into a new plant. You are therefore very likely to spread spear grass in this way during land and seedbed preparation for planting cassava.

Spread by tubers: Tubers are underground stems without leaves but with buds ("eyes"). The stems are swollen with stored food. *Cyperus* and *Mariscus* species spread by tubers. The tubers of *Cyperus* species occur as large "beads" on underground slender stems which join the individual plants together (Figure 15). If cut up into pieces each piece of the tuber with a bud ("eye") is capable of growing into a new *Cyperus* plant.

Spread by stolons: A stolon is a slender stem that runs on the surface of the soil. Stolons have normal leaves and roots. The bermuda grass, *Cynodon dactylon*, reproduces by stolons which are very long (Figure 16). If stolons are cut up into pieces, each piece is capable of growing into a new plant. You are therefore very likely to spread bermuda grass in this way during land and seedbed preparation for planting cassava.

Other vegetative structures: In addition to rhizomes, stolons, and tubers, some weeds spread through other vegetative parts such as stem cuttings and basal shoot stocks. The waterleaf, *Talinum triangulare* (Figure 11), and tropical spiderwort, *Commelina benghalensis* (Figure 13), are propagated by both seeds and stem cuttings. In addition to the production of seeds, *Chromolaena odorata* (Figure 3) is capable of sprouting into whole plants from cut basal shoots.

Figure 14: Rhizomes (arrows) of spear grass, *Imperata cylindrica*

Figure 15: Tubers (arrows) of purple nutsedge, *Cyperus rotundus*

Table: Weed propagating structures and life cycles

Problem weed	Propagating structure					Life cycle
	Seed	Rhizome	Stolon	Tuber	Cutting	
Grasses						
Spear grass *Imperata cylindrica*	●	●				Perennial
Bermuda grass *Cynodon dactylon*	●			●		Perennial
Guinea grass *Panicum maximum*	●					Perennial
Feathery pennisetum *Pennisetum polystachion*	●				●	Annual or perennial
Sedges						
Cyperus rotundus	●			●		Perennial
Mariscus alternifolius	●			●		Perennial
Broadleaf weeds						
Siam weed *Chromolaena odorata*	●					Perennial
Giant sensitive weed *Mimosa invisa*	●					Perennial
Tropical spiderwort *Commelina benghalensis*	●				●	Perennial
Wild poinsettia *Euphorbia heterophylla*	●					Annual
Tridax *Tridax procumbens*	●					Annual
Goat weed *Ageratum conyzoides*	●					Annual
Waterleaf *Talinum triangulare*	●				●	Annual
Parasitic weeds						
Dodder *Cuscuta australis*	●				●	Annual

Perennial = persists for several years and present at all seasons of the year

Figure 16: Farmer showing stolon length of bermuda grass, *Cynodon dactylon*

How do weeds become a problem in cassava farms?

Cassava grows poorly in weedy farms and produces fewer and smaller storage roots. However, the presence of weed plants in your farm does not always mean that they will cause severe losses in food and income from the farm. Weeds become a problem in growing cassava because of a number of reasons.

Weeds grow abundantly: Weeds harm cassava mainly when they are abundant in the farm. They will cover the ground almost completely and increase the time you spend on weeding. When they are abundant, they will also use up lots of nutrients and water from the soil, making these materials unavailable for cassava plant growth.

Weeds grow vigorously: Weeds grow more rapidly than cassava and this enables them to "choke" cassava farms very quickly. For example the giant sensitive weed, *Mimosa invisa*, rapidly occupies the spaces between cassava plants (Figure 17); Siam weed, *Chromolaena odorata* (Figure 3), chokes cassava farms in a similar manner. By their rapid growth, weeds also shade cassava plants from sunlight.

Weeds are difficult to remove: Weeds are difficult to remove for a number of reasons. For example, if the thorns of the giant sensitive weed, *Mimosa invisa*, hook into young cassava stems, it will be difficult to remove the weed without breaking the stems. Similarly, the parasitic weed dodder, *Cuscuta australis* (Figure 18), which climbs and wraps tightly on cassava plants, causes breakage of cassava shoot tips during hand weeding. Weeds can also be difficult to remove if they injure people. For example, it is difficult to remove *Mimosa invisa* (Figures 9 and 17) by hand-weeding or hoeing because its thorns scratch and cause wounds to people. Similarly, the hairy pods of *Mucuna pruriens* var. *pruriens* (Figure 18), and several hairy weeds cause intense itching.

Weeds which reproduce by rhizomes (Figure 14), stolons (Figure 15), and tubers (Figure 16) are difficult to remove from the soil. They break easily into pieces during hand or hoe weeding. The pieces remain in the soil and sprout later. Weeds with these structures will therefore be "stubborn" in the farm. Examples of such stubborn weeds are spear grass, *Imperata cylindrica* (Figure 1), bermuda grass, *Cynodon dactylon* (Figure 4), and the purple nutsedge, *Cyperus rotundus* (Figure 7).

Some weeds grow on cassava: Certain weeds grow and feed directly on cassava stems. For example dodder, *Cuscuta australis* (Figure 19), attaches itself tightly to cassava stems and sucks water and nutrients from the plant.

Weeds harbor pests: Cassava pests and diseases can multiply on weeds and later move on to cassava. For example, immature stages of the variegated grasshopper, *Zonocerus variegatus*, gather on bushes of *Chromolaena odorata* (Figure 20) and then move on to cassava plants as they become mature grasshoppers.

Weeds injure cassava roots: The emerging shoots of spear grass, *Imperata cylindrica*, sometimes pierce and destroy cassava storage roots.

Figure 17: Thick growth of giant sensitive weed, *Mimosa invisa*, in a cassava farm

Figure 18: Pods of *Mucuna pruriens* var. *pruriens*

Figure 19: The stem parasitic plant dodder, *Cuscuta australis*, covering a cassava plant

Figure 20: Nymphs of variegated grasshopper on Siam weed, *Chromolaena odorata*

How can I best control weeds in cassava farms?

Under traditional farming conditions and on small cassava farms, weeds are commonly controlled by slashing, or hand or hoe weeding. This can be very labor intensive. The best way to control weeds in a cassava farm is to combine different cultural practices, especially at land clearing, seedbed preparation, planting and post-planting stages of growing the crop. If herbicides are to be used, you should consult the label for guidelines on their application methods and how to avoid personal and environmental hazards associated with their use.

IPM practices at planting

Prepare your land properly: When clearing land for planting cassava in wet areas, you can slash the bush before the rains start. Weeds will emerge on the cleared land soon after the rains. You can then remove these weeds as you plant cassava stem cuttings. This will greatly reduce the frequency and labor of weeding in the crop. When preparing seedbeds for planting cassava, remove weed rhizomes, stolons, tubers, and other structures that germinate and spread the weed in the farm. Farm tillage tools should also be checked and cleaned from time to time to make sure they are free of these weed structures, otherwise you will spread the weeds through contaminated tools.

Grow suitable cassava varieties: Some cassava varieties have an early, low, and much branching habit (Figure 21). This habit allows these varieties to suppress weeds because they develop a lot of branches and leaves which form a thick canopy that shades weeds and prevents them from growing properly. Cassava varieties with a late, high and less branching habit (Figure 22) are not very good at suppressing weeds. In selecting suitable cassava varieties against weeds, you should find out if the selected variety also has other features you may want. Table 2 indicates the weed suppression ability and other features of some cassava varieties available in West and Central Africa.

Mulch cassava seedbeds with dead plant foliage: Mulching involves covering the soil surface with very large amounts of plant foliage. The companion IPM guide, "Starting a Cassava Farm", presents mulching as a soil improvement practice. In addition to improving soil properties, mulching reduces weed problems. Good sources of mulch materials are foliage from alley crops, leguminous plants, rice husk, coffee hull, and general crop and weed residues. Straws of maize and guinea grass (Figure 5) are bad mulch materials because they take too long to rot. Avoid using weed residues containing weed seeds, rhizomes, stolons or tubers as mulch because these can cause weed problems on your farm.

Use cover crops as live mulch on seedbeds: You can use food crops such as *egusi* melon as cover crops, and/or plant intercrops (such as maize) to reduce weed infestation in cassava farms. *Egusi* melon is a good "live mulch" in cassava farms (Figure 23). If you decide to use *egusi* melon as live mulch you should plant it before planting the cassava. The *egusi* melon should be planted at very close spacing on the seed beds to enable it to spread and cover the soil very quickly.

Figure 21: Cassava variety with early, low, and much branching habit

Figure 22: Cassava variety with late, high, and less branching habit

Figure 23: Cassava in a live mulch of *egusi* melon intercropped with maize

In this way it suppresses many types of weeds, especially annual weeds. However, *egusi* melon is not very effective against stubborn grasses like spear grass, *Imperata cylindrica*.

Plant cassava in association with other crops: You can also reduce weed problems in cassava farms by intercropping (mixing) cassava with other crops at planting. Crops that are commonly intercropped with cassava are maize (Figure 23), rice, grain legumes, and vegetables. It is helpful to intercrop cassava with grain legumes such as cowpea and groundnuts, which manufacture and release nutrients into the soil.

IPM practices after planting

It is important that you weed at the right time to prevent weeds from competing with cassava storage root formation and bulking (the filling of storage roots with food/starch) and reduce other damage the weeds may cause to cassava. When cassava is planted alone (as a sole crop), it is best to weed three times before harvest: at 3–4 weeks after planting, 7–8 weeks after planting, and 12 weeks after planting. After this you can slash any weed regrowth to make it easy to work between the plants and also to discourage rodents.

The frequency and labor required to hand weed will be greatly reduced if you:

- cleaned cassava seedbeds of rhizomes, stolons, and tubers,
- planted cassava varieties that are capable of suppressing weeds,
- adopted suitable intercrops, and
- mulched where necessary.

If herbicides are required to kill weeds, you should consult the label for guidelines on their application methods and how to avoid personal and environmental hazards associated with their use.

The companion field guide "Pest Control in Cassava Farms" explains that certain weeds provide shelter for natural enemies of pests, and thereby play useful roles in pest control. Natural enemies are commonly insects and mites which feed on pests. For example, certain natural enemies of the cassava green mite (Figure 24) live on the weeds *Euphorbia heterophylla* (Figure 8) and *Mallotus oppositifolius* (Figure 25). Such weeds are therefore useful in the control of the pest. During weeding you can leave the weeds to grow along the margins or in other parts of cassava farms to attract the natural enemies. This cultural practice will be especially useful at sites where cassava is grown continuously with little or no fallow.

Figure 24: Cassava green mites (as seen enlarged under the microscope)

Figure 25: Shoot of *Mallotus oppositifolius*

Improved fallow practices

Non-food crops can be used as "live mulches", but these are normally grown as improved fallow plants. For example, during fallow periods you can grow *Mucuna pruriens* var. *utilis* (Figure 26) on land you select for growing cassava in the following season. The growth of *Mucuna* will completely cover the land and greatly reduce the population of weeds, the frequency of weeding and the labor required to weed in the following season. At cassava planting time you can plant the cassava stem cuttings either on mounds or ridges, or directly into the mulch covering with little or no land clearing. *Mucuna pruriens* var. *utilis* is effective against spear grass, *Imperata cylindrica*, and many other stubborn weeds. It produces lots of leaves which stay green and cover weeds for up to 9 months after it has been planted. By the time it produces seeds and dies it will have controlled most of the weeds on the land. Improved fallow with *Mucuna pruriens* var. *utilis* is therefore good for long-term weed control and soil improvement. *Mucuna pruriens* var. *utilis* is, however, a fire hazard in the dry season when its foliage dries.

Canavalia ensiformis (Figure 27) is another leguminous fallow plant that is effective against spear grass and other stubborn weeds. *Canavalia ensiformis* should be planted at very close spacing in order for it to be effective. However, the leaves of *Canavalia ensiformis* drop early, usually at 4–5 months after planting. After this period, if weeds receive adequate sunlight and water they will grow abundantly and "undo" the benefits gained from the improved fallow plant. Therefore, in zones with two wet seasons a year it will be necessary to plant *Canavalia ensiformis* twice a year, early in the first and second wet seasons. *Canavalia ensiformis* is therefore good as a short duration fallow crop and largely useful in areas where farmers cannot afford to leave the land to fallow plants for long periods. The seeds of *Canavalia ensiformis* can be used as food and/or animal feed.

Figure 26: Live mulch of *Mucuna* on fallow land

Figure 27: Farmer in his live mulch of *Canavalia ensiformis*

Table 2: Some features of common cassava varieties in West and Central Africa

Variety	Expression of selected features							
	Yield potential	% dry matter	Cyanogenic potential	Ground storability	Weed suppression	Tolerance to CGM	Tolerance to CMD	Tolerance to CBB
IITA								
TMS 4(2)1425	High	High	Low	Good	Good	Moderate	Moderate	Good
TMS 30572	High	High	Moderate	Moderate	Good	Moderate	Good	Good
Benin								
BEN 86052	High	High	Low	Poor	Moderate	Good	Good	Poor
RB 89509	Moderate	Moderate	Low	Good	Poor	Poor	Good	Moderate
Cameroon								
8017	High	High	Moderate	Poor	Good	Moderate	Moderate	Moderate
8034	High	High	Moderate	Poor	Good	Moderate	Moderate	Moderate
Ghana								
"Afisiafi"	High	High	Moderate	Moderate	Good	Moderate	Good	Good
"Abasa fitaa"	High	High	Low	Good	Good	Moderate	Moderate	Good
Nigeria								
MS 6	High	High	Low	Poor	Poor	Good	Good	Moderate
NR 8082	High	High	High	Moderate	Good	Good	Good	Good

CGM = Cassava green mite
CMD = Cassava mosaic disease
CBB = Cassava bacterial blight
Source: IITA, INRAB-Benin, MoFA-CSD Ghana, IRAD-Cameroon, and NRCRI-Nigeria

Summary

- Remove weed rhizomes, stolons, and tubers from cassava seed beds to reduce weed problems.
- Mulch cassava seed beds with live or dead mulch materials to reduce weed problems and improve soils.
- Grow cassava varieties with early, low, and much branching habit; these will suppress weed growth better than varieties with late, high, or no branching habits.
- Intercrop cassava with appropriate crops to reduce weed problems and improve soils.
- Use improved fallow plant as "live mulch" on land for planting cassava.
- Hand weed three times within 3 months after planting cassava; this will reduce weed competition with cassava for nutrients.
- Combine the most appropriate weed control practices for more effective control of the weeds.

Acknowledgements

Special thanks to the United Nations Development Programme and the Austrian government which provided funds, and to the following institutions which provided materials, information and services for the production of the set of cassava IPM field guides:

- Agricultural Development Programmes (ADPs) in Abia, Akwa Ibom, Anambra, Benue, Cross Rivers, Rivers, Delta, Edo, Enugu, Imo, Kogi, Kwara, Ogun, Ondo, Osun, Oyo, and Plateau State Governments, Nigeria
- Centre d'Action Régionale pour le Développement Rural (CARDER), Bénin
- Centro International de Agricultura Tropical (CIAT), Cali, Colombia
- Crop Services Department (CSD), Department of Agricultural Extension Services (DAES), and Plant Protection and Regulatory Services Department (PPRSD), Ministry of Food and Agriculture, Ghana
- Federal University of Technology, Owerri, Nigeria
- Fourah Bay College, University of Sierra Leone, Freetown, Sierra Leone
- IITA Eastern and Southern African Regional Centre (ESARC), Uganda
- Institut de Recherche Agronomique et du Développement (IRAD), Cameroon
- Institut National de Recherche Agronomique du Bénin (INRAB), Bénin
- National Root Crops Research Institute (NRCRI), Umudike, Nigeria,
- Rural Training Centre (RTC, Presbyterian Church) in Fonta and Kumba, Cameroon
- Sasakawa Global 2000, Bénin
- Service de Protection des Végétaux et du Contrôle Phytosanitaire (SPVC), Bénin
- Southern African Root Crops Research Network (SARRNET), Malawi
- University of Agriculture, Abeokuta, Nigeria
- University of Buea, Buea, Cameroon
- University of Cape Coast, Cape Coast, Ghana