# Cassava Weed Management Project at Work

# 2014 Progress Report

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# Content

# Acronyms

| | |
|---|---|
| ADP | Agricultural Development Programme |
| ALS | Acetolactate Synthase |
| EDADP | Edo State Agricultural Development Programme |
| FMARD | Federal Ministry of Agriculture and Rural Development |
| FUNAAB | Federal University of Agriculture Abeokuta |
| GIT | Good in Transit |
| GPS | Global Positioning System |
| KAP | Knowledge, Attitude and Practices |
| LGA | Local Government Area |
| NAFDAC | National Agency for Food and Drug Administration and Control |
| NCGA | Nigeria Cassava Growers Association |
| NESREA | National Environmental Standards and Regulations Enforcement Agency |
| NRCRI | National Root Crops Research Institute |
| PAO | Project Administration Office |
| PC | Project Coordinator |
| PM | Project Management |
| PI | Principal Investigator |
| SABs | South African Bureau of Standards |
| SAS | Statistical Analysis Software |
| SC | Steering Committee |
| SWOT | Strength, Weakness, Opportunities and Threats |
| UAM | University of Agriculture Makurdi |
| WAP | Weeks after planting |
| WAT | Weeks after treatment |
| WHO | World Health Organization |
| WSC | Weed Science Center |

# Background

The Cassava Weed Management Project (Sustainable Weed Management Technologies for Cassava Systems in Nigeria) is a 5-year project designed in response to the devastating effects of weeds on cassava and farm families in Nigeria. The project, which started in late 2013 aims to minimize the drudgery of hand weeding by women and children, and increase cassava productivity using improved and integrated approaches to weed management that reduce labour requirements and enhance the productivity of smallholders' cassava farms. This will be achieved by supporting smallholder farmers to use modern, relevant, and appropriate cassava weed management technologies suitable for sustainable intensification in major agro-ecological and socio-economic conditions of Nigeria.

This project builds on existing and new partnerships that include cassava producer associations, agro-dealers, chemical companies, the University of Agriculture at Makurdi; National Root Crops Research Institute( NRCRI), Umudike; the Federal University of Agriculture, Abeokuta (FUNAAB); the Federal Ministry of Agriculture and Rural Development; National Agency for Food and Drug Administration and Control (NAFDAC); Standards Organization of Nigeria; National Environmental Standards and Regulations Enforcement Agency (NESREA); Agricultural Development Programs and other extension service providers. Over the five-year period, the project will provide knowledge to 125,000 Nigerian cassava farm families with better crop and weed management know-how/ options.

Since its commencement in 2013/2014, the Cassava Weed Management Project has made some gains. This progress is captured in this report in the context of the project's Results Framework under the following Objectives:

# Objective One

**This Objective seeks to develop appropriate agronomic practices that increase cassava productivity, and reduce losses from weed competition and drudgery for women and children. To achieve this Objective, the following outputs were recorded from the milestones below:**

*Key Milestone: Agreed-upon protocols ready for implementation.*

*Output: An agronomic research team focusing on weed control in cassava-production system is constituted with shared vision on the scope of work and on responsibilities.*

During the project kick-off meeting, one agronomist from each partner institution was identified and an agronomy team was constituted. Following this, all protocols and data collection forms for the implementation of the agronomy trials were developed in consultation with the agronomy team. For every operation, a protocol was prepared and circulated in advance to allow partners to give their feedback. The set of protocols was expanded as new activities were established and new observations were deemed necessary.

In early 2014, a workshop and a training session were conducted at IITA to introduce the concept of agronomic research for weed control. The workshop was based on a proposed multi-locational five factorial trial to investigate which factors affect weed growth (biomass) and weed composition (species and numbers) in cassava crops. Partners and IITA scientists discussed the factors, the factor levels and the implementation approach. A conclusive protocol was decided upon, and a training followed to ensure the implementation was correctly executed by all partners. Partners received training on-site by IITA staff in situations where protocols were new to the research portfolio of a partner (For example, NRCRI never worked on maize, yet maize was an intercrop in the trial and thus they required training on handling the crop and the data collection).


*Participants at the kick-off meeting*

Also a two-day training workshop on statistical analysis of data generated from the agronomy trial using SAS software was conducted for partners. At the end of the training, a model developed by IITA Biometrician for analyzing data from the agronomy trial was given to each partner institution. Each institution already has SAS software installed in their computers by IITA.

*Key Milestone: Data on single factor effects and interactions on weed abundance and biomass and cassava yields*

*Output: Agronomic trials to optimize productivity, while minimizing weed stress, are conducted in three agro-ecologies.*

The agronomy trial was conducted in two seasons [early and late wet seasons] in 8 sites. The trials' factors were (apart from site): (1) cassava variety with 2 levels; TMS 30572 (low and profusely branching), and TME 419 (erect and not or late and high branching); (2) tillage at 2 levels: ridged after harrowing and ploughing) versus flat soil (only harrowing); (3) cropping system at 2 levels with cassava monocrop versus cassava intercropped with a high density (50000 $ha^{-1}$) maize crop; (4) fertilizer at 2 levels: fertilizer applied versus no fertilizer; and (5) variable cassava densities ranging from 10000 to 20000 $ha^{-1}$ in 6 steps.

*Dr Stefan Hauser (2nd from right) with researchers from partner institutions*

As a result of the training, which our national partners received, they were able to implement the trials in two sites each in two seasons. IITA's sites were at Moniya and Ido in Oyo State. Moniya is on relatively fertile Alfisol of five years' fallow dominated by broadleaved vegetation, while Ido is on poor sandy soil (Entisol) with a one year fallow dominated by grasses and sedges. NRCRI established trials at the Umudike Institute site in Abia State, and in their out station site at Igbariam in Anambra State. FUNAAB established one trial at the university campus in Abeokuta in Ogun State, and a second one at Ile-ogbo, east of Ibadan in Osun State. UAM established the trials at the university campus in Makurdi in Benue State, and at Anyigba in Kogi State all in the Southern Guinea Savanna.

At all sites, data collection on weed biomass and density has been completed. Cassava root yield assessment at all sites is expected to be completed by the end of June 2015.

IITA and all partners conducted the maize harvest successfully, and a good data set was collected except at the Umudike site where the soil did not support maize growth due to high soil acidity [pH 4.5 – 5.1] and clay content. Weed sampling started 4 WAP – the sampling is simple yet the preparation of the field site to conduct the sampling in the shortest possible time required additional training of technicians from partner institutions and on-the-job help in setting the sampling spot locations in all plots. All partners conducted this activity correctly, and weed biomass and composition data are currently being compiled and analyzed.

Whilst compilation of weed biomass and composition of data is still ongoing, we hereby present a summary of result of maize grain yield and weed biomass from IITA and partner institutions.

## Maize performance

**IITA**: Maize grain yield was higher at Moniya (1.626 Mg $ha^{-1}$) than at Ido (0.482 Mg $ha^{-1}$, $p<0.0001$). On flat soil, grain yield was higher (1.124 Mg $ha^{-1}$) than when ridged (0.983 Mg $ha^{-1}$, $p<0.0087$). When intercropped with cassava variety TME 419, maize grain yield was significantly lower (0.620 Mg $ha^{-1}$) than when intercropped with cassava variety TMS 30572 (1.488 Mg $ha^{-1}$, $p<0.0001$). Fertilizer application increased grain yield from 0.875 Mg $ha^{-1}$ to 1.233 Mg $ha^{-1}$ ($p<0.0001$). The cassava plant density affected maize grain yield with highest yield at 11111 cassava plants $ha^{-1}$, and lowest at 16667 and 20000 cassava plants $ha^{-1}$ ($p<0.0336$). Five of the possible 2-way interactions and five of the possible 3-way interactions were significant. However, cassava density did not significantly interact with any other factor. The sequence of factor effects on maize grain yield showed strong differences in the importance of factors in maize grain yield formation.

**NRCRI:** At Igbariam site maize yield data showed a clear hierarchy of the factors: fertilizer, cassava variety, and tillage. All were highly significant. Fertilizer caused the largest grain yield increase, as fertilized plots had around three times higher yields. The cassava variety TME 419 reduced maize yield by around 50% compared to TMS 30572. Similar yet stronger depressions were observed at the IITA sites. Ridging increased grain yield to almost double the yields on flat soil.

**FUNAAB:** FUNAAB and Ile-ogbo sites differed slightly, yet differences failed the $p< 0.05$ margin. Overall, the application of fertilizer had the strongest impact on grain, as yield from fertilized plots more than doubled (1.4 Mg $ha^{-1}$) the yield from unfertilized treatments (0.6 Mg $ha^{-1}$). Tillage had the second strongest impact with the same margin of grain yield increase when ridged than when soil was left flat. As in the previous sites, cassava variety TME 419 intercropped with maize reduced the maize grain yield compared to that obtained when intercropped with TMS 30572.

**UAM:** In the UAM trials, fertilizer was the most important factor affecting maize grain yield with 5 times higher grain yield when fertilizer was applied. The Anyigba site was significantly less productive than the site at UAM campus. Ridging increased grain yield by around 30% over flat soil. The cassava varieties did not have a significant effect yet the trend was towards a lower maize grain yield when intercropped with TME 419.

Overall, fertilizer had the strongest impact on maize grain yield in partner trials, with all other factors not following the same sequence. The latter indicates that site by site analysis may be more appropriate. The rather strong effect of fertilizer indicates that soil properties are a driving factor in yield formation, and any interaction with agronomic measures would need to be identified to improve the treatment combinations that are most suitable to increase crop production and weed control at the same time.

## Weed biomass production

**IITA:** Weed biomass was determined at 4 dates [4, 8, 12 and 24 weeks after planting (WAP)]. The trial serves to establish which agronomic measures are most suitable in reducing weed biomass. Differences between sites were larger than differences caused by treatments, pointing at the need for site specific approaches. Tillage had strongest effects on cumulative weed biomass, followed by cassava variety. Intercropping maize and the application of fertilizer had no significant effect on cumulative weed biomass. However, there were differences between treatments at the different individual weed samplings, showing that the dynamics of weed growth is influenced by the presence of an intercrop (maize in this case) and fertilizer application. Several factors interacted significantly indicating that the correct factor combination is likely to reduce weed biomass beyond reductions attainable by single factor application. The presented data are a subset of agronomic data and have to be considered as preliminary results pending the final cassava harvest of these trials at the sites in March 2015.

*Weed identification in progress*

**FUNAAB:** Sites and tillage had the strongest impact on the weed biomass with the Ile-Ogbo site being more 'weedy' than the Abeokuta site. Ridging reduced weed biomass to less than half of the amount found on flat soil. The cropping system had significant impact on weed biomass. However the individual weedings did not produce consistently higher weed biomass in the intercrop as the 8 and 12 WAP weedings had lower weed biomass in the intercrop. The cassava varieties did not significantly affect weed biomass yet there was a trend towards lower weed biomass in TME 419 plots, confirming somewhat the observations made at the IITA sites. Fertilizer had no effect on weed biomass.

*Key Milestone: New and improved manual and powered mechanical weeding tools and machines attaining reduced weeding labor.*

Three brush cutters [Model Einhel GH-BC 25 As] and eight Mantis rotary weeding tiller/machines were procured. Two additional locally fabricated motorized rotary weeders and four manual long handle cone weeders were also ordered. A team of engineers from different Nigerian institutions: Federal Ministry of Agriculture and Rural Development (FMARD), Federal University of Technology Akure (FUTA), Federal Institute of Industrial Research, Oshodi (FIIRO), Edo State Agricultural Development Program (EDADP), and IITA were assembled to adapt the imported weeders to local conditions in cassava farming system. The team worked on the mechanical weeders to adjust the depth of cutting, and to prevent clogging by the tines. The modified tines are detachable and could be replaced if damaged. The engineers conducted several preliminary field tests on the modified rotary weeding machines in preparation for actual field experimentation in 2015.

*A team of researchers examining a motorised weeder*

Results of the preliminary field tests show that the modified mantis rotary weeding machine shreds up the weeds as the operator pulls the machine forward and backward. The machine uproots and crushes weeds and spreads them in contrast to weeding with the hoe, which just uproots the weeds and if not packed out could regenerate. The machine weeds faster than the hand hoe, and it is lightweight and easy to operate. It requires little energy and trained females could operate it. Overall, with proper training of the operators, it takes a shorter time to weed a given area than weeding with the hoe. However, the following challenges were noted: if weeding is carried out on ridges, it requires two persons such that while one is operating the machine, the other would be heaping the ridge to avoid roots exposure as well as serve the purpose of an assistant to the operator when needed; and it is difficult to use the machine under low branching cassava varieties. However, this challenge is shared with manual hoe weeding where the farmer needs to stoop down to weed. Weeding on the flat ground is the most promising. For the brush cutters, it was observed that they do not completely remove weeds but rather slash the weeds. Protocols have been developed for extensive field experimentation for labor and economic analyses for weed control using these machines during the 2015 cropping season.


*One of the motorised weeders ready for testing on the field*

# Objective Two

**This Objective seeks to identify effective and safe herbicides for weed control in cassava in Nigeria.**

*Key Milestone: A prioritized list of major cassava weeds is produced in the first quarter of year 1 for use in site selection.*

*Output: A prioritized list of major cassava weeds is produced in the first quarter of year 1 for use in site selection.*

**(i) Desktop assessment of major cassava weeds in Nigeria:**

A desktop assessment of major weeds of cassava was carried out in January 2014 using published literature, students' dissertations and theses in Nigerian universities. About thirty weeds species were recorded in the literature in cassava based systems in Nigeria (Table 1). In the Guinea Savanna agro-ecological zone, *Imperata cylindrica, Pennisetum polystachion, Rottboellia cochinchinensis, Commelina benghalensis, C. erecta, C. diffusa, Cyperus rotundus, and Adropogon gayanus* are common in occurrence and distribution. In the forest zone and transition savanna, *I. cylindrica, Chromolaena odorata, Panicum maximum, Mimosa invisa, Pennisetum purpureum, Paspalum orbiculare, Stachetapheta caynnesis, Sida acuta, Ageratum conyzoides, Portulaca oleraceae, Euphorbia heterophylla, Calopogonium mucunoides, Digitaria horizontalis and Cynodon dactylon* occur frequently in cassava fields (Ayoola and Agboola, 2001; Chikoye et al., 1999; Ezedinma et al., 2007; Melifonwu, 1994). The frequency of occurrence of *I. cylindrica* and the severity of its infestation in cassava is highest in the transition savanna and rainforest than in the dry savanna (Chikoye et al., 1999).

*Cassava field infested by weeds*

**Table 1. Major weeds of cassava in Nigeria.**

| S/no | Family | Species | Life cycle |
|---|---|---|---|
| 1 | Asteraceae | *Chromolaena odorata* (L.) R. M. King & Robinson | Perennial |
| 2 | Asteraceae | *Aspilia Africana* (Pers.) C. D. Adams | Perennial |
| 3 | Asteraceae | *Ageratum conyzoides* L. | Annual |
| 4 | Amarantheceae | *Alternanthera sessilis* L. | Annual |
| 5 | Asteraceae | *Tridax procumbens* L. | Annual |
| 6 | Commelinaceae | *Commelina benghalensis* L. | Annual |
| 7 | Commelinaceae | *Commelina erecta* L. | Annual |
| 8 | Commelinaceae | *Commelina diffusa* L. | Annual |
| 9 | Commelinaceae | *Aneilema beniniense* (P. Beauv.) Kunth | Perennial |
| 10 | Cyperaceae | *Cyperus rotundus* L. | Perennial |
| 11 | Cyperaceae | *Cyperus esculentus* L. | Perennial |
| 12 | Euphorbiaceae | *Euphorbia heterophylla* L. | Annual |
| 13 | Mimosaceae | *Mimosa invisa* Mart. | Perennial |
| 14 | Malvaceae | *Sida acuta Burm*. f. | Perennial |
| 15 | Malvaceae | *Sida rhombifolia* L. | Perennial |
| 16 | Poaceae | *Imperata cylindrica* (L.) Raeuschel | Perennial |
| 17 | Poaceae | *Panicum maximum* Jacq. | Perennial |
| 18 | Poaceae | *Andropogon gayanus* Kunth. | Perennial |
| 19 | Poaceae | *Paspalum orbiculare* Berg. | Perennial |
| 20 | Poaceae | *Pennisetum polystachion* (L.) Schult. | Perennial |
| 21 | Poaceae | *Pennisetum purpureum* Schum. | Perennial |
| 22 | Poaceae | *Rottboellia conchinchinensis* (Lour.) Clayton | Annual |
| 23 | Poaceae | *Cynodon dactylon* (L.) Pers. | Perennial |
| 24 | Poaceae | *Digitaria horizontalis* Willd. | Annual |
| 25 | Poaceae | *Eleusine indica* Gaertn. | Annual |
| 26 | Poaceae | *Setaria barbata* (Lam.) Kunth | Annual |
| 27 | Poaceae | *Setaria megaphylla* (Stend.) Dur. & Shinz | Annual |
| 28 | Tiliaceae | *Triumfetta cordifolia* A. Rich. | Perennial |
| 29 | Fabaceae | *Calopogonium mucunoides* Desv. | Annual |
| 30 | Verbenaceae | *Stachytarpheta cayennensis* (L. C. Rich.) Schau. | Perennia |

Sources: Melifonwu 1994; Akobundu and Agyakwa, 1998; Chikoye et al. 1999; Arukwe 2007 [unpublished M.Sc thesis]; Ezedinma et al. 2007.

**(ii) Ground-truthing assessment of major cassava weeds in Nigeria:**

A survey of weeds of cassava in farmers' fields was carried out in four benchmark States of the project (Oyo, Ogun, Benue and Abia) between May and June 2014 by IITA and national partners from NRCRI, UAM and FUNAAB. In each state, 50% of Local Government Areas (LGAs) were sampled taking note of major cassava producing areas. The LGAs were selected using local state maps and in consultation with the ADP officials in each State.

In each LGA, five major cassava producing villages were identified and one cassava farm was selected randomly for sampling. In each farm, five quadrats were sampled systematically along two intercepting diagonals with one of the quadrats placed at the interception of the two transects. In each quadrat, weed species were identified and counted. Soil samples were taken at 0-10 cm depth from the five quadrats used for weed assessment. Soil samples from the five quadrats were bulked to form a sample. In each community, a structured questionnaire was administered to farmers whose farms were sampled. The position of each farm sampled was recorded using a GPS. Importance Value Index (IVI) was calculated for each species as Relative Frequency + Relative density, divided by 2. Importance Value Index measures the overall significance of a species in a community.

A total of 153 species belonging to 32 families were identified in cassava farms in all the States. Overall, more weed species were encountered in Benue State than in the other States [No of weed species: Abia =69; Ogun = 70; Oyo = 75; Benue = 83]. In each State, the number of weed species in cassava farms varied among LGAs.

In Abia State, the number of weed species in cassava farms was highest in Ikwuano LGA followed by Bende and Umuahia. In these LGAs, *Calopogonium mucunoides, Commelina benghalensis, Ipomoea involucrata, Mitracarpus villosus, Ageratum conyzoides, Axonopus compressus* and *Platostoma africanum* occurred more frequently (60-100%). Other species with 60% frequency of occurrence in Ikwuano LGA were *Centrosema pubescens, Digitaria horizontalis, Phyllanthus amarus, Urena lobata, Eleusine indica and Croton hirtus. Chromolaena odorata* occurred frequently in Umuahia South (80%), Ohafia (80%) and Isuikwuato (100%) LGAs. The frequency of occurrence of *Mimosa invisa* was 40% in four out of nine LGAs in the State. Using the Importance Value Index, the most important 30 species in decreasing order of importance in cassava fields in Abia State were *Ageratum conyzoides > Cyperus rotundus > Aspilia Africana > Platostoma africanum > Commelina benghalensis > Chromolaena odorata > Panicum maximum > Calapogonium mucunoides >Axonopus compressus > Mitracarpus villosus >Mimosa invisa > Digitaria horizontalis > Urena lobata > Oldenlandia corymbosa > Croton hirtus > Mariscus alternifolius > Euphorbia heterophylla > Kyllinga erecta >Centrosema pubescens > Achyranthes aspera > Ipomoea involucrate > Vernonia cinerea > Pteridium acquilinum > Imperata cylindrica > Cynodon dactylon > Peperomia pellucida > Alternanthera sessilis > Ludwigia spp > Spigelia anthelmia > Richardia brasiliensis.*

In Benue State, there were more weed species in Katsina Ala, Gboko and Ushongo LGAs than in the other LGAs. The most important 30 weed species in decreasing order of importance were *Tridax procumbens > Euphorbia heterophylla > Imperata cylindrica > Rottboellia cochinchinensis > Paspalum orbiculare > Euphorbia hirta > Ageratum conyzoides > Digitaria horizontalis > Pennisetum pedicellatum > Panicum maximum > Phyllantus amarus > Cyperus rotundus > Unidentified1 > Spigelia anthelmia > Setaria pumila > Andropogon sp, > Daniellia oliveri > Hyptis suaveolens, > Commelina diffusa > Tephrosia bracteolate > Cyperus haspan > Desmodium scorpiurus > Brachiaria deflexa > Urena lobata > Oldenlandia corymbosa > Nauclea latifolia > Gomephrena celosioides > Unidentified2 > Commelina benghalensis > Brachiaria lata.*

In Ogun State, species composition was highest in Odedu LGA followed by the number of species in cassava farms at Ilaro and Ewekoro LGAs. Across LGAs,*Tridax procumbens > Aspilla Africana > Chromolaena odorata > Commelina diffusa > Digitaria horizontalis > Spigelia anthelmia > Brachiaria deflexa > Calopogonium mucunoides > Commelina benghalensis > Talinum triangulare > Mariscus alternifolius > Perotis indica > Phyllanthus amarus > Panicum maximum > Andropogon sp > Rottboellia cochinchinensis > Euphorbia heterophylla > Cyperus esculentus > Sida acuta > Ageratum conyzoides > Imperata cylindrica > Passiflora foetida > Sclerocarpus africausa > Acroceras zizanioides > Daniellia oliveri > Mitracarpus villosus > Mucuna sp, > Synedrella nodiflora > Cyperus rotundus > Stylosanthes,* were the most important 30 weed species in a decreasing order.

In Oyo State, Itesiwaju and Akinleye LGAs had the highest number of weed species followed by Saki and Afijio LGAs. Across the LGAs, the most important 30 weed species in decreasing order were *Tridax procumbens > Imperata cylindrica > Euphorbia heterophylla > Mitracarpus villosus > Brachiaria deflexa > Digitaria horizontalis > Commelina benghalensis > Rottboellia cochinchinensis > Phyllantus amarus > Sedges > Euphorbia hirta > Brachiaria lata > Pennisetum polystachion > Passiflora foetida > Chromolaena odorata > Mariscus alternifolius > Dactyloctenium aegyptium > Panicum maximum > Talinum triangulare > Sida acuta > Borreria diffusa > Paspalum orbiculare > Desmodium scorpiurus > Tephrosia elegans > Calopogonium mucunoides > Cleome viscosa > Acroceras zizanioides > Commelina diffusa > Tithonia diversifolia > Indigofera hirsuta.*

Although more weed species were encountered in the ground-truthing assessment, the result of the farmer field survey generally agreed with the desktop compilation of major cassava weeds in Nigeria.

*Key Milestone: Candidate herbicides with potentials for weed control in cassava is compiled and sourced from major chemical companies in the first quarter of year one.*

*Output: Candidate herbicides with potentials for weed control in cassava is compiled and sourced from major chemical companies in the first quarter of year one.*

Candidate herbicides with potentials for weed control in cassava systems were compiled. The compilation was done by the herbicide team in IITA and national partners from NRCRI, UAM and FUNAAB in collaboration with representatives of major chemical companies in Nigeria, international partners from Purdue University, CropLife Nigeria and International, NAFDAC, and NESREA using due diligence. A total of 44 herbicides consisting of 24 pre- and 20 post-emergence herbicides were received from eight chemical companies. Import permit was obtained for 29 herbicides. Nine of the herbicides do not require import permit because they are already registered in Nigeria.

*Output: Regulatory agencies in Nigeria are sensitized on project objectives.*

IITA project management team visited and had meetings with key officers of the Nigerian Federal Ministry of Agriculture and Rural Development (FMARD), and partner institutions (NRCRI, FUNAAB and UAM), as well as regulatory agencies: National Environmental Standards, Regulations and Enforcement Agency (NESREA), and National Agency for Food and Drug Administration and Control (NAFDAC), responsible for registration and environmental standards. The IITA team also visited and had a meeting with CropLife - an institution representing the plant industry in Nigeria. The objectives of these meetings were to: sensitize them of the project (briefing on project objectives and implementation plans), show how this new project is linked to the Agricultural Transformation

Agenda of the Federal Government of Nigeria, and solicit their institutions' active participation. Meetings with the senior management of FUNAAB, UAM, and NRCRI were on February 18, 28, and March 3, 2014, respectively. The meetings with NESREA, FMARD, NAFDAC, and CropLife were on March 30, March 31, April 1 and April 15, 2014, respectively. The Vice Chancellors [FUNAAB (Prof. Olusola B. Oyewole) and UAM (Engr. Prof. Emmanuel I. Kucha)], Executive Director [NRCRI (Dr. J.C. Okonkwo)], and the Director Generals [NESREA (Dr. Ngeri S. Benebo) and NAFDAC (Dr. Paul B. Orhi)] were in attendance in respective meetings. In the meeting with the FMARD, the Director of the Federal Department of Agriculture (Dr. T.J. Odeyemi) and the Senior Technical Adviser to the Honorable Minister of Agriculture and Rural Development (Dr. Martin Fregene), representing the Honorable Minister, were in attendance. In the meeting with CropLife Nigeria, the President (Mr. Seun Ogunnaike) and General Secretary (Mr. Wole Adeyegbe) were in attendance. Copies of the executive summary of the Project kick-off meeting were presented to all of the officials.

A 2-day working visit was also facilitated in November 2014 for officials of the regulatory agencies (NAFDAC and NESREA) to have an independent assessment of the herbicide screening trials of the project at IITA and FUNAAB.

*Key Milestone: Preliminary screening of candidate herbicides at IITA (Ibadan) to determine the best candidate herbicides for extensive testing in cassava cropping situations (sole cassava, companion crops and weeds) is carried out in year one.*

*Output Preliminary screening of candidate herbicides at IITA (Ibadan) to determine best herbicides for extensive testing in cassava cropping situations (sole cassava, companion crops and weeds).*

Preliminary screening of candidate herbicides was implemented by IITA in 2014 in the research farms of IITA, FUNAAB, UAM and NRCRI under controlled conditions to determine the best candidate herbicides for extensive evaluation in cassava cropping situations (sole cassava, companion crops and weeds) in 2015. In carrying out these evaluations, special consideration was given to ALS-inhibiting candidate herbicides, especially at the post emergence level, given the potential development of new, herbicide-tolerant cassava cultivars.

*A team from NESREA and researchers from IITA on an experimental plot*

*Cassava in second season trials*

A total of 22 pre- and 16 post-emergence herbicides at different rates with two non-herbicide treatments [hoe-weeded 3 times and unweeded checks] were evaluated in two cropping seasons [1st season starting June 2014 and 2nd season starting August 2014]. The first season evaluation was carried out in four locations and the second season in three locations. At each site 49 pre-emergence herbicide treatments replicated 3 times (147 plots) and 33 post-emergence herbicide treatments also replicated 3 times (99 plots) were evaluated. An erect cassava variety, TME 419 was used in the evaluation at 10,000 and 20,000 plants/ha in the 1st and 2nd season respectively. In the second season, cassava was intercropped with cowpea, soybean, melon and maize at a seeding rate of 40,000 plants/ha. At all the sites, post-emergence herbicides were applied to cassava shoot at 3 WAP when cassava was at 3 to 5 leaf growth stage. Weed control efficacy and crop injury rating was done every 2 weeks for both pre- and post-emergence trials using visual rating and from dry matter of weeds. In all locations and in both cropping seasons with the exception of the 2nd season evaluation in IITA, all plots treated with pre-emergence herbicides were hoe-weeded at 8 WAT. This operation was carried 15 WAT for the 2nd season evaluation at the IITA research farm. Plots treated with post-emergence herbicides were hoe-weeded at 6 WAT.

For pre-emergence herbicides, cassava sprouts ranged from 71 – 98%. In all herbicide treated plots, cassava had early stunting compared with the hoe-weeded treatment, but recovered at 4 WAT and in most cases grew taller than cassava in the untreated hoe-weed plots.

Cassava root yield will be determined in March and April 2015 when cassava will be at 9 months' growth stage. After harvesting, cassava root and leaf from plots treated with herbicides will be sent to the South African Bureau of Standards (SABS), which has certification for pesticide residue analysis and where arrangements have already been made for sending the samples for herbicide residue analysis.

# Objective Four

**This Objective seeks to involve farmers and other stakeholders in the research to develop improved weed management practices in cassava. It also aims to empower extension services, primarily the ADPs but also NGOs, agro-dealers, and spray service providers, to provide farmers with the knowledge they need to improve weed management practices**.

*Key Milestone: A community assessment and 22 FGDs are conducted in 11 local governments (1 with women, 1 with men) by year 2.*

*Output: Preliminary set-ups for effective extension and communication material development and dissemination are completed by the end of year 2*

In mid-2014, the Cassava Weed Management Project hired a Communication & Knowledge Exchange Expert, and a Social Media Officer to drive the communication and knowledge exchange agenda of the project. The project also identified, and established three communication focal persons in the three partner institutions: NRCRI, UAM, and FUNAAB. To foster better relations with the communication focal persons, two meetings were organized with all of them in attendance. The meetings provided the opportunity for the participatory development of a work plan for 2014/2015. The venues of the meetings alternated between IITA and UAM. During the meetings, a taskforce was formed to develop instruments for the implementation of a Knowledge, Attitudes and Practices (KAP) study, and Training Needs Assessment for ADP staff for the project states in year 2.

*Key Milestone: Research findings are translated in content and language and packaged in different formats ready for dissemination to farmers and different stakeholders and uploaded on the web by year 3.*

*Output: Research findings are translated in content and language and packaged in different formats ready for dissemination to farmers and different stakeholders and uploaded on the web by year 3.*

In the last quarter of 2014, the project's website was developed (www.cassavaweed.org) as part of efforts to increase the visibility of the project and also promote knowledge sharing. Project accounts on social media platforms such as Facebook (https://www.facebook.com/Sustainablecassavasystems), Twitter (https://twitter.com/Cassavaweedmgt), Slideshare (http://www.slideshare.net/CassavaWeed14), and LinkedIn were created as knowledge sharing platforms and linked to the website. As at the time of filing this report, the website had a total of 425 downloads of the publications uploaded.

*Key Milestone: Effective print materials are produced and distributed to farmers and other stakeholders.*

*Output: Quarterly newsletters are uploaded on the website (from last quarter of year 1 onwards) and disseminated to governmental services, partners, potential donors, and media release services, providing summaries on the research process for non-scientists.*

During the period, the team developed content and produced two quarterly newsletters. The newsletters and other communication products such as the website had inputs of all the implementing partners and the Bill & Melinda Gates Foundation (for materials that had the foundation name/logo mentioned). The newsletters were shared with farmers, partners, governmental services and the media. The project participated in two exhibitions: One was to mark the International Year of Family Farming that was organized by the Nigeria Model United Nations Society at the University of Ibadan, Nigeria. The second was during the IITA Open Day. At both exhibitions, the strategy was to raise the flag on the weed problem. During the exhibitions, women and the youth were given the opportunity to better understand the weed problem. Some common weeds of cassava were also displayed. The different weed control options were also shared with visitors both in print and verbal communication.

Other communication materials developed and shared included: 1. Project brief flyer. 2. Roll up banner for project (Unleashing the Power of Sustainable Weed Management Technologies). 3. Project poster (Facts about weeds and cassava in Nigeria). 4. Scientific poster (Unleashing the Yield Potential of Cassava in sub-Saharan Africa through Sustainable Weed Management Technologies). 5. Project flyer (Unleashing the Yield Potential of Cassava in sub-Saharan Africa through Sustainable Weed Management Technologies). 6. Seasons Greeting Card.

*Conducting interviews with farmers for knowledge sharing*

# Objective Five

**This Objective seeks to ensure that the project creates impact through good governance, and that there are effective management strategies for result, which will eventually lead to handover to national partners.**

*Key Milestone: Project is operational*

*Output: Project staff, administrative mechanisms, and capital equipment are in place, operational and coordinated by month 3 following the project launching.*

The Cassava Weed Management Project became operational immediately after the stakeholder's Kick-off Workshop in January 2014. Recruitment of all key project staff of IITA and partner institutions were finalized in line with the approved proposal. The Project Coordinator assumed duties in January 2014. Following consultation with national implementing partners, and for smooth implementation of project activities, capital items including vehicles, office equipment, field, and lab supplies were ordered by IITA and distributed to all partner institutions. Since then, the project team at IITA has been monitoring and backstopping the implementing partners—NRCRI, FUNAAB and UAM.

*Key Milestone: One workshop organized*

The project successfully organized a Kick-off Workshop with a wide range of stakeholders on 28 – 31 January 2014 at IITA, Ibadan, Nigeria. About 77 participants were in attendance. The objectives of the meeting were to create a joint understanding of the project by implementing partners on project goals, objectives, results, milestones and implementation modalities; agree on roles, responsibilities and accountabilities; and develop detailed work plans for year 1. The proceedings of the workshop was finalized and distributed via a drop-box to all participants.

*Key Milestone: Steering Committee meetings held.*

The Steering Committee (SC) and subcommittees of the Project were constituted in consultation with the Program Officer for the project at the Gates Foundation, and the IITA Deputy Director General for Partnerships and Capacity Development during the Kick-off Meeting of the project (see list below). The first meeting of the SC was successfully organized at IITA Campus, Ibadan on 18-19 August 2014. There was a 100% representation of all the members of the committee. Sub-committee members for Herbicides and Herbicides Safe Usage were also in attendance as resource persons at the meeting. During the SC meeting, the Executive Director of NRCRI, Dr J.C. Okonkwo was unanimously selected as the chairperson of the SC. By the end of the meeting, the SC formulated 22 resolutions/recommendations and these were signed by the chair of the SC and distributed to the members of the SC including the Program Officer of the Gates Foundation - Dr. Vasey Mwaja, who joined the meeting through a teleconference call. On the second day of the meeting, a field trip was undertaken by the Committee members to the experimental plots on cassava weed management project at the IITA Campus, and Moniya in Ibadan, Oyo State; and Ile-ogbo in Osun state, as well as the IITA Business Incubation Platform in Ibadan.

| Steering Committee | | Sub-committee on Herbicides | |
|---|---|---|---|
| 1 | Dr. Ken Dashiell (IITA) | 1 | Prof. Stephen C. Weller. |
| 2 | Dr. Vasey Mwaja (Bill & Melinda Gates Foundation). | 2 | Prof. Friday Ekeleme. |
| 3 | Mr. Seun Ogunaike (CropLife, Nigeria). | 3 | Dr. Vasey Mwaja. |
| 4 | Dr. Charlie Riches (Consultant). | 4 | Dr. David Chikoye. |
| 5 | Pastor Segun Adewumi (NCGA). | | |
| 6 | Dr. Damilola Eniaiyeju (FMARD). | Sub-committee on Herbicides Safe Usage | |
| 7 | Dr. Paul B. Orhii (NAFDAC). | 1 | Prof. Friday Ekeleme. |
| 8 | Engr. Prof. Emmanuel I. Kucha (UAM). | 2 | Prof. Segun T.O. Lagoke. |
| 9 | Prof. Olusola B. Oyewole (FUNAAB). | 3 | Dr. Charlie Riches. |
| 10 | Dr. Julius C. Okonkwo (NRCRI). | 4 | Dr. U.E. Udensi. |
| 11 | Dr. Alfred Dixon [IITA (Secretary, Ex Officio)]. | | |
| 12 | Prof. Friday Ekeleme [IITA (Ex Officio)]. | | |

The Director General of IITA, in reiterating the Institute's commitment to reviving, and boosting weed science research for cassava, and other mandate crops at IITA provided about US $68, 000.00 from the Institute's core budget for the rehabilitation of a formerly dilapidated Head House into a new building now called - Weed Science Center (WSC). During the SC meeting, the WSC was commissioned by the IITA Deputy Director General for Partnership and Capacity Development, and it now houses the IITA Project team.

*Key Milestone: Webportal operational.*

*Output: The project's Information Hub will, by month 9, be functional with a web-portal.*

*Steering Committee members visit field during maiden meeting in Ibadan*

In the last quarter of 2014, the project's website became functional (www.cassavaweed.org) as part of efforts to increase the visibility of the project and also promote knowledge sharing. Project accounts on social media platforms such as Facebook (https://www.facebook.com/Sustainablecassavasystems), Twitter (https://twitter.com/Cassavaweedmgt), Slideshare (http://www.slideshare.net/CassavaWeed14), and LinkedIn were created as knowledge sharing platforms and linked to the website.

*Key Milestone: Project Management Trainings held.*

*Output: The capacity for NRCRI to manage complex projects, such as this one, will be enhanced through direct training on project management provided by the PC, PM, Project Management Team, and IITA's Management Team, beginning in year 2.*

Orientation training visits to all partner institutions were conducted by a representative from IITA Project Administration Office and a representative from the IITA Finance Directorate following a request made by project partner institutions during the Kick-off Workshop in January 2014. The 2-day training for project staff of each partner institutions at their different locations was on Budget and Grant Management, and general overview of the Cassava Weed

Management Project including the outcomes, outputs and milestones of the project.

A 2-day Situation Analysis including a SWOT Analysis Workshop (October 20-23, 2014) was also conducted at the NRCRI for officials who will take over the leadership of the Project in the fourth year. Currently, the capacity at NRCRI needs strengthening, and key persons to be trained were identified as well as the scope of each training determined with regards to grants management and proposal writing, contract administration and intellectual property, contract reporting and requirements (financial and administrative procedures), and project database management. Selected staff will undergo training in year 2 by learning-by-doing' models at IITA for two weeks on project management. Training visits are planned for IITA project staff to NRCRI to work with the trainees in their own environment. Following the situation analysis, a one-day refresher training workshop was also conducted at the request of NRCRI on grants management, project administration, robust financial management in projects execution, preparation of financial report (Bill & Melinda Gates Foundation standards), and fixed asset management in line with best practices.

At the request of other two project partner institutions in November 2014, the IITA Project Administrator and Project Accountant also visited UAM and FUNAAB to organize a 2-day training workshop on financial management in project execution, preparation of financial report (Bill & Melinda Gates Foundation standards), and fixed asset management in line with the best practices.

In addition to monthly IITA Project Staff Meeting, the Project Coordination Unit instituted Joint Quarterly Review Meetings with key IITA and project staff of partner institutions to create a forum for review of project implementation and progress, and addressing emerging issues arising from project implementation as well as build capacity. The venue for the meetings is rotated among IITA and the partner institutions.

*Key Milestone: M&E of Project is conducted.*

*Output: Internal monitoring of the project is conducted to ensure timely adjustments in strategies and tactics to realize the desired outputs of the proje*ct.

An M&E consultant for the project was engaged during the last quarter of year 1 to ensure efficient internal monitoring of the project and timely adjustment. The consultant has developed a draft M&E framework, which is being reviewed. The framework will be finalized in 2015. The framework will help the M&E team to conduct a baseline study in 2015.

Output 5: A proactive PR approach is applied and effective messaging on integrated weed management strategies is created and shared among stakeholders.

The project communication team has been involved in regular updates of project activities on the website and social media platforms. The website of the project is designed for stakeholders in cassava weed management in a manner that it provides information, but also gives room for comments and feedback in an open and transparent manner. The team developed a communication and knowledge exchange strategy, and shared with partners for inputs. Media relations' efforts to promote a good image of the project included the development of nine news articles that were shared with more than 100 online and traditional media (television, radio and newspapers). Messages were developed beginning from the Kick-off Meeting and throughout the project cycle in year 1 and shared with partners and the media. Major newspapers in Nigeria—Guardian, Punch, Thisday, and Daily Trust — have carried news about the project, thereby improving the visibility of the project and its image generally. We also had coverage in the radio.

The project also created social media platforms to encourage knowledge sharing in a transparent manner. During the reporting period, followership on Facebook grew to 324 with a people reach of 497 in Nigeria; in some other countries such as Tanzania people reach was 74; DRC 41, Ghana 8, United States 39, and Malawi 11, amongst some others. The Facebook likes have reached 192. Twitter now has 48 followers with an average mention reach of about 1729 as at 13 January 2014. Slideshare has a total of 313 document views. LinkedIn now has a total of 99 connections and a profile view ranking 98% as at 15 January. Two newsletters were produced and shared to more than 400 persons in both print and electronic format.


*Our website: www.cassavaweed.org*

# From Our Newsletter

## Cassava Weed Management Project gets followers on Facebook and Twitter

The Cassava Weed Management Project has launched its Facebook and Twitter accounts as part of the vision to create visibility for the project in order to reach the 125,000 farm families target. Early "likers" of the Facebook account after it was announced included Dr Kenton Dashiell, Deputy Director General (partnerships & Capacity Development), and several other scientists and partners. The creation of these accounts will serve as a knowledge sharing and engagement platform for people who are interested in cassava weed management best practices as well as those that share in the vision of the project.

The Facebook and Twitter accounts are basically ongoing project as they will be revised and updated as new social media platforms emerge, best practices evolve, and new concerns arise as well.

The Cassava Weed Management Project otherwise known as Sustainable Weed Management Technologies is a 5-year project that is assessing sustainable weed management technologies for cassava-based farming systems in Nigeria. The project is seeking to find solutions to labor-intensive weeding usually performed by women and children and to increase cassava productivity in Nigeria.


*"Follow us" and "like us"*

"These channels will help us capture young women and men who go into agriculture but in most cases are discouraged by weeds," said Dr Alfred Dixon, Project Leader, Cassava Weed Management Project.

It is envisaged that a two-step flow of information will ensue where young women and men will pass on the information to other members of the community.

Godwin Atser, Communication & Knowledge Exchange Expert, said the team was excited with the development.

"With this, we are optimistic about sharing knowledge to more than 125,000 farm families and beyond," he added.

He encouraged partners to share the social media accounts to friends and other colleagues.

The Facebook page can be found on the following link: https://www.facebook.com/Sustainablecassavasystems while the twitter handle is: @Cassavaweedmgt

## IYFF: Cassava Weed Management Project makes exhibition to create awareness on weeds


*Cassava Weed Management Project's exhibition booth*

The Nigeria Model United Nations Society recently hosted a symposium to mark the 2014 United Nations International Year of Family Farming (IYFF) at the University of Ibadan, Oyo State, Nigeria. The Cassava Weed Management Project, Postharvest Utilization Unit, IITA Youth Agripreneurs, and the Cassava Breeding Unit were on hand to exhibit their numerous groundbreaking achievements in agriculture in support of the symposium themed: *"The Role of Youth in the Sustainability of the Agricultural Sector; A Tool for Eradicating Extreme Poverty and Hunger through Food Security."* The event provided opportunity for students and guests at the event to understand and appreciate the devastation caused by weeds on the farm, farm families, and the efforts by researchers to turn around the situation.

The Director General of the IITA, Dr Nteranya Sanginga, who was guest speaker at the event, was represented by Dr Alfred Dixon, the Project Leader, Cassava Weed Management Project.

Dr Dixon extolled the gains of agriculture especially with improved practices as a viable means of ending extreme poverty in any society especially in Africa and encouraged youths and every one present at the symposium to explore the opportunities inherent in agriculture.

Making reference to the IITA Youth Agripreneur model, Dr Dixon said the successes recorded by this group of youngsters in terms of agro-entrepreneurial expertise demonstrated that if young men and women were given the necessary training, mentorship and support, they could take agriculture as a profession and create wealth for themselves.

Though for this to happen, he advised that issues such as soil fertility, finance, agronomy including weed management needed to be addressed.

At the exhibition booth, participants were exposed to the various products from IITA's agricultural research programs, while also creating a platform for knowledge sharing for visitors. A good turnout of visitors showed interest in the institute's activities as they asked questions about how they could benefit from the wealth of information on display at the IITA booth.