

An impact assessment of the cassava enterprise development project

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IITA Ibadan, Nigeria
Telephone: (234-2) 7517472
Fax: +44 208 7113786
E-mail: iita@cgiar.org
Web: www.iita.org

To Headquarters from outside Nigeria:
IITA, Carolyn House
26 Dingwall Road, Croydon, CR9 3EE, UK

Within Nigeria:
PMB 5320, Oyo Road
Ibadan, Oyo State

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Contents

Acronyms and abbreviations	vi
Acknowledgments	vii
Executive summary	viii
1. Introduction	1
The place of cassava in the Nigerian economy	1
Cassava development initiatives	2
The cassava enterprise development project	3
2. Assessment objectives and methodology	6
Assessment objectives	6
Methodology	6
Data collection and analysis	8
Constraints	10
3. Impact assessment	11
Reduced impact and spread of cassava mosaic disease	11
Distribution of improved varieties	12
Increased cassava productivity	13
Reduction in CMD	14
CEDP estimates	18
Impact assessment estimates	19
Farmer incomes from cassava production	20
Farmer livelihood improvements	22
Development of postharvest processing and marketing	23
Employment created	26
CEDP other stakeholders benefits	27
Conclusion	32
Looking to the future	35
References	36

Tables

1. Farmers randomly selected from sampled communities in each state	8
2. Cassava processing centers supported and processors interviewed	9
3. Other public, private and NGO stakeholders interviewed	9
4. Improved cassava varieties released in Nigeria	11
5. Features of five selected varieties	11
6. Areas planted to local and CMD-resistant varieties, other crops, and fallow before and after CEDP (ha)	15
7. Median of farmers' estimates of production costs of local and CMD-resistant varieties of cassava (N/ha)	21
8. Percentage of farmers reporting reduced poverty, improved food security, and increased incomes ..	23
9. Equipment provided for processing	25
10. Days worked, customers, revenue, costs, and net income per week	26
11. Employment created by processors	26
12. Agrodealer estimates of employees, customers, sales, and income	27
13. Weed group own estimates of costs and returns for weeding services (Naira)	28

Figures

1. Contribution of cassava production by geopolitical zones.....	1
2. CEDP target states in the south–south and southeast of Nigeria.....	4
3. Cassava value chain and uptake pathways (production components).....	5
4. Cassava value chain and uptake pathways (processing components).....	5
5. Planning workshops and data collection.....	6
6. Sources of planting material.....	12
7. Percentage of farmers reporting sales and gifts of cassava cuttings across states.....	13
8. Loading and packaging of improved planting materials.....	13
9. Mean value of cuttings sold and given per farmer across states.....	13
10. Distribution of improved planting materials.....	14
11. Incidence of CMD in cassava fields.....	15
12. National cassava production and yields NAERLS and NFRA (2011).....	16
13. Nigeria cassava production and yields.....	16
14. National cassava production and yields for the CEDP states.....	17
15. National cassava production and yields for each CEDP States (NFRA 2011).....	17
16. Sample of cassava yields from local and improved varieties.....	18
17. Cassava yields baseline, 2006–2007 and 2008–2009.....	18
18. Farmers' perceptions of local and CMD-resistant cassava yields.....	19
19. Measured yields from sampled fields of local and CMD-resistant cassava yields (2010).....	19
20. Facets of the cassava value chain system in CEDP states.....	20
21. Comparison of gross incomes from local and CMD-resistant cassava based on measured yields.....	20
22. Farmer reported production costs of local and CMD-resistant cassava yields (2010).....	21
23. Comparison of net incomes from local and CMD-resistant cassava based on measured yields.....	22
24. Comparison of benefit: cost ratios from production of local and CMD-resistant cassava.....	22
25. Transportation and utilization components of the cassava value chain in CEDP states.....	23
26. Outcomes from the CEDP interventions.....	25
27. Different types of employment.....	26
28. Agrodealers and service providers in project states.....	27
29. Finance and microcredit partners in Nigeria's cassava value chain sector.....	28
30. Equipment fabricators and samples of their cassava processing machines.....	29

Annexes

1. Socioeconomic characterization of farmers.....	37
2. Farming systems.....	38
3. CMD cuttings given and sold.....	39
4. Yields, income, costs, and benefit: cost ratio comparisons of CMD and local varieties (Naira per ha) ..	40
5. Socioeconomic characteristics of processors.....	41
6. Processor sources of cassava and benefits of CMD-resistant varieties.....	42
7. Benefits reported by processors.....	43
8. List of publications and public relation activities.....	44

Boxes

1. Composition of the impact assessment team.....	7
2. The <i>gari</i> production process.....	24

Acronyms and abbreviations

ADP	Agricultural Development Project/Program (State extension organizations)
AC	assisted center
CEDP	Cassava Enterprise Development Project
CMD	Cassava Mosaic Disease
FAO	Food and Agricultural Organization of the United Nations
FGD	focus group discussions
FGN	Federal Government of Nigeria
FMARD	Federal Ministry of Agriculture and Rural Development
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
LGA	Local Government Area
MG	mobile grater
MOU	Memorandum of Understanding
MPC	microprocessing center
NACRDB	Nigerian Agricultural Cooperative and Rural Development Bank
NAFDAC	National Agency for Food and Drug Administration
NAERLS	National Agricultural Extension and Research Liaison Services
NDDC	Niger Delta Development Commission
NEPAD	New Partnership for Africa's Development
NFRA	National Food Reserve Agency
NGOs	nongovernmental organizations
NIFOR	National Institute for Oil Palm Research
NPFS	National Programme on Food Security
NPI	Nigerian Presidential Initiative
NRCRI	National Root Crops Research Institute
RMRDC	Raw Materials Research and Development Council
RTEP	Roots and Tuber Expansion Programme
SEDI	Scientific Equipment and Development Institute
SME	Small and Medium Enterprise
SON	Standards Organization of Nigeria
SPDC	Shell Petroleum Development Company
USAID	United States Agency for International Development
WIA	Women in Agriculture

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The authors would like to acknowledge all those CEDP stakeholders who contributed to this study, in particular the impact assessment evaluation team (Box 1), the farmers, processors, fabricators, traders, industrialists, agrodealers, and weeding control groups as well as the state extension agencies, NGOs, scientists, and other public sector organizations and individuals, who participated in discussions and answered many questions. Special thanks to all the enumerators and data input technicians.

Executive summary

Introduction

Nigeria is the largest producer of cassava in the world with the crop being widely cultivated over many parts of the country, where it plays a vital role in the food security of the rural economy. It provides a livelihood for over 30 million farmers and countless processors and traders all over the country. The crop performs five main roles: as a rural food staple, a famine reserve crop, a cash crop for urban consumption, an industrial raw material, and an earner of foreign exchange. While mainly used for food, significant opportunities are available to enhance the marketing of processed products. Unfortunately cassava has been threatened by Cassava Mosaic Disease (CMD), where it posed a serious threat, which if left unchecked, could have resulted in a serious food security crisis and undermined the potential to develop markets for cassava and its component products.

In order to prevent the potentially devastating effect, the Federal Government in collaboration with the International Institute of Tropical Agriculture (IITA), the United States Agency for International Development (USAID), and other donor partners, (Nigerian National Petroleum Company—NNPC, Shell Petroleum Development Company—SPDC, Niger Delta Development Commission—NDDC), and the petroleum producing states initiated a pre-emptive Integrated CMD Prevention Project to address the threat in 2003. At the same time it was recognized that the development, dissemination, adoption, and extensive cultivation of improved cassava varieties would quickly lead to an increase in cassava tuber output. And, in order to utilize surplus production and enhance levels of income and livelihoods of producers and reduce unemployment, an integrated cassava development program should plan beyond CMD prevention and encourage postharvest processing, development of new products, utilization, and marketing.

The Cassava Enterprise Development Project

CEDP was planned as a complementary follow-up to the integrated CMD prevention project. It was conceived as a public private sector initiative aimed at utilizing cassava to drive the growth of rural enterprises. It aimed to integrate cassava production, plant protection, postharvest storage, and processing with good marketing outlets and strategies to drive agricultural intensification, diversification, and commercialization in line with national food security needs and poverty alleviation working with a wide range of stakeholders in existing national structures and organizations. Specifically CEDP aimed to reduce the impact of CMD working in selected communities in the south–south and southeast states, to increase the productivity of cassava, and to develop and expand postharvest processing and marketing outlets for cassava products.

CEDP focused on selected communities in eleven states of the southeast (Anambra, Ebonyi, Edo, Enugu, and Imo) and the south–south (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, and Rivers) including the Niger Delta region (NDR). The primary beneficiaries were an expected 300,000 resource-poor farmers and producer groups, most of them women. Secondary beneficiaries were expected to include small and medium-scale processors, fabricators, commodity traders, consumers, and private-sector agribusiness entrepreneurs involved in cassava production, processing, handling, marketing, and consumption in the cassava subsector, through increased cassava availability, demand, and commercialization.

Assessment objectives and methodology

The purpose of this assessment has been to assess CEDP achievements and in particular how the three project outputs contributed to increasing economic opportunities in the 11 participating states, namely:

1. Reduction of CMD through growing of released CMD-resistant varieties.
2. Increased production and productivity of cassava using CMD-resistant varieties.
3. The development and expansion of postharvest processing and marketing for cassava products.

Central to this was the improved capacity of CEDP stakeholders, who provided valuable information of the benefits they had received from the project.

This assessment of CEDP builds on the work of earlier drafts, using the 2010 survey data as well as other relevant secondary information. The survey data was based on structured questionnaires and discussion guidelines used with CEDP stakeholders.

Reduction of CMD through growing of released CMD-resistant varieties

In the period prior to 1990 up to 2010, 33 new cassava varieties were officially released by the Nigerian National Variety Release Committee, 17 of these being released up to 2004 and 16 after this date, the latter period coinciding with CEDP activities. Distribution was initially undertaken by CEDP from multiplication locations established by IITA and ADPs, after which farmers sold and gave planting material to neighbors and friends. Stem sales of new varieties became a business for over 10% of farmers generating income through sales especially for the first three years, but then dropping to less than 5% by the fifth year. Over 30% of farmers also reported making gifts of cuttings, although this also dropped to 15% in the fifth year as the availability of improved varieties increased. Theft of improved varieties was also reported by over 30% of farmers, indicating its popularity.

This high demand for improved planting materials and the spread of improved varieties in farmers' fields reduced the incidence of CMD. Field surveys undertaken in 2006 showed that 74% of cassava fields had been planted with newly introduced CMD-resistant cassava. This compared with the baseline survey, which showed that 41% of farmers planted improved varieties and the 2010 survey where 57% of farmers reported planting new varieties. On average, the activities of CEDP reduced the severity of CMD by 20% between 2003 and 2006 with some states previously reporting severe infestations in 2003 being either clean or only mildly affected by the virus by 2006, indicating that the introduction of the new varieties was limiting the spread of the disease. A further survey in 2009 indicated that the appearance of CMD in farmers' fields averaged around 8%.

Of the 680 farmers interviewed in the 2010 survey, 99% reported growing cassava and 57% growing improved varieties. Although the median area of cassava grown both before and after CEDP was reported as 3.5 ha, the area of local cassava had reduced by 0.5 ha, a 25% reduction over the project period. Over the same period the areas of CMD-resistant cassava also increased by 0.5 ha, an increase of 33%.

Increased production and productivity of cassava using the CMD-resistant varieties

The project reported that 19,185 ha had been planted by the time the project had been completed. NFRA statistics for the 11 CEDP states indicated that the area under cassava climbed steadily from 12.5 million tons (t) in 2004 to over 24 million t in 2010, an increase of over 11% per year. Yields also increased steadily from 12.5 t in 2004 to over 14 t/ha in 2009, before falling slightly to 13.5 t/ha in 2010, but showing an annual increase of 1.4% over the CEDP period.

Cassava yield measured in CEDP's baseline survey in 2004 showed a mean yield of about 11.2 t with local variety yields averaging 10.4 t and improved varieties 12.1 t/ha. Following the release of the first set of improved, CMD-resistant varieties in 2005, a survey conducted in 2006–2007 recorded yields of over 25 t/ha for farmers growing the new varieties. A survey in 2008–2009 showed that the yield across states for new varieties had increased to 29 t/ha. Sampled yield estimates undertaken during the 2010 survey showed yields of 12 t/ha for local varieties and 29 t/ha for new varieties, an improvement of 138%.

Almost all respondents indicated that poverty had been reduced, food security improved, and incomes increased as a result of CEDP's interventions.

The development and expansion of postharvest processing and marketing

CEDP established and supported 626 rural-based processor groups and individuals in cassava processing including 32 small and medium enterprises (SMEs), 148 microprocessing centers (MPCs), 377 mobile graters (MGs), and 63 assisted centers (ACs) with 86% of these reported to be functioning effectively when CEDP was completed. Most of the processors also grew cassava, 83% being an improved variety, most being sourced through CEDP. Benefits reported for the new varieties included higher yields, earlier maturity, resistance to CMD, and the production of better flour and *gari*.

The main benefits from processing activities were reported as being drudgery reduction, faster processing, improved hygiene, and the new products introduced, as well as acquisition of the machines. Other benefits reported included business training and to a lesser extent provision of links to credit institutions. The main training benefits included the provision of knowledge on machine operation and knowledge on maintenance. Most processors reported increased market demand, increased sales, and increased incomes.

The total number of work opportunities created by the processors has been estimated at just over 14,000 jobs, 25% of these being for permanent positions (12% for males and 13% for female) and 75% part-time positions (20% for males and 55% for females).

Benefits for other stakeholders

Other stakeholders who benefitted either directly or indirectly from or contributed to CEDP included private-sector service providers, marketing agents and industrial users, extension agents, researchers, others in the public sector, and consumers.

Private-sector service providers, marketing agents, and industrial users

- Most *agrodealers* were aware of CEDP activities and reported that the number of their customers, sales, and income had increased.
- *Weeding groups* reported that weed control using herbicides had become a profitable business that was appreciated by farmers. Group members also indicated that the availability of profitable work had reduced the incidence of loitering, fighting, militancy, stealing, and drunkenness amongst group members.
- *Credit institutions* reported loan repayments averaging 74% helping to increase both production and processing profits.
- *Machine fabricators* reported having learnt new skills and consequently increased production and sales through CEDP support. Most reported to be operating profitably with CEDP having contributed to improving their businesses. Currently six people on average are employed by fabricators and all report having apprentices undertaking training.
- Forty percent of marketing agents (wholesalers, retailers, and bulk traders) were aware of CEDP, indicating the main benefits as being increased cassava production, more products, and larger quantities of processed goods being available on the market. All considered buying and selling of cassava and cassava products a profitable business.
- *Industrial users* reported increased use of cassava resulting in increased utilization of their existing facilities with six of the seven indicating an expansion or establishment of other factories and new employment being created. All reported that the market for cassava had increased with the widening of cassava-based products indicating that their sales had increased.

Extension agents

- Some 700 ADP staff were reported as being involved with the project with all those interviewed indicating that CEDP had added relevance to their organization, placing the ADP in a better position to serve farmers than had previously been the case. Most also reported that CEDP had added to their job satisfaction and had improved their extension capabilities, which would help to sustain CEDP benefits in the future.

- Twenty-two of the 28 *NGOs* interviewed had been involved with CEDP in various roles, in sensitization, advocacy, and on-farm demonstrations. Most indicated that they had also played an important role in scaling out CEDP benefits and that as a result of their participation, their organizations had a stronger relationship with both host communities and donors.
- Eleven of the 15 *other development projects* interviewed indicated that they had been associated with CEDP for a period of five years, with their work benefitting from the demonstrations and on-farm trials, increased availability of new cassava varieties, the establishment of processing centers, and the availability of new cassava products particularly flour for use in bread making. Most indicated that they had also contributed to scaling out CEDP benefits.

Researchers

- The 15 scientists interviewed reported that their institutions had been active participants in cassava research with CEDP facilitating training, attendance at conferences and workshops as well as research funding. Benefits from training resulted in degrees being awarded: 1730 at BSc level, 227 at MSc level, and 70 at PhD level with another 60 scientists and technicians also benefitting from training. Twenty-five scientific journal papers, 18 proceedings, and six other publications were reported by the 15 scientists interviewed.

The public sector

- Individuals from eight *State Ministries of Agriculture* were interviewed all being aware of CEDP activities and indicating that the project had made a significant contribution to improving cassava production in their states, contributing also to increased cassava product exports and foreign exchange earnings, with exports reported to Asia, China, and Europe.
- Individuals from NAFDAC in six states reported working with CEDP being responsible for inspection, registration, and monitoring processors and ensuring compliance with standards for cassava products. All reported being satisfied with the standard of products and indicating that the project had supported national development. Three felt that CEDP had added to the relevance of their organization and increased NAFDAC'S drive to increase revenue generation to cover their operating costs.

Consumers

- Fifty-eight percent of those interviewed reported being aware of CEDP activities and that the project had made cassava products safer and of improved quality. All indicated that the consumption of new cassava products had increased amongst their families and friends.

Looking to the future

The assessment has confirmed CMD reduction, yield and productivity increases achieved by farmers as well as the success of many of the processing enterprises. However a number of ongoing challenges require support by national institutions. These include a need for (i) ongoing support to improve the capacity of local fabricators and processors to ensure the profitability and sustainability of processing enterprises, (ii) improving access to inputs including credit by farmers, processing enterprises, and traders, (iii) promoting appropriate mechanization to reduce labor costs, (iv) resolving internal group disagreements, (v) advocating for enforcement of policies, especially the use of cassava flour in bread-making, and (vi) reducing the problems contributing to irregular and unreliable power supply and poor infrastructure.

The full potential impact of CEDP is likely to be achieved in the five years after project closure, as national institutions take up the identified challenges. It would then be appropriate to re-assess the sustainability of the cassava production and processing enterprises that have been established.

Introduction

The place of cassava in the Nigerian economy

Nigeria is the largest producer of cassava in the world with an estimated area of 3.8 ha million under cultivation and producing over 40 million t in 2004 (FAO 2011). The crop is widely cultivated over many parts of the country, where it plays a vital role in the food security of the rural economy, because of both its capacity to yield under marginal soil conditions and its tolerance to drought. Cassava provides a livelihood for over 30 million farmers and countless processors and traders all over the country with the southern states providing over 60% of the cassava produced in the country (Fig. 1).

Cassava performs five main roles: as a rural food staple, a famine reserve crop, a cash crop for urban consumption, an industrial raw material, and an earner of foreign exchange (Nweke et al. 2002). While mainly used for food, significant opportunities are available to enhance the marketing of processed products.

Unfortunately cassava has been threatened by the Cassava Mosaic Disease (CMD—caused by virus), which devastated the crop in Uganda in the late 1980s and by 1999, CMD had become a pandemic in East and Central Africa, causing up to 100% losses of the crop in many places. In Nigeria, CMD posed a serious threat with the most vulnerable areas being in the south—south and southeast states including the Niger Delta region. If CMD had been left unchecked, it could have resulted in a serious food security crisis having a major social impact throughout the region. It would also have undermined the potential to develop markets for cassava and its component products.

It is recognized that Nigeria has considerable potential to diversify the use of cassava both as a primary industrial raw material and livestock feed. The two main factors that give the country this potential have been the rapid adoption of improved cassava varieties and the development of small-scale processing technologies. In addition, among the many crops widely cultivated in southern Nigeria, research has probably made the greatest impact on cassava. Production has increased substantially over the last twenty years due to both an increase in the area cultivated and improvements in production efficiency through the introduction of high-yielding, disease- and pest-resistant cultivars.

However despite these developments, demand for cassava has mainly been for food, with a lack of agro-industrial markets posing the main constraint to the further development of the crop. Unfortunately cassava production has shown high levels of variability with cyclical gluts mainly due to the inability of markets to absorb

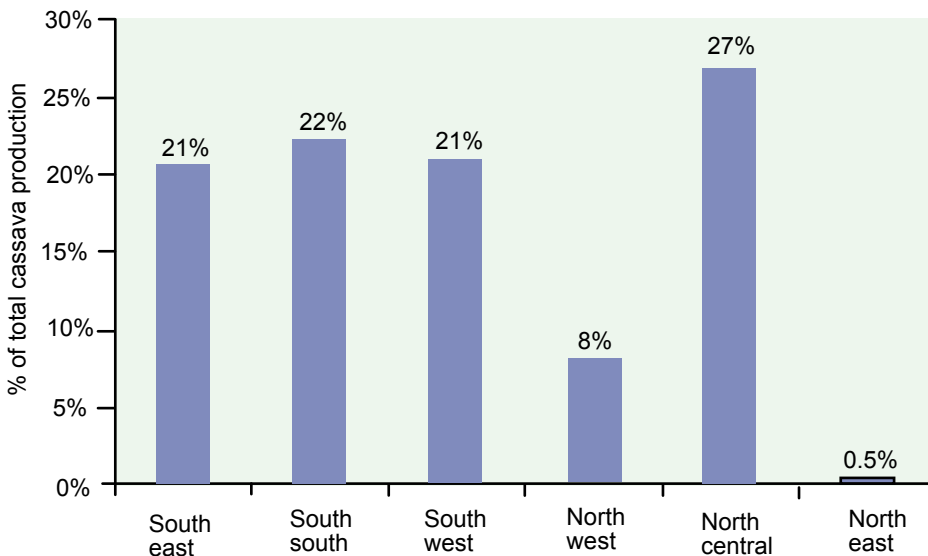


Figure 1. Contribution of cassava production by geopolitical zones.

Source: Data from PCU 2003.

supplies. Consequently prices decline sharply and production levels are reduced in succeeding years before recovering again. This has caused serious price instability over the years, which has significantly increased income risk to producers. At the same time a lack of processing options, inadequate marketing channels, and poor linkages between producers and the end-users have been major factors hindering development and preventing greater profitability for both producers and processors. It was recognized that there was great potential to generate multiple economic benefits through improved postharvest handling and processing of fresh tubers. However attaining this potential and its economic benefits has been elusive.

Cassava development initiatives

The importance of cassava to Africa's economic development for food security and poverty reduction had been highlighted by the New Partnership for Africa's Development (NEPAD) and resulted in a pan-African cassava initiative with a strong emphasis on "Cassava as a Powerful Poverty Fighter in Africa". In Nigeria, a Presidential Initiative (PI) on cassava was launched in 2002 to promote cassava not only to satisfy local demand but also to contribute to foreign exchange earnings. This PI envisaged an increased contribution of cassava as a food security crop and a major source of industrial raw material for income generation and economic development. It was recognized that this required an integrated business-orientated approach in the provision of new technologies to cassava producers and linking them to markets through sustained public and private sector support. The PI envisioned the development and organization of a commodity chain approach between stakeholders particularly farmers, processors, researchers, extension agents, marketing organizations, and training institutions.

Unfortunately the PI was threatened by the spread of a virulent variant of CMD from Uganda spreading through the Democratic Republic of the Congo, Kenya, Rwanda, Tanzania, and Cameroon. In order to prevent the potentially devastating effect, the Federal Government in collaboration with the International Institute of Tropical Agriculture (IITA), the United States Agency for International Development (USAID), and other donors (Nigerian National Petroleum Company—NNPC, Shell Petroleum Development Company—SPDC, Niger Delta Development Commission—NDDC), and the petroleum producing states initiated a pre-emptive Integrated CMD Prevention Project to address the threat in 2004 (IITA 2004). This joint effort aimed at contributing to the sustainable increase of food availability, reducing rural poverty and unemployment, and enhancing the agro-industrial and socioeconomic development of the country.

At the same time it was recognized that the development, dissemination, adoption, and extensive cultivation of improved cassava varieties by a large number of small and medium-scale producers would quickly lead to an increase in cassava tuber output. Additionally, in order to utilize surplus production and enhance levels of income and livelihoods of producers and reduce unemployment, an integrated cassava development program should plan beyond CMD prevention and encourage postharvest processing, utilization, marketing, and development of new products.

Hence the Cassava Enterprise Development Project (CEDP) was planned as a rational and complementary follow-up to the integrated CMD prevention project (IITA 2005a). CEDP was conceived as a public-private sector initiative aimed at utilizing cassava to drive the growth of rural enterprises. It was believed that these enterprises would create jobs and wealth, reduce rural poverty, expand the area under cassava production using improved cassava varieties, and grow a rural industry based on cassava. The project became necessary following the success in containing the spread of CMD with the intention that CEDP would provide a postharvest solution to the increased production resulting from the combined use of improved varieties and control of CMD.

CEDP arose from a partnership agreement between SPDC, USAID, and IITA on the CEDP in late 2003. The project operated for five years starting in 2004 and ended in 2009 with a budget over the 5-year period of US\$ 11.7 million, of which \$7.5 million came from SPDC, \$2.9 million from USAID, and \$ 1.3 million from IITA. CEDP was launched with IITA as the implementing agency with the support of the PI on cassava, to address the threat of CMD and develop processing and marketing outlets for cassava products.

The cassava enterprise development project

CEDP aimed to integrate cassava production, plant protection, postharvest storage, and processing with good marketing outlets and strategies to drive agricultural intensification, diversification, and commercialization in line with the national food security needs and poverty alleviation working with a wide range of stakeholders in existing national structures and organizations. Specifically, the aim of CEDP is to reduce the impact of CMD working in selected communities in the south–south and southeast states and to increase the productivity of cassava, and develop and expand postharvest processing and marketing outlets for cassava products.

CEDP's goal, purpose, and outputs were:

Goal: To diversify and strengthen the rural economy in selected geopolitical zones using cassava as the engine for growth.

Purpose: To increase economic opportunities through sustainable and competitive cassava production, marketing, and agro-enterprise development in selected communities of the 11 states of the southeast and the south–south geopolitical zones including the Niger Delta region (NDR).

Outputs: Three outputs were envisaged as follows:

1. Reduction in the impact of CMD through diversification, participatory evaluation, multiplication, and distribution of CMD-resistant germplasm to farmers.
2. Increased productivity of cassava through the generation, promotion, and adoption of demand driven, competitive, and sustainable cassava production.
3. Development and expansion of postharvest processing and storage and marketing outlets for cassava products

Fundamental to the achievement of these objectives was the strengthening of the human and institutional capacity of producers, processors, commodity traders, and fabricators to produce, process, and market cassava efficiently, as well as increased private sector investment in production, processing, storage, and marketing.

CEDP focused on selected communities in eleven states of the southeast (Anambra, Ebonyi, Edo, Enugu, and Imo) and the south–south (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, and Rivers) including the NDR (Fig. 2).

Project activities initially focused on a selected number of sites to develop cassava clusters. These clusters were based on a number of criteria, namely: existing and potential cassava production, land availability, presence of alternative crops, rural infrastructure, existing or proposed agroprocessing industries, and available support for cassava production and most importantly, contribution of funds by each state government and the private sector (IITA 2005b).

The primary beneficiaries were an expected 300,000 resource-poor farmers and producer groups, most of them women. Benefits expected included: an increased capacity to manage cassava production systems for higher and stable productivity; increased availability of a range of marketable cassava products; an increased creation of local employment opportunities; reduced exodus of young people to urban areas; improved rural and urban food security and livelihoods; and fostering of healthy production environments.

Secondary beneficiaries were expected to include small and medium-scale processors, fabricators, commodity traders, consumers, and private-sector agribusiness entrepreneurs involved in cassava production, processing, handling, marketing, and consumption in the cassava subsector, through increased cassava availability, demand, and commercialization.

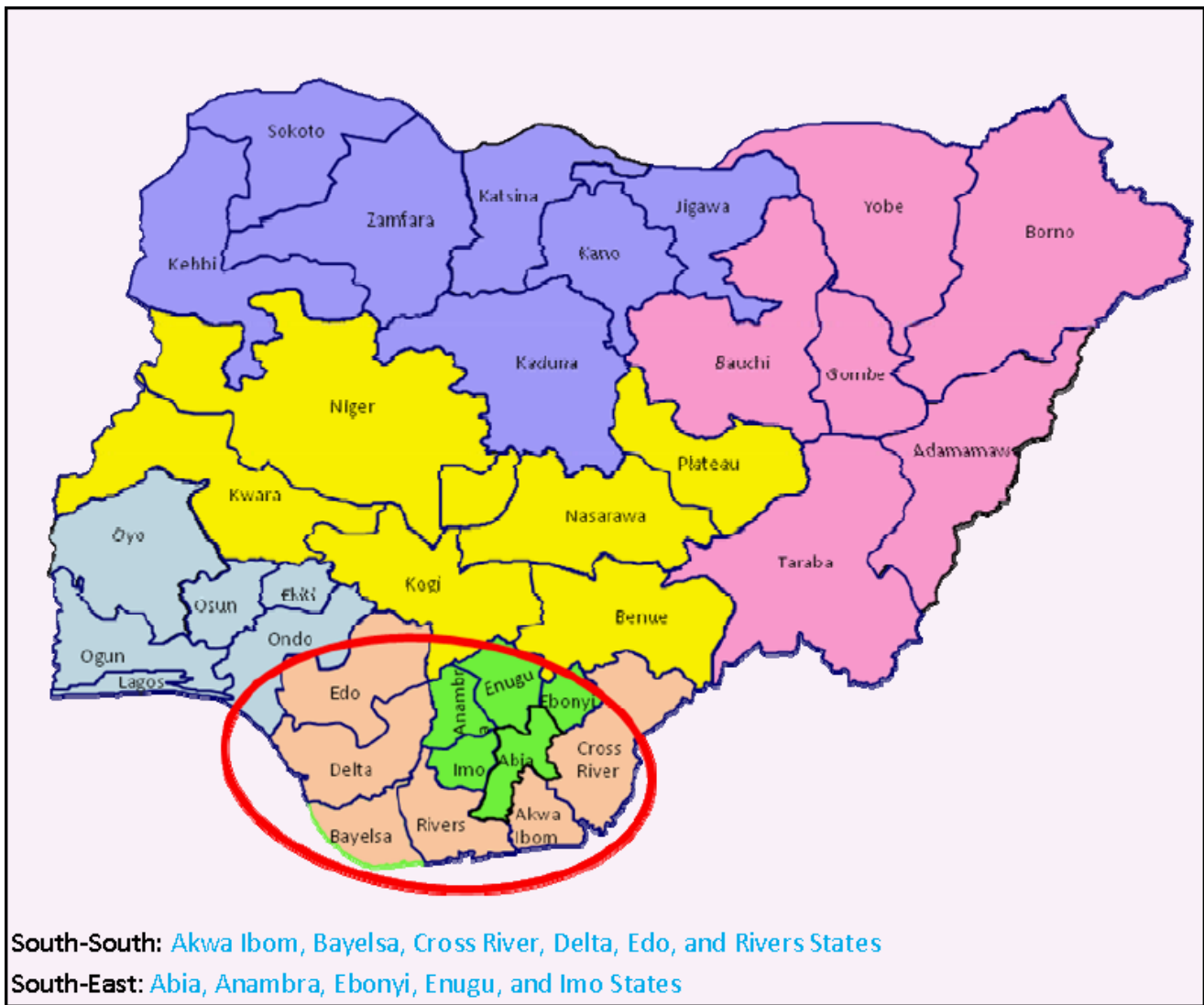


Figure 2. CEDP target states in the south–south and southeast of Nigeria.

In addition, the National Agricultural Research and Extension Systems (NARES) were also expected to benefit from international collaboration, training, and the exchange of information and genetic resources. State governments were expected to gain from domestically available raw materials for food, feed, and industries.

CEDP was based on the premise that newly introduced improved varieties would reduce the incidence of diseases and bring about increased production that would require efficient processing, value addition, and expanded marketing to turn around the economic fortunes of project beneficiaries. This would involve and benefit many stakeholders including agrodealers, weed control groups, NGOs, ADPs, NAFDAC, traders, and transporters through improved economic opportunities, job creation, and increasing incomes. At the same time increased processing activities would require improved machines to enhance efficiency. This in turn would lead to the emergence of fabricators and processors, who would also create jobs for people in local communities.

Two interlinked impact pathways (derived from Ezedinma et al. 2007), one for production (Fig. 3) and the other for processing (Fig. 4) based on the cassava value chain have been used as a framework for assessing impact.

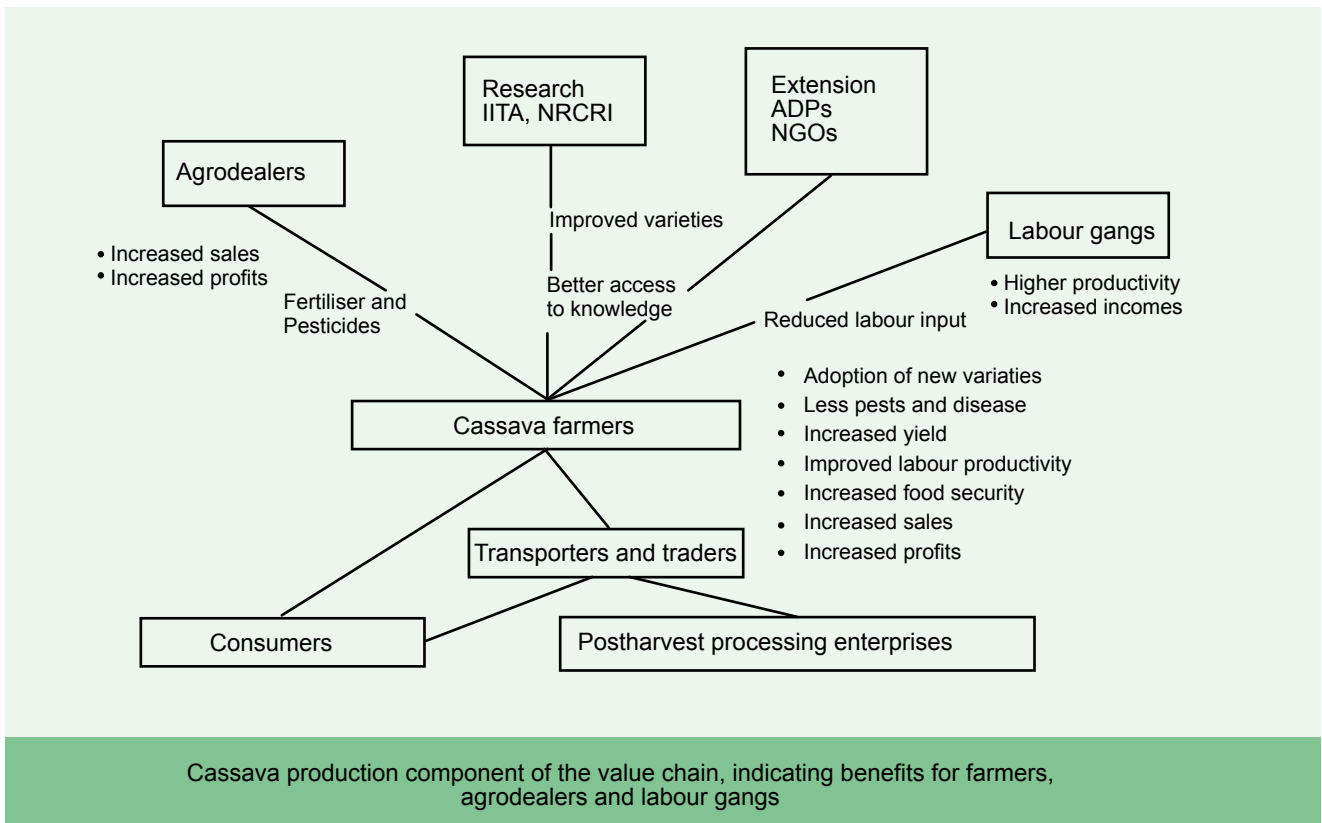


Figure 3. Cassava value chain and uptake pathways (production components).

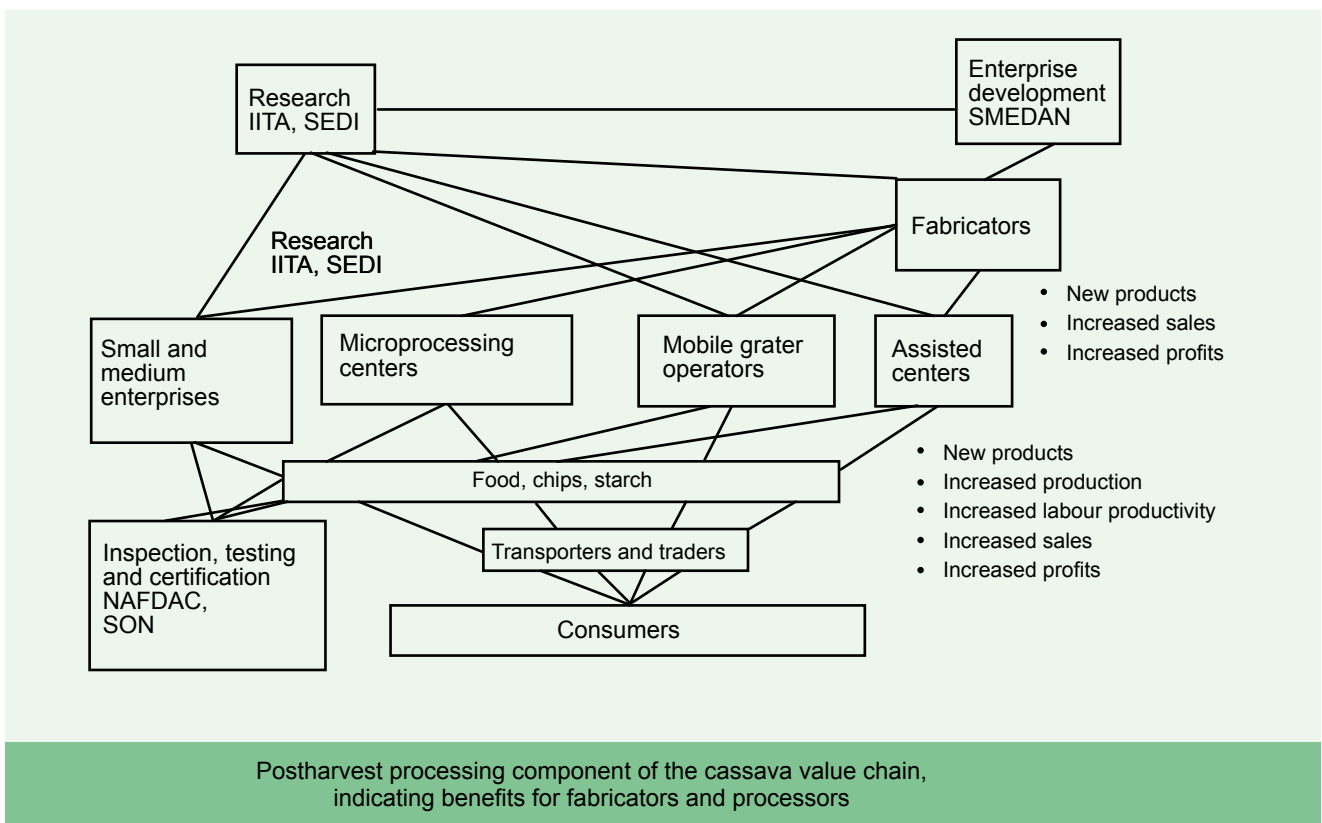


Figure 4. Cassava value chain and uptake pathways (processing components).

Assessment objectives and methodology

Assessment objectives

The purpose of this impact assessment has been to assess how the CEDP has been able to achieve its objectives and in particular how the three project outputs have contributed to the project purpose of increasing economic opportunities in the 11 participating states namely:

1. Reduction of CMD through growing of released CMD-resistant varieties by farmers in the participating states.
2. Increased production and productivity of cassava using the CMD-resistant varieties.
3. The development and expansion of postharvest processing, storage, and marketing outlets for cassava products.

Based on these intended outputs, the impact evaluation has:

- Estimated the reduction of CMD and increase in area and yields comparing local and CMD-resistant cassava varieties.
- Evaluated how effective the postharvest processing technologies deployed by the project have been and what the impact has been on the marketing of cassava and cassava products.
- Assessed the impact of the project on farmers' incomes and livelihoods.
- Identified lessons that could facilitate the better implementation of similar projects in future.

Methodology

Following an impact evaluation planning meeting at IITA's offices in Ibadan to decide the most appropriate approaches, the impact evaluation instruments were developed. These included: (i) a review of secondary data including CEDP's project proposal outlining the goal, purpose, and expected outputs and CEDP quarterly and annual reports and, (ii) the development of questionnaires and/or guidelines for discussions with each beneficiary.

After the review of the secondary data, the evaluation team (Box 1) finalized the questionnaires and checklists and undertook a detailed observation tour of the intervention sites in the 11 participating states to ascertain the extent of the impact of the project on the beneficiaries. Planning and organization of field work was undertaken at Owerri, Imo State and was immediately followed by data collection in each state (Fig. 5). Data coding was also undertaken at Owerri, with analysis and initial report writing at Ibadan. A preliminary draft based on the 11 state reports was presented to IITA management and other stakeholders. This was modified and a further draft was submitted in December 2010.



Methodology workshop, Ibadan.



Stakeholders workshop, Owerri.



South-south team A.



Southeast team C in the field.

Figure 5. Planning workshops and data collection.

Box 1. Composition of the Impact Assessment Team		
CEDP Impact Assessment Study		
Umuahia, Abia State and others		
Program (31/03/10–26/04/10)		
Date	Activity	
• Wednesday 31/03/10	• Arrival of Tarawali, Omolehin, and Okarter in Abia State	
• Thursday 01/04/10	• Meeting to finalize program and logistics • Arrival of all consultants/participants in Abia State	
• Friday 02/04/10	• Introduction and discussion of questionnaire • Group formation/allocation • Addressing logistics: vehicles, funds, modalities, etc	
• Saturday 03/04/10	• Pre-testing of questionnaire (am) • Discussion of results from pre-test (pm) • Group planning meetings (pm)	
• Sunday 04/04/10	• Consultants travel to states of operation • AOB	
• Monday 05/04/10	• Field work commences	
• Thursday 15/04/10	• Field work completed	
• Friday 16/04/10	• Team/group leaders, plus other resource persons travel to Ibadan for collation and analyses of data • Preparation of first draft of report	
• Monday 26/04/10	• Presentation of first draft to IITA	
• Wednesday 30/04/10	• Presentation of final report to donors and other stakeholders (flexible)	
Groups and Members		
A	Akwa Ibom, Cross River, and Rivers	Ben Isife (Leader), Rivers State University Tosan Fregene, University of Ibadan Cindy Faith, Cross River *Edna Akpan, IITA, Akwa Ibom *Ele-ele Uche, IITA, Rivers *Silas Basse, IITA, Cross River *Data Entry Operator (Lucky)
B	Bayelsa, Delta, and Edo	Dicta Ogisi (Leader), Delta State University Taye Olugbemi, ABU, Zaria Ike Ezeagu, UNN, Nsukka, Enugu *Patrick Ezekiel, IITA, Bayelsa/Delta/Edo *Dirisu Abdul Salami *Data Entry Operator (Shalom Peters)
C	Abia, Anambra, Ebonyi, Enugu, and Imo	Johnson Ekpere (Leader), University of Ibadan Sabass Asoegwu, FUTU, Owerri Nnemeka Ogu, Imo State *Udensi Udensi, IITA, Abia /Imo *Eze Iroche, IITA, Anambra/Ebonyi/ Enugu *Data Entry Operator (Ms Udensi)
Overall Coordination: Tarawali, Asumugha, and Okarter (IITA); Stella Emeka-Okoli (SPDC)		
Team Leader: Omolehin, ABU, Zaria		
Other resource persons/observers: SPDC: Anyim, and Lasisi		

This current document consolidates information from the 11 states (IITA 2010 and IITA 2011) into an overall assessment, and is based on re-analyzing data by IITA biometricians as well as building on the work of the earlier evaluations.

Data collection and analysis

Three teams comprising four persons in each were formed to collect the data. The first team covered Akwa Ibom, Cross River, and River states, the second team covered Bayelsa, Delta, and Edo states, and the third team covered Abia, Anambra, Ebonyi, Enugu, and Imo states.

CEDP State managers guided each team and facilitated access to the communities selected for the survey. Respondents interviewed during the survey included farmers, processors, machine fabricators, agrodealers, marketing agents, weed control groups, and industrial users of cassava and cassava products. Discussants included senior staff from NGOs, special projects, credit institutions, State Agricultural Development Projects (ADPs), the National Drug Law Enforcement Agency (NAFDAC), Government agencies, and non-farmer consumers of cassava and cassava products. Each group spent four days in each state to collect the required data.

Farmers were selected randomly and although separated into participating and non-participating farmers (Table 1), in practice it became difficult to distinguish between the two categories, since non-participating farmers regarded themselves as participating farmers as soon they adopted a new variety. Hence comparison of yields between local and CMD-resistant varieties was the main means of assessing the impact on productivity.

Data from and NFRA (2008), NAERLS and NFRA (2010), and FAOSTAT (2011) on areas, production, and yields of cassava together with those collected by CEDP (Tarawali and Okarter 2010) and the 2010 survey were also used in the assessment.

Different types of processors were also randomly selected from each state (Table 2) and owners or managers of each interviewed.

Table 1. Farmers randomly selected from sampled communities in each state.

State	Participating farmers	Non-participating farmers	Total interviewed
Abia	77	65	142
Akwa Ibom	48	58	106
Anambra	31	12	43
Bayelsa	7	6	13
Cross River	22	13	35
Delta	19	33	52
Ebonyi	17	15	33
Edo	22	31	53
Enugu	10	4	14
Imo	13	15	28
Rivers	51	46	97
Total	317	298	616

Source: Survey 2010.

Table 2. Cassava processing centers supported and processors interviewed.

State	SME	MPC	MG	AC	Total
Abia	6	13	20	1	40
Akwa Ibom	4	18	20	1	43
Anambra	3	6	19	3	31
Bayelsa	1	20	86	15	122
Cross River	4	12	9	0	25
Delta	6	14	79	9	108
Ebonyi	0	6	16	0	22
Edo	7	33	20	11	71
Enugu	2	6	19	2	29
Imo	1	9	3	19	32
Rivers	4	11	86	2	103
Total	38	148	377	63	626
No. interviewed	20	32	42	0	88
% of total	52%	22%	11%	0%	14%

SME = small-medium enterprises, MPC = microprocessing centers, MGE = mobile grater enterprises, AC = assisted centers.
Source: Survey 2010.

Senior staff of stakeholders from the private, public, and NGO sectors across the 11 states were also interviewed (Table 3).

Table 3. Other public, private, and NGO stakeholders interviewed.

Stakeholders	Numbers interviewed
<i>Private sector service providers and marketers</i>	
Agrodealers	16
Credit institutions	18
Weed control groups	13
Machine fabricators	19
Marketing agents	13
Industrial users	8
<i>Extension agents (Public, private, and NGO)</i>	
ADP	35
Other development projects	15
NGOs	28
<i>Researchers</i>	
Scientists and institutions	15
<i>Public sector</i>	
State Government	8
NAFDAC and SON	7
Non-farmer consumers	91
Total	286

Source: Survey 2010.

Data were collected through the use of both structured questionnaires and discussions using checklists administered by three teams either through interview or interactive dialog with farmers, owners of enterprises, group members, chairpersons of associations, cooperatives, and unregistered groups. Even though the questionnaires and checklists were worded in English, discussions where appropriate took place in local languages to ensure full understanding.

Data collected from farmers, processing enterprises, and non-farmer consumers of cassava were coded into a spreadsheet and analyzed using SAS statistical software. Data generated through checklists were manually analyzed. Data from both quantitative and qualitative responses were interpreted to provide evidence for making an assessment of the project on the beneficiaries. The levels of evidence were complimented by virtual evidence obtained during field observations and interactions with the beneficiaries, information obtained from the project implementation team, and the valued judgments of the teams involved.

A summary of analyzed data from farmers and processors is shown in the Annexes with summaries of this being used in the main report.

Constraints

The data collection process was constrained by time and the resources available for the team in covering the 11 states in less than two weeks. The locations of the projects were not only far apart, but even with the assistance of CEDP field supervisors, it was difficult to locate some of the selected respondents. Some respondents were unable to spare sufficient time for full interaction. Periodic harvesting and the use of different measurement units (cups, basins, bags, kg, and t) made it almost impossible to determine the yields per hectare as well as incomes and costs related to the different enterprises.

The problem of yield estimation was overcome by using both national data and actual yield estimates of harvests sampled from farmers' fields in the study areas.

Impact assessment

Reduced impact and spread of cassava mosaic disease

Development of improved varieties

To mitigate the threat of CMD, a large group of stakeholders engaged in activities that lead to cultivar substitution on farmers' fields by replacing susceptible varieties with superior genotypes that were not only tolerant or resistant to CMD but were also high yielding with high dry matter content.

In 2003–2004 and 2004–2005 multilocation trials were conducted by NRCRI researchers across different agroecologies of the country as part of the National Coordinated Research Project (NRCRP). During the same period, on farm trials, also used for farmer demonstrations, were conducted by farmers with assistance from the state ADPs using participatory varietal selection approaches with over 40 new varieties being evaluated. From data analysis of some 2500 trials a number of new varieties were released from both IITA and NRCRI. These had multiple resistances to CMD as well as other major cassava pests including bacterial blight, anthracnose, cassava green mite, and cassava mealy bug. At the same time they were high yielding and suitable for food, industry, and livestock feed. These varieties along with others evaluated are all in circulation with farmers who participated in the on-farm trials. Some are locally adapted and are now popular within those areas even though they may not have been nationally released.

In the period up to 2010, 33 new improved varieties were officially released by the Nigerian National Variety Release Committee (Table 4). Seventeen of these varieties were released up to 2004, and another 16 subsequent to this, the latter period coinciding with CEDP activities.

The agronomic and quality attributes of the most recently released varieties included: yields higher than 25 t/ha, dry matter content above 30%, and CMD resistance with an ability to satisfy the food, industrial, and livestock demands. In addition, new varieties are early maturing (10–12 months compared to 18–24 months for older varieties). The characteristics of the five varieties most popular among farmers are shown in Table 5.

Table 4. Improved cassava varieties released in Nigeria.

Year	Number	Released varieties
Pre 1990	4	NR 41044, TMS 30555, TMS 50395, TMS 30001
1990–2004	13	TMS 30572, TMS 4(2)1425, TMS 91934, NR 8208, NR 8083, NR 83107, NR 8212, NR 8082, TMS 81/00110, TMS 90257, TMS 84537, TMS 82/00058, TMS 82/00661
2005	5	TMS 97/2205, TMS 98/0505, TMS 98/0510, TMS 98/0581, and TME 419
2006	5	TMS 96/1632, TMS 98/0002, TMS 92/0326, TMS 92/0057, and NR 87184
2008	2	TMS 96/1089A, NR 930199
2010	4	NR 01/0004, CR 41-10, TMS 00/0203, and TMS 01/0040
Total	33	

Source: IITA Ibadan.

Table 5. Features of five selected varieties.

Traits	TME 419	96/1632	98/0581	98/0505	92/0326
Months to maturity	12	12	12	12	10
Root yield (t/ha)	25–40	25–45	30–45	25–40	25–41
% dry matter	36	30.5	34	33.2	30
% starch	68	65	68	67.1	62
Cyanide potential (ppm)	6.5	20	8	15	10

Source: IITA Ibadan.

Distribution of improved varieties

The deployment of the newly released improved varieties provided the basis for stimulating increased cassava production and increased rural incomes. CEDP provided and distributed these new varieties to farmers from the second year of project implementation. The distribution was initially undertaken by direct IITA distribution from multiplication locations often operated by ADPs, after which farmers increasingly sold or gave planting material to neighbors and friends.

A total of 680 farmers (51% male and 49% female) with an age range of 14–83 years were interviewed across the 11 states. Most (82%) were married with the majority (63%) having secondary or higher education. Nearly all (99%) reported that farming was the main source of their livelihoods, with trading (24%) and civil servant positions (9%) also being important. Nearly all (99%) reported that they were growing cassava with 57% growing an improved variety, although 73% were aware of new varieties and 66% aware that new varieties could control CMD. Those growing CMD-resistant varieties had been growing them for more than four years. More detail across states is shown in Annex 1.

Most respondents (89%) reported that they had sourced at least some of their planting material from IITA. Other reported sources included the ADPs (19%) and increasingly other farmers, family, or friends (20%) with relatively little being accessed directly from NRCRI (Fig. 6), although this did vary considerably between states (Annex 2). Other sources included provision through schools, churches, village markets, and NGOs.

It was observed that stem sales and gifts of CMD-resistant and high-yielding varieties became a business for beneficiaries with income being generated through sales of cuttings (Fig. 7) with over 10% of farmers selling cuttings in the first three years of the project, but dropping to less than 5% by the fifth year. In the second year over 30% of farmers reported making gifts of cuttings, but dropping to around 15% in the fifth year as the availability of improved varieties increased, probably due to increased availability of new stems. Involvement of large-scale processors with the recent launching of the Cassava Transformation Agenda has led to a wide demand for improved varieties nationwide.

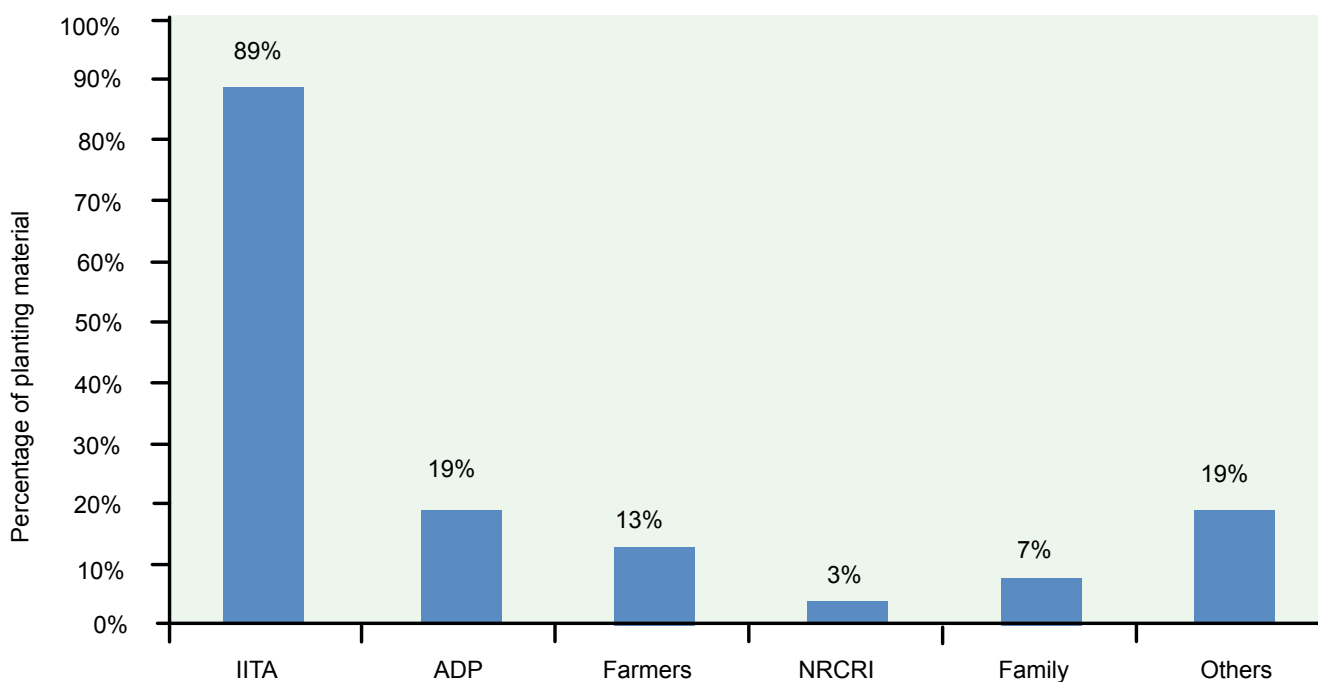


Figure 6. Sources of planting material.



Stem supply in bundles.



Stem supply in bundles.



Off-loading stems for farmers.



Stem supply in sachets.

Figure 7. Percentage of farmers reporting sales and gifts of cassava cuttings across states.

Figure 8. Loading and packaging of improved planting materials.

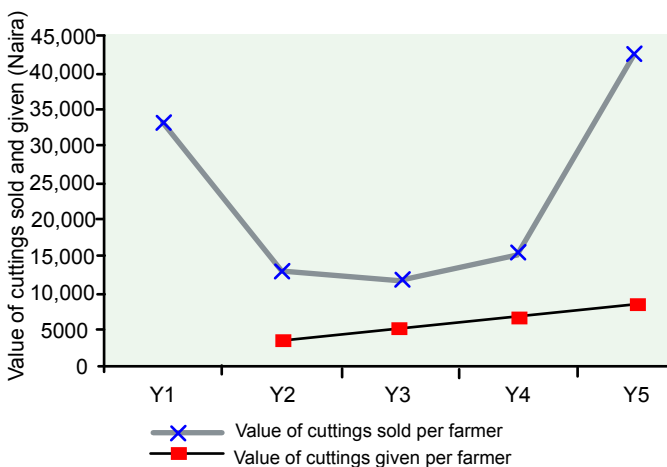


Figure 9. Mean value of cuttings sold and given per farmer across states.

Typically a bundle of cassava stems sells for between N350 and N500 in the project states. Based on a value of N400 per bundle, the value of cuttings sold by those reporting sales decreased from over N30,000 in the first year to under N15,000 in the second, third, and fourth years before recovering to over N40,000 per year (Fig. 9). The reason for the recoveries is attributed to fewer farmers selling, but those doing so gaining reputations for providing disease-free improved planting material. Over the same period the value of cuttings gifts also gradually increased although the percentage of farmers providing

gifts declined. This could also be due to increased awareness and opportunities for the sale of stems through emerging markets from large-scale processors, and Government-led programs. There was however considerable variation between states, which is shown in Annex 3.

Increased cassava productivity

Over 12,000 farmers, extension workers, and processors were trained on commercial cassava production techniques, processing, and utilization, enterprise development, and environmental hygiene (Tarawali and Okarter 2010). Farmers were also linked to service providers, such as chemical companies, tractor-hiring services, and microcredit schemes. Weed control groups were formed in collaboration with Syngenta in all the senatorial districts of each state, as a means of providing reliable weed control services for farmers and creating employment especially for young people.

CMD-resistant cassava areas grown

The project targeted a total area of 17,400 ha of new varieties being grown within five years and reported that 19,185 ha had been planted by the time the project had been completed. This

achievement was attributed to the multiple approaches used for distributing CMD planting material, not only directly to farmers but through schools, faith-based organizations, farmer associations, and civil and youth organizations as well as directly to farmers from community squares (Fig. 9). The distribution was then supported by extension agent and farmer training on good management practices.



Onne, Rivers State.



Secondary School, Nenwe, Enugu State.



Farmers' defied rain to collect stems.



Women scrambling for stems.

Figure 10. Distribution of improved planting materials.

The survey shows that 99% of those interviewed reported growing cassava, with 57% indicating that they were now growing improved varieties. Although the median area for cassava production before and after CEDP was 3.5 ha, the area of local cassava reduced by 0.5 ha, a 25% reduction over the project period. Over the same period the areas of CMD-resistant cassava increased also by 0.5 ha, an increase of 33%. The number of farmers reporting cultivation of local varieties reduced by 33% and those cultivating improved varieties increased by 37% (Table 6).

Although the total area of cassava produced remained the same before and after CEDP, the area of other crops cultivated increased by 0.5 ha, a 22% increase, while the area of fallow reduced by 33%, indicating intensification of land use. Analysis shows some differences between male and female farmers but these are not considered significant. Differences between states are shown in Annex 4.

Reduction in CMD

The high demand for improved planting materials and consequently, the spread of improved varieties in farmers' fields has reduced the incidence of CMD. The additional care taken by farmers to plant cuttings from healthy plants, whenever they used stems from their old fields emanated from on-farm trainings, organized for numerous farmers, on the sanitation of planting materials and good nursery management. Consequently most farmers were able to readily identify the major diseases of cassava and have coined names that they can easily remember such as "Cassava AIDS" for CMD. Farmers are also largely aware that any disease or pest that affects cassava leaves also reduces tuber yields. They are aware that these diseases and pests can be carried from one location to another through stems, hence the need for sanitation and good field management so as to produce healthy and high quality cassava planting materials. Field surveys undertaken in 2005 (Ogbe et al. 2005) showed that 74% of cassava fields had been planted either solely with newly introduced CMD-resistant cassava varieties or mixed with other improved and moderately CMD-resistant varieties, or a mixture of CMD-resistant and local varieties. On average, the activities of CEDP had reduced the severity of CMD by 20% between 2003 and 2006 with some states that had previously had severe infestations in 2003 now being either clean of the virus or only mildly affected in 2006, indicating that the introduction of the new varieties was limiting the spread of the disease.

Table 6. Areas planted to local and CMD-resistant varieties, other crops, and fallow before and after CEDP (ha).

Before and after CEDP	Gender	Local cassava		CMD-resistant cassava		Other crops		Fallow	
		n	Median	n	Median	n	Median	n	Median
Before	Male	263	2	130	1.5	96	1.5	70	4
	Female	257	1.5	110	1	100	1	80	2.5
	Total	520	2	240	1.5	196	1.3	150	3
After	Male	164	2	187	2	90	2	87	2
	Female	186	1	141	2	90	1.4	96	2
	Total	350	1.5	328	2	180	1.8	183	2
Change	Male	-99	0	57	0.5	-6	0.5	17	-2
	Female	-71	-0.5	31	1	-10	0.4	16	-0.5
	Total	-170	-0.5	88	0.5	-16	0.5	33	-1
Percentage change	Male	-38%	0%	44%	33%	-6%	33%	24%	-50%
	Female	-28%	-33%	28%	100%	-10%	40%	20%	-20%
	Total	-33%	-25%	37%	33%	-8%	38%	22%	-33%

Source: Survey 2010.

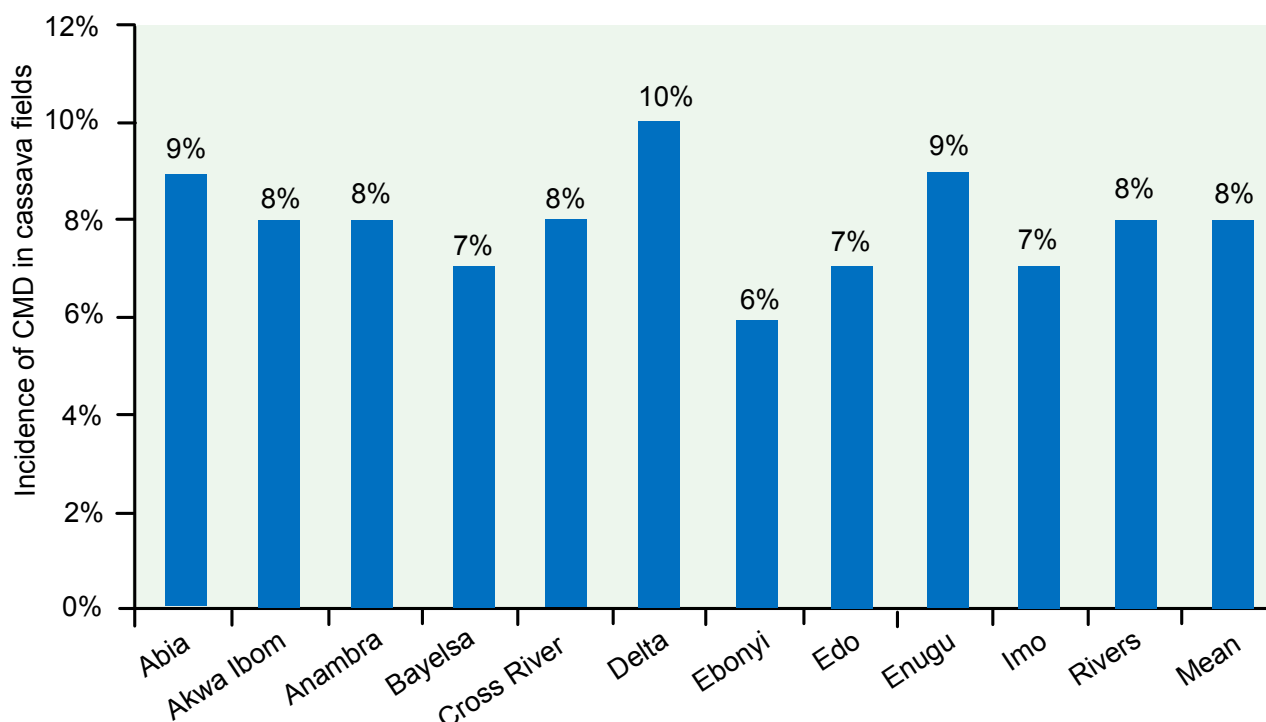


Figure 11. Incidence of CMD in cassava fields.

Source: CEDP report 2009.

In 2009 a further survey was undertaken to consider the incidence of CMD in farmers' fields using a score for the percentage of CMD appearance on cassava fields. This indicated that the appearance of CMD in farmers' fields averaged around 8% (Fig 11).

Data from the impact assessment survey showed that 73% of farmers reporting awareness of the new varieties and 66% awareness of their resistance to CMD. The mean length of time for growing CMD-resistant varieties was reported as being over five years with a range from 3.5 to seven years.

Yields assessments

In order to assess yield changes a number of sources have been examined. This includes NFRA and FAO statistics as well as CEDP yield estimates and those made during the 2010 survey.

National statistics

NAERLS and NFRA (2011) national statistics show a steady increase in total yields from 28 million t in 1999 to 31 million t in 2004, an increase of 2% per annum over the period. From 2004 to 2010 total production increased to over 50 million t an increase of 9% per annum nationally over this period (Fig. 12).

While yield per ha declined over the period 1999–2004 from around 12 t/ha to 10.5 t/ha, a decline of 2% per year, over the period from 2004 to 2010 yields increased to over 13 t/ha, an increase of 4% per year over the period.

This increase in total production and yield per ha differs from FAO statistics (FAOSTAT 2011) which show declines over the same period for the whole country (Fig. 13). These indicate that national cassava production peaked at just over 45 million t in 2004 then gradually declined to about 32 million t in 2009, with yields peaking at around 12 t/ha before falling back to just under 10 t/ha (Fig. 13). The reason for the differences between NFRA and FAO estimates is unclear, but FAO statistics have consistently showed lower production than national statistics since they became available in 1999 (Philips et al. 2005).

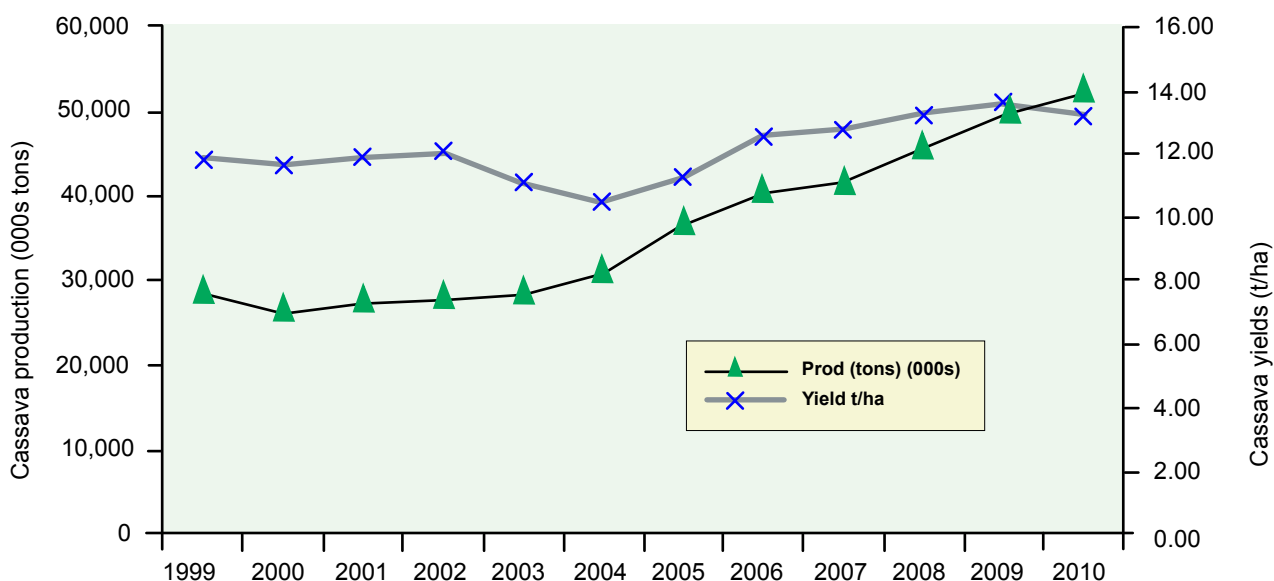


Figure 12. National cassava production and yields NAERLS and NFRA (2011).

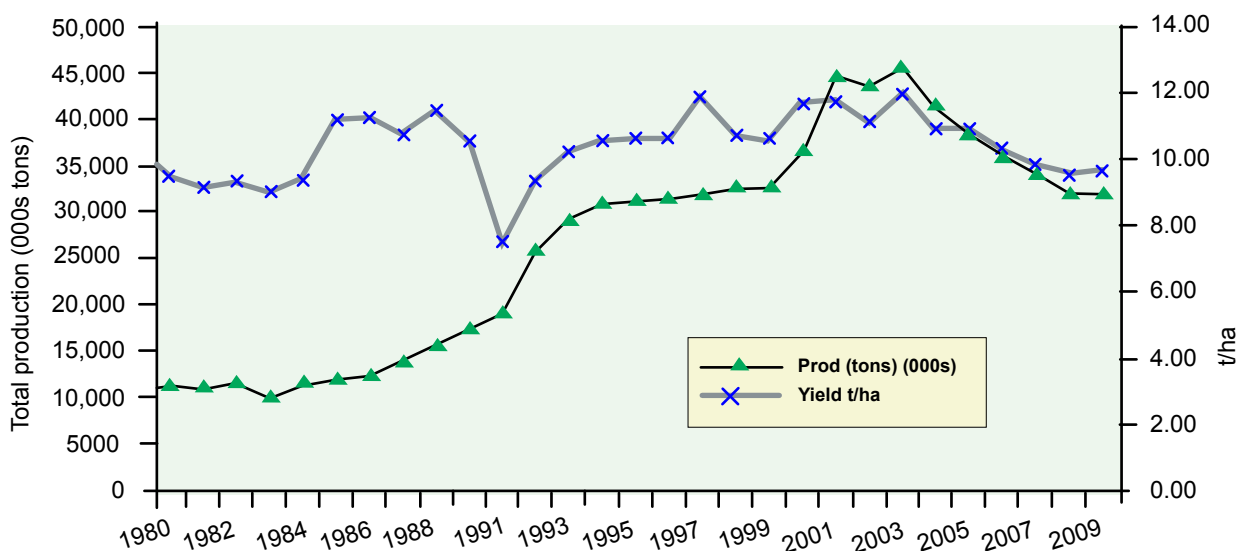


Figure 13. Nigeria cassava production and yields.

Source: FAOSTAT 2011.

For the 11 CEDP states, NAERLS and NFRA (2011) indicated that production remained static or declined slightly at around 12.5 million t in the period 1999 to 2004, when CEDP started. It then climbed steadily to over 24 million t in 2010, an increase of over 11% per year. Yields also increased steadily to over 14 t/ha in 2009, before falling slightly to 13.5 t/ha in 2010, but showing an annual increase of 1.4% over the CEDP period.

A comparison of yield estimates across the 11 states over the period 2004–2009 indicate yield increases across all states, except Abia and Imo which experienced slight declines (Figure 15). Across all the states yields increased from 11.7 to 12.7 t per ha.

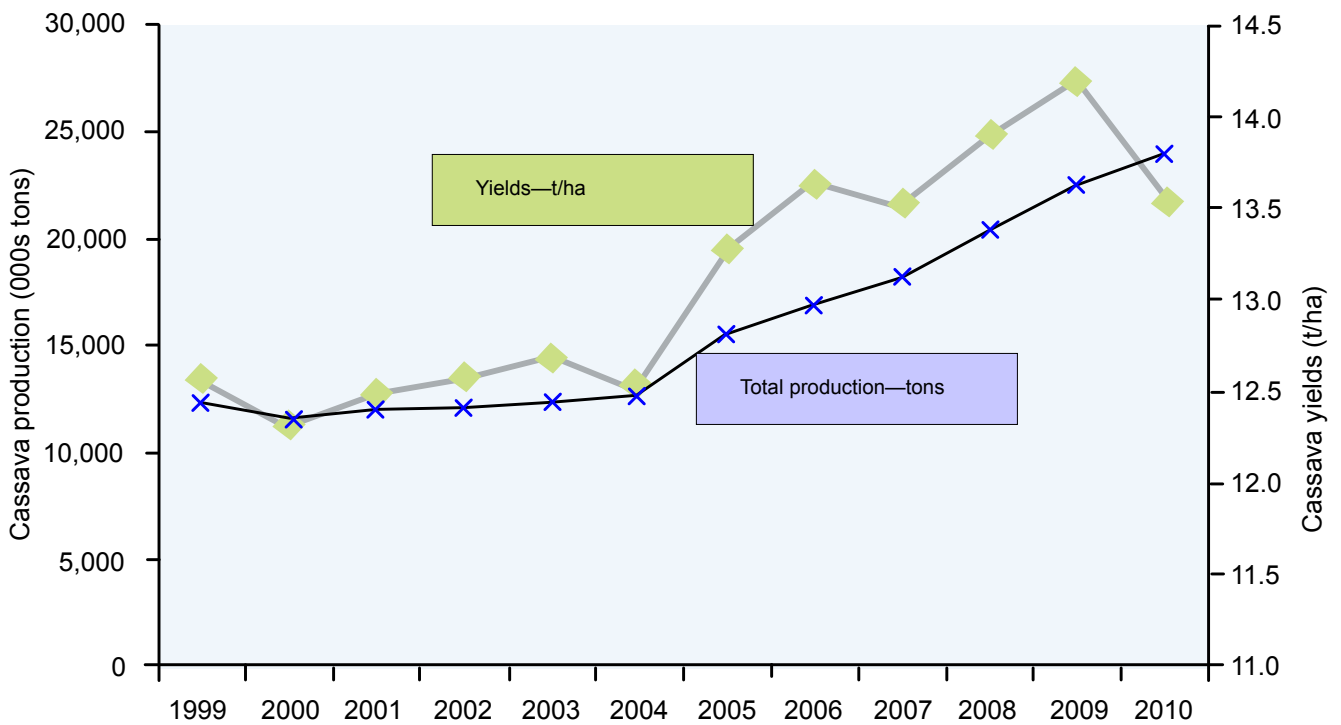


Figure 14. National cassava production and yields for the CEDP states.
Source: NAERLS and NFRA (2011).

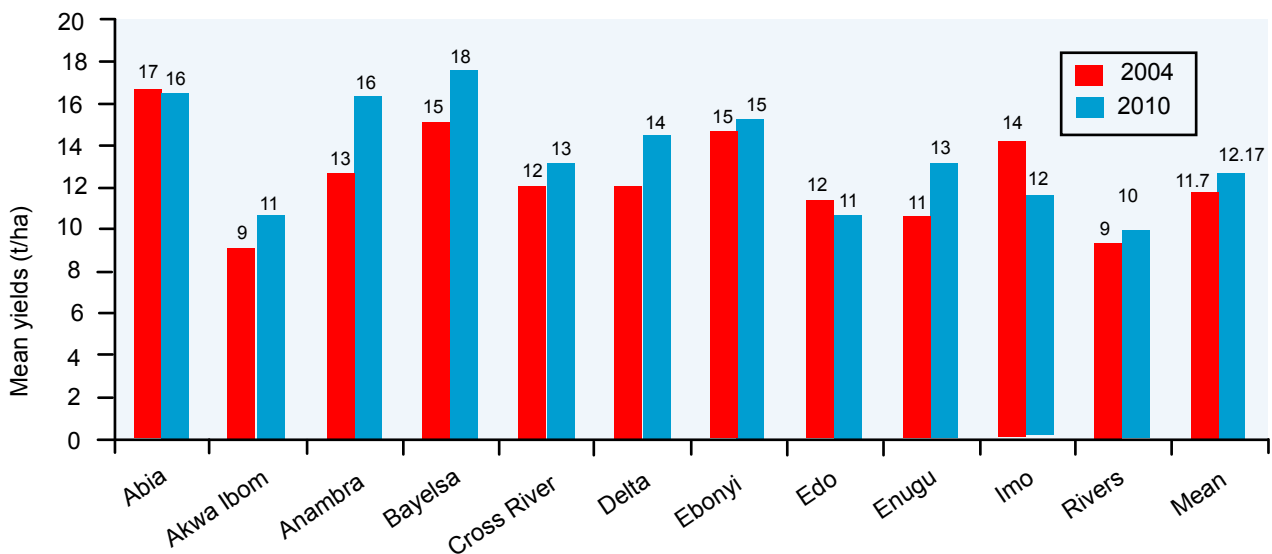


Figure 15. National cassava production and yields for each CEDP States (NFRA 2011).

CEDP estimates

Cassava yield samples obtained and measured from the fields in CEDP's baseline survey in 2004, prior to full implementation of the project showed a mean yield of about 11.2 t/ha with a range from 4 to 36 t/ha. These were slightly less than NFRA statistics for CEDP states in 2004. The low yields at that time were attributed to a lack of farmer access to inputs, especially fertilizer with very few farmers using fertilizer or herbicides for cassava. The baseline also showed that 59% of the fields surveyed were planted with local varieties and 41% planted with improved varieties. Root yields obtained from fields with only local varieties averaged 10.4 t/ha, while those with improved varieties averaged 12.1 t/ha.

Following the release of the first set of improved CMD-resistant varieties in 2005, a further survey conducted in the 2006–2007 harvest season amongst farmers growing new varieties recorded yields of over 25 t/ha. Although this survey did not include Bayelsa and Rivers states because of security reasons, another survey in 2008–2009 showed that the yield in all states had increased to 29 t/ha among participating farmers. Mean yields for each CEDP state from each of the three surveys are shown in Figure 17.



Size of tubers from local varieties.



Improved varieties.

Figure 17. Cassava yields baseline, 2006–2007 and 2008–2009.

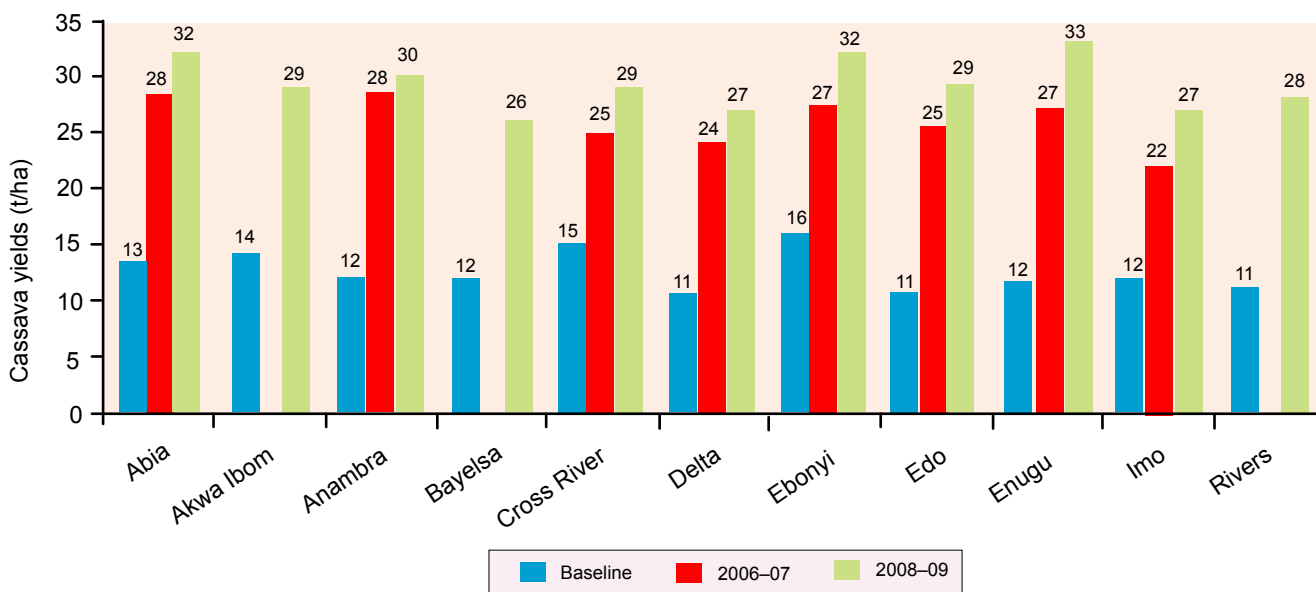


Figure 16. Sample of cassava yields from local and improved varieties.

Impact assessment estimates

Yield estimates undertaken during the impact assessment survey were derived in two ways, firstly through farmer recall (Fig. 18), and secondly by measuring yields from sample plots (Fig. 19). Those figures derived from farmer recall although inaccurate do reflect farmers' consistent perceptions of the difference between local and CMD-resistant varieties being 6 t/ha for local and 13 t/ha for improved varieties. This represented an overall 145% yield increase across states of CMD-resistant varieties over local ones.

Sampled yields from fields in each state showed a mean increase from 12 to 29 t/ha (Fig. 17), an increase of 138%, very similar to farmers percentage yield increases. The increase was lowest in Akwa Ibom (106%) and highest in Imo (223%).

Local variety yields are similar to both baseline and national yield estimates of 2004, while estimates of CMD-resistant varieties are similar to CEDP project estimates of 2008–2009.

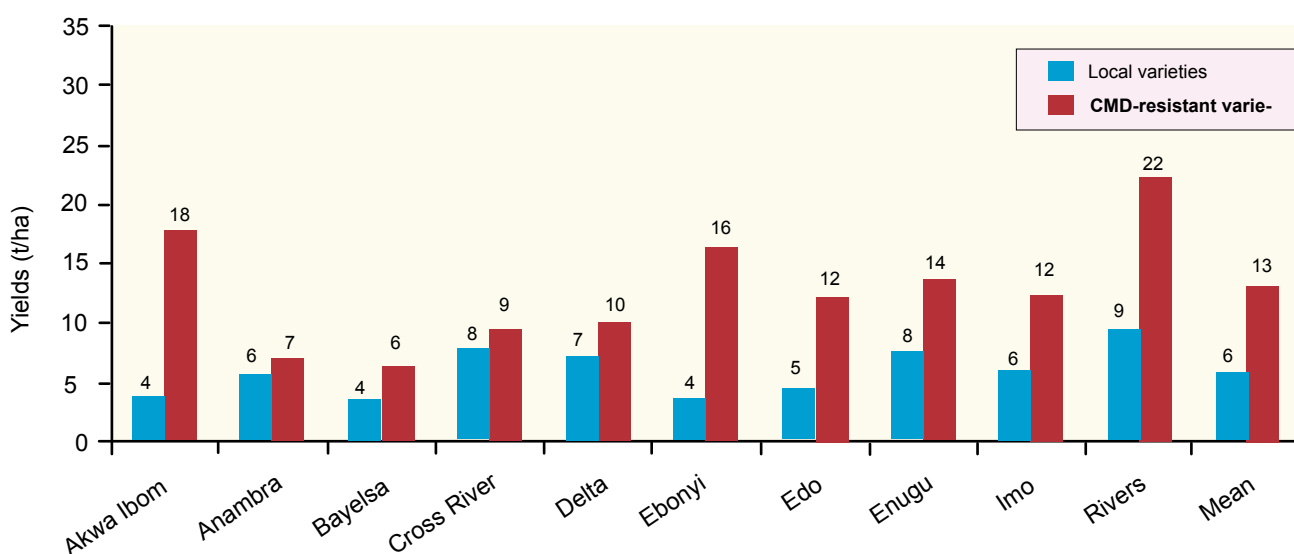


Figure 18. Farmers' perceptions of local and CMD-resistant cassava yields.

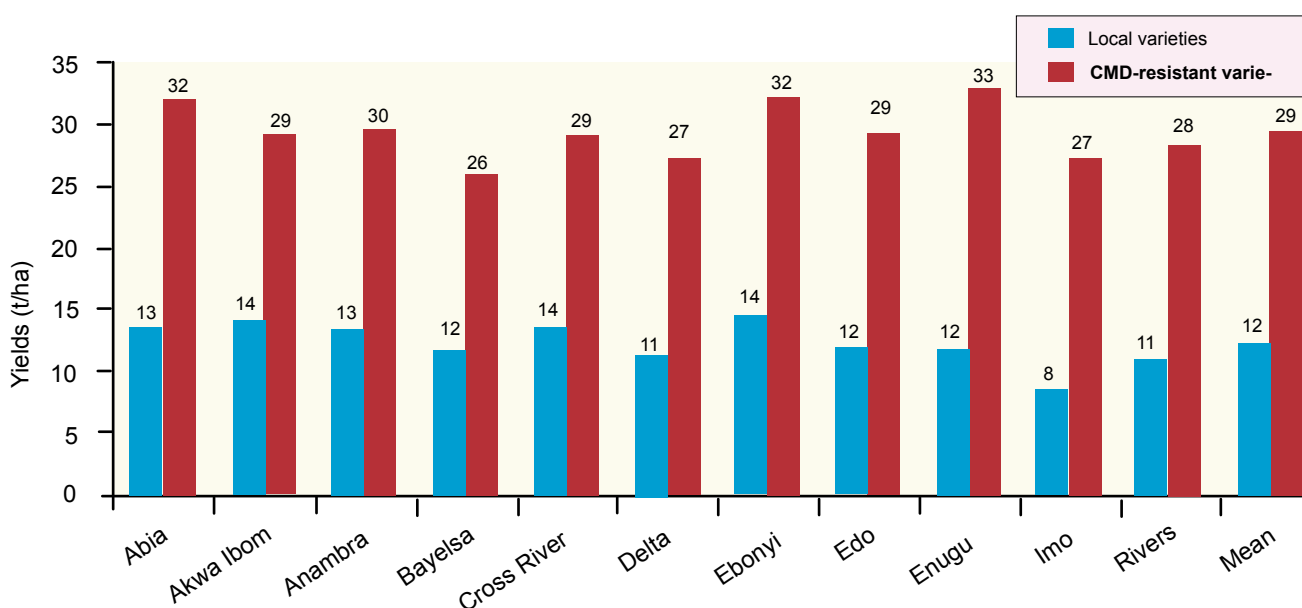


Figure 19. Measured yields from sampled fields of local and CMD-resistant cassava yields (2010).

Farmer incomes from cassava production

Gross incomes: Gross incomes per ha have been determined based on the measured yields shown in Figure 16 and an average price of Naira 20 per kg being farmers' valuation. This indicates a mean gross income across states of ₦580,000 per ha for improved varieties compared with ₦245,000 for local varieties; an increase of 189%.



Training of farmers on planting.



A well-established cassava field.



Sale of stems.



Sale of roots to processing centers.

Figure 20. Facets of the cassava value chain system in CEDP states.

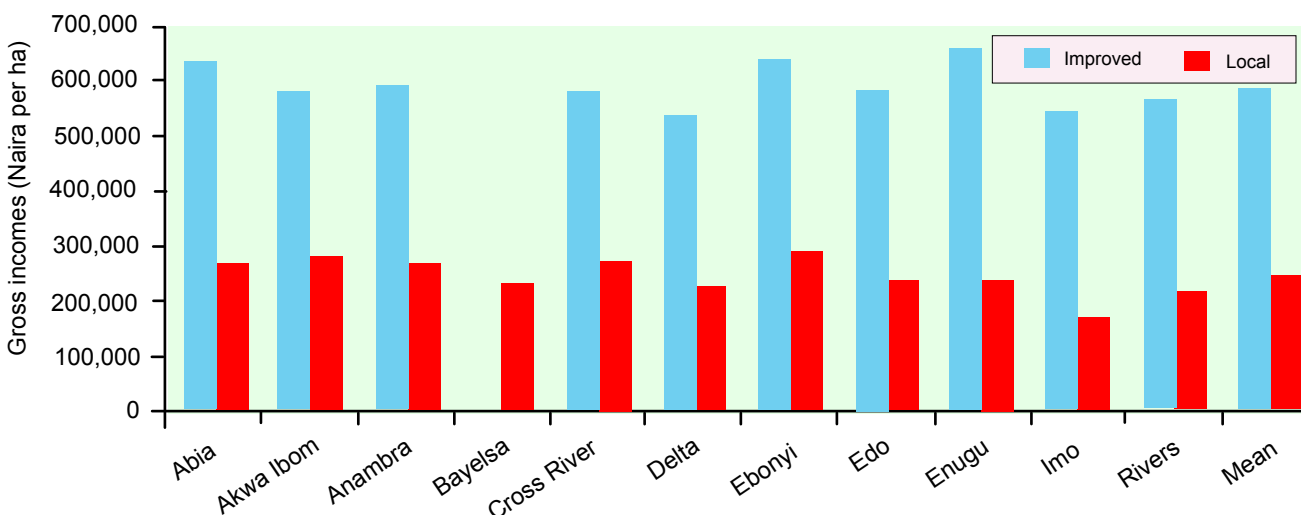


Figure 21. Comparison of gross incomes from local and CMD-resistant cassava based on measured yields.

Costs of production: Farmers were asked to compare the production costs of local and CMD-resistant cassava varieties. As could be expected there was very wide variation between states and farmers for many reasons including difficulties in area measurement, a wide variation in actual areas planted, use of both household supplied and purchased inputs, and lack of awareness of costs between planting and harvest. The figures shown in Table 7 are the median across states and can be regarded as farmers' perceptions of costs. They show an increase of 22% in producing CMD-resistant cassava with male respondents indicating a 9% increase and female respondents a 22% increase, although this cost difference is not considered significant. This is likely to be due to use of improved varieties, better management practices with greater use of fertilizer and herbicides, and consequent higher labor requirement during harvest due to increased yields.

Production costs across states as reported by farmers are compared in Figure 22. These show an increase in all states except Cross River. The mean cost of growing improved cassava is ₦91,000/ha compared with ₦74,525 for local varieties; a 22% increase. Although some costs are likely to have increased especially if more fertilizer or agrochemicals were used, the higher costs are also likely to reflect a higher level of management given to the improved varieties.

Table 7. Median of farmers' estimates of production costs of local and CMD resistant varieties of cassava (N/ha).

Cassava variety	Gender	Planting material	Land preparation	Planting	1 st Weeding	Fertilizer	Fertiliser Application	2 nd Weeding	Harvest	Other	Total
Local varieties	Male	8500	18,000	11,000	15,000	12,000	4000	11,000	10,000	4000	93,500
	Female	5400	12,000	6000	9000	10000	4000	8000	6000	5000	65,400
	Both	6000	15,000	8000	10,000	10,000	4000	10,000	7000	4525	74,525
CMD-resistant varieties	Male	7500	20,000	12,000	14,000	14,000	5000	12,500	10,000	5000	100,000
	Female	7550	15000	8000	10000	10050	4000	10000	9000	5500	79,100
	Both	7500	18,000	10,000	12,000	12,000	4000	12,000	10,000	5500	91,000
Increase	Male	-1000	2000	1000	-1000	2000	1000	1500	0	1000	6500
	Female	2150	3000	2000	1000	50	0	2000	3000	500	13700
	Both	1500	3000	2000	2000	2000	0	2000	3000	975	16475
Percentage change	Male	-12%	11%	9%	-7%	17%	25%	14%	0%	25%	9%
	Female	40%	25%	33%	11%	1%	0%	25%	50%	10%	22%
	Both	25%	20%	25%	20%	20%	0%	20%	43%	22%	22%

Source: Survey 2010.

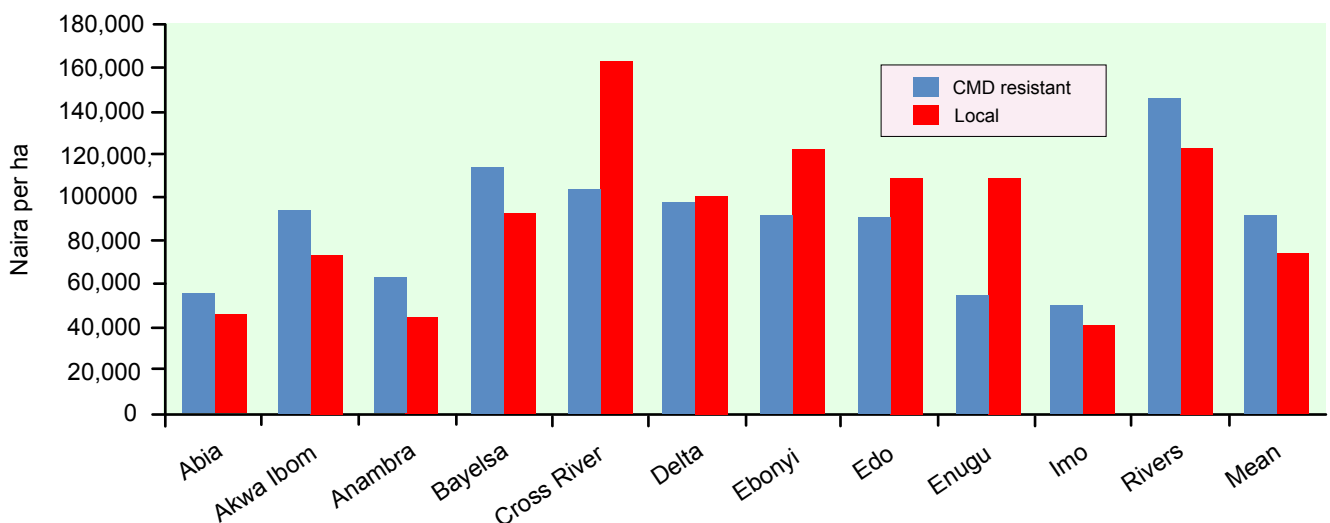


Figure 22. Farmer reported production costs of local and CMD-resistant cassava yields (2010).

Net incomes: The net incomes or gross margins across states are shown in Figure 23, all of which show substantial increases for improved over local varieties, the mean showing an increase of over ₦300,000/ha; a 189% increase.

Benefit: cost ratios. A comparison of the benefit: cost ratios between production of local and improved varieties (Fig. 24) shows a substantial improvement across all states, the mean showing more than a 100% improvement.

Farmer livelihood improvements

Almost all (97%) of respondents indicated that poverty had been reduced, food security improved, and incomes increased as a result of CEDP’s interventions (Table 8).

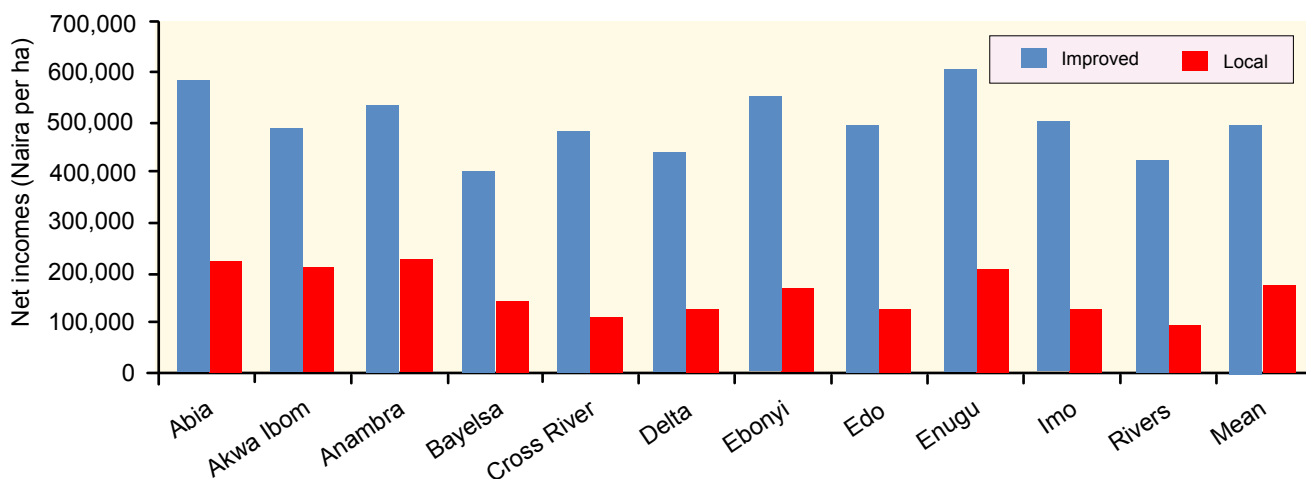


Figure 23. Comparison of net incomes from local and CMD-resistant cassava based on measured yields.

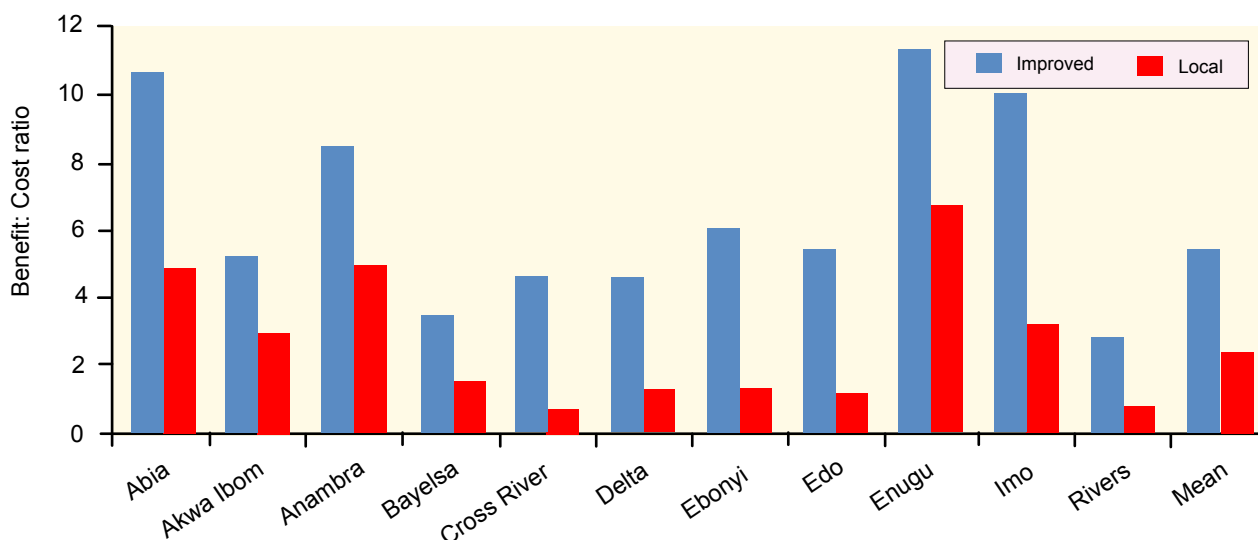


Figure 24. Comparison of benefit: cost ratios from production of local and CMD-resistant cassava.

Table 8. Percentage of farmers reporting reduced poverty, improved food security, and increased incomes.

	Abia	Akwa Ibom	Anambra	Bayelsa	Cross River	Delta	Ebonyi	Edo	Enugu	Imo	Rivers	Total/ mean
Reduced poverty	96%	97%	100%	100%	88%	100%	100%	100%	100%	91%	96%	97%
Improved food security	96%	98%	100%	100%	89%	100%	100%	100%	100%	92%	96%	97%
Increased incomes	96%	97%	100%	100%	90%	94%	100%	100%	100%	92%	100%	97%

Source: Survey 2010.



Bags of gari.



Peeled tubers.



Snacks.



Dairy cattle.

Figure 25. Transportation and utilization components of the cassava value chain in CEDP states.

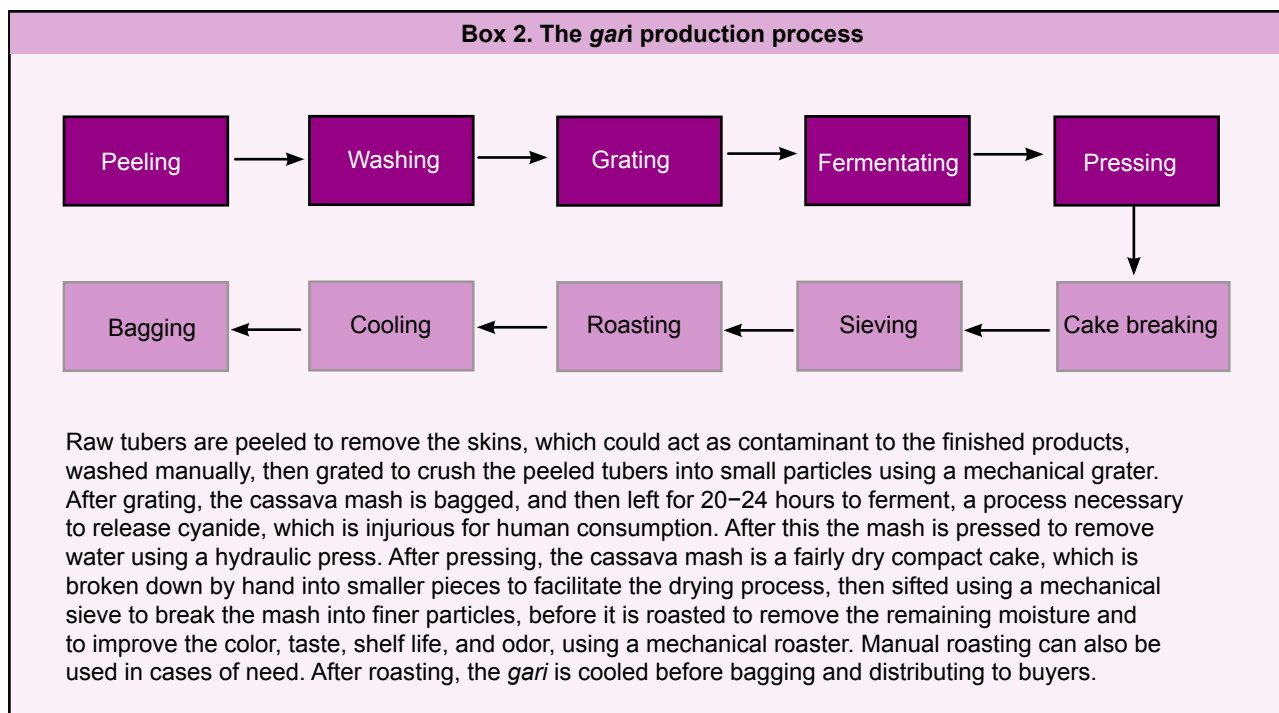
Development of postharvest processing and marketing

CEDP established and supported 626 rural-based groups and individuals in cassava processing with four types of income generation categories (Table 2). These included:

- 32 *Small to medium-scale cassava processing enterprises* (SMEs), each of which has a capacity to produce two t/day of dry matter, targeted at either private individuals or groups of investors.
- 148 *Microprocessing centers* (MPC), each of which has a capacity to process 1 t/day of dry matter targeted at poor but organized groups (mostly women's groups).
- 377 *Mobile graters* (MGs) targeting the youth and which have a capacity to half a ton per day of dry matter.
- 63 *Assisted Centers* (ACs), which were existing processing facilities similar to MPCs run by local groups, which were supported through training and/or the provision of one or two items of better equipment, such as presses, graters, fryers, or sifters. Each had a capacity of 1 t/day of dry matter, similar to the MPCs.

The criteria for eligibility for support followed a process, guided by a needs assessment based on mobilization of potential groups and their ability to provide some commitment to “their” enterprise. For MPCs and SMEs, this commitment varied from the provision of a floored foundation to a complete building. Thereafter, CEDP provided and installed processing equipment, based on need, followed by training in on-farm production product development, agro-enterprise/business training, and group cohesion skills. Finally the plant was commissioned and handed over to the group, with the building and the equipment being provided as a loan. MG beneficiaries contributed 10% of the total cost of the MG. AC groups had already made their investment by owning their centers, thereby committing themselves to the assistance provided. Products sold by the MPCs and SMEs include *gari*, odourless *fufu* flour (a new product), high quality cassava flour, tapioca (a new product), and *kpokpo gari*. The basic *gari* making process is shown in Box 2.

IITA's Business Development Services training included product development, information and mobilization,



Microprocessing center, Cross River.



Small/medium enterprise, Akwa Ibom.



Mobile grate enterprise, Enugu.



Assisted center, Beyelsa.

Table 9. Equipment provided for processing.

Equipment and daily capacity	SMEs 2 t	MPCs 1 t	MGs 0.5 t
Engine	1	1	1
Grater	1	1	1
Press	1	1	—
Sifter	1	1	—
Fryer	1	1	—
Grinder	1	1	—
Rotary Dryer	1	—	—
Flash Dryer	1	—	—
Cabinet Dryer	1	—	—
Building	1	—	—
Septic Tank	1	—	—

Source: Survey 2010.

advice on building construction, machinery installation, and enterprise development which covered business advice given to processors during visits and trainings. The training sessions included *Starting a new Cassava Business, Enterprise Management, Book and Record keeping and Marketing, Equipment and General Factory Maintenance and Hygiene, and Product Diversification and Development*.

CEDP reported that by project completion, 86% of the 626 processing centers were functioning effectively with the equipment provided (Table 9). It is our hope that the State and Local Governments, and community leaders through Shell will sustain this effort.

Of the 88 processors interviewed, 20 were SME



Procured a motorcycle.



MGE beneficiary.

Figure 26. Outcomes from the CEDP interventions.

beneficiaries, 32 MPC, and 42 MG. Most (85%) were individually owned and 15% group owned. Those interviewed included 98 males and 51 females with an average age of 49 years; most of whom had secondary or higher education. Most reported farming as the main activity. Further detail is shown in Annex 1.

The majority (97%) of the processors also grew cassava in most cases (83%), an improved variety, often being sourced through IITA. Benefits associated with growing the new varieties over local ones included higher yields (31%), earlier maturity (27%), resistance to CMD (26%), and better flour and *gari* (13%). Commodities produced included *gari, fufu*, and flour. A minority (27%) processed cassava produced on their own farms. Further detail is shown in Annex 2.

The main benefits from processing activities were reported as being drudgery reduction (18%), faster processing (18%), improved hygiene (17%), and the new technologies provided, as well as acquisition of the machines. Other benefits included business training (11%) and the provision of links to credit institutions (5%). The main training benefits included the provision of knowledge on machine operation (36%), knowledge on maintenance (33%), others being group formation (15%) and joint ownership of assets (12%). Further detail is shown in Annex 3.

Most reported increased incomes (98%), an increased market (95%), and increased sales (95%). The mean revenue, costs, and net income varied



Giving testimony—maintaining home.



Award winner.

Table 10. Days worked, customers, revenue, costs, and net income per week.

		SME	MPC	MGE
Days worked	Per week	5	5	5
Customers	Per week	18	18	10
Revenue	₦ per week	155,861	11,606	2131
Repairs	₦ per week	7300	1300	1500
Labor	₦ per week	31,950	5271	1538
Net income	₦ per week	134,600	92,665	3818

Source: Survey 2010.

as expected for each processing type, with weekly incomes being greatest for SMEs (₦134,600) compared with ₦92,655 for MPCs and ₦3818 for MGs (Table 10).

The mean number of days worked across all processor types was five although this varied from

2–7 depending on the season and supply of cassava, rather than the demand. The mean number of customers buying produce was 18 each for SMEs and MPCs and five for MGs.

Employment created

The total number of work opportunities created by the processors has been estimated at just over 14,000 (Table 11). This includes employment for peelers, packers, and field workers. The total is based on the mean number of jobs for each processor type applied to the total number of processors supported including ACs. A total of 25% of the work opportunities created were for permanent positions (12% for males and 13% for female) and 75% were part-time (20% for males and 55% for females).

CEDP other stakeholders benefits

Other stakeholders who have benefitted either

Table 11. Employment created by processors.

Type	Mean			Total for all						
	SME	MPC	MGE	SME	MPC	MGE	AC	Total	Percent	
Male—full time	5	3	2	190	444	754	315	1703	12%	
Female—full time	8	4	1	304	592	377	504	1777	13%	
Male—part time	6	10	2	228	1480	754	378	2840	20%	
Female—part time	23	16	8	874	2368	3016	1449	7707	55%	
Total	42	33	13	1596	4884	4901	2646	14,027	100%	

Source: Survey 2010.



Jobs for widows in a processing center ,



Youth employment in a bakery,



Factory workers (loading bags of HQCF into a trailer).



Agripreneurs.

Figure 27. Different types of employment.

directly or indirectly from or contributed to CEDP included the private sector service providers, marketing agents and industrial users, extension agents, researchers, the public sector, and consumers. Representatives of each of these groups were interviewed and their views reported.

Private sector service providers, marketers, and industrial users

Agrodealers

In this study, 16 agrodealers were interviewed across eight states, their average age being 40 years with a range of 24–63. All but two of the 16 were male. Most sold a wide range of agri-inputs suitable for cassava production, including knapsack sprayers, agrochemicals, fertilizer, and implements. Their main source of inputs was from larger wholesalers or dealers or sometimes directly from importers. Eleven of the 16 (68%) were aware of CEDP activities, and reported that as a result the number of their customers, sales, and income had increased (Table 12), although they were unable to indicate the extent. All indicated that they were making a profit from sale of agri-inputs.

Agrodealers on average reported employing four full-time and six part-time employees with an average of 18 customers per week.



Agrodealers.



Weed control group.



Tractor.



Fertilizer.

Figure 28. Agrodealers and service providers in project states.

Table 12. Agrodealer estimates of employees, customers, sales, and income.

State	Employees full time	Employees part time	No of customers per week	Gross sales per week	Income per week	Gross sales per year	Profit from agri-inputs
Abia	2	2	8	37,500	6000	175,750	10,000
Akwa-Ibom	10	20	10	35,000	75,000	1,300,000	65,000
Anambra	1	2	8	7750	6750	60,000	12,500
Bayelsa	3	10	28	17,500	18,500	380,000	11,500
Delta	3	2	8	80,000	80,000	20,000,000	200,000
Ebonyi	1	1	5	10,000	2000	120,000	8000
Edo	4	3	24	86,000	86,000	1,600,000	300,667
Enugu	6	10	50	460,000	68,750	29,100	200,000
Mean	4	6	18	91,719	42,875	2,958,106	100,958
Minimum	1	1	5	7750	2000	29,100	8000
Maximum	10	20	50	460,000	86,000	20,000,000	300,667

Source: Survey 2010.

Weed control groups

Members of 13 weed control groups across eight states provided information on their activities. Group size varied from two to 22 people, the smaller ones being largely males but the larger ones being mixed gender. Ages ranged from 15 to 45, largely with secondary education and mostly with other income sources such as farming or trading. Twelve of the 13 groups provided both hand and chemical weed control options with just one undertaking hand weeding. The weed control groups had received training in the use and application of agrochemicals from a variety of sources including IITA, ADPs, and agrodealers as well as other members of the group. Glyphosate was the most commonly applied chemical, but other herbicides were also used.

The cost of establishing a weed control business as estimated by respondents was N18,053 with a range depending on group size from just over N4000 to over N60,000 with the acquisition of sprayers being the highest cost item (Table 13). The cost and the income of providing weed control services according to the respondents varied greatly with a mean cost of N30,269 and a net income of N5600 per ha. These wide estimates are attributed to the fact that the gangs/groups used other units to estimate costs. Likewise the area covered each week varied greatly. Notwithstanding all gangs indicated that it was a profitable business that was appreciated by farmers. At the same time group members indicated that the availability of profitable work had reduced problems of loitering, fighting, militancy, stealing, and drunkenness amongst group members.

Table 13. Weed group own estimates of costs and returns for weeding services (Naira).

State	Sprayer costs	Chemical costs	Water	Protective clothing	Total	Estimated cost per ha	Net income per ha	Area (ha) per week	Income per week
Abia	46,000	4504	50	11,100	61,654	56,220	10,000	20	200,000
Akwa-Ibom	12,000	2000	10	–	14,010	125,000	2400	7	16,800
Bayelsa	250	2500	120	1500	4370	8370	4000	80	320,000
Cross-River	18,000	1500	80	2500	22,080	13,400	3900	240	936,000
Delta	800	6500	150	1200	8650	10,000	7000	16	112,000
Edo	6000	8600	360	3000	17,960	14,660	14,000	20	280,000
Enugu	3500	–	500	4000	8000	13,000	3000	30	90,000
Rivers	5000	1200	–	1500	7700	1500	500	5	2500
Mean	11,444	3829	181	3543	18,053	30,269	5600	52	244,663
Min	250	1200	10	1200	4370	1500	500	5	2500
Max	46,000	8600	500	11,100	61,654	125,000	14,000	240	936,000

Source: Survey 2010.

Credit institutions

Individuals from 18 different credit institutions were interviewed across all states. These ranged from small microcredit institutions to larger banks that had extended credit to farmers (Fig. 29). The average time they had been offering credit to agriculture was 12 years with a range from 3 to 35 years. Sixteen of the 18 gave credit for cassava production with the number of farmers receiving credit reported as averaging just over 1800, ranging from ten to over 10,000. The credit provided per farmers ranged from N5000 to N150,000. Fifteen of the 18 also provided credit to processors for production of *gari*, *fufu*, and starch.

Loan repayments were averaging 74% ranging from 40% up to 100% between credit providers. All indicated



Microcredit schemes (North–South Development) Cassava Endowment Fund Committee (FGN/NARCDB)

Figure 29. Finance and microcredit partners in Nigeria's cassava value chain sector.

that the loans provided had helped to increase production and processing profits the range being from 15% up to 95%, with a mean of 60%.

Machine fabricators

Nineteen machine fabricators (18 male and one female) with an average age of 44 years (ranging from 29 to 62) all involved with CEDP were interviewed across all states (Fig. 30). Their education levels included no formal education (1), primary education (4), secondary education (6), and post-secondary education (6). They had been involved in fabricating equipment for an average of 14 years (ranging from 5 to 33 years). Training had come from a variety of different sources including IITA, ADPs, local engineering companies, and UK-provided training. The range of equipment fabricated included peelers, graters, presses, dryers, and chippers, all of which were regarded as being profitable businesses.

All 19 reported having learnt new skills resulting from their involvement with CEDP. This had provided new confidence and new knowledge, and an ability to provide better quality machinery. Fourteen of the 19 reported improved skills, and increased production capacity and sales. Sixteen reported increased incomes with 18 of the 19 reporting operating profitability. Average incomes per month had increased from N216,000 to N977,000, an increase of over 300%. All indicated that CEDP had contributed to improving their businesses.

Six of the fabricators reported belonging to a Cassava Machine Fabricator Association, which provided links to other fabricators. Benefits from membership included access to new ideas, new technology, and publicity to help with marketing. Three fabricators reported exporting machinery to Cameroon and Cotonou, this being valued at ₦768,000 (ranging from ₦15,000 to ₦2,250,000) per annum.

Currently six people on average are employed by each fabricator ranging from zero to 16, a total of 114 employees amongst the 19 fabricators. All reported having apprentices currently learning machine fabrication,



Fabricators.



Branded mobile graters.

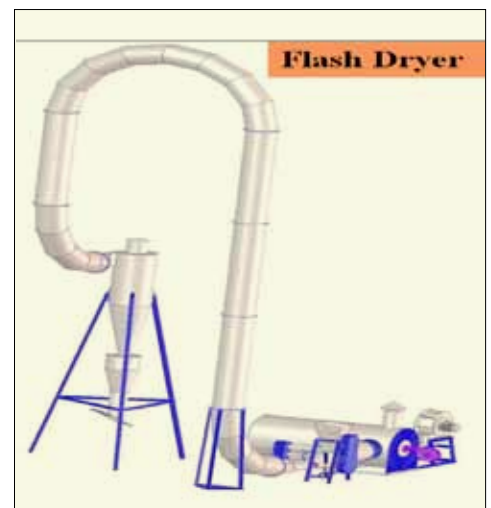


Figure 30. Equipment fabricators and samples of their cassava processing machines.

an average of seven individuals with a range of between 2 to 28. On average 20 had already graduated with a range of between 2 to 90, a total of 380 graduate apprentices.

Marketing agents

Thirteen marketing agents (five male and eight female) with an average age of 40 years ranging from 25 to 62 across all states were interviewed. Levels of education included two with no formal education, three with primary education, two with secondary education, and five with post-secondary education. The mean of years of marketing experience was 11 ranging from two to 38. Five described themselves as wholesalers, four as retailers, and two as bulk traders. Five of the 13 were aware of the CEDP project describing the main benefits as increased cassava production (5), more products available on the market (6), and larger quantities of processed goods on the market (6).

Those selling raw cassava obtained their product from their own farm (5), other farms (3), and from designated village collecting points (1), with none buying from sellers in village bulk markets or collection points near farms. Units used for purchase included basins, bags, and baskets as well as kg and t¹. Gross sales per week were reported as being on average ₦24,289 and net revenue ₦18,800.

Processed cassava products sold included *gari*, *fufu*, tapioca, and starch which were all purchased at local markets and then sold at the farm gate (2), own shop (2), district market (2), and urban market (8) with units of sale being cups, basins, and bags as well as kg. All 13 considered buying and selling cassava and cassava products a profitable business and those aware of CEDP had benefited from its activities. The 13 knew of 161 people (average 17 each) who had started this kind of business. The major problem identified was lack of credit.

Industrial users of cassava and cassava derivatives

Individuals representing seven industrial users of cassava product initiatives operating between 1992 and 2006 were interviewed. Products included cassava flour and starch used in the production of *gari*, *fufu*, cassava chips, bread, buns, and cakes. All reported increased use of cassava resulting in increased utilization of their existing facilities with six of the seven indicating an expansion or establishment of other factories. All reported that the market for cassava had increased with the widening of cassava-based products indicating that their sales had increased. All reported acceptability all over the country with four of the seven reporting acceptability outside Nigeria. One of the seven reported exports. Employment had increased with the average employment being 28 individuals (14 male and 14 female). This ranged from three to 50 people across the industries. The seven industrial users employed a total of 196 individuals.

Extension agents (public, private, and NGOS)

ADPs

Thirty-five ADP members of staff across the states were interviewed, of whom 90% were aware of the CEDP, with more than 700 ADP staff reported as being involved with the project. All those interviewed indicated that the project had added relevance to their organization with over 90% indicating that the ADP was in a better position to serve farmers than in the past. This was due to improved knowledge, direct participation, and the training provided. Over 90% also reported that the project had added to their job satisfaction with over 45% ranking their job satisfaction as excellent compared to only 2% before the commencement of CEDP. A total of 74% of respondents reported that CEDP had improved their experience with extension activities with 80% indicating that this would help to sustain project benefits in the future.

Nongovernment organizations

Individuals representing 28 NGOs (initiated between 1998 and 2007) were interviewed. Twenty-two of

¹These multiple units for purchase and selling of products have made the determination of income and expenditure from cassava products not possible in this survey.

the 28 had been involved with CEDP in various roles—15 in sensitization, five in advocacy, 17 in on-farm demonstrations, and another five in other direct implementation activities. Nineteen indicated that they had played an important role in scaling out CEDP benefits with all indicating that as a result of their participation, their organizations had a stronger relationship with host communities. Seventeen also indicated an improved relationship with their donors with 13 indicating that donor support had increased as a result.

Other development projects

Individuals from 15 other development projects were interviewed. These included the IFAD/FGN Cassava Initiative, RTEP, NPFS, and Women-in-Agriculture. Eleven of the 15 indicated that they had been associated with CEDP for a period of five years benefitting through demonstrations and on-farm trials, the increased availability of new cassava varieties, the establishment of processing centers, and the availability of new cassava products particularly flour for use in bread making. Most also indicated that they had contributed to scaling out CEDP benefits.

Research institutions

Fifteen scientists representing those research institutions working with CEDP were interviewed. These included state universities and NRCRI. All worked with cassava; some as their sole mandate crop, others more generally as multi-crop research activities. All 15 scientists indicated that their institutions had been active participants in CMD/CEDP research with CEDP facilitating training, workshops, and research funding. Six of the 15 reported involvement in CEDP planning meetings. Beneficiaries included undergraduate and postgraduate training with degrees being awarded, 1731 at BSc level, 227 at MSc level, and 70 at PhD level and another 60 scientists and technicians also benefitting. Fourteen of the 15 respondents indicated that they had benefitted through sponsorship to attend conferences, reporting 25 journal papers, 18 proceedings, and six other publications. A full list of publications is shown in Annex 8.

Public sector

State government

Individuals from eight State Ministries of Agriculture were interviewed. All were aware of CEDP and indicate that the project had been successful making a significant contribution to improving cassava production in their states and contributing to increased cassava product exports and foreign exchange earnings, with exports reported to Asia, China, and Europe.

NAFDAC

All processing centers were expected to acquire a clearance certificate from the National Agency for Food and Drug Administration and Council (NAFDAC) before officially processing and marketing cassava products. This required NAFDAC visits to the processing centers to verify that the enterprises conformed to standard hygienic/environmental practices and the products met the basic requirements for consumption. In addition NAFDAC product certification includes chemical analysis for certain elements, notably the cyanide content of cassava.

Seven individuals representing NAFDAC across seven states were interviewed. Six of the seven institutions had been working with CEDP with responsibility for inspection, registration, and monitoring the roles of processors ensuring compliance with standards for cassava products. All reported being satisfied with the standard of products indicating that the project had supported national development. Three felt that CEDP had added to the relevance of their organization and increased NAFDAC drive to increase revenue generation to cover their operating costs.

Consumers

A total of 91 consumers (60% male and 40% female) varying in age from 20 to 75 years were interviewed across the states. Over 60% reported consuming cassava on a daily basis, 25% every other day, 6% once a

week, and the rest rarely. Nearly 70% was consumed as *fufu*, 47% as *apu*, 26% as starch, 23% as *chin chin*, and 20% as boiled cassava with over 85% considering cassava-based food products being more affordable than other food items.

Fifty-eight percent of the respondents were aware of CEDP with all indicating that the project had made cassava products safer and of improved quality. All also indicated that the consumption of new cassava products had increased amongst their families and friends.

Conclusion

This impact assessment of CEDP has built on the work of earlier drafts and reports including the USAID-led mid-term evaluation in 2008, using the 2010 survey data as well as other relevant secondary data. It has endeavored to assess how the three project outputs have contributed to the project purpose of increasing economic opportunities across the 11 participating states as highlighted below:

Reduction of CMD through growing of released CMD-resistant varieties

In the period prior to 1990 up to 2010, 31 new cassava varieties were officially released by the Nigerian National Variety Release Committee, 17 being released up to 2004 and 16 after this, the latter period coinciding with CEDP activities.

- Distribution was initially undertaken by CEDP from multiplication sites managed by IITA and ADPs, after which farmers increasingly sold or gave planting material to neighbors and friends. Stem sales of new varieties became a business for over 10% of farmers generating income through sales especially in the first three years of the project, dropping to less than 5% by the fifth year. Over 30% of farmers also reported making gifts of cuttings, although this also dropped to 15% in the fifth year as the availability of improved varieties increased. Theft of improved varieties was also reported.
- High demand for improved planting materials and the spread of improved varieties in farmers' fields reduced the incidence of CMD. Field surveys undertaken in 2006 showed that 74% of cassava fields had been planted with newly introduced CMD-resistant cassava. This compares with the baseline survey, which showed that only 41% planted with improved varieties and the 2010 survey where 57% of farmers reported planting new varieties. On average, the activities of CEDP reduced the severity of CMD by 20% between 2003 and 2006 with some states that had previously had severe infestations in 2003 being either clean of the virus or only mildly affected in 2006, indicating that the introduction of the new varieties was limiting the spread of the disease. In 2009 a further survey indicated that the appearance of CMD in farmers' fields averaged around 8%.
- Ninety-nine percent of the 680 farmers interviewed reported growing cassava, with 57% indicating that they were now growing improved varieties. Although the median area of cassava grown before and after CEDP was reported as 3.5 ha, the area of local cassava had reduced by 0.5 ha, a 25% reduction over the project period. Over the same period the areas of CMD-resistant cassava increased also by 0.5 ha, an increase of 33%.

Increased production and productivity of cassava using the CMD-resistant varieties

- The project reported that 19,185 ha had been planted by the time the project had been completed.
- NFRA statistics for the 11 CEDP states indicated that production climbed steadily from 12.5 million t in 2004 to over 24 million t in 2010, an increase of over 11% per year. Yields increased steadily from 12.5 t in 2004 to over 14 t/ha in 2009, before falling slightly to 13.5 t/ha in 2010, but showing an annual increase of 1.4% over the CEDP period.
- Cassava yield measured in CEDP's baseline survey in 2004 showed a mean yield of about 11.2 t with local variety yields averaging 10.4 t/ha and improved varieties 12.1 t/ha. Following the release of the first set of improved CMD-resistant varieties in 2005, a survey conducted in 2006-7 recorded yields of over 25 t/ha for farmers growing the new varieties. A 2008-9 survey showed that the yield across states in the project areas for new varieties had increased to 29 t/ha.

- Sampled yield estimates undertaken during the 2010 survey showed yields of 12 t/ha for local varieties and 29 t/ha for new varieties, an increase of 138%.
- A comparison of the benefit: cost ratios between production of local and improved varieties showed more than a 100% improvement, with almost all of respondents indicating that poverty had been reduced, food security improved, and incomes increased as a result of CEDP's interventions.

The development and expansion of postharvest processing and marketing

- CEDP established and supported 626 rural-based processor groups and individuals in cassava processing including 32 SMEs, 148 MPCs, 377 MGs, and 63 ACs. A total of 86% of these were reported to be functioning effectively when CEDP was completed.
- Most processors also grew cassava with 83% being an improved variety, most being sourced through CEDP. Benefits reported for the new varieties included higher yields, early maturity, resistance to CMD, and better flour and *gari*.
- The main benefits from processing activities were reported as being reduction in drudgery, faster processing, improved hygiene, and the new technologies provided, as well as the availability and acquisition of processing machines. Other benefits included business training and to a lesser extent provision of links to credit institutions. The main training benefits included the provision of knowledge on machine operation and knowledge on maintenance.
- Most processors reported increased market, sales, and incomes. Most reported increased incomes (98%), an increased market (95%), and increased sales (95%). The mean revenue, costs and net income varied as expected for each processing type, with weekly incomes being greatest for SMEs (N134,600) compared with N92,655 for MPCs and N3818 for MGs.
- The total number of employment opportunities created by the processors had been estimated at just over 14,000 jobs, with 25% of these being permanent positions (12% for males and 13% for female) and 75% part time (20% for males and 55% for females).

Benefits for other stakeholders

Other stakeholders who have benefitted either directly or indirectly from or contributed to CEDP included the private sector, service providers, marketing agents, industrial users, extension agents, researchers, the public sector, and consumers.

Private sector service providers, marketing agents, and industrial users

- Most *agrodealers* were aware of CEDP activities and reported that the number of their customers, sales, and income had increased. Agrodealers on average reported employing four full-time and six part-time employees.
- *Weeding gangs* reported that weed control using herbicides, mainly Glyphosate, was a profitable business that was appreciated by farmers. Group members also indicated that the availability of profitable work had reduced the incidence of loitering, fighting, militancy, stealing, and drunkenness amongst group members.
- *Credit institutions* reported loan repayments averaging 74% helping to increase both production and processing profits. All indicated that the loans provided had helped to increase production and processing profits, the range being from 15% up to 95%, with a mean of 60%.
- *Machine fabricators* reported having learnt new skills and consequently increased production and sales through CEDP support. Most reported to be operating profitably with CEDP having contributed to improving their businesses. Average incomes per month had increased from ₦216,000 to ₦977,000 an increase of over 300%. Currently six people on average are employed by fabricators and all report having apprentices.
- Forty percent of marketing agents (wholesalers, retailers, and bulk traders) were aware of CEDP, indicating the main benefits as being increased cassava production, with more products and larger quantities of

processed goods being available on the market. All considered buying and selling of cassava and cassava products a profitable business.

- *Industrial users* reported an increased use of cassava resulting in increased utilization of their existing facilities with six of the seven indicating an expansion or establishment of other factories and new employment being created. All reported that the market for cassava had increased with the widening of cassava-based products indicating that their sales had increased.

Extension agents

- Some 700 *ADP* staff were reported as being involved with the project with all those interviewed indicating that the project had added relevance to their organization, placing the ADP in a better position to serve farmers than had previously been the case. Most also reported that CEDP had added to their job satisfaction and had improved their extension capabilities, which would enhance the sustainability of CEDP interventions and subsequent benefits in the future.
- Twenty-two of the 28 *NGOs* interviewed had been involved with CEDP in various roles—in sensitization, advocacy, and on-farm demonstrations. Most indicated that they had also played an important role in scaling out CEDP benefits and that as a result of their participation their organizations had a stronger relationship with both host communities and donors.
- Eleven of the 15 *other development projects* interviewed indicated that they had been associated with CEDP for a period of five years with their activities benefitting through demonstrations and on-farm trials, increased availability of new cassava varieties, the establishment of processing centers, and the availability of new cassava products particularly flour for use in bread making. Most indicated that they had contributed to scaling out CEDP benefits.

Researchers

The 15 scientists interviewed reported that their institutions had been active participants in research with CEDP facilitating training, attendance at conferences and workshops as well as research funding. Student beneficiaries resulted in degrees being awarded, 1730 at BSc level, 227 at MSc level, and 70 at PhD level and another 60 scientists and technicians also benefitting from training. Twenty-five scientific journal papers, 18 proceedings, and six other publications were reported.

The public sector

- Individuals from eight State Ministries of Agriculture were interviewed and were all aware of CEDP activities, indicating that the project had made a significant contribution to improving cassava production in their states contributing to increased cassava product exports and foreign exchange earnings, with exports reported to Asia, China, and Europe.
- Individuals from NAFDAC in six states reported working with CEDP and being responsible for inspection, registration, and monitoring processors to ensure compliance with standards for cassava products. All reported being satisfied with the standard of products, and that the project had supported national development. Three felt that CEDP had added to the relevance of their organization and increased NAFDAC'S drive to increase revenue generation to cover their operating costs.

Consumers

Fifty-eight percent of those interviewed reported being aware of CEDP activities and that the project had made cassava products safer and of improved quality. All indicated that the consumption of new cassava products had increased amongst their families and friends.

Looking to the future

This assessment has confirmed CMD reduction, and yield and productivity increases achieved by farmers as well as the success of many of the processing enterprises. However a number of ongoing challenges were also identified, which require support by national institutions and investors. These include a need for:

- Ongoing support to improve the capacity of the local fabricators and processors to improve business management skills to ensure the profitability and sustainability of processing enterprises.
- Improving access to inputs including credit by farmers, processing enterprises, and traders.
- Promoting appropriate mechanization to reduce labor costs.
- Resolving internal group disagreements, especially MPC beneficiaries.
- Advocating for enforcement of policies, especially the use of cassava flour in bread-making.
- Reducing the problems contributing to irregular and unreliable power supply and poor infrastructure.
- Extending the concept to other states and regions.

The full potential impact of CEDP is likely to be achieved in the five years after project closure, as and if national institutions take up the identified challenges. It would then be appropriate to reassess the sustainability of the cassava production and processing enterprises that have been established.

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Annexes

Annex 1. Socioeconomic characterization of farmers.

		Abia	Akwa Ibom	Anambra	Bayelsa	Cross River	Delta	Ebonyi	Edo	Enugu	Imo	Rivers	Total/mean	Percentage
Farmers	Participants	82	49	32	32	22	40	18	23	10	12	51	371	55%
	Non participants	61	57	11	20	13	36	14	31	4	16	46	309	45%
	Total	143	106	43	52	35	76	32	54	14	28	97	680	100%
Gender	Male	66	55	22	31	25	41	19	38	2	6	37	342	51%
	Female	77	51	21	21	10	35	12	16	12	22	60	337	49%
	Total	143	106	43	52	35	76	31	54	14	28	97	679	100%
Marital status	Single	8	14	5	3	5	3	3	4	1	3	10	60	9%
	Married	124	83	34	46	26	64	28	43	11	20	75	554	82%
	Divorce/widow	11	6	4	3	4	8	0	7	2	5	9	59	9%
	Total	143	103	43	52	35	75	31	54	14	28	95	673	100%
Age	Minimum	23	16	20	31	21	27	25	37	28	20	14	14	-
	Maximum	82	70	69	68	65	70	60	75	65	60	73	82	-
Education	No formal	8	5	3	7	1	10	3	26	4	2	8	77	12%
	Primary	40	33	13	9	12	11	7	7	5	14	14	165	26%
	Secondary	50	24	20	23	13	32	10	12	4	9	31	228	35%
	Post secondary	42	27	4	4	8	19	6	5	0	1	27	143	22%
	Adult	3	6	3	2	1	3	5	2	1	1	8	35	5%
	Total	143	95	43	45	35	75	31	52	14	27	88	648	100%
Occupation	Farming	143	105	42	52	35	75	31	54	14	27	97	675	99%
	Government	10	11	1	9	1	7	4	12		1	3	59	9%
	Trading	46	28	13	9	2	17	8	11	1	11	16	162	24%
	Teaching	4	4	1		2	6	1	1			8	27	4%
	Transporter		5		1	1	1					0	8	1%
	Other	37	27	8	14	20	25	9	6	1	4	22	173	25%
	Total	240	180	65	99	61	131	53	90	16	46	146	1127	-

Annex 2. Farming systems.

		Abia	Akwa Ibom	Anambra	Bayelsa	Cross River	Delta	Ebonyi	Edo	Enugu	Imo	Rivers	Total/mean	Percentage
Grow cassava	Yes	134	101	43	49	35	59	31	47	14	27	97	637	99%
	No	2	3	0	0	0	1	0	3	0	0	0	9	1%
Variety grown	Improved	84	55	31	32	19	31	17	27	11	15	47	369	57%
	Local	54	49	10	18	16	30	13	25	3	11	44	273	43%
Source of variety	IITA	185	60	46	31	20	44	12	29	22	16	100	565	89%
	ADP/MoA	27	11	5	19	6	34	1	7	3	5	6	124	19%
	Farmers/neighbors	43	5	0	6	5	9	0	3	1	2	7	81	13%
	SPDC Shell				3		2						5	1%
	NCRI	19	1	0						1		1	22	3%
	Family	24	6	1	3	3			4		9	3	47	7%
	Others	50	15	21	2	5	4	2	2	1	10	6	118	19%
	Total	348	98	73	64	39	93	15	45	28	42	123	962	151%
Aware of CMD varieties	Yes	114	55	36	46	26	36	19	32	10	18	61	453	73%
	No	20	41	7	3	8	23	12	22	3	9	23	171	27%
CEDP reduces disease	Yes	77	42	32	24	14	25	16	23	10	10	35	308	66%
	No	16	40	2	17	9	23	4	22	0	1	22	156	34%
Years of CMD	Years	3.4	4.3	7	4.1	4.5	4.2	5.1	4.8	3.5	4.1	3.5	4.3	
Other crops grown	Maize	115	76	38	18	19	36	21	30	11	24	60	458	67%
	Yam	117	64	30	4	30	12	30	4	6	24	76	419	62%
	Vegetables	82	69	25	24	12	14	2	14	8	19	61	305	45%
	<i>Egusi</i> /melon	57	43	8	3	10	14	7	5	7	11	29	194	29%
	Cocoyam	56	26	19	3	10	6	8	0	5	13	34	180	26%
	Okra	42	24	7	11	6	15	2	7	6	9	45	174	26%
	Plantain	4	24	2	17	4	19	2	9	0	0	20	101	15%
	Pepper	13	6	1	1		1	8	1	4	2	17	54	8%
	Oil palm	8	6	0	0	1	7	0	6	1	0	3	32	5%
	Others	48	50	34	25	35	42	27	13	24	9	61	368	54%

Annex 3. CMD cuttings given and sold.

	Akwa					Cross					Total	Mean	Male	Fe- male	%	
	Abia	Ibom	Anambra	Bayelsa	Rivers	Delta	Ebonyi	Edo	Enugu	Imo						Rivers
No. of respondents	143	106	43	52	35	76	31	54	14	28	97	679	342	337		
No. of friends told about CMD variety	77	36	25	18	13	19	16	7	10	11	41	273	148	125	40%	
no. of friends cultivating CMD variety	63	36	28	17	9	19	10	7	9	10	40	248	142	106	37%	
no of people given CMD cuttings in year 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	
no of people given CMD cuttings in year 2	59	35	28	9	12	12	7	6	7	9	23	207	120	95	30%	
no of people given CMD cuttings in year 2	52	30	23	5	8	13	8	1	8	5	18	171	96	75	25%	
no of people given CMD cuttings in year 3	40	17	24	2	6	10	6	0	6	4	13	128	76	53	19%	
no of people given CMD cuttings in year 4	26	10	15	1	2	35	2	2	2	6	5	106	41	35	16%	
Mean no of CMD cuttings given in year 1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	
Mean no of CMD cuttings given in year 2	12	10	7	4	5	6	18	2	5	6	10	-	9	10	9	
Mean no of CMD cuttings given in year 3	16	14	6	6	11	6	26	2	4	7	11	-	13	14	11	
Mean no of CMD cuttings given in year 4	21	19	7	9	20	4	35	0	5	7	13	-	17	20	14	
Mean no of CMD cuttings given in year 5	23	18	7	5	27	3	22	0	23	6	20	-	21	25	16	
No of farmers selling CMD bundles in year 1	31	5	9	3	5	8	9	0	2	1	5	78	39	39	11%	
No of people selling CMD bundles in year 2	28	10	21	0	3	5	9	0	2	2	3	83	38	34	12%	
No of people selling CMD bundles in year 3	24	6	19	2	3	2	8	0	3	3	2	72	35	27	11%	
No of people selling CMD bundles in year 4	17	5	10	0	2	1	4	0	1	1	1	42	4	21	6%	
No of people selling CMD bundles in year 5	12	1	8	1	9	0	2	0	0	0	0	23	3	10	3%	
Mean no of CMD bundles sold in year 1	11	20	11	4	49	7	54	0	1	3	102	-	83	151	15	
Mean no of CMD bundles sold in year 2	26	26	12	0	108	9	60	0	13	13	101	-	33	40	24	
Mean no of CMD bundles sold in year 3	31	37	5	8	33	14	58	0	19	19	88	-	30	30	30	
Mean no of CMD bundles sold in year 4	12	41	17	0	105	14	50	0	10	10	60	-	38	46	30	
Mean no of CMD bundles sold in year 5	191	50	7	10	0	0	35	0	0	0	0	-	107	49	152	
No of people experiencing theft of CMD cuttings	52	42	17	13	6	19	7	9	5	7	41	218	-	105	113	32%
No of bundles of CMD stolen	4	10	8	9	8	3	20	2	3	15	7	-	8	8	7	

Annex 4. Yields, income, costs, and benefit: cost ratio comparisons of CMD and local varieties (Naira per ha).

State	Yields (t/ha) ¹		Gross income ²		Costs ²		Net income		Benefit: cost		
	Improved	Local	Improved	Local	Improved	Local	Improved	Local	% Increase	Improved	Local
Abia	31.9	13.5	638,000	270,000	54,800	46,000	583,200	224,000	160%	10.6	4.9
Akwa-Ibom	29.1	14.1	582,000	282,000	94,000	72,000	488,000	210,000	132%	5.2	2.9
Anambra	29.6	13.4	592,000	268,000	62,620	45,150	529,380	222,850	138%	8.5	4.9
Bayelsa	25.8	11.7	516,000	234,000	114,300	92,030	401,700	141,970	183%	3.5	1.5
Cross-River	29.2	13.7	584,000	274,000	103,710	162,275	480,290	111,725	330%	4.6	0.7
Delta	27	11.3	540,000	226,000	97,150	101,250	442,850	124,750	255%	4.6	1.2
Ebonyi	32	14.4	640,000	288,000	90,660	121,550	549,340	166,450	230%	6.1	1.4
Edo	29.3	11.8	586,000	236,000	91,000	108,750	495,000	127,250	289%	5.4	1.2
Enugu	32.9	11.8	658,000	236,000	53,450	30,700	604,550	205,300	194%	11.3	6.7
Imo	27.3	8.5	546,000	170,000	49,700	40,650	496,300	129,350	284%	10.0	3.2
Rivers	28.3	10.9	566,000	218,000	146,500	122,000	419,500	96,000	337%	2.9	0.8
Mean	29.3	12.3	586,182	245,636	91,000	74,525	495,182	171,111	189%	5.4	2.3

¹Based on measured yields, ²Based on a tuber value of N20 per kg, ³Based on farmer recall.

Annex 5. Socioeconomic characteristics of processors.

		Total reported in survey				Percentage			
		SME	MPC	MG	Total	SME	MPC	MG	Total
Processors supported	Total	38	148	377	563	7%	26%	67%	100%
	Number interviewed	20	32	42	94	34%	18%	10%	14%
Ownership	Group	2	8	4	14	10%	25%	10%	15%
	Individual	18	24	38	80	90%	75%	90%	85%
Gender	Male	11	21	66	98	55%	70%	67%	66%
	Female	9	9	33	51	45%	30%	33%	34%
Marital status	Single	2	5	5	12	10%	17%	12%	13%
	Married	1	23	35	59	5%	77%	83%	64%
	Divorce/widow	17	2	2	21	85%	7%	5%	23%
Age	Mean	54	47	45	49				
	Minimum	40	21	24	21				
	Maximum	72	75	76	76				
Education	No formal	0	1	1	2	0%	3%	2%	2%
	Primary	0	2	4	6	0%	6%	10%	6%
	Secondary	0	5	21	26	0%	16%	50%	28%
	Post secondary	2	11	16	29	10%	34%	38%	31%
	Adult	18	13	0	31	90%	41%	0%	33%
Main source of income	Farming	7	14	34	55	35%	56%	77%	62%
	Government	1	3	2	6	5%	12%	5%	7%
	Trading	0	1	2	3	0%	4%	5%	3%
	Teaching	0	2	2	4	0%	8%	5%	4%
	Other	12	5	4	21	60%	20%	9%	24%

Annex 6. Processor sources of cassava and benefits of CMD-resistant varieties.

		Total interviewed				Percentage of total			
		SME	MPC	MG	Total	SME	MPC	MG	Total
Grow cassava	Yes	19	28	42	89	95%	93%	100%	97%
	No	1	2	0	3	5%	7%	0%	3%
Variety grown	Improved	18	23	34	75	95%	77%	83%	83%
	Local	1	7	7	15	5%	23%	17%	17%
Source of variety	IITA	16	18	20	54	67%	69%	30%	47%
	ADP/MoA	5	6	13	24	21%	23%	20%	21%
	Farmers/neighbors				0	0%	0%	0%	0%
	SPDC Shell				0	0%	0%	0%	0%
	NCRI	2	1	0	3	8%	4%	0%	3%
	Family				0	0%	0%	0%	0%
	Others	1	1	33	35	4%	4%	50%	30%
	Matures early	8	18	22	48	18%	30%	30%	27%
	Resistant to CMD	11	14	22	47	24%	23%	30%	26%
	Higher yields than local	12	17	26	55	27%	28%	35%	31%
CMD resistant variety benefits	Better flour or gari	10	11	2	23	22%	18%	3%	13%
	Other	4	0	2	6	9%	0%	3%	3%
	Total	45	60	74	179	100%	100%	100%	100%

Annex 7. Benefits reported by processors.

		Total reported in survey				Percentage			
		SME	MPC	MG	Total	SME	MPC	MG	Total
CEDP processing benefits	Machine acquisition	11	15	25	51	16%	18%	17%	17%
	Less drudgery	11	18	24	53	16%	21%	16%	18%
	More hygienic	14	12	25	51	20%	14%	17%	17%
	Faster processing	12	16	25	53	17%	19%	17%	18%
	Many new technologies	8	10	26	44	12%	12%	17%	15%
	Business training	7	9	16	32	10%	11%	11%	11%
	Links to credit	4	4	7	15	6%	5%	5%	5%
	Other	2	0	1	3	3%	0%	1%	1%
	Total	69	84	149	302	100%	100%	100%	100%
Training benefits	Knowledge on machine operation	11	22	28	61	33%	37%	37%	36%
	Knowledge on maintenance	11	18	27	56	33%	30%	36%	33%
	Group formation/working together	4	11	11	26	12%	18%	14%	15%
	Joint ownership of assets	4	8	8	20	12%	13%	11%	12%
	Other	3	1	2	6	9%	2%	3%	4%
	Total	33	60	76	169	100%	100%	100%	100%
Process from own farm only	Yes	4	8	11	23	20%	27%	32%	27%
	No	16	22	23	61	80%	73%	68%	73%
Increased incomes	Yes	19	28	42	89	95%	97%	100%	98%
	No	1	1	0	2	5%	3%	0%	2%
Increased market	Yes	19	27	40	86	95%	93%	95%	95%
	No	1	2	2	5	5%	7%	5%	5%
Increased sales	Yes	19	27	40	86	95%	93%	95%	95%
	No	1	2	2	5	5%	7%	5%	5%

Annex 8. List of publications and public relation activities.

Journal papers

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Television and Radio 2007

NTA periscope (Policy on 10% inclusion of cassava flour in bread; Featured R. Okechukwu, M. Akoroda; Postharvest handling of food crops; featured Maziya-Dixon, Paul Ilona, and C. Okonkwo)

NTA Special: Weekend file (Research for Development; featured R. Okechukwu)

Television for the Environment (TVE) London; interview R. Okechukwu on Orphan crops.

Osun State news media; interview T. Babaleye, R. Okechukwu, S. Ajala, and B. Maziya-Dixon.

Awards

Okechukwu, R.U.: Time News 2007 Leadership in Nigeria: Education Merit Award for Leadership and entrepreneurial excellence, April 5, 2007.

CEDP collaborators in Bayelsa State bagged best cassava processor of the year award, and best crop farmer of the year award, 16 October 2007 during the World Food Day.

Tarawali, G. : Merit Award from Rural Widows & Orphans Foundation, 26 January 2008.

Invited lectures

Okechukwu, R.U.: Agribusiness information point and business management, organized by IFDC/MISTOWA July 13, 2007.

Okechukwu, R.U.: Breeding data analysis at EARRNET.

Key visitors to IITA-Ibadan Cassava project in 2007

- Liberia Minister of Agriculture
- Oyo State Commissioner of Police
- Acting USAID Mission Director
- Several private investors
- Malawi farmers
- Nigeria Starch Mills
- UNIDO consultants, August 2007
- Zambian farmers, 4–12 Sept 2007
- IFAD consultant, 17 Sept 2007

CEDP Project reports and documents:

Annual Progress Reports, 2005, 2006, 2007

Quarterly Progress Reports, 2007

Performance Monitoring Plan, 2007

Cooperative/Contractual Agreement with USAID/Nigeria and SPDC, 2004