CIP
INTERNATIONAL POTATO CENTER
A CGIAR RESEARCH CENTER

Generating Advances in Incomes and Nutrition through Sweetpotato (GAINS) project

Year 4 Annual Report

August 2016–July 2017

Submitted to:
Directorate of Horticulture, Government of Odisha, India

Submitted by:
International Potato Center (CIP)–Bhubaneswar, Odisha, India

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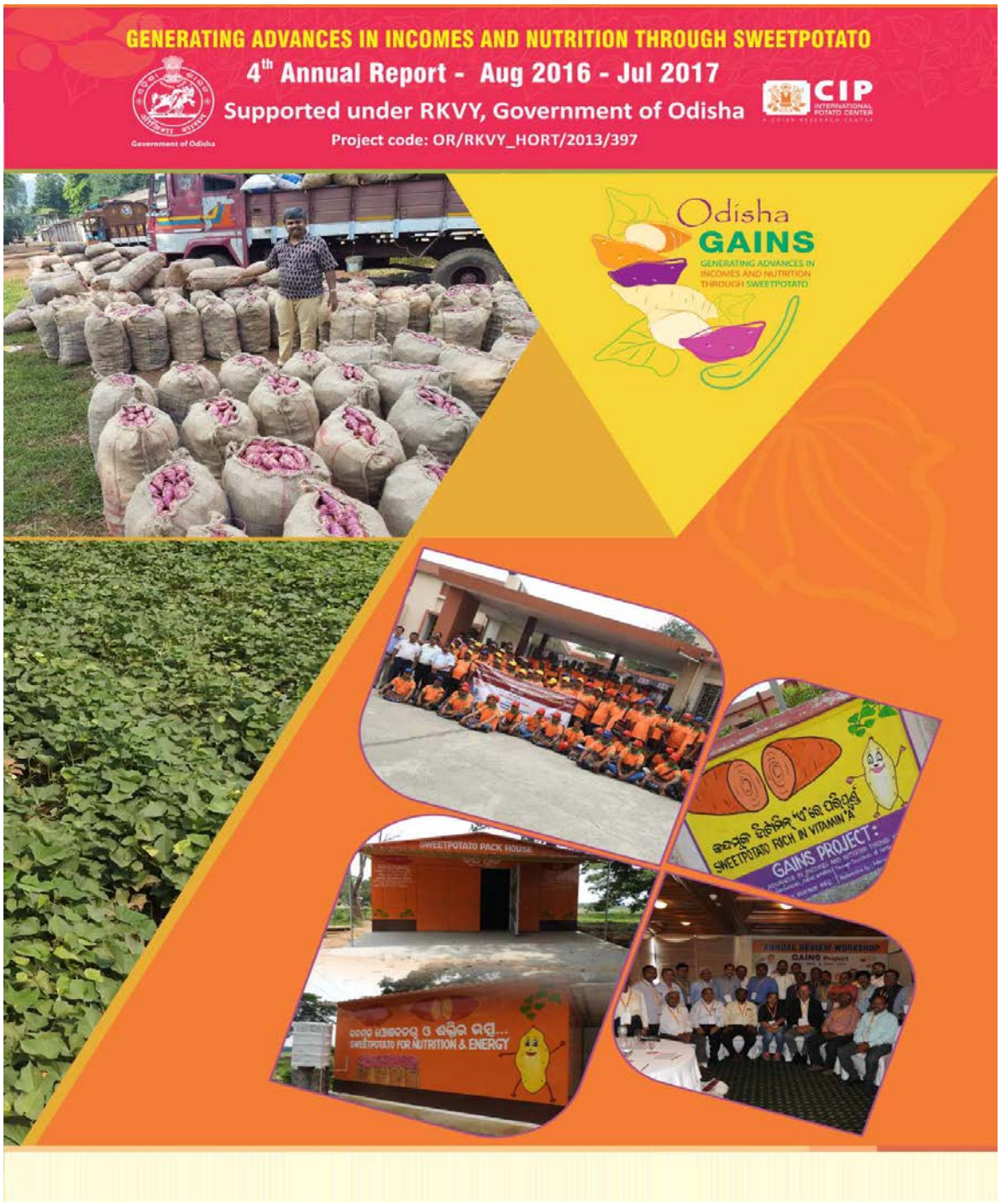

Project Manager: Dr Sreekanth Attaluri
International Potato Center (CIP) Liaison office, Regional Center of Central Tuber Crops Research Institute (CTCRI), Dumuduma, Bhubaneswar, 751019, Odisha, India
Tel: +91 674 2472244, Mob: 9437069177, Fax: +91 674 2470768

Executing Agency
CIP Liaison Office, Regional Center of CTCRI, Dumuduma, Bhubaneswar, 751019, Odisha, India
Tel: +91 674 2472244, Fax: +91 674 2470768
Email: s.attaluri@cgiar.org

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ACRONYMS

BCKV	Bidhan Chandra Krishi Viswavidyalaya
CGIAR	Consultative Group for International Agricultural Research
CHES	Central Horticultural Experiment Station
CIP	International Potato Center
CTCRI	Central Tuber Crops Research Institute
DDH	Deputy Director of Horticulture
DoH	Directorate of Horticulture
FFN	Farmer field nursery
FPOs	Farmer producer organisations
GAINS	Generating Advances in Incomes and Nutrition through Sweetpotato
GoO	Government of Odisha
GPS	Global Positioning System
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crops Research Institute for the Semi-Arid-Tropics
NABARD	National Bank for Agriculture and Rural Development
NABCON	NABARD Consultancy
OFSP	Orange-fleshed sweetpotato
RKVY	Rashtriya krishi vikas yojana (scheme)
SGCARS	Saheed Gundadhur College of Agriculture and Research Station
STAR	Sweetpotato Transformation and Adaptation in sub-Region

EXECUTIVE SUMMARY

This report presents Year 4 (Y4) (Aug. 2016–July 2017) activities of the Generating Advances in Incomes and Nutrition through Sweetpotato (GAINS) project. The project was granted a no-cost extension by the Directorate of Horticulture (DoH) of the government of Odisha (GoO) till November 2017 in Y4 of implementation. The International Potato Center (CIP) implemented the project in collaboration with the DoH and the following participating institutions of the Indian Council of Agricultural Research (ICAR) institutes and the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) (a CGIAR member institution) (Fig. 1):

- Department of Agriculture, Directorate of Agriculture, GoO
- Regional Centre of Central Tuber Crops Research Institute (CTCRI), ICAR, Bhubaneswar
- Central Horticultural Experiment Station (CHES), ICAR, Bhubaneswar
- ICRISAT, Hyderabad and Bhubaneswar.

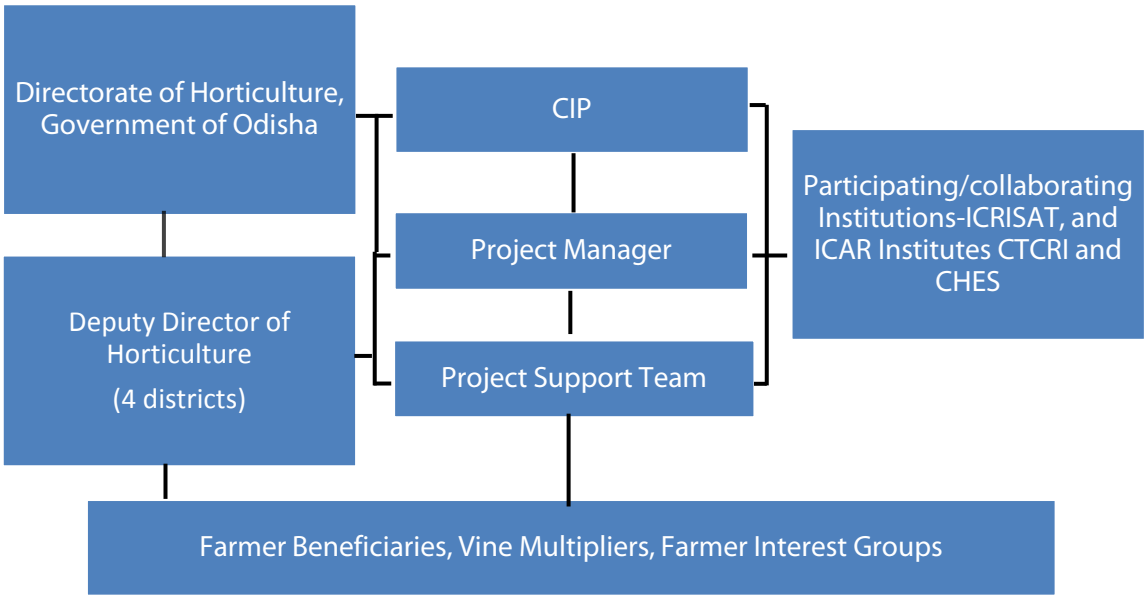


Figure 1. Flowchart of the organisational set up and project relationships with implementers and beneficiaries.

The objective is to continue to supply the best varieties and technologies that improve livelihoods of poor farmers for better incomes and nutrition in Ganjam, Koraput, Sundargarh, and Dhenkanal districts of Odisha (Fig. 2). To accomplish this objective, activities were implemented in Y4 in two seasons—*kharif* (2016) and *rabi* (2016–2017)—as per the approved operational guidelines. Activities included the following:

- Continue the multiplication of promising varieties of sweetpotato that could be suitable to grow in four selected districts of Odisha.
- The planting material multiplied at the research stations of CHES and Horticulture farm in Dhenkanal and Sundargarh districts, including farmer field nursery sites, was distributed to target districts suitable for cultivation.
- Training on crop production of sweetpotato was imparted to farmers and technical staff of each district of the DoH.
- Exposure and learning visits were conducted for technical officers of the GoO and farmers of four target districts to one of the progressive states of India.

- Periodical monitoring and necessary advice to farmers were occasionally provided along with timely supply of planting material and inputs in all four districts.
- Promotion campaign, video production, formation of farmer interest groups, distribution of processing equipment to these groups, and marketing strategies were worked out in Y4.
- Yields improved and new economic opportunities have emerged such as income for smallholder farmers and food processing units. These are in the offing in and around and adjoining the districts of Khurda, corroborated by the DoH to capitalise on diversified demand for sweetpotato in Odisha.

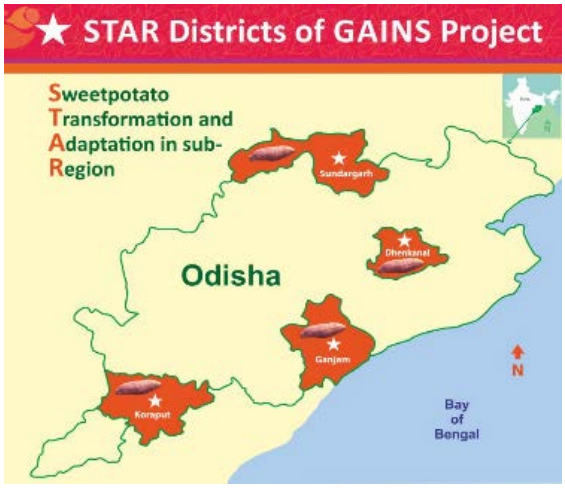


Figure 2. Target areas of the project were named as "STAR" (Sweetpotato Transformation and Adaptation in sub-Region) districts.

The activities implemented and accomplishments achieved in Y4 are presented in this report (see also Table 1). A total of 550 ha of sweetpotato area was covered in four districts, of which 454.92 ha was covered in *kharif* (2016) and 95.8 ha in *rabi* (2016–2017). The report also covers activities to be accomplished at the beginning of *kharif* 2016.

Table 1. Key accomplishments in project Y4 of implementation (Apr. 2016–October 2017)

S. No.	Activity	Period/Date
1	Multiplication of sweetpotato material at chosen sites	15 Apr. 2016–1 Jan. 2017
2	412.5 ha was covered in *kharif* 2016	1 July–30 Nov. 2016
3	137.5 ha was covered in *rabi* 2016–2017	1 Dec. 2016–15 Apr. 2017
4	27.5 ha intercropping with pigeonpea–sweetpotato	25 July 2016–1 Dec. 2017
5	Farmers learning visit on sweetpotato to IGKV, SGCARS, Jagdalpur, Chattisgarh	1–2 March 2017
6	Farmers learning visit on sweetpotato to BCKV, Kalyani, West Bengal	10–11 Mar. 2017
7	Submission of utilisation certificates to the DoH of Y4	19 July 2017, 20 Oct. 2017, and 30 Nov. 2017

NOTE: IGKV = Indira Gandhi Krishi Vishwavidyalaya; SGCARS = Saheed Gundadhur College of Agriculture and Research Station; BCKV = Bidhan Chandra Krishi Viswavidyalaya.

1. INTRODUCTION AND BACKGROUND

In Odisha, sweetpotato, plays an important role in the livelihoods of resource-poor farmers and children. Since its inception, the Generating Advances in Incomes and Nutrition through Sweetpotato (GAINS) project has advanced to provide knowledge on sweetpotato for improving yields and nutrition among communities. Subsidy to farmers in Year 4 helped to meet the costs of cultivating the crop, farm mechanisation helped to reduce the cost of cultivation, and project activities thus promoted sweetpotato as a nutrition-enhancing and gender-friendly crop in the four target districts of Odisha (i.e. Ganjam, Koraput, Sundargarh, and Dhenkanal). The 4-year project, led by the International Potato Center (CIP), with the support from the Directorate of Horticulture (DoH), government of Odisha (GoO), under the rashtriya krishi vikas yojana (RKVY)[1] scheme, extended both technical and training support to farmers in four districts.

The GAINS project started in late 2013, with *rabi* (dry, post-monsoon) season followed by *kharif* (wet, south-west monsoon) season and subsequently continued to the end of Year 4 (Y4). Uninterrupted supply of planting material in both the seasons through farmer field nurseries (FFN) has helped farmers to boost yields and increase area of cultivation under demonstration fields in Y4. The Y4 planting season began in July 2016 and ended in March/April 2017 in both *kharif* and *rabi* seasons.

This report assesses and presents the changes and improvements brought for sweetpotato growers and new growers in the expanded areas of the four project districts and covering new blocks during the *kharif* and *rabi* season. Comparisons between Y3 and Y4 crop performance, economic gains, and access to nutrition-rich food, such as orange-fleshed sweetpotato (OFSP) have generated interest among farming communities and policymakers to achieve the desired targets, especially the physical targets by the end of Y4. The marketing of sweetpotato has been highly encouraging by Y4 as farmers started sending produce to neighbouring states more frequently.

In Y4, cross-learning and improving the knowledge on sweetpotato among the farmers and technicians continued through capacity-building strategies. Study and learning visits became essential to see and understand the practices and innovative technologies adopted out of Odisha. In response, two exposure and learning visits were organised in Y4, whereby technical staff from the GoO and farmers were trained by experts of Agricultural Universities of Chattisgarh and West Bengal, on strengths in utilisation of sweetpotato.

CIP, in its Strategy and Corporate Plan for 2014–2018, identified six strategic programmes that will direct its research and development efforts for the coming 5–10 years. One of these strategic programmes, "Combating Micronutrient Deficiency with Resilient, Nutritious Sweetpotato" provides the main platform for sweetpotato-based research in the new CIP strategy. Other strategic programmes provide additional opportunities for upstream research and systems analysis related to sweetpotato that will be important for achieving CIP's overall strategic goals. The GAINS project is aligned with both this strategic programme and the one on "Resilient Food Systems".

[1] The Planning Commission, Department of Agriculture & Cooperation, Ministry of Agriculture, Gov. of India launched RKVY from 2007 to 2008 to spur growth in agriculture and allied sectors. It is a special additional central assistance scheme introduced to incentivise states to draw up comprehensive agriculture development plans, taking into account agro-climatic conditions, natural resources, and technology for ensuring more inclusive and integrated development of agriculture and allied sectors.

2. PROJECT IMPLEMENTATION AND PHYSICAL ACHIEVEMENTS RELATED TO PRODUCTION IN Y4

2.1 MAJOR ACTIVITIES

The following set of major component-specific activities was carried out across Y4 of the project period:

- Identified new sweetpotato-growing areas (new blocks) in consultation with local authorities and farmers and expanded block to block within the target districts.
- Conducted the review workshop of the project, installed new facilities like sweetpotato pack houses (for curing, grading, weighing, packing, and storing of sweetpotato). These facilities can also be equipped with machines like sweetpotato harvester, ridger, and vine cutter along with chipping and flour machines in all districts. Machines were handed over to the group leader under the supervision of respective deputy directors of horticulture (DDHs).
- Developed a project video; Global Positioning System (GPS) photographs captured for beneficiaries of both *kharif* and *rabi* season under demo trials and GPS technology used to capture most of the promotional activities conducted in Y4.
- Organised training programmes and conducted exposure and learning visits for technical staff and farmers.
- Carried out promotional activities like a mobile kitchen, established a sweetpotato kiosk near temples, established school nutrition gardens, and created wall paintings and advertisements (nutrition messages) in local language (Odia) and in English.

2.2 IMPROVED SWEEPOTATO CULTIVATION

As in previous years, in Y4 the project continued to facilitate the availability of improved varieties of sweetpotato to the selected farmers in four districts (Table 2). The assured and timely supply of improved sweetpotato variety vines from FFN growers to the demo farmers enabled the growers to plant sweetpotato in time that helped to improve yields. As the initial planting was planned to coincide with the *kharif* season, farmers were selected based on land availability, preference for growing sweetpotato for consumption and use of surplus for marketing, proximity to FFN sites to receive vines, and eligibility to obtain government subsidy. Prior to the selection of farmers, sufficient quantity of planting material was ensured for multiplication through FFN.

Table 2. Details of the project areas covered in Odisha

STAR Districts (sweetpotato total area in ha)	Total Villages (existing no.)	Total Block (existing no.)	Target Area (ha)				
			Y1	Y2	Y3	Y4	Total
Ganjam (8,500)	3,229	22	40	80	120	150	**390**
Koraput (5,500)	1,997	14	25	50	100	125	**300**
Dhenkanal (3,290)	1,047	8	20	50	120	150	**340**
Sundargarh (3,222)	1,744	17	20	50	100	125	**295**
Total (20,512)	**8,017**	**61**	**105**	**230**	**440**	**550**	**1,325**

NOTE: Data shaded in orange represents achieved target in hectare.

An advanced variety of sweetpotato, 'Kanjangad', which proved promising from Y1 to Y3 of the project, was continued in Y4. Its acceptance by farmers was good because of its following characteristics:

- Yield: 12–20 t/ha in all four districts
- Duration of crop: 110–120 days

- Vegetative growth: Semi-spreading type and compact growth feasible for good intercultural operations like weeding, spraying, and harvest
- Tuber shape: Long, cylindrical, and even
- Taste and nutrition: Good with average sweetness and nutritionally rich
- Relatively long shelf life and weevil tolerance.

Other improved varieties promoted are 'Bidhan Jyoti (earlier termed 'Kamala Sundari', a variety of West Bengal) and CIP-440127, both OFSP varieties with good yields (12–16 t/ha) and medium to high beta-carotene content.

2.3 Trends in Districts Related to Production, Productivity, and Area Covered

Interest among farming communities developed gradually. As the seasons passed among the new sweetpotato growers the results in terms of production were encouraging in all four districts. In Y4, also sweetpotato price in Koraput and Sundargarh districts has increased steeply in the markets as the produce was diverted to places (blocks) where it is not grown and also by sending some produce to the neighbouring states of Odisha. These strategies helped farmers towards the goal of gainful income and nutrition. As in Y3 obvious changes were also seen in Y4 at ground level with optimism and confidence in the lives of beneficiaries. Sweetpotato cultivation, which was seen merely as a secondary source of income, is now viewed as a reliable source of income.

The total production by the end of Y4 stood at 8,438.3 tonnes (t) and productivity at 15.40 t/ha, which was up from 15.07 t/ha in Y3 (Table 3). A few of the reasons for the increase in productivity were the rigorous training of farmers, both on and off field, in using best cropping practices, exposure of farmers to other sites for cross-learning, and regular monitoring of the crop at different sites both by district functionaries as well as the project team.

Table 3. Yearly production, target, and productivity of sweetpotato

Year	Production (t)	Target Area (ha)	Target Area (acres)	Productivity (t/ha)
Y1	1,572.0	105.0	262.5	14.97
Y2	3,425.4	230.0	575.0	15.02
Y3	6,632.3	440.0	1,100.0	15.07
Y4	8,438.3	550.0	1,375.0	15.40
All	**20,067.98**	**1,325.0**	**3,312.5**	**15.12**

In all four districts, by and large the (local) variety 'Desi', which is white-fleshed, poor yielding, and long duration, is still being cultivated. To shift from using local to improved variety cultivation, thorough demonstration at multiple sites, as well as awareness on the important traits of improved varieties, needs to be spread across the state's efforts at training and promotion. Replacing 'Desi' with 'Kanjangad' and other OFSP varieties could help to meet the requirement of better nutrition availability through sweetpotato.

Table 4 presents the total production, target area in acreage and hectares, and productivity for all the cropping seasons since the inception of the GAINS project.

Table 4. Years (1–4) and seasonal production and productivity of four target districts

District	Season*	Total Production (t)	Target Achieved (ha)	Productivity (t/ha)
Dhenkanal	Y1R	322.6	20.0	16.13
	Y2K	594.8	37.6	15.82
	Y2R	205.1	12.4	16.54
	Y3K	1,350.9	90.0	15.01
	Y3R	504.0	30.0	16.80
	Y4K	2,009.76	127.2	15.80
	Y4R	351.12	22.8	15.40
	Subtotal	5,338.28	340.0	15.92
Ganjam	Y1R	648.8	40.0	16.22
	Y2K	978.6	60.0	16.31
	Y2R	327.0	20.0	16.35
	Y3K	1,530.9	90.0	17.01
	Y3R	523.8	30.0	17.46
	Y4K	1,872.0	120.0	15.60
	Y4R	456.0	30.0	15.20
	Subtotal	6,337.1	390.0	16.30
Sundargarh	Y1R	221.6	20.0	11.08
	Y2K	478.8	40.0	11.97
	Y2R	136.3	10.0	13.63
	Y3K	1,112.4	90.0	12.65
	Y3R	142.1	10.0	14.21
	Y4K	1,583.6	107.0	14.80
	Y4R	280.8	18.0	15.60
	Subtotal	3,955.6	295.0	13.42
Koraput	Y1R	379.0	25.0	15.16
	Y2K	550.0	40.0	13.75
	Y2R	154.8	10.0	15.48
	Y3K	1,305.9	90.0	14.51
	Y3R	162.3	10.0	16.23
	Y4K	1,500.0	100.0	15.00
	Y4R	385.0	25.0	15.40
	Subtotal	4,437.0	300.0	15.07
All districts	**All seasons**	**20,067.98**	**1,325.0**	**15.17**

*Y1R = Y1 *rabi*; Y2K = Y2 *kharif*; Y2R = Y2 *rabi*; Y3K = Y3 *kharif*; Y3R = Y3 *rabi.* Y4K = Y4 *kharif*; Y4R = Y4 *rabi*.

2.4 PIGEONPEA AND SWEETPOTATO INTERCROPPING

Intercropping sweetpotato with pigeonpea (*Cajanus cajan*) has become popular in all four districts. It proved profitable to farmers (based on the feedback and result from Y1–Y3 farmers) as well as provided food and nutrition to the growers and consumers.

The following pigeonpea variety (ICPL-88039) has been chosen that could give better yields to farmers and generate income (Table 5). This variety was recommended by ICRISAT (like CIP, a CGIAR centre) to be promoted in the districts. Intercropping of sweetpotato with millet, cereals, and pulses can also help as a contingent crop in upland rain-fed conditions. The pigeonpea variety, along with sweetpotato variety 'Kanjangad', were intercropped in three sweetpotato rows

(60 x 30 cm) and three pigeonpea rows (60 x 30 cm) planted in strips alternately as per CTCRI's recommendations.

Table 5. Pigeonpea varietal characteristics

Characteristics of VL Arhar 1

• Variety name : (Year of release)	ICPL 88039 (1997, India)
• Release name:	VL Arhar 1
• Parentage : ICP 6 X Pant A 2 • Pedigree : ICPL 161-H2-HB-H1-H1-HB-HB • Duration : Extra-Short-duration, Indeterminate	
• Days to 50% fl.:	55-60
• Days to 75% Mat.:	100-110
• Plant height(cm): • No. of Seeds/pod : • 100-seed weight(g): • Seed color : • Yield kg/ha :	115-125 3.0 – 4.0 9.0-10.0 Brown 1700-1800
• Special character: Suitable for rice fallows	

A total of 68.75 acres of pigeonpea was covered in *kharif* season (Table 6). Higher storage root yield of 12–15 t/ha of sweetpotato was obtained with sweetpotato + pigeonpea strip intercropping (with pigeonpea recording 1,800 kg/ha). The net return obtained through intercropping was Rs 58,000/ha remained like that of previous years and compared with mono-cropping in upland ecosystem. Inclusion of pigeonpea with sweetpotato improved soil fertility and reduced sweetpotato weevil infestation. Both crops were considered hardy and drought tolerant as they can be grown under rain-fed conditions and needed few inputs. It was understood that these crops complement one another in terms of soil fertility and nutrient availability in the soil. The combination of the two crops is also acceptable due to availability of pigeonpea and sweetpotato as food for farmers for own consumption (i.e. sweetpotato as rich in carbohydrates and vitamins/minerals and pigeonpea as rich in protein) and because they provide immediate cash in hand by selling both crops in the markets. Moreover, both crops are promoted as nutritionally rich and provide adequate nutrition.

Table 6. Distribution of pigeonpea seeds in STAR districts of Odisha

S. No.	District	Block	Pigeonpea Variety	Area Covered (acres)	Pigeonpea Seed Quantity (kg)	Total Area (acres)
1	Ganjam	Sheragada Sankhemundi	ICPL-88039 ICPL-88039	8.75 10	30.00	18.75
2	Dhenkanal	Khamakya Nagar Kankadahad	ICPL-88039 ICPL-88039	10.75 8	30.00	18.75
3	Koraput	Semiliguda	ICPL-88039	15	24.00	15
4	Sundargarh	Lephripada	ICPL-88039	16.25	26.00	16.25
Total				**68.75**	**110.00**	**68.75**

2.5 SEED SYSTEM AND PLANTING MATERIAL DISTRIBUTION IN Y4 OF PROJECT IMPLEMENTATION

The demand for quality planting material of improved varieties continued. Planting material was distributed through various channels (Fig. 3). The focus was on high-yielding and nutritious sweetpotato, which helped to generate income and enhance nutrition at the focus sites.

Figure 3. Vine distribution flow in the GAINS project.

2.6 Activity Schedule and Channels of Supply of Vines at Various Levels

Sweetpotato in Odisha is grown in two cropping seasons. It is generally grown as a rain-fed crop in *kharif* and, to a lesser extent, in *rabi*. The number of beneficiaries in *kharif* (2016) and *rabi* (2016–2017) at the end of Y4 of the project is shown in Table 7.

Table 7. Number of beneficiaries shown by season and year

S. No.	Season	Year	Beneficiaries	Type of Beneficiary
1	*Kharif*	2016–2017	1,088	Demo grower
2	*Rabi*	2016–2017	290	Demo grower
3	*Kharif and rabi*	2016–2017	60	FFN grower
	Total		**1,438**	

2.7 Season-Wise Multiplication And Distribution Of Planting Materials (2016–2017)

For *kharif* cultivation in 2016 (Aug.–Nov. 2016 *demo trial*), planting material was multiplied in two stages: at research stations and at FFN. The vines obtained from research stations are transferred to FFN. FFN growers also receive planting material from previous *rabi* 2015–2016 demo trial.

For *rabi* 2016–2017, a demo trial started in December 2016 and was harvested by the end of March/April 2017; the planting material was supplied by FFN. As explained above, the planting material was multiplied in two stages (at research stations and FFN). The material raised was used in a demo trial, which is the main cultivation. The flow and quantity of planting material from one stage to the other are explained below.

Stage 1. Research stations

Vine multiplication started from mid-April to the end of May 2016. At the research station (CHES, 1 ha) and farms (Dhenkanal Horticulture farm, 3 ha and Sundargarh Horticulture farm, 1 ha), the total area covered was 5 ha (Table 8). The number of vines planted/ha was 80,000 cuttings with 60 x 20 cm spacing. Within 45 days, nearly 168,000 cuttings/ha (starting from the second week of April until the end of May) were obtained in the research stations. At least 840,000 cuttings were obtained from 5 ha.

Table 8. Area covered for vine multiplication in research stations and horticulture/agri. farms of districts (2016–2017)

Districts (ha)					Total (ha)
Khurda (R)	Ganjam (H)	Koraput (H)	Dhenkanal (H)	Sundargarh (H)	
1.0	0.0	0.0	3.0	1.0	5.0

R = Research station; H = Horticulture Farm

Stage 2. FFN

In FFN, the vines obtained from research stations were multiplied for nearly 2.5 months. The area covered under FFN was 55.0 ha in all four districts (Table 9). The total number of vines planted/ha was 80,000. The number of vines required for multiplication on 55.0 ha was 44,00,000 and the vines produced from it were 3,63,36,000 (for *kharif* to cover at least 454.2 ha) and 76,64,000 (for *rabi* to cover the remaining 95.8 ha). In *kharif* 2016, 454.2 ha was covered and the remaining 95.8

ha was completed in *rabi* 2016–2017. The target area for 2016–2017 under demonstration was 550 ha. Vines were multiplied in FFN in four districts from the end of May to July 2016. The vines obtained from FFN were planted for demonstration in *kharif and rabi* seasons.

Table 9. Area covered for vine multiplication in FFN of target districts (2016–2017)

Districts (ha)				Total ha
Ganjam	Koraput	Dhenkanal	Sundargarh	
15.0	12.5	15.0	12.5	55.0

Stage 3. Demonstration in kharif and rabi

The area accomplished under demonstration in Y4 was 550 ha (Table 10). The number of vines planted/ha was 80,000. The total requirement of vines for the target area was 4,40,00,000 for the crop period July 2016 to first week of April 2017. Farmers selected for nursery maintenance were not subsidised under demonstration. The area covered for nursery maintenance ranged 0.1–2.5 acres per farmer; demonstration area per farmer ranged 0.2–4 ha.

Table 10. Area covered under demonstration of sweetpotato in different target districts (2016–2017)

Season	Districts				Total ha
	Ganjam	Koraput	Dhenkanal	Sundargarh	
Kharif	120	100	127.2	107	454.2
Rabi	30	25	22.8	18	95.8
Subtotal	**150**	**125**	**150**	**125**	**550**

2.8 CREATING VALUE TO VINES

The farmers (vine suppliers) who cultivated sweetpotato with project support under demonstration in the previous season will continue to grow sweetpotato vines both for income generation (by selling vines) and for their own use. These farmers were not considered for a subsidy on demonstration cultivation for the subsequent season. The FFN was also responsible for supplying vines during *rabi* which will ensure continuity of raising vines for the second season in a year (see Tables 9 and 10). In all four districts on average, sweetpotato variety 'Kanjangad' yielded 12–18 t/ha compared with local variety of 6–8 t/ha, which was a great boost to producers.

2.9 BLOCK-WISE DISTRIBUTION OF SWEETPOTATO DEMONSTRATION TRIALS

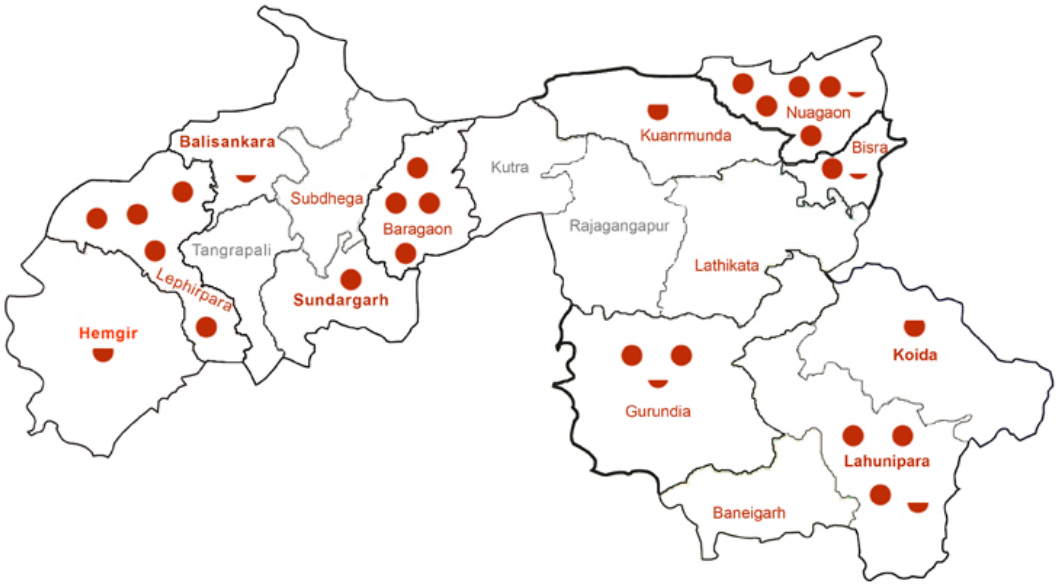
Since project inception the area coverage has been increased gradually, as per the operational guidelines, in tune with number of blocks in each of the districts. The spread of the sweetpotato coverage increased as the number of aspirants increased as recommended by the DoH in each district. Table 11 shows the block-wise representation in area coverage this project.

Table 11. Number of blocks covered in different target districts till 2016-17

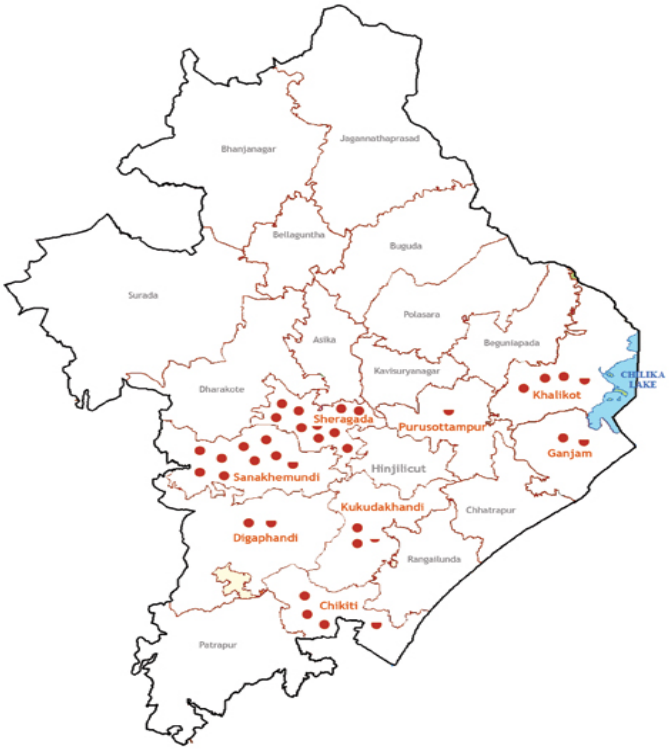
S. No.	District	No. of Blocks Covered	Percentage Covered in Each District
1	Sundargarh	11	39
2	Dhenkanal	5	18
3	Ganjam	8	29
4	Koraput	4	14

Out of 61 blocks in four target districts of Odisha, 28 have been covered under the GAINS project belonging to STAR districts since its inception. In Sundargarh, more blocks were covered and the spread of activities was much faster to different blocks within the district when compared with other districts.

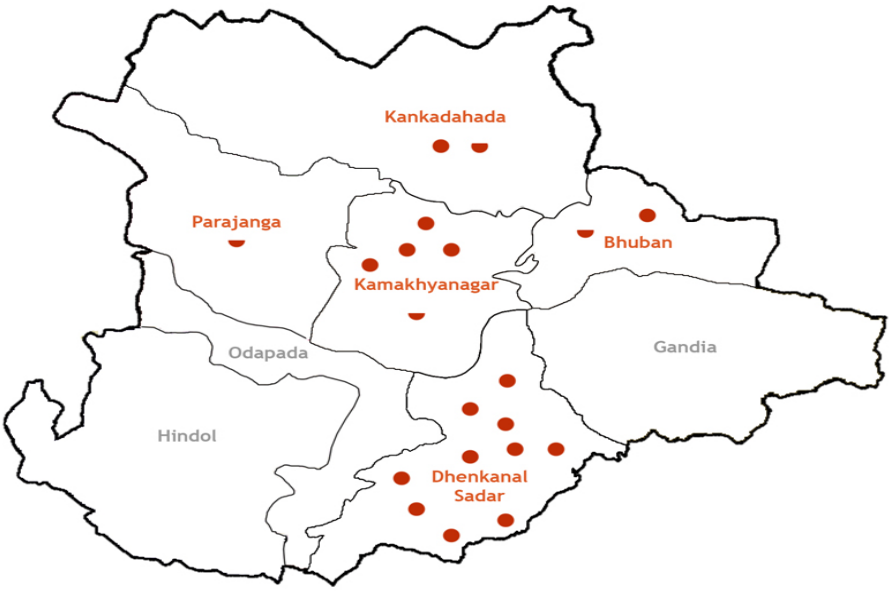
Maps 1–4 of districts show the extent of sweetpotato spread in different blocks in Y4 of the project period.



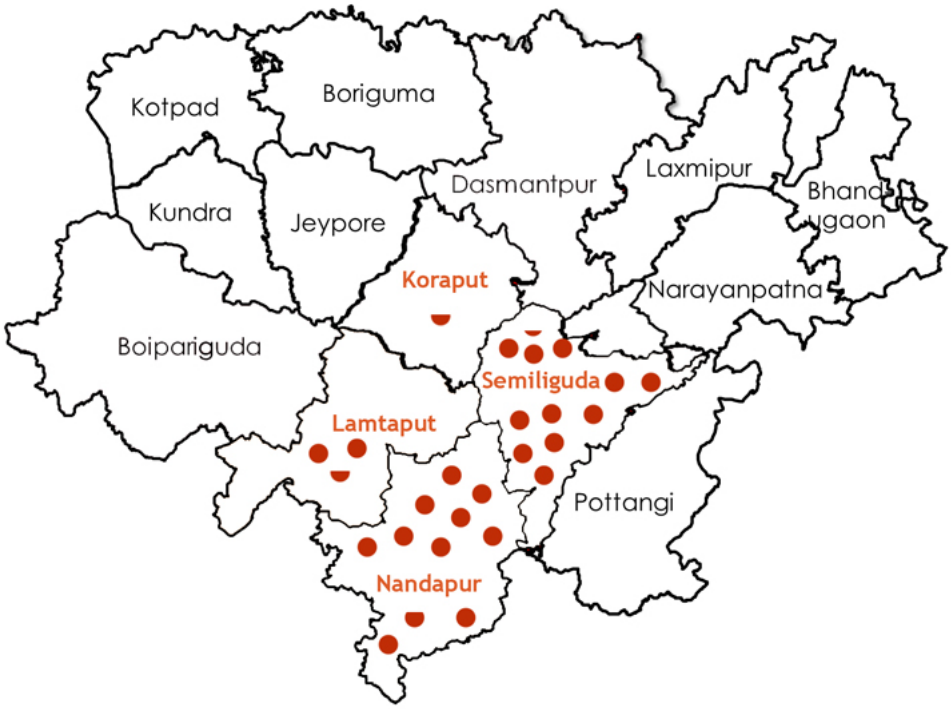
Map 1. Sundargarh District—Extent of sweetpotato spread (demonstration) across blocks 2016–2017 (each red dot represents 5 ha of sweetpotato coverage), which has maximum coverage with 11 blocks of the district.



Map 2. Ganjam District—Extent of sweetpotato spread (demonstration) across blocks 2016–2017 (each red dot represents 5 ha of sweetpotato coverage); 8 blocks were covered in this district.



Map 3. Dhenkanal district—Extent of sweetpotato spread (demonstration) across blocks 2016–2017 (each red dot represents 5 ha of sweetpotato coverage); sweetpotato was covered in 5 blocks.



Map 4. Koraput District—Extent of sweetpotato spread (demonstration) across blocks 2016–2017 (each red dot represents 5 ha of sweetpotato coverage); sweetpotato was covered in 4 blocks.

3. CAPACITY BUILDING AND PUBLICATIONS

Several farmers and technicians were trained in Y4 in the STAR project districts (Table 12). Trainings included knowledge on sweetpotato and on operations, from production (mainly on the pre-planting and harvest stages) to consumption. Farmers showed great interest while being trained on sweetpotato and practical demos on use of sweetpotato. Women farmers also participated in each training: out of 668 farmers who attended in each season, nearly 22% are women who participated from four districts.

Table 12. No. of farmers trained in STAR project districts on pre-planting and postharvest (2016–2017)

S. No.	Season	District	No. of Farmers Trained
1	*Rabi*	Ganjam	100
2	*Rabi*	Dhenkanal	90
3	*Rabi*	Koraput	74
4	*Rabi*	Sundargarh	70
5	*Kharif*	Ganjam	100
6	*Kharif*	Dhenkanal	90
7	*Kharif*	Koraput	74
8	*Kharif*	Sundargarh	70
Total			**668**

3.1 Publications (Booklets and Pamphlets) and Media Coverage

To support and complement the trainings, review meetings, and workshops conducted in four districts and in Bhubaneswar, publications were prepared in Y4 which could be easily understood by farmers in Odia language (regional language) and in English for partners and implementing agencies. For wider circulation of activities, visuals were recorded in districts and documented the success stories for video production. Within CIP, regular updates were shared through centre-wide "Gathering Under the Tree" monthly meetings as well as through regional monthly reports/updates.

3.2 Training and Exposure Visit to Chattisgarh, India

A 2-day event was organised by CIP–Bhubaneswar to farmers and technical officers of the GoO from 1–2 March 2017, at Indira Gandhi Krishi Vishwavidyalaya (IGKV, State Agricultural University) and Saheed Gundadhur College of Agriculture and Research Station Kumharavand, Jagdalpur, Bastar District, Chattisgarh, India. Nearly 80 farmers from the four project target districts and 20 technical officers of the GoO attended, as did university staff, including research and academic staff along with director of research and director of extension. CIP's project manager, Dr Sreekanth Attaluri, and GAINS project team coordinated and conducted this event. Farmers were happy to learn and see the hi-tech nurseries maintained at university campuses that helps to conserve the germplasm and further to improve yields of horticultural crops along with postharvest utilisation of income-generating crops. Odisha farmers also witnessed various farmer-friendly and income-generating technologies developed by the university for other tuber crops (e.g. cassava). Odisha farmers visited the experimental plots of horticulture crops at the station. These technologies helped them to understand the modern package of practices that underlie the scientific basis for enhancing yields. A field visit on the same day was also organised for Odisha farmers to see the sweetpotato fields and interact with the local growers. The discussion mainly focussed on the production practices and technologies involved in reducing the cost of cultivation of sweetpotato. The programme details are illustrated in Annex 1.

3.3 Exposure Visit to West Bengal, India

Also in March 2017, a 2-day exposure visit was organised by CIP to farmers and technical officers of the GoO from 10 to 11 March 2017, at BCKV–State Agricultural University, Farmers Academy and Convention Center, Kalyani, West Bengal. Nearly 80 farmers from the four project target districts and 20 technical officers of the GoO attended, as did university staff, including research and academic staff along with director of research and director of extension. As with the training in Chattisgarh (described above), Dr Attaluri and the GAINS project team coordinated and conducted this event highlighting sweetpotato and also related tuber crops. Odisha farmers witnessed various farmer-friendly and income-generating technologies developed by the university for other cash crops. Farmers visited the experimental plots of sweetpotato where experiments were

conducted with the application of different dosage of fertilizers for their varietal response contributing to enhancement in yields. A field visit on the same day was also organised for Odisha farmers to visit the sweetpotato fields and interact with the local growers. The discussion mainly focussed on the production practices and technologies involved in reducing the cost of cultivation of sweetpotato. The programme details are illustrated in Annex 2.

3.4 GAINS Project Review Meeting In Odisha

CIP showcased its success stories of the GAINS project at the annual project review workshop held at Bhubaneswar on 21 July 2017. Since there was a time gap in funds released at the end of Y3, the annual project review workshops of 2015–2016 and 2016–2017 were combined and organised involving all stakeholders. The programme included display of sweetpotato equipment, products, brochures, and sweetpotato varieties, as well as detailed presentation and interaction by participants during the workshop. CIP's team participated in interaction sessions during the event, with Dr Attaluri explaining details of the project. The participants included representatives of CHES, ICRISAT, DDHs of the four project target districts, an additional director of horticulture, non-governmental organisations, Tata Trust, Nourish Inc. Future Group, Regional Medical Research Center, CIP-Delhi, and the vice-chancellor of the University of Horticulture Sciences, Bagalkot (Karnataka).

4. ENHANCED MARKET OPPORTUNITIES FOR SWEETPOTATO THROUGH THE GAINS PROJECT

The GAINS project has several components—from production to consumption—to be addressed in 2013–2017. One of the important ones is the sweetpotato value chain that helps in generating incomes for poor farmers in Odisha. Of the four target districts (Koraput, Sundargarh, Dhenkanal, and Ganjam), the latter two play a vital role in the market linkages, especially with the vibrant peri-urban and urban markets. The other two target districts have predominantly tribal populations that mainly consume and sell the surplus in the markets. In all four districts, sweetpotatoes are mainly grown for consumption by the farmers and the surplus is sold in the markets through the linkages identified. The sweetpotato aggregators identified during *kharif* 2014 continued to operate in smooth collection of the produce at the sites that needed attention for marketing of produce. During the past 2 years these aggregators were allowed to reach an understanding with the GAINS project and necessary implementation steps on the collection tasks from sweetpotato demo farmers, who were supervised by the DDH and the CIP project team. The functioning of aggregators was streamlined, mainly by having them pay the farmers directly for their produce at an agreeable rate before the produce was loaded onto the truck for transport.

Collection of the produce from the fields was supervised by the GAINS project team during the harvest period. The demo farmers, who were selected only once in the project period for provision of subsidy, are encouraged to continue for the next season when grown with sweetpotato along with the aggregators identified by CIP.

4.1 Sweetpotato Pack House and Store House

Sweetpotato pack houses were established in all four districts to allow the farmers to aggregate the produce; cure sweetpotato; and grade, weigh, and pack the sweetpotatoes for market sale (or, in the case of Koraput District, store them at 15°C).

Solar sweetpotato cold storage facility at Koraput District

Under the GAINS project the model sweetpotato cold storage that is run on solar energy developed at Assistant Horticulture office at 'Pottangi' block in Koraput District, Odisha, is helpful to farmers to store sweetpotato when market sale rates are down. The farmers can put nearly 1.5–2 t of

sweetpotato in the cold store developed. To reduce storage costs at and make them affordable to farmers, efforts were made to reduce the running cost of air conditioning in the storage room. To support this idea, solar energy is used to generate necessary electricity (2.7 KW) that can run the air conditioner. The electricity generated by this system is directly connected to the government's electricity supply grid with net metering; the air conditioner is connected to the government's electricity supply grid. So the cost of net billing of the electric energy used will be the cost of difference between electricity used from the grid minus electricity supplied to the grid by the solar power system. The additional benefit of connecting this system to the grid is that the air conditioner could be run if the solar power system does not provide electricity, especially during night or during cloudy days.

Guidelines were developed in local Odia language on farmers' use of the pack house that is near them. The pack house also accommodates farm machinery like vine cutter, ridger, and harvester, as well as small entrepreneur processing machines like mincer, chips machine, and a scale. Some essential features and terms and conditions are:

- Pack house is made to facilitate sweetpotato farmers to aggregate the produce during the pre- and post-production of sweetpotato. It is also equipped with the following machines:
  - Ridger: To prepare ridges using tractor in the fields
  - Vine cutter: To cut vines before planting of sweetpotato
  - Harvester: To harvest sweetpotatoes mechanically using a tractor
  - Scale: To weigh the sweetpotato produce obtained after harvest
  - Plastic crates: To keep sweetpotatoes for storage
  - Grinder, mincer, and chipping machine: To use sweetpotatoes for making puree or dices/ chips for drying
  - Grading and cleaning tanks: For harvested sweetpotatoes cleaned, dried, and packed
  - The pack house at Koraput is also called a sweetpotato store house, where the roots can be stored at 15°C for more than 4 months.
- The ownership of pack house remains with the DDH of the concerned district, whereas the day-to-day operational rights remain with the sweetpotato farmers group duly selected by the DDH.
- At any time if the DDH finds that the existing farmers group in charge of the day-to-day operation of the pack house is not performing well and misusing the machinery, he is empowered to handover the operational rights to a different farmers group.
- The pack house will display the name and contact details of the farmers group currently in charge of operations.
- The farmers interested in using the pack house should contact the concerned farmers group, who should then refer the request to DDH for approval. With DDH's final approval the interested farmer can use the services of pack house.
- Farmers should maintain proper cleanliness and hygiene inside and around the pack house during and after every use.
- Machines used within the pack house should be properly handled under the supervision of an expert to avoid any damage to the equipment or its operator.
- Farmers interested in taking the equipment into the field should return it in the same (good) condition within 24 hr. Delay in return or damage to machinery shall incur penalty as decided by the farmers group.

- Detail records of the day-to-day use of the pack houses are to be maintained in registers available in the facility. These records can be verified any time by any of the concerned officers of the DDH office.
- Store house: The same terms and conditions will be followed as per the pack house mentioned above. Nearly 2 t of sweetpotato can be stored in the store house at Pottangi, Koraput, maintained at 15°C. Solar power is to be used to maintain the required temperature. This helps to minimise the electricity cost over time.

4.2 Role of School and Mass Education System

Children, especially those aged 4–12 years, like sweetpotatoes. To promote the crop in the school, school nutrition garden concept was introduced under GAINS. The objective of introducing sweetpotato in schools is not only to provide nutrition through sweetpotato to children, but also provide an opportunity to sweetpotato producers to link sweetpotato to schools. This ensures income for producers where the procurement is done through schools and mass education departments. Though this concept of introducing sweetpotatoes in schools has a long way to go, there is enormous opportunity to link the produce to schools and supply all year long.

4.3 Marketing Linkages

As in Y3 of project implementation, several efforts were made in Y4 to increase the demand of sweetpotato and its use in the target districts. In Dhenkanal District, market demand continues and linkage of sweetpotato continued with the local markets/weekly market transport to urban and peri-urban areas of Cuttack/Bhubaneswar/Puri. Similarly, for Shankapur area of Dhenkanal District, where our interventions began, growers readily send their produce to the Bhubaneswar and Cuttack markets to fetch reasonable/better prices. In Ganjam, Berhampur, and its vicinity, blocks have been the hot-spots for linking sweetpotato produce. In Koraput District, Koraput, Semiliguda, Nandapur, Jeypore, and Pottangi blocks have been the hot-spots for linking the produce. The weekly *haat* at Kunduli market, which is situated between Semiliguda and Pottangi, is the sales point where aggregators of neighbouring blocks bring the produce for better sales. In this district, the sale of sweetpotato is predominantly done for Andhra traders, who pick up for better price and sell in the neighbouring state's urban and peri-urban areas. Now, sweetpotato growers in Koraput can use the store house at Pottangi to store sweetpotatoes as so avoid having to sell when sale prices are low. When compared with other target districts, Sundargarh is mainly based on fresh consumption by the growers, and the surplus is sold in retail at the daily/weekly *haat* for better sales. The sale of sweetpotato is predominantly done locally or at the bigger markets to be exported either to Chattisgarh or Jharkand for better prices and selling in the neighbouring state's urban and peri-urban areas. Under the GAINS project, necessary knowledge and expertise are being imparted on practical product preparations. This effort could help in the overall marketing of sweetpotato. Some of the products that could be started with under the GAINS project are discussed in section 5.

5. PROMOTIONAL ACTIVITIES IN THE TARGET DISTRICTS

Several promotional campaigns have been planned for the end of Y4 that included popularising sweetpotato as a nutrition-rich and income-generating crop. The key promotional activities included disseminating nutrition messages through published posters, street play by artists, demonstration of sweetpotato recipes at mobile kitchens, partnering with schools and mass education departments under the GoO and research institutions, and print and electronic media in the state. All the activities were implemented in project Y4.

5.1 School Campaign–Nutrition Garden in Schools

Nearly 24 schools (Annex 3) have been covered in the sweetpotato campaign that educated children and teaching staff on the importance of sweetpotato with the theme "Food and Nutrition to Children". Schools were provided with posters, charts that displayed messages on nutrition and utilisation of sweetpotato, and with planting material (vines) to be planted on school premises. On the school premises of the residential schools in target districts, plots of 10 x 10 ft was laid out in which nearly 50 cuttings were planted. The objective of planting sweetpotatoes at schools is to create children's awareness of sweetpotato's plant growth by applying modern package of agronomic practices, and involve them in a socially useful and productive work and to taste the crop after harvest. The OFSP variety provided was 'Bidhan Jyoti', a high yielding, good tasting one.

This activity in schools can pave the way to introducing sweetpotato in the mid-day meal scheme programme of the Department of School and Mass Education of the GoO. The response from teachers and schoolchildren was highly encouraging after the introduction of sweetpotato in school nutrition garden.

5.2 Sweetpotato Mobile Kitchen

An innovative model namely mobile kitchen reached out to the masses and demonstrated various dishes made out of sweetpotato. It made the people taste the food, shared recipes and educated the audience regarding the benefits of sweetpotato. As per the approved operational guidelines of RKVY funded GAINS project, a sweetpotato cooking demonstration concept named "mobile kitchen" was introduced to bring awareness on nutritional values, preparation of sweetpotato recipes and more over sensitizing farmers and people of Ganjam Koraput, Dhenkanal and Sundargarh on the utilization and value addition of sweetpotato. In this context, programmes were scheduled in different districts in consultation with the district officers. Each venue (village) mentioned in Annex IV covered at least 40 beneficiaries in the program to demonstrate the preparation of the recipes as well as to conduct organoleptic tests in one of the district divided into groups. Bilingual (English and Odia) brochures on recipe preparation were distributed to participants and who attended the mobile kitchen show.

5.2.1 Names of sweetpotato recipes prepared

- Product 1: Kandamula Khiri (sweetpotato dessert)
- Product 2: Kandamual Singada (sweetpotato snack)
- Product 3: Kandamula Gulab Jamun (sweetpotato dessert)
- Product 4: Kandamula Chips (sweetpotato snack)
- Product 5: Kandamula Chap (sweetpotato snack)
- Product 6: Kandamula Paratha (sweetpotato Indian bread)

The chef, along with the supporting staff, prepared the above recipes and demonstrated the preparation of each and every recipe as prescribed in the brochure. High hygiene conditions were maintained during the preparation of the food items.

The format used for conducting the organoleptic tests conducted in Dhenkanal District are presented below.

The participants were provided with an evaluation sheet (Annex 4) containing seven different attributes—appearance; colour (intensity/uniformity); odour/smell/flavour; taste (sweetness); feel/texture; and fibre—as well as "others". They also rated overall taste acceptability. The ranking/rating for the recipes was based on different attributes on a scale of 1–5. Univariate analysis was done to derive appropriate conclusions based on the organoleptic tests.

Two different comparisons were made based on the rankings given by the participants for the different attributes of six products, separately and individually. The comparisons are differentiated as *intra-comparison* and *inter-comparison*.

Intra-comparison: This comparison is make within the same product by taking into consideration different attributes of the product and comparing them individually (Table 13). The sums of all the rankings/ratings given by different farmers were taken for a single product and for a particular attribute. By doing this, the strengths and weaknesses of the attribute within a product could be identified and could be improved upon.

Table 13. Results of the intra-comparison rankings/ratings

Product	Strength	Weakness
1	Texture	others
2	Odour, taste, and overall acceptability	Fibre
3	Sweetness	Fibre
4	Texture	Appearance
5	Sweetness	Fibre
6	Taste and Texture	Others

Inter-comparison: The comparison could be made between different products for a particular attribute. Different scores (percentage of responses) were obtained for each attribute and product. The scores were categorized into *very good* and *good*. The scores reveal the superiority of products in relation to the attributes; they also provide information on the products for improvement over others to enhance marketability and demand. By combining *very good* and *good* scores for each product, we derived the top-rated products as shown below.

Appearance: Product 3; Colour: Product 1; Odour: Products 2 and 1; Taste: Products 6 and 2; Sweetness: Product 3; Texture: Product 1; Fibre: Product 4; and Overall taste acceptability: Product 2.

5.3 CONSUMERS' PREFERENCES

The products preferred by the participants were assessed using a holistic approach that took into consideration the method of preparation, preparation time, cost and availability of ingredients, taste, acceptability, and, most importantly, whether the product is culturally/traditionally friendly to consumers. Taking all these factors into consideration, out of 160 participants in Dhenkanal District, Products 2 and 3 were preferred by 102, Products 1, 5, and 6 were preferred by 46, and Product 4 was preferred by 12. By calculating "mode" (mode of data sample is the element that occurs most often in the collection) values, we found that Products 2 and 3 were preferred the most, whereas the least-preferred was Product 4.

5.3.1 Attributes preferred by consumers

The mode was calculated for all the attributes on a scale of 1–5. The highly rated attributes are odour, texture, and overall taste acceptability. Colour and fibre were rated lower, indicating scope for improvement of these attributes.

5.3.2 Conclusion of the organoleptic test

The sweetpotato varieties 'Singada and 'Gulab Jamun' were liked by most of the participants, although the other recipes were on par in terms of taste and other preferred attributes.

5.3.3 Sweetpotato kiosk at Puri Temple

As a part of a promotion campaign and marketing strategy, a sweetpotato kiosk at the Puri Temple was set up to provide sweetpotatoes to consumers. The sweetpotatoes obtained through

channels or traders of various farmer interest groups in target districts were part of procurement chain to the temple or for general sales outside it. The kiosk was welcomed by consumers at the Grand Road in Puri town as it highlighted the importance of sweetpotato, both culturally and as a nutritious product. The produce was provided to the public by using the "buy-and-sale" method. Sweetpotatoes were bought from the producer and sold to the consumer, and the revenue generated by selling was used to buy sweetpotato again and sold to the public. This process continued until the revenue generation from selling stopped. There was good response from the consumers as they understood the importance of sweetpotato for income and nutrition. There were audio-visual aids used to campaign and distribute the brochures prepared for the consumers.

5.4 VIDEO PRODUCTION ON GAINS PROJECT

A short (18-min)) video was developed, highlighting the major activities of the GAINS project. The video included short interviews with farmers and scientists, and achievements attained through promotional events conducted during the project period. The video was released on 21 July 2017, by the Additional Director of Horticulture, Shri Ramesh, of Chandra Das of the DoH, during the concluding workshop conducted in Bhubaneswar, Odisha.

About the video

The video covered sequence of events starting from the importance of nutritious sweetpotato (OFSP) that brings on smiles, especially to children because of its colour and sweetness. It also described the OFSP as a bright orange root vegetable that is one of the biofortified foods readily available. Sweetpotato has fibre content and is rich in vitamins A and C, calcium, and iron. Odisha as the largest producer and consumer of sweetpotato in India was highlighted. Sweetpotato was well described as a disaster relief crop and is liked by all age groups. The crop is culturally and religiously attached to many Odia people.

The film also covered the fact that in all four districts, by and large the local variety, which is white-fleshed, poor yielding, and of long duration, is still being cultivated. To shift from using local to improved variety cultivation, thorough demonstration at multiple sites as well as awareness on the important traits of improved varieties was needed to be spread across the state's efforts at training and promotion. Replacing 'Desi' with the popular 'Kanjangad'—a variety introduced by CTCRI—and other OFSP varieties released by CTCRI and state agricultural universities helped to meet the requirement of better nutrition availability. Sweetpotato vines were multiplied at research stations and government horticulture farms every year to promote quality planting material production in FFNs. From these nurseries, the vines are distributed to demonstration farms. Sweetpotato intercropping with pigeonpea (Arhar "Dal") had given good results to farmers as better incomes from their own land and nutrition from both crops.

The importance of farm mechanisation to reduce the cost of cultivation was well projected. Machines such as ridgers, harvesters, and vine cutters were highlighted as saving time and labour costs. Processing machines for farmers or skilled entrepreneurs could make the local products accepted by local people. The essence of the video described that though sweetpotato is a traditional food of Odisha with numerous benefits, the area for the production of the crop is gradually declining. Non-availability of improved varieties of the planting material and the absence of a processing industry in the state has made the marketing channels weak; however, these issues are well addressed by the GAINS project. Showcasing sweetpotato as a snack food or in a meal in selected residential schools of the targeted districts has given a right message as the food for children.

Moreover, CIP's GAINS project team for the first time participated in the prestigious agriculture event of Odisha, "Krishi Mahotsav" (Agriculture Fair) 2016 at Bhubaneswar. Besides, a sweetpotato kiosk had been set up in Puri near the temple that displayed the crop and its products to consumers.

Odisha is a land rich in natural resources with good amount of rainfall, active rivers, and fertile land. The state's economy thrives on agricultural income serving millions of farmers and their livelihoods. Both innovation and integration are keys for success of any crop. This is clearly visible in sweetpotato. One can receive more from sweetpotato than from any other crop. The rich vegetable provides nutrition, energy, and better income. This "wonder crop" of the GAINS project has opened new opportunities to maintain a better standard of living.

6. SOCIOECONOMIC INTERVENTIONS AND CONSUMPTION IN GAINS

6.1 GENDER PARTICIPATION

The Gender Empowerment Measure (a measure of inequalities between men and women's opportunities in India) has been minimised to a possible extent. Compared with the previous years, more female farmers have participated. Koraput led (45%) in female farmers 'participation, followed by Ganjam (30%), Dhenkanal (20%), and Sundargarh (5%).

In all the years, the trend reveals a gradual increase in women's participation. They realised that sweetpotato cultivation and consumption are good for income and nutrition within the family.

As far as the STAR districts are concerned, the gender ratio also increased and the area of cultivation ensued with the production and the income generation aspects of the districts. Comparatively, in all the seasons and in the consecutive years, the margin between both genders has been reducing steadily.

6.2 CONSUMPTION OF SWEETPOTATO IN TARGET DISTRICTS OF ODISHA

Odisha is a major sweetpotato-producing and consuming region, where vitamin A deficiency is also prevalent among the poor. In general, there is potential for OFSP to contribute to vitamin A nutrition improvement. Unlike other regions where it is a primary staple food, sweetpotato is a supplementary staple and buffer food in Odisha. OFSP can be promoted through dietary diversification, while exploiting the crop as a cheaper and more readily available food source. Increased OFSP consumption require stimulating demand from the consumption–user side and innovations for value chain development. Partnership with nutrition, education, business, and social welfare sectors is essential.

According to the survey on household coping mechanisms (Pandey et al. 2007), during food shortages poor households shift from cereals to cheaper foods—for example, root crops (80%)—and reduce their overall food intake (73%). Women are most affected during food shortages, since men and children are prioritised for food. During the GAINS project implementation, however, a sweetpotato consumption survey was conducted for 200 households with lactating/pregnant women and children under 5 years in sweetpotato-growing districts in four districts of Odisha, with 50 households in each district (Fig. 4). Sweetpotato is consumed year-round but is more important in October–February, when rice/food stocks are low (70%). About 72% sweetpotato-consuming households surveyed are from schedule castes/tribes and other backward castes; 48% are officially classified as below the poverty line. During the survey conducted (Oct.–Feb.) in Y4 of project from 200 respondents, it was found that 42% respondents are **major consumers** (daily to three times per week) and 58% **minor consumers** (twice per week or less) (Table 14). Sweetpotato is often consumed for breakfast but is generally eaten throughout the day.

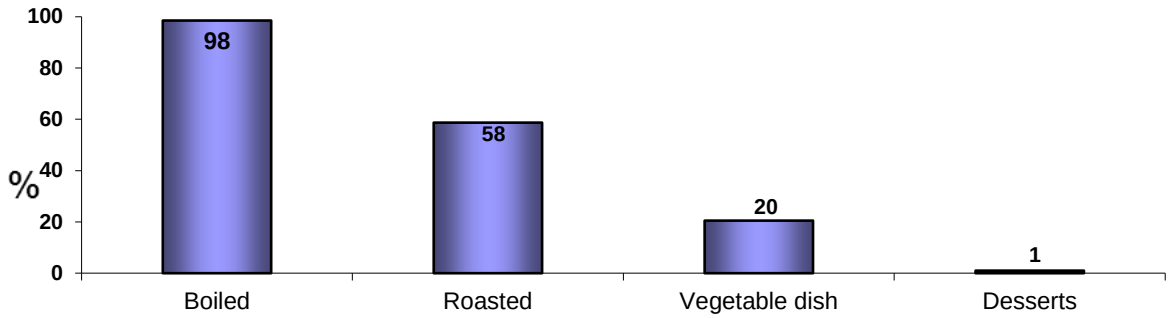


Figure 4. Sweetpotato is mainly prepared as boiled and roasted food in 4 target districts of Odisha.

Table 14. Percentage of respondents for different parameters of consumer preference

S. No.	Parameters	Perception of Major Consumers (%)	Perception of Minor Consumers %
1	Cheap food source	40	30
2	Good for health	90	60
3	Used during festivals	20	30
4	Availability	45	18
5	Children preference	75	70
6	Ease of preparation	70	40
7	Vitamin A rich	22	18

An advanced variety of sweetpotato, 'Bidhan Jyoti' (previously called 'Kamala Sundari'), was selected for GAINS. It is better than the 'Desi' (local) variety in terms of yield and is early bulking and rich in beta-carotene (a precursor of vitamin A) and other properties. It is moderately sweet, is nutritionally rich, and has a relatively long shelf-life (can be stored for a longer period using traditional techniques). The variety released in West Bengal by BCKV State Horticulture University was introduced in different districts of Odisha. The response of farmers in accepting this variety to grow and eat was good.

Intake of sweetpotato has increased many times over in districts because of availability and awareness of improved varieties. Farmers and children started consuming sweetpotato in many forms, such as by frying/roasting, boiling, and curries, aside from snack foods.

6.3 Key Learnings in GAINS Project and the Way Forward

Although during the GAINS project period many major achievements have been made and outputs accomplished, some key lessons learned need to be considered in the expansion of the project to the new target districts. Some of them are addressed below:

- The demand for sweetpotato planting material in the target districts for new sweetpotato growers had increased many times as the project progressed year by year. This was due to the successful campaigns made during the project period on sweetpotato utilisation and opportunities that can boost farm income. This experience of meeting the demand and requirement of planting material to the new sweetpotato growers will be dealt with meticulously if taken up in new districts.
- During the project period, the increase in area of cultivation of sweetpotato was estimated to be more than 25%; this trend is expected to continue. The paradigm shift from traditional to non-traditional areas will boost marketing opportunities.
- The availability of farm machinery that helped to reduce the cost of cultivation was not adequate to farmers groups in GAINS project. Such machinery needs to be made available to maximum number of farmers' groups in the coming years.

- Outreach programmes through capacity building were limited in the pilot phase. Trainings should be given more importance in order to expand the knowledge to the broader spectrum of farmers.
- The inclusion of schools with children participating in promotional activities and women in both on- and off-field activities has shown great results, especially in increased consumption of sweetpotato. These activities should be strongly continued.
- The potential yields obtained and with average increase in productivity recorded by 17% using improved and adapted varieties had encouraged farmers to shift to sweetpotato cultivation. This will be continued and extended into the new districts by introducing new varieties, especially OFSP one.
- Livelihoods improved in the districts of GAINS Phase I through increased incomes and connecting the produce to potential markets. In GAINS Phase II, new markets will be explored and more efforts to link farmers directly to the processing industry will be made.
- Innovative sweetpotato products like puree, flour, and chips need to be highlighted more in the coming seasons. The opportunities to use the products commercially will be given special importance.
- The interest in supporting sweetpotato activities by policymakers has become quite evident in the GAINS project. More partners and institutions are likely to be included should GAINS be extended.
- Contract farming opportunities that link sweetpotato to existing food-processing industries in Odisha could be explored and more entrepreneurs/traders be invited to be part of the state's sweetpotato mission.

7. SUMMARY OF GAINS PROJECT

The GAINS project, supported by the Government of Odisha under the RKVY scheme of the government of India, was executed by CIP from August 2013 to November 2017, in close collaboration with the DoH of the GoO, and with participation of other ICAR institutes. The main achievements are summarised as follows:

- **Two varieties** ('Kanjangad' and 'Bidhan Jyoti') were widely popularised due to better growing and nutritious characteristics compared with existing local or other introduced varieties.
- About **6,000 beneficiaries** were reached directly through the project's interventions and farmers who grow nutritious sweetpotato.
- **Multiplication of varieties** organised in a systematic and sustainable way with the participation of different institutions in the districts. CIP/CHES and DoH farms provided sufficient key planting material to FFNs for demonstrations. Participating farmers realised good income and their families profited from nutritious sweetpotato.
- **OFSP** rich in vitamin A has been introduced on a large scale for the first time for better nutrition and income generation.
- The multiplied planting material was carefully distributed to the different target districts occupying an **1,325 ha** after the 4-year project period.
- **Vigorous trainings** on innovative production practices, including intercropping with pigeonpea, combined with the distribution of training materials and campaigns on the diverse utilisation of sweetpotato has encouraged farmers to cultivate sweetpotato season after season.

- Different promotional activities and the provision of four pack houses for **improving the marketing** of sweetpotato, exposure visits, and nutritional messages were widely implemented in the four districts.
- **Sweetpotato farm mechanisation** was introduced for the first time in the country to boost production and farm income.
- A complete **video documentation** about the GAINS project, led by the DoH in association with CIP, was released in the state to encourage Odisha people to consume more sweetpotato for better nutrition and health.
- An **increase of the sweetpotato production area of >25%** was recorded in the four districts of Odisha during the 4-year project implementation.
- **Small entrepreneur sweetpotato processing** machines were introduced to encourage self-employment and to generate income.
- The **innovations** implemented under GAINS increased sweetpotato productivity as recorded by 17%; increases in farm incomes have been reported up to 40%.
- Participation in the state agriculture show and organising innovative campaigns in the state has led to the **popularisation** of the crop.
- Sweetpotato is considered to be one of the most important crops under the State Contingency Plan and that also thrives well under more frequent drought and heat conditions caused by **climate change**. Also, sweetpotato is considered a disaster relief crop that survives the cyclonic storms, thus ensuring food security to farmers after disasters. This last point was well documented as Odisha experienced a severe cyclone, Phailin, in 2013.

The successful completion of the GAINS project provided a well-established platform to spill over the successful achievements of the project to four more districts of Odisha, preferably in Phase II if approved by the GoO. Through Phase II project interventions there is an opportunity to gradually create two major sweetpotato production zones, one in the south and another in the northern part of Odisha. This will facilitate the export of the produce to different states of southern and northern India. Further, some of the tribal districts will directly profit through increased production and the addressing of malnutrition.

Moreover, the school nutrition programme, awareness campaigns, and trainings have to assume centre-stage, building further confidence of consumers and farmers with a better image of the crop through nutrition messages and with increased marketing opportunities for better incomes.

8. FINANCIAL REPORT

The financial report presents the receipt and utilisation of funds in FY 2016–2017. This report also provides information on the utilisation of funds of Y3 that were submitted to the DoH, GoO (see pages 21–23).

UTILISATION CERTIFICATE

Sl.No.	Letter No. And Date	Amount Sanctioned
1	RKVY (H2)32/2015 2/800 Date:18-01-2017	Rs. 337.11 Lakh
		Rs.337.11 Lakh

1. Certified that out of **Rs 337.11 Lakh** grants-in-aid sanctioned during the year **2016-17** in favour of **Program Director, CIP, Bhubaneswar (Through ICRISAT)** under **International Potato Centre** Lt.No. Given in the margin a Sum of **Rs. 254.3615 lakh** has been utilized in full for the purpose of GAINS Project for which it was sanctioned. A sum of **Rs. 82.7485** remains unspent till date.

2.Certified that I have satisfied myself that the conditions which the grants in aid was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose which it was sanctioned.

Kinds of checks exercised

1. Joint Verification by the concerned District Horticulture Authority
2. Cash Register maintained by CIP
3. Stock Register maintained by CIP
4. Report related to the Project
5. Photographs and Knowledge products

Date: 19/07/2017

Signature

19/07/2017

Designation: Program Director

Program Director
INTERNATIONAL POTATO CENTER (CIP)
CIP LIAISON OFFICE, RC CTCRI
DUMDUMA, BHUBANESWAR-15
ODISHA. TEL : +91 674 2472244

FORM GFR 19 - A
[See Government of India's Decision (1) below Rule 150]
Form of Utilization Certificate

S.No.	Letter No. and date	Amount (Lakhs in Rupees)
01	Memo No. 2720, Dt. 29.12.16 of DDH Ganjam	62.88462
02	Memo No. 39, Dt. 06.01.17 of DDH Sundargarh	52.54929
03	Memo No. 45, Dt. 06.01.17 of DDH Dhenkanal	63.75726
04	Memo No. 21, Dt. 03.01.17 of DDH Koraput to ICRISAT	52.54929
05	Lt. No. 2/800 Dt. 18.01.2017	105.36954
	TOTAL	337.11

1. Certified that out of Rs **337.11** Lakh grants in aid sanctioned during the year 2016-17 in favor of CIP, Bhubaneswar under this Ministry / Department Letter No. given in the margin and Rs **Nil** on account of unspent balance of the previous year, a sum of Rs **277.19182** Lakh has been utilized for the purpose of GAINS project for which it was sanctioned and that the balance Rs. **59.91818** Lakh of remaining unutilized at the end of the year will be utilized.

2. Certified that I have satisfied myself that the conditions on which the grants- in- aid was sanctioned have been duly fulfilled / are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised

1 Joint verification by the concerned District Horticulture Authority
2. Cash Register maintained by CIP
3. Stock Register maintained by CIP
4. Report related to the project
5. Photographs and knowledge products

Note: ***An amount of Rs. 254.3615 Lakh UC was submitted for 2016-17 on date 19.07.2017 to the Director, Directorate of Horticulture, Bhubaneswar***

Signature

20/10/2017

Designation: Program Director

Program Director
INTERNATIONAL POTATO CENTER (CIP)
CIP LIAISON OFFICE, RC CTCRI
DUMDUMA, BHUBANESWAR-19
ODISHA. TEL : +91 674 2472244

FORM GFR 19 - A
[See Government of India's Decision (1) below Rule 150]
Form of Utilization Certificate

Sl.No.	Letter No. and date	Amount (lakhs)
01	Memo No. 2720, Dt. 29.12.16 of DDH Ganjam	62.88462
02	Memo No. 38, Dt. 06.01.17 of DDH Sundargarh	52.54929
03	Memo No. 45, Dt. 06.01.17 of DDH Dhenkanal	63.75726
04	Memo No. 21, Dt. 03.01.17 of DDH Koraput to ICRISAT	52.54929
05	Lt. No. 2/800 Dt. 18.01.2017	105.36954
	TOTAL	337.11

Certified that out of Rs **337.11** Lakhs grants in aid sanctioned during the year 2016-17 in favour of CIP, Bhubaneswar under this Ministry / Department Letter No. given in the margin and Rs **Nil** on account of unspent balance of the previous year, a sum of Rs **333.11** Lakhs has been utilized for the purpose of GAINS project for which it was sanctioned and that the balance Rs. **4.00** Lakh of remaining unutilized at the end of the year has been refunded on 30.11.2017 to Directorate of Horticulture, Govt. of Odisha, Bhubaneswar.

2. Certified that I have satisfied myself that the conditions on which the grants- in- aid was sanctioned have been duly fulfilled / are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised

1 Joint verification by the concerned District Horticulture Authority
2. Cash Register maintained by CIP
3. Stock Register maintained by CIP
4. Report related to the project
5. Photographs and knowledge products

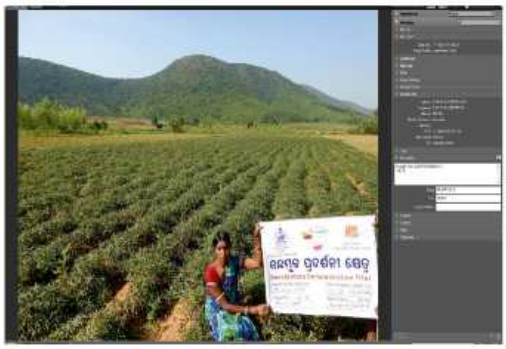
Rs. 254.3615 Lakh 1st phase UC submitted on dated 19.07.2017
Rs. 22.83032 Lakh 2nd phase UC submitted on dated 20.10.2017

30/11/2017

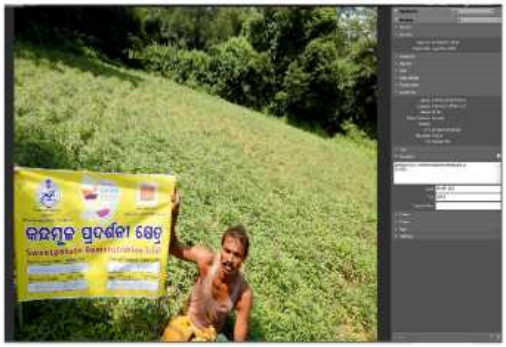
Signature:
Designation:

Program Director
INTERNATIONAL POTATO CENTER (CIP)
CIP LIAISON OFFICE, RC CTCRI
DUMDUMA, BHUBANESWAR-19
ODISHA. TEL : +91 674 2472244

9. PHOTO DOCUMENTATION



Koraput



Dhenkanal

GPS Mapping

GPS Mapping

Ganjam

Sundargarh

Annual Review workshop

Odisha farmers and technical officers visit to Chhattisgarh State

Odisha farmers and technical officers visit to West Bengal

Capacity building

Sweetpotato Mobile Kitchen

Sweetpotato Kiosk at Puri

Sweetpotato Kiosk at Puri

Sweetpotato Hoarding

Media Coverage

ଓଡ଼ିଶା
ଭାସ୍କର
ODISHA BHASKAR

ସଚେତନତା ରଥର ଶୁଭାରମ୍ଭ

किसान सीखेंगे कंदीय फसलों की खेती

कालेंग के 40 किसानों को मिलेगी सौलर पम्प की सौगात

ओडिशा के कृषक करेंगे कंदीय फसलों का अध्ययन

उगदलपुर| शासकीय गुण्डाधुर कृषि महाविद्यालय एवं अनुसंधान केन्द्र में आयोजित प्रशिक्षण कार्यक्रम में कंदीय फसलों की कृषि के लिए उन्नत तकनीकों के अध्ययन के लिए ओडिशा से आए कृषकों व कृषि वैज्ञानिकों के दल को कमिश्नर दिलीप वासनीकर ने संबोधित किया। ओडिशा से 80 किसानों का दल यहां आया हुआ है।

किसान सीखेंगे कंदीय

कृषि कालेज में ओडिशा से आए किसानों को बताया नया उन्नत कृषि के तौर- तरीके

कंदीय फसलों की खेती की दी जानकारी

ओडिशा का दल बस्तर में करेगा फसलों का अध्ययन

गुण्डाधुर कॉलेज में हुआ प्रशिक्षण शिविर

Sweetpotato Pack House

Wall Panting

School nutrition programs

School nutrition programs

ANNEX 1.

Exposure visit to farmers of Odisha and orientation and training program on sweetpotato and other tuber crops under GAINS (Generating Advances in Incomes and Nutrition through Sweetpotato) project organized by CIP and AICRP on Tuber Crops, Jagdalpur centre, ICAR, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Jagdalpur, Chhattisgarh state.

Program Schedule
Venue: Semiar Hall, College of Agriculture, Jagdalpur
1–2 March 2017

Day 1. Inaugural session: 1 March 2017

Time	Programme
10.00 AM	Registration
10.30 AM	Welcome address by Dr S.C. Mukherjee, Dean, SGCARS, Jagdalpur, IGKV
11:20 AM	About the training & exposure visit by Dr Sreekanth Attaluri, Project Manager, CIP
11.45 AM	Presidential address by Dr J.S. Urkurkar, Director, Directorate of Research Services, IGKV
11.45 AM	Vote of thanks, Dr Deo Shankar Ram, Scientist, Tuber Crops
11.50 AM	Tea Break

Day 1. Technical session: 1 March 2017

Time	Programme
12.15PM	Prospects of Sweetpotato in Eastern and Central India by Dr Attaluri, Project Manager, CIP
12.45–1.15PM	Dr Ram, Status of sweetpotato in Chhattisgarh and production technologies of minor tuber crops
1.15–2-30 PM	LUNCH Break
2.30PM	Dr Adikant Pradhan, Scientist, Integrated cropping systems involving tuber crops for incomes and nutrition
2.50PM	Dr Avinash Gupta, Scientist, Entomology, Plant protection in tuber crops with emphasis on Sweetpotato
3.30–4.30 PM	Interaction between Odisha technical officers/farmers and scientists of SGCARS Jagdalpur
4.30–4.45 PM	Tea
4.45–5.30 PM	Visit to the exhibited products: Odisha and Chhattisgarh

Day 2. Field Visit 2 March 2017

Time	Programme
9.30–11.00AM	Visit to the Experimental Field of AICRP Tuber Crops, Jagdalpur centre and Sweetpotato germplasm Blocks; other related tuber crops/state of art technlogies
11:00AM–2.00 PM	Field visit and Odisha/Chhattisgarh famers interaction
2.00–3.00 PM	LUNCH
3.00–4.30PM	Return to Jagdalpur

ANNEX 2.

Program Schedule

Venue: Farmers Academy and Convention Center, BCKV, Kalyani, West Bengal
10–11 March 2017

Day 1. Inaugural session: 10 March 2017 (Friday)

Time	Programme
9.00–10.00 AM	Registration
10.00 AM	Welcome address by Prof. SriKumar Pal, Director of Research, BCKV
10.05 AM	Address by Prof. Kajal Sengupta, Dean, Faculty of Agriculture, BCKV
10:10 AM	Address by Prof. Jitesh Hore, Dean, Faculty of Horticulture, BCKV
10:15 AM	About the training & exposure visit by Dr Attaluri, Project Manager, CIP
10: 20 AM	Presidential address by Prof. Dharani Dhar Patra, Vice Chancellor, BCKV
10: 25 AM	Vote of thanks by Prof. Jayanta Tarafdar, Officer in Charge, AICRP Tuber crops
10.30 AM	Tea Break

Day 1. Technical session: 10 March 2017

Time	Programme
10.45 AM	Raising hopes and creating opportunities for sweetpotato growers in Odisha by Dr Attaluri, Project Manager, CIP
11:10 AM	Fertilizer response to sweetpotato, Dr Niharendu Saha, OIC, ICAR-STCR, BCKV
11: 30 AM	Integrated Pest Management on Sweetpotato, Prof. Anirudha Pramanik
12:00 PM	Postharvest and value addition of sweetpotato, Prof. Surajit Mitra, AICRP on tuber crops, BCKV
12:30 PM	Present status of tuber crops and value addition in West Bengal- Prof J Tarafdar
2:00 PM	LUNCH
3:00–6:00 PM	Visit to the Experimental Field of AICRP Tuber Crops, Sweetpotato germplasm blocks and showcasing state of art technologies by BCKV

Day 2. Field Visit: 11 March 2017

Time	Programme
9.30 AM–6:00 PM	Field visit and Odisha/ West Bengal famers interaction
6:00 PM	Return to Kalyani

ANNEX 3

Schools participating in the school nutrition garden programme

Date	School	Village	Gram Panchayat	Block	District
07-09-2017	Govt. high school	Mahipani	Bhalulata	Bisra	Sundargarh
07-09-2017	Govt. high school	Manko	Manko	Bisra	Sundargarh
08-09-2017	Govt. girls high school	Chhatenpali	Chhatenpali	Lephripada	Sundargarh
08-09-2017	Govt. girls high school	Baragada	Baragada	Sundargarh	Sundargarh
11-09-2017	Lakhananda high school	Subai	Subai	Semliguda	Koraput
11-09-2017	Kanya Aashram UP school	Subai	Subai	Semliguda	Koraput
11-09-2017	Bala Aashram high school	Subai	Subai	Semliguda	Koraput
11-09-2017	Bala Aashram UP school	Pitaguda	Pitaguda	Semliguda	Koraput
18-09-2017	Samantrapur School	Samantrapur	T Gobindpur	Sanakhemundi	Ganjam
18-09-2017	Dhimirapalli School	Dhimirapalli	T Gobindpur	Sanakhemundi	Ganjam
18-09-2017	Daseipur	Daseipur	T Gobindpur	Sanakhemundi	Ganjam
19-09-2017	Karadakana Govt. High School	Karadakana	Karadakana	Sheragada	Ganjam
19-09-2017	Khamara UP school	Khamara	Mahupadara	Sheragada	Ganjam
19-09-2017	Takarada Sahid High School	Takarada	Takarada	Sheragada	Ganjam
19-09-2017	Dhinkisala High School	Dhinkisala	Dhinkisala	Sheragada	Ganjam
20-09-2017	Prakalpa Prathamika Vidyalay	Banimari	Konkia	Kukudakhandi	Ganjam
20-09-2017	Kalinga Ashrama	Amania	Khinkia	Kukudakhandi	Ganjam
21-09-2017	Guharia Pata Ashrama School	Guharia Pata	Dimiraia	Khallikhote	Ganjam
21-09-2017	Badapalli Ashrama School	Badapalli	Badapalli	Khallikote	Ganjam
26-09-2017	Gengutia Prathamika Vidyalaya	Gengutia	Gengutia	Khamkhyanagar	Dhenkanal
26-09-2017	Gengutia UP School	Gengutia	Gengutia	Khamkhyanagar	Dhenkanal
26-09-2017	Rayanarasinghpur Prathamika Vidyalaya	Kamagara	Rayanarasingpur	Khamkhyanagar	Dhenkanal
26-09-2017	Godaribili Prathamika Vidyalaya	Godaribili	Kotagara	Khamkhyanagar	Dhenkanal
26-09-2017	Kotagara UP School	Kotagara	Kotagara	Khamkhyanagar	Dhenkanal

Villages and blocks visited during the Mobile Kitchen Campaign

S. No.	Date	Time	Village	Gram Panchayat	Block	District
1	29-08-2017	10.00 AM	Jharapalli	B.N.Pur	Khallikote	Ganjam
2	29-08-2017	2.30 PM	Naibandha	Kurula	Sheragada	Ganjam
3	30-08-2017	10.00 AM	S.Gopalpur	S.Gopalpur	Sanakhemundi	Ganjam
4	30-08-2017	2.30 PM	Sindurapur	K.Nuagaon	Chikiti	Ganjam
5	04-09-2017	10.30 AM	Alusingh	Alusingh	Hindol	Dhenkanal
6	04-09-2017	3.00 PM	Baisinga	Baisinga	Kamakhyanagar	Dhenkanal
7	18-08-2017	10.00 AM	Alapakka	Alappakka	Lephripada	Sundargarh
8	18-08-2017	2.30 PM	Latao	Badagaon	Badagaon	Sundargarh
9	19-08-2017	10.00 AM	Phooljhar	Nuagaon	Nuagaon	Sundargarh
10	19-08-2017	2.30 PM	Sanpokhar (BSS)	Bisra	Bisra	Sundargarh
11	10-08-2017	10.00 AM	Malibelgaon	Malibelgaon	Nandpur	Koraput
12	10-08-2017	2.30 PM	Devapujariput	Banamaliput	Lamtaput	Koraput
13	11-08-2017	10.00 AM	Nuaput	Pakhajhola	Semiliguda	Koraput
14	11-08-2017	2.30 PM	Pukali	Pukali	Pottangi	Koraput

ANNEX 4.

Evaluation sheet:

SWEETPOTATO RECIPE (Product) EVALUATION SHEET

Name of evaluator: _____ Age: _____ years Sex (M/F):

Village: _____District_____ Date: _____ Name of the recipe (English/Bangla)_____

Attribute	 **1= Very Bad**	 **2= Bad**	 **3= Fair**	 **4= Good**	 **5= Very Good**
Appearance					
Colour (intensity/uniformity)					
Odour/Smell /Flavour					
Taste					
Sweetness					
Feel /Texture					
Fibre					
Others (specify)					
Overall Taste Acceptability					

ANNEX 5.

S. No.	Machines	Specifications
1	Vine Cutter	Machine Size : 700 x 700 x 1,700 mm Petrol Engine Capacity : Petrol Engine of 5 HP. Production Capacity : 3600 vines/hr i.e., 3600 x 4 cuts = 14400 cut pieces/hr Continuous operation : Approx. 4 hrs at full tank
2	Chipping Machine	Power : 1 HP 1 Ph Output capacity : Approx. 100 kg of chips
3	Harvester	Output capacity : Approx. 4 Acres of land/hr
4	Mincer	Power : 1 HP 1 Ph Output capacity : Approx. 30kgs of puree
5	Sweetpotato Combo Machine (3 in 1 processor)	This machine is a prototype for carrying out 3 different processes on sweet pototat i.e., Cutting, Drying and Flour. The production capacity of Cutting section is Approx. 100kgs/hr In Cutting process by changing the blades 3 different type of cutting is possible 1. Slices 2. Finger Chips 3. Dices Drying section consist of two parts 1. Front Conveyor dryer where Slices and Finger chips can be dryed 2. Rear Dryer: 3nos. of Rear Dryers are also installed in the machine to dry small finger chips and dices as well. The Drying capacity is of Approx. 92%. The front conveyor has a capacity of Approx. 4kg/hr of Raw sweetpotato i.e., cut piece which will give approx. 1.2kg of dried chips. The Rear Dryer too has a capacity of Approx. 4 kg/hr of Raw pieces which will give approx. 1.2kg of dried finger chips and dices. The Final section consist of Flour Machine which has production capacity of 8kgs/hr of flour. The size of the machine is 850mm x 1000mm x 2300mm(L) Electricity : Approx. 1.25HP 1 PH for slicing with conveyor and 0.5HP for flour making machine Gas consumption : Front Conveyor : Approx. 0.8kg gas/hr Rear Dryer : Approx. 0.55kg gas/hr each dryer
6	Solar energy run sweetpotato cold storage facility	System: Solar PV panels of 3,000 W were used and structural work with earthing was done, along with lightening safety, inverter, electric meters control panel and cabling with net metering; Air conditioner: Air conditioner of capacity of 2 t (6,000 Kcal/Hr.) with min. temperature 12°C. The room temperature can be set at any temperature in the range of 12°–28°C. Temperature inside storage room maintained at 15°C for sweetpotato. Room insulation: To avoid heat transition between outer and inner atmosphere all the walls and roof are insulated with thermocol (40 mm thickness) and plastic insulation sheets (6-mm plastic sheet) covering 4 side walls and ceiling only (floor not included)

The International Potato Center (known by its Spanish acronym CIP) is a research-for-development organization with a focus on potato, sweetpotato, and Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change, and the preservation of our Earth's fragile biodiversity and natural resources.
www.cipotato.org

CIP is a member of CGIAR.

CGIAR is a global research partnership for a food-secure future. Its science is carried out by 15 research centers in close collaboration with hundreds of partners across the globe.

For more information, please contact CIP Headquarters:
Av. La Molina 1895, La Molina Apartado 1558, Lima, 12 Peru.
5-11-3496017 m.bellido@cgiar.org www.cipotato.org