
Half-yearly Progress Report

April – September 2020

Enhancing Agricultural Productivity and Rural Livelihoods through Scaling-up of Science-led Development in Odisha: Bhoochetana



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Department of Agriculture & Farmer Empowerment
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INTERNATIONAL CROPS RESEARCH
INSTITUTE FOR THE SEMI-ARID TROPICS

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1. Executive Summary

The Odisha *Bhoochetana* Project has the mandate of improving crop productivity and rural livelihoods through science-based Natural Resource Management in the State. The objectives of the project include assessment of nutrient status of soils in 30 districts through stratified random sampling, identification of best bet soil, water and crop management practices to increase the productivity, upgrading of two laboratories as referral labs, capacity building of Dept. of Agriculture staff and consortium partners including farmers and concurrently monitor, evaluate, assess and document the impacts for mid-term corrections.

During Rabi, 2019-20 season, a total of 1717 demonstrations were conducted in an area of 934 acres across all the 30 districts. Majority of the demonstrations were laid out to showcase the benefits of application of deficient micronutrient (zinc and boron) and also improved cultivars and humic acid. The crops chosen for demonstrations included paddy, finger millet, chickpea, blackgram, greengram, groundnut, mustard and sunflower. The average increase in crop yield ranged between 22% and 53 % and the highest yield response was obtained in finger millet (53%) followed by chickpea (36%), mustard (34%), blackgram (33%) greengram (32%), sunflower (29%), groundnut (27%) and paddy (22%).

With regard to setting up of referral laboratories at Bhubaneswar and Sambalpur, the laboratory in Bhubaneswar is in commencement stage and in Sambalpur, all equipment are ready on site after addressing the wiring issue. Installation of MPES in Bhubaneswar is pending for that want of approval by Soil Chemist on account of COVID-19 situation. Requisite glassware and chemicals for analysis of 10000 samples at each site have been dispatched from ICRISAT, Hyderabad and reached the respective sites i.e. Bhubaneswar and Sambalpur.

For wider dissemination of the findings of 2 years of Bhoochetana work, the *Odisha Bhoochetana* project story was published in ICRISAT Happenings Newsletter (23 July 2020).

2. Introduction

ICRISAT has joined hands with the Government of Odisha since 2018 and initiated a mission mode project called “*Odisha Bhoochetana*” with a mandate of improving crop productivity and rural livelihoods through science based natural resource management. ICRISAT worked with more than 20 local NGO partners, Odisha University of Agriculture & Technology (OUAT) and Department of Agriculture in the state.

Under the project, efforts are directed on provision of best bet management practices for increasing crop productivity in 30 districts along with the assessment of nutrient status of soils, followed by soil health mapping and upgrading two soil testing laboratories into referral laboratories.

3. Objectives

The specific objectives are;

- To upgrade two existing soil analytical laboratories in the state to serve as referral laboratories and run them efficiently with government support.
- Identify the best soil, crop, water and nutrient management options for sustainable intensification of major crops in different agro-ecoregions to increase productivity through demonstrations in pilot sites and scalingup in partnership with DoA and other partners through convergence.
- To assess the nutrient status of soils in the 30 districts of Odisha through stratified soil sampling.
- To build the capacity of DoA staff in undertaking soil analysis, handling data and that of other consortium partners including farmers for scalingup science-led holistic development strategy using ICT tools.
- To concurrently monitor, evaluate, assess and document the impacts of the scalingup approach in order to enable mid-course corrections.

4. Demonstration of Improved Practices – Crop Responses during Rabi 2019-20

As part of the Bhoochetana project, ICRISAT has committed to carry out 1600 crop trials per year covering all 30 districts of the state. Based soil test results, demos on soil test based nutrient management, and also improved cultivars, integrated pest management were laid out in farmer-participatory mode during rabi, 2019-20 season (Table 1). A total of 1717 demos covering an area of 934 acres were conducted across 30 districts in clusters of villages to develop sites of learning in each district. Majority of the trials were laid out for evaluation of deficient micronutrient application, improved cultivars and humic acid application. In view of growing long duration paddy during kharif and no scope for taking second crop, emphasis was laid on growing short duration pulses viz. chickpea, green gram and black gram in rice fallow situation. To facilitate production of more number of auxillary flower bearing branches and to overcoming the apical dominance, nipping of apical bud using simple devise is also demonstrated in chickpea. In view of wide spread deficiency of organic carbon and low

productivity, demonstration were also organized on application of humic acid. Since majority of soils are acidic in nature and higher prevalence of micro-nutrient deficiencies like zinc and boron, demonstrations were organized with a combination of micronutrients and STBR practices. In places where farmers continued to use low input responsive varieties, demonstrations on improved cultivars that are responsive to nutrients and showing tolerance to abiotic stress like submergence, moisture stress and pest and disease infestation were organized according to location specific situation. Trials were conducted in 0.5-1.0 acre fields.

Table 1. Details of demonstration conducted in Rabi, 2019-20

District	Crop	Area (acres)	No. of Demos
Angul	Finger Millet	3.50	10
	Groundnut	7.90	19
	Total	11.40	29
Balangir	Chickpea	14.82	30
	Total	14.82	30
Balasore	Blackgram	6.50	13
	Greengram	6.50	13
	Mustard	5.00	10
	Paddy	9.50	19
	Total	27.5	55
Bargarh	Greengram	6.00	12
	Paddy	19.00	38
	Total	25.00	50
Bhadrak	Blackgram	15.00	40
	Greengram	5.00	20
	Total	20.00	60
Boudh	Blackgram	5.00	10
	Chickpea	5.00	10
	Greengram	5.00	10
	Total	15.00	30
Cuttack	Blackgram	10.00	20
	Greengram	10.00	20
	Total	20.00	40
Deogarh	Groundnut	25.00	70
	Total	25.00	70
Dhenkanal	Blackgram	10.00	20
	Greengram	9.00	18
	Total	19.00	38
Gajapati	Blackgram	15.50	31
	Total	15.50	31
Ganjam	Blackgram	12.50	27
	Greengram	11.25	23
	Total	23.75	50
Jagatsinghpur	Blackgram	18.00	31

	Greengram	23.00	33
	Total	41.00	64
Jajpur	Blackgram	4.75	19
	Greengram	14.25	39
	Total	19.00	58
Jharsuguda	Blackgram	8.50	16
	Chickpea	9.50	19
	Greengram	15.75	30
	Mustard	7.30	11
	Total	41.05	76
Kalahandi	Chickpea	10.00	20
	Greengram	10.00	20
	Paddy	10.00	20
	Total	30.00	60
Kandhamal	Paddy	45.00	90
	Total	45.00	90
Kendrapara	Blackgram	10.00	20
	Greengram	58.50	61
	Total	68.50	81
Keonjhar	Chickpea	64.40	83
	Total	64.40	83
Khordha	Blackgram	9.00	18
	Chickpea	16.50	33
	Greengram	3.00	6
	Total	28.50	57
Koraput	Chickpea	12.50	25
	Total	12.50	25
Malkangiri	Groundnut	70.00	100
	Total	70.00	100
Mayurbhanj	Chickpea	28.80	72
	Groundnut	8.20	20
	Mustard	14.00	15
	Total	51.00	107
Nabarangpur	Chickpea	30.00	60
	Total	30.00	60
Nayagarh	Greengram	12.50	39
	Paddy	46.50	70
	Total	59.00	109
Nuapada	Chickpea	14.82	30
	Total	14.82	30
Puri	Blackgram	10.50	21
	Greengram	9.50	19
	Total	20.00	40
Rayagada	Sunflower	30.00	60

	Total	30.00	60
Sambalpur	Blackgram	9.25	15
	Greengram	11.50	20
	Mustard	10.00	8
	Paddy	12.00	24
	Total	42.75	67
Subarnapur	Blackgram	7.50	15
	Greengram	7.50	15
	Total	15.00	30
Sundargarh	Chickpea	34.50	37
	Total	34.50	37
Grand Total		933.99	1717

4.1 Response of crops to various technologies

There is a varied response of crops to improved technologies viz. improved cultivar, soil test based nutrient management, application of micro-nutrients (boron and zinc) across various districts in Odisha (Figure 1). Highest yield response was obtained in finger millet (53%) followed by chickpea (36%), mustard (34%), blackgram (34%), greengram (32%), sunflower (29%), groundnut (27%) and paddy (22%).

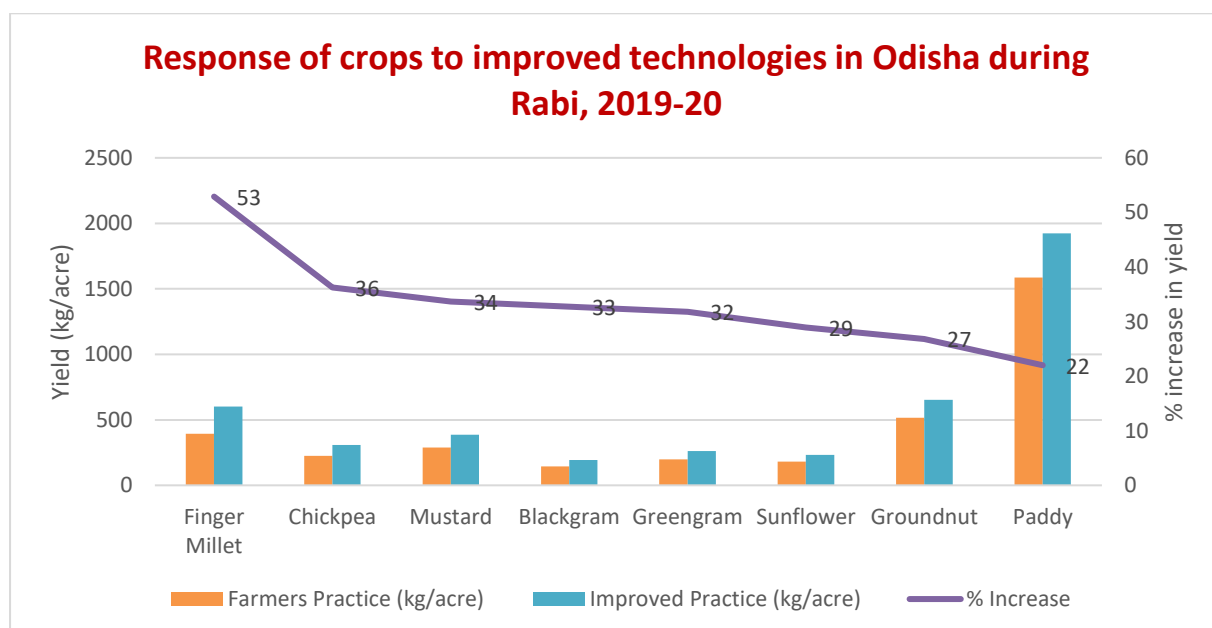


Figure 1. Response of crops to improved technologies in Odisha

4.2 Responses to soil test-based nutrient management

Application of nutrients as per the soil test values gave increased yields across various districts in Odisha (Table 2). In case of blackgram application of zinc + boron + humic acid gave higher yield (48%) compared to application of either boron or zinc or humic acid alone or in combinations. Similar yield response was noticed in case of greengram where application of zinc + boron + humic acid gave higher yield (51%) compared to application of either zinc + boron or humic acid alone. In case of chickpea

application of zinc + boron + humic acid gave higher yields to the extent of 54%. In finger millet application of zinc + boron gave higher yield (53%). Application of nutrients as per soil test based values i.e. NPK in groundnut gave higher yield (37%). In case of mustard application of zinc and boron along with humic acid gave showed yield response of 38% compared to application zinc + boron. Similar yield response was noticed in paddy (28%). In sunflower, application of boron increased the yield by 29% compared to farmers practice.

Table 2. Response of crops to soil test-based nutrient management practices

Crop	Yield (kg/acre)		% Increase
	Farmers Practice	Improved Practice	
Blackgram			
Humic Acid	99	118	19
STBR	90	103	14
STBR (B)	167	192	14
STBR (Zn)	97	110	13
STBR (Zn + B)	117	151	26
STBR (Zn + B) + Humic Acid	173	256	48
Chickpea			
Humic Acid	412	444	8
STBR	232	339	46
STBR (Zn + B)	208	293	41
STBR (Zn + B) + Humic Acid	175	269	54
Finger Millet			
STBR (Zn + B)	393	602	53
Greengram			
Humic Acid	107	128	19
STBR (B) + Humic Acid	177	195	10
STBR (Zn + B)	221	299	35
STBR (Zn + B) + Humic Acid	167	253	51
Groundnut			
STBR	514	703	37
STBR (Zn + B)	523	656	26
STBR (Zn + B) + Humic Acid	427	556	30
Mustard			
STBR (Zn + B)	287	371	29
STBR (Zn + B) + Humic Acid	290	398	38
Paddy			
STBR (Zn + B)	1803	2139	19
STBR (B) + Humic Acid	1327	1700	28
Sunflower			
STBR (B)	180	232	29



Figure 2. Demonstration on boron application in sunflower in Rayagada

4.3 Permormace of improved crop cultivars

Improved cultivars are highly responsive to fertilizer nutrients including the micronutrients. In case of blackgram UP-31 gave significantly higher yield (89%) in Subarnapur compared to non-descript local cultivars (Figure 3). Improved greengram cultivar IPM 02-14 showed varied yield response across the districts with highest response in Subarnapur (111%) followed by Boudh (51%), Kalahandi (39%), Jharsuguda (38%), Ganjam (25%), Bargarh (20%), Cuttack and Khorda (19%), Balasore (15%) and Nayagarh (10%). There is a varied response of improved cultivars in chickpea across the districts (Figure 5). Highest yield response was observed with NBGE-3 variety in Boudh (54%) followed by JG-11 in Kalahandi (52%), JAKI-9218 in Nabrangpur (41%), JG-14 in Khorda (28%), JAKI-9218 in Jharsuguda (26%) and NBGE-3 in Koraput (20%).

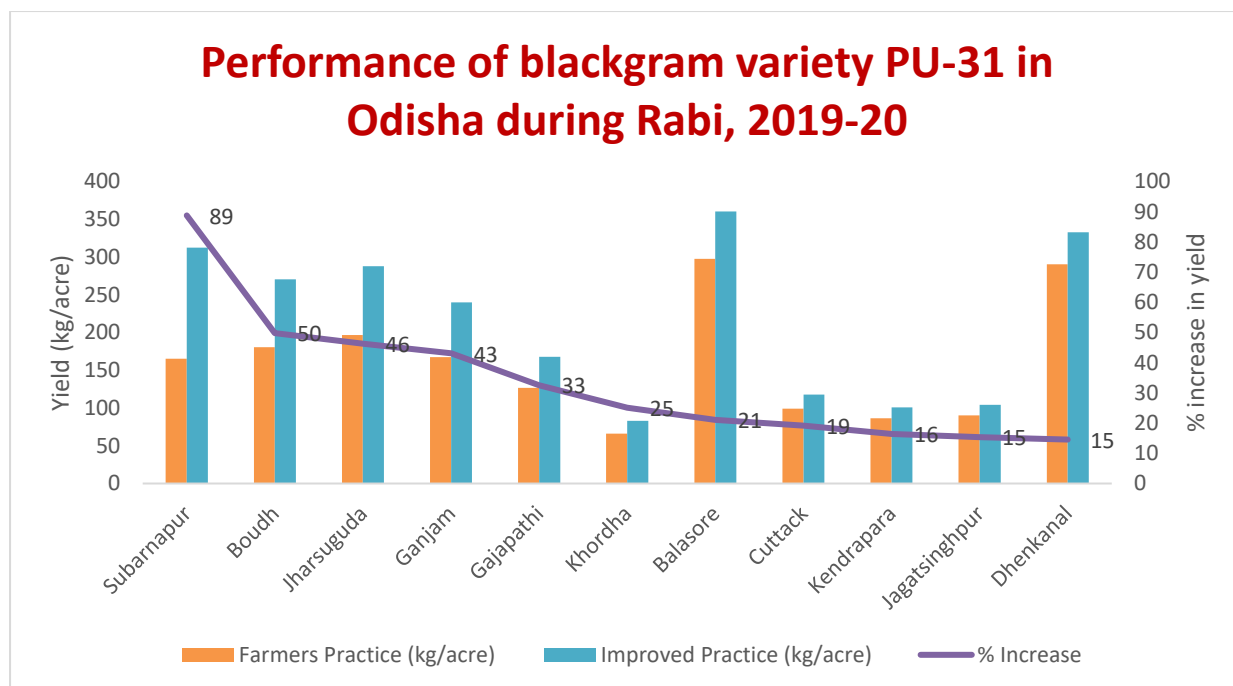


Figure 3. Performance of blackgram variety PU-31 in Odisha during Rabi, 2019-20

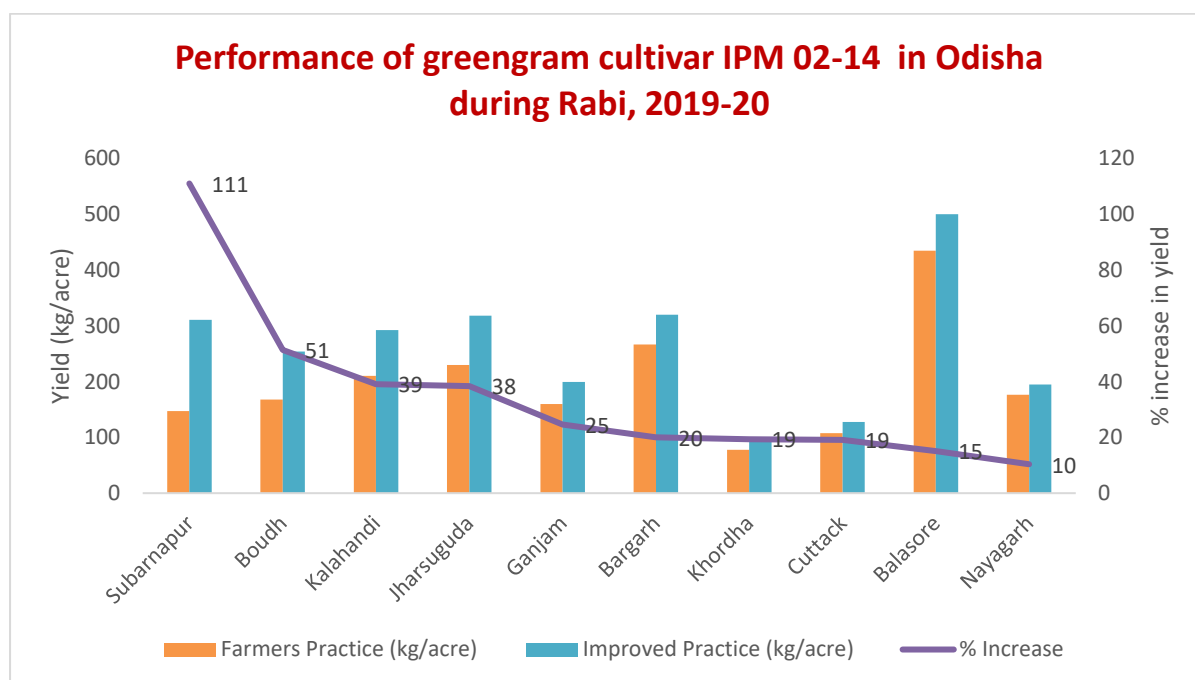


Figure 4. Performance of greengram cultivars in Odisha during Rabi, 2019-20

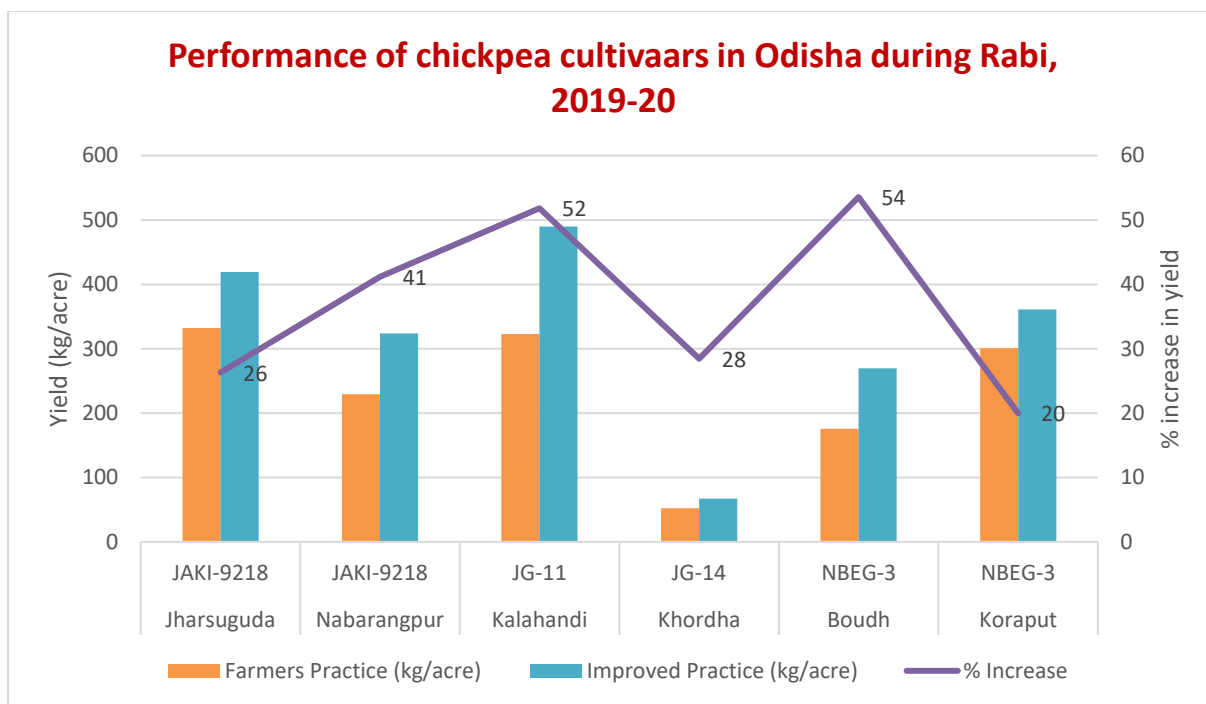


Figure 5. Performance of chickpea cultivars in Odisha during Rabi, 2019-20



Figure 6. Greengram demonstration on IPM 02-14 in Nayagarh



Figure 7. Demonstration of chickpea cultivar JAKI-9218 in Jharsuguda



Figure 8. Crop cutting experiments in chickpea in Nuapada

In case of Oilseeds crops, there is a varied performance of groundnut cultivar Devi across the districts (Figure 9) and the highest response was noticed in Malkangiri (37%) followed by Mayrubhanj (30%), Deogarh (21%) and Angul (4%). Among mustard cultivars (Figure 10), DRMR-1153-12 gave higher yield response (38%) followe by DRMR-150-35 (37%) and Anuradha (26%).

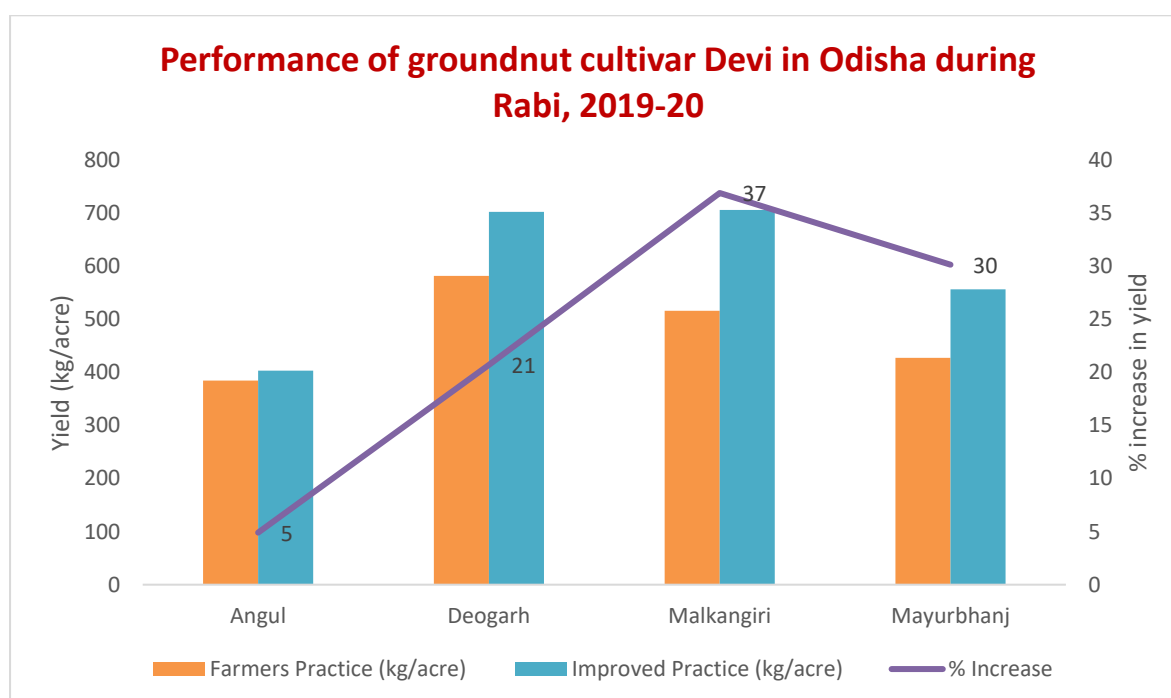


Figure 9. Performance of groundnut cultivar Devi in Odisha during Rabi, 2019-20

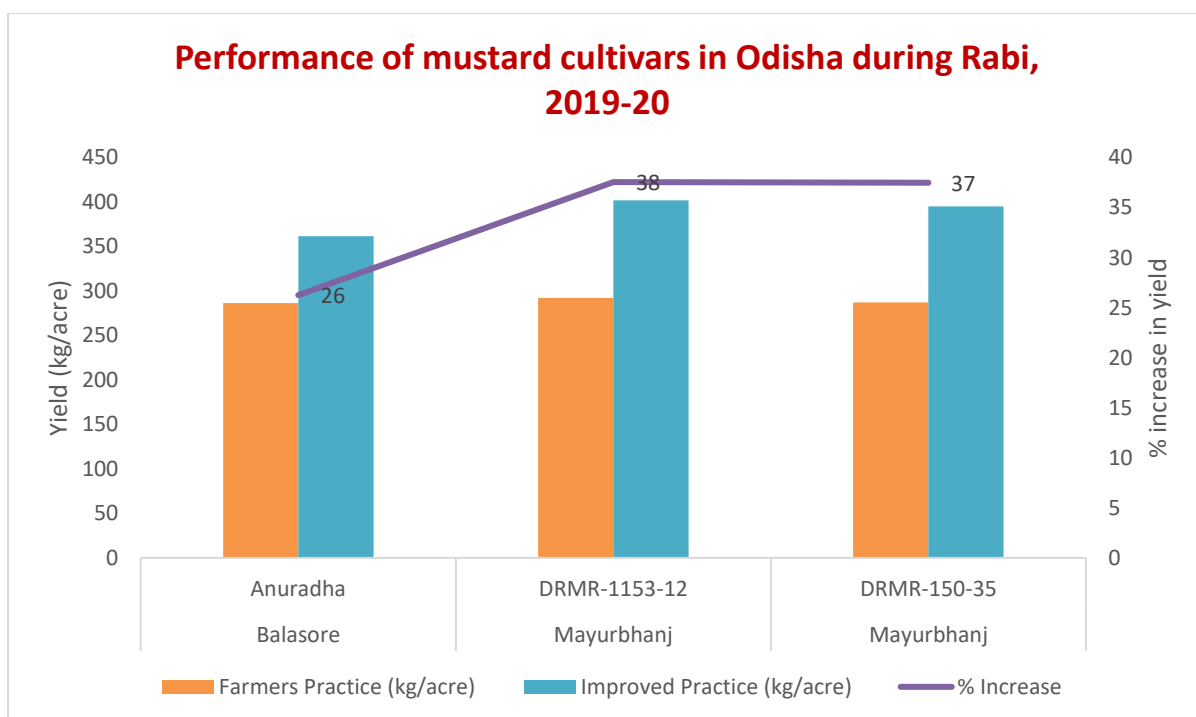


Figure 10. Performance of mustard cultivars in Odisha during Rabi, 2019-20

Demonstrations on improved cultivars were organized in finger millet and paddy. In case of finger millet GPU-48 variety performed better (53%) compared to non-descript local cultivar. Similarly in case of paddy (Figure 11), highest yield response was obtained with Parijat in Khandmal (28%) followed by Lalat in Bargarh (23%) and in Balasore (17%), Swarna in Sambalpur (17%), MTU-1010 in Sambalpur (16%), Puja in Sambalpur (13%), Jamuna in Sambalpur (10%).

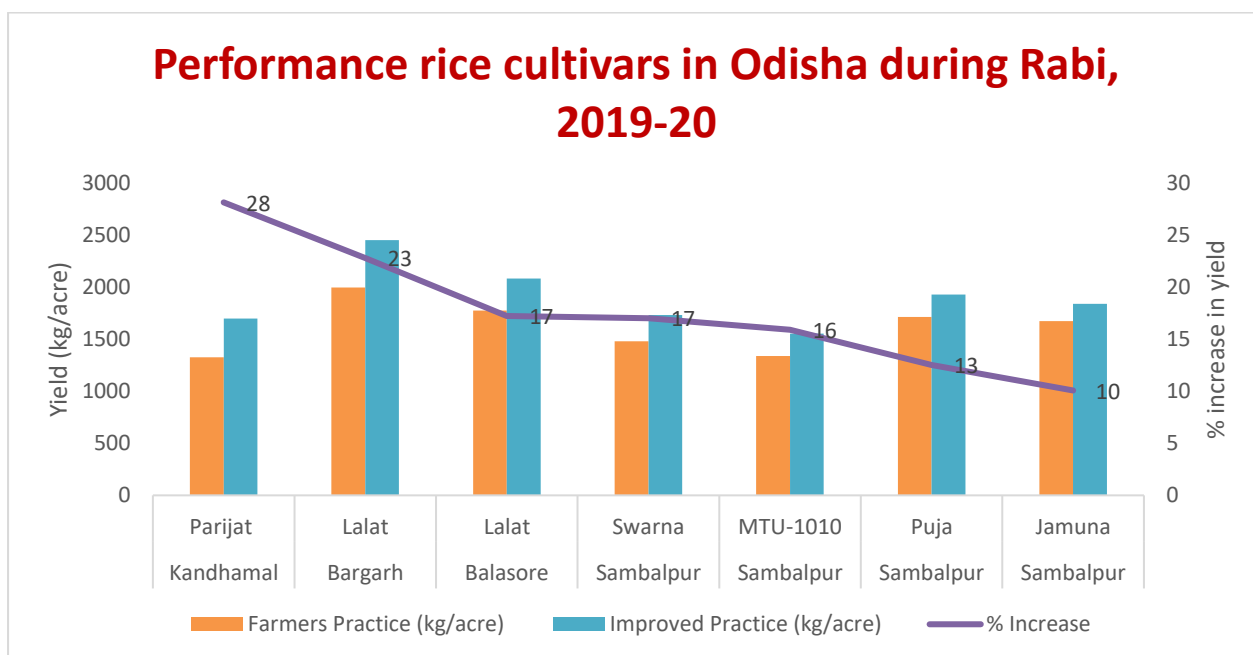


Figure 11. Performance of rice cultivars in Odisha during Rabi, 2019-20

5. Upgradation of Referral Laboratories

In commensurate with the project document IDC, ICRISAT has committed establishment of two referral laboratories at Bhubaneswar and Sambalpur with the state-of-the-art facilities. In this regard, the renovation of buildings, furniture, airconditioning of the lab, electric fitting, water and drainage pipelines works have been completed. The shipment of MPES and other equipment has been completed. The requisite glass ware and chemical to handle 10000 samples at each site have been successfully deployed at both the places. A dedicated vehicle was hired to deploy lab chemicals/glasswares (required for analysing 10,000 soil samples) from ICRISAT, Hyderabad to each of the laboratory at Bhubaneshwar and Sambalpur. ADAs from concerned referral laboratories gave a helping hand by sanitizing the received lab materials as per the COVID guidelines of Odisha government. Engineers from Kolkata were coordinated and MPAES gas panels were installed in both the sites. Millipore distillation water unit was installed in Sambalpur. Installation of MPAES at Bhubaneshwar site is pending for that want of approval by Soil Chemist in view of COVID-19 pandemic. Three-phase and internal wiring (panels, sockets/electrical boards) in the newly renovated rooms in Sambalpur is pending due to COVID-19 situation.



Figure 12. Dispatching of glassware and chemical from ICRISAT, Hyderabad

Please see Annexure-1 for details of chemicals and other lab items sent to each of the laboratory at Bhubaneshwar and Sambalpur

Please Annexure-2 & 3 for details of all equipments installed/sent till date at Bhubaneshwar and Sambalpur sites

6. Publications

For wider dissemination of the findings of 2 years of Bhoochetana work, the *Odisha Bhoochetana* project story was published in ICRISAT Happenings Newsletter (23 July 2020). The article is called **Soil health key priority for better livelihoods of Odisha farmers** and can be accessed at <https://www.icrisat.org/soil-health-key-priority-for-better-livelihoods-of-odisha-farmers/> (Figure 13).

Soil health key priority for better livelihoods of Odisha farmers



A field demonstration in Boudh district, Odisha.

Under an extensive soil health mapping program in Odisha state, India, over 40,200 soil samples from farmers' fields across 309 blocks in 30 districts were collected and analyzed, and recommendations made in response to the micronutrient deficiencies in the soil. Also, best management practices for increasing crop productivity were shared via 8,000 demonstrations, and two soil testing laboratories were upgraded into referral laboratories for the entire state. Based on the learnings from the pilots in the state, it is estimated that if improved nutrient management is scaled out in even 50% of the cultivated areas, the state's agricultural productivity will increase by at least 10%.

All this was done under the project *Bhoochetana* – a multi-stakeholder project with more than 20 local NGO partners, the Odisha University of Agriculture and Technology (OUAT), the state's Department of Agriculture, and ICRISAT. It has a mandate of improving crop productivity and rural livelihoods through scientific natural resource management.

Soil mapping and identification of nutrient deficiencies

The soil health mapping initiative revealed widespread deficiencies of micronutrients and secondary nutrients; about 30% fields were deficient in boron, 42% in zinc, 51% in sulphur, 28% in magnesium and 49% in carbon (Figure 1). Therefore, recommendations were developed to include deficient micronutrients and secondary nutrients, and optimize macronutrients. This

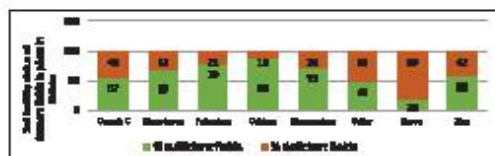


Figure 1. Soil fertility status of farmers' fields.

Information was shared with agriculture officials, who in turn, shared it with farmers through Soil Health Cards.

Moreover, tools such as online GIS maps along with block-level inputs and relevant calculations, and tablets loaded with analysis and recommendations were readied for officials to help them make effective decisions. (<https://odimap.13.ap-south-1.amazonaws.com/map.html?http://111.99.2.168/odimap/>).

Farm demonstrations of best practices

Additionally, over 8,000 demonstrations were carried out in 30 pilot sites (each site comprising 500-1000 ha in each district) to highlight that the adoption of need-based input management or improved varieties can help increase crop productivity by 20-50%, resulting in higher profits for smallholder farmers (Figure 2). In the process, more than 25,000 farmers were taught how to implement the code of fertilizers.

Development of referral labs

The Odisha state government reviewed the status of the soil testing laboratories in the state and collaborated

Figure 13. Snapshot of *Odisha Bhoochetana* project outcome story published in ICRISAT Happenings Newsletter (23 July 2020).

7. Annexure

Annexure 1. Details of chemicals and other lab items sent to each of the laboratory at Bhubaneswar and Sambalpur.

S.No	Chemicals Items List	Manufacturer	Grade	Unit	Total items sent	Purpose
1	Nitric acid	Qualigens	ExcelaR	no	10	Lab common use
2	Ammonium Fluoride	Qualigens	SQ	500 gm	150	Phosphorous analysis (Brays)
3	Ammonium Acetate	Qualigens	ExcelaR	500 gm	100	Macro nutrients (K,Ca,Mg and Na) analysis
4	Potassium Dichromate	Qualigens	ExcelaR	500 gm	100	Organic Carbon analysis
5	Hydrochloric Acid (SQ)	Qualigens	SQ	5 litre	10	Glassware washing
6	Sodium Hydrogen carbonate	Qualigens	ExcelaR	500 gm	100	Phosphorous analysis (Olsen's)
7	Triethanolamine	Qualigens	SQ	500 ml	20	Micro nutrients (Fe,Cu,Mn and Zn) analysis
8	Labolene	Qualigens	SQ	5 ltr	5	Labware washing
9	Potassium chloride ER	Qualigens	ER	500 gm	10	Mineral-N analysis
10	Phenanthroline monohydrate ER	Qualigens	ER	25 gm	15	Organic Carbon analysis
11	Powder free purple nitrile Gloves (M,L)	Fisher	N/A	pack	3M+3L	Safety
12	Sulphuric Acid	Qualigens	ER	2.5 ltr	100	Organic Carbon analysis
13	Solar Hand operated bottle top titrator	Hirshmann	N/A	no	1	Organic Carbon analysis
14	EM-Dispenser pp	Hirshmann	N/A	no	3	To dispense reagents
15	Ammonium Ferrous Sulphate	Qualigens	ExcelaR	500 gm	200	Organic Carbon analysis
16	Sample Container	Tarsons	N/A	Pack		Filtration
17	Potassium Sulphate	Qualigens	ER	500 gm	3	Sulphur analysis
18	Ammonium molybdate	Qualigens	ER	500 gm	5	Phosphorous analysis
19	potassium dihydrogen orthophosphate	Qualigens	ER	500 gm	3	Phosphorous analysis
20	sodium chloride	Qualigens	ER	500 gm	5	Lab common use
21	Spatulas	Fisher	N/A	pack	2	Lab tool, To weigh the samples and chemicals

S.No	Chemicals Items List	Manufacturer	Grade	Unit	Total items sent	Purpose
22	Diethylenetriaminepentacetic acid(DTPA)	Qualigens	AR	500 gm	10	Micro nutrients (Fe,Cu,Mn and Zn) analysis
23	Ferrous Sulphate	Qualigens	ER	500 gm	10	Organic Carbon analysis
24	Barium chloride	Qualigens	ER	500 gm	10	Sulphur analysis
25	L-Ascorbic Acid	Qualigens	SQ	250 gm	20	Phosphorous analysis
26	Antimony Potassium tartrate	Qualigens	SQ	500 gm	5	Phosphorous analysis
27	Boric Acid	Qualigens	ER	500 gm	5	Boron analysis
28	Sodium Hydroxide pellets	Qualigens	ER	500 gm	5	Lab common use
29	Calcium chloride dihydrate	Merck	EMPARTA ACS	500 gm	25	Boron and Sulphur analysis
30	Hydrochloric Acid	Qualigens	ER	2.5 ltr	5	Lab common use
31	Thermo Fisher brand flask 150ml	Fisher	N/A	no	300	Sample preparation (Filtration)
32	Conical Flask 250ml	Fisher	N/A	no	300	Sample preparation (Titration)
33	Volumetric flask 1000ml	Fisher	class A	no	5	Reagents and standards preparation
34	Volumetric flask 200ml	Fisher	class A	no	3	Reagents and standards preparation
35	Volumetric flask 2000ml	Fisher	class A	no	2	Reagents and standards preparation
36	Volumetric flask 500ml	Fisher	class A	no	5	Reagents and standards preparation
37	Volumetric flask 50ml	Fisher	class A	no	20	Reagents and standards preparation
38	Volumetric flask 100ml	Fisher	class A	no	50	Reagents and standards preparation
39	Volumetric flask 5ml	Fisher	class A	no	6	Reagents and standards preparation
40	Volumetric flask 25ml	Fisher	class A	no	20	Reagents and standards preparation
41	Measuring Cylinder 100ml	Fisher	class A	no	5	Reagents preparation
42	Measuring Cylinder 10ml	Fisher	class A	no	5	Reagents preparation
43	Measuring Cylinder 50ml	Fisher	class A	no	5	Reagents preparation
44	Measuring Cylinder 500ml	Fisher	class A	no	2	Reagents preparation
45	Measuring Cylinder 1000ml	Fisher	class A	no	2	Reagents preparation
46	Beakers 10ml	Fisher	spout	no	10	Reagents preparation
47	Beakers 5ml	Fisher	spout	no	10	Reagents preparation

S.No	Chemicals Items List	Manufacturer	Grade	Unit	Total items sent	Purpose
48	Beakers 50ml	Fisher	spout	no	50	Reagents preparation
49	Beakers 100ml	Fisher	spout	no	20	Reagents preparation
50	Beakers 250ml	Fisher	spout	no	20	Reagents preparation
51	Beakers 500ml	Fisher	spout	no	8	Reagents preparation
52	Beakers 1000ml	Fisher	spout	no	6	Reagents preparation
53	Carboy Stop 25ltr	Tarsons	N/A	no	5	Distilled water storage
54	Wide Mouth Bottles 125ml	Tarsons	N/A	no	6	Sample preparation (Shaking)
55	Narrow Mouth Bottle 125ml	Tarsons	N/A	no	6	Sample preparation (Shaking)
56	Powder funnel 100mm	Tarsons	N/A	no	30	Sample preparation (Filtration)
57	Tarsons Volumetric flask 100ml	Tarsons	N/A	no	20	Reagents and standards preparation
58	Measuring Cylinder 1000ml	Tarsons	N/A	no	4	Reagents and standards preparation
59	Dropping Bottle 125ml	Tarsons	N/A	no	1	Reagents and standards preparation
60	SS Lab Jack 6*6	Tarsons	N/A	no	1	Titration and lab common use
61	Magnetic Retriever 30cm	Tarsons	N/A	pack	1	Titration and lab common use
62	U V Safety goggles	Tarsons	N/A	no	5	Safety
63	Poly Magnetic stirring bar 8*22mm	Tarsons	N/A	no	4	Reagents preparation and titration
64	Round Magnetic Stiring Bar 12.7*76mm	Tarsons	N/A	no	2	Reagents preparation and titration
65	Poly Magnetic stirring bar 8*22mm	Tarsons	N/A	no	2	Reagents preparation and titration
66	PH Buffer capsules	Merck	N/A	pack	1	pH meter standard
67	wash bottles 500ml	Tarsons	N/A	pack	1	Distilled water storage
68	Wash bottles 1000ml	Tarsons	N/A	pack	1	Distilled water storage
69	Tube Rack 50ml	Tarsons	N/A	no	2	Lab common use
70	Utility tray	Tarsons	N/A	no	3	Lab common use
71	Draining Tray	Tarsons	N/A	no	3	Lab common use
72	Spint Magnetic stirer 18*18cm	Tarsons	N/A	no	1	Lab common use
73	Measuring Beakers handle 500ml	Tarsons	N/A	no	5	Reagents preparation

S.No	Chemicals Items List	Manufacturer	Grade	Unit	Total items sent	Purpose
74	Measuring Beakers handle 5000ml	Tarsons	N/A	no	5	Reagents preparation
75	Measuring Beakers handle 2000ml	Tarsons	N/A	no	5	Reagents preparation
76	Zinc Standard	Alfa aesar/Merck	Std	500 ml	4	Calibration standard
77	Magnesium	Alfa aesar/Merck	Std	500 ml	5	Calibration standard
78	Calcium	Alfa aesar/Merck	Std	500 ml	5	Calibration standard
79	Iron	Alfa aesar/Merck	Std	500 ml	5	Calibration standard
80	Sodium	Alfa aesar/Merck	Std	500 ml	5	Calibration standard
81	Potassium	Alfa aesar/Merck	Std	500 ml	5	Calibration standard
82	Manganes	Alfa aesar/Merck	Std	500 ml	4	Calibration standard
83	Copper	Alfa aesar/Merck	Std	500 ml	3	Calibration standard
84	Boron	Alfa aesar/Merck	Std	500 ml	1	Calibration standard
85	Eppendorf TIPS 0.2-5ml	Eppendorf	N/A	pack	3	Standard preparation
86	Eppendorf TIPS 0.5-5ml	Eppendorf	N/A	pack	1	Standard preparation
87	Micro pipettes100-1000	Eppendorf	N/A	no	1	Standard preparation
88	Micro Pipettes 1-10ml	Eppendorf	N/A	no	1	Standard preparation
89	Micro pipettes 0.5-10ml	Eppendorf	N/A	no	1	Standard preparation
90	Eppendorf tips 50-1000ml	Eppendorf	N/A	pack	1	Standard preparation
91	Eppendorf tips 0.5-5ml	Eppendorf	N/A	pack	1	Standard preparation
92	Fisher brand thermo bottle 500ml	Fisher	N/A	no	5	Reagent storage
93	Fisher brand thermo bottle 1000ml	Fisher	N/A	no	5	Reagent storage
94	Munsell soil chart	Munsell	N/A	no	1	Soil color and type identification chart
95	Glycerol anhydrous for analysis	Merck	EMPARTA ACS	2.5 ltr	6	Sulphur analysis
96	Lab Stools	Messung	N/A	no	10	Lab common use
97	Filter papers 1.NO	Whatman	Grade 1	no	200	Filtration
98	Filter paper 42.No	Whatman	Grade 42	no	300	Filtration
99	Bulb Condensors	Local	N/A	no	70	Boron analysis

S.No	Chemicals Items List	Manufacturer	Grade	Unit	Total items sent	Purpose
100	Trolleys	Local	N/A	no	6	Lab common use
101	pH meter with electrodes	Elico	N/A	no	1	pH analysis (Sambalpur pending)
102	EC meter with electrodes	Elico	N/A	no	1	EC analysis (Sambalpur pending)
103	Island Table	Cassia Siamia Technologies	N/A	no	1	To place millipore distilled water unit

Annexure 7.2. Details of all equipments installed/sent till date at Bhubaneswar

S.NO	Item Description	Manufacturer	Quantity	Remarks
1	Shakers	CASSIA SIAMIA	1	Plug and play
2	MP-AES Instrument	Agilent	1	Installation under process
3	Nitrogen Generator	Agilent	1	Installation under process
4	MP-AES Dryer	Trident	1	Installation under process
5	Compressor Tank	Hitachi	1	Installed
6	HITACHI Compressor	Hitachi	1	Installed
7	Suction Motor For MP-AES	Agilent	1	Installed
8	UPS Battery Black Steel Stand	Agilent	1	Installed
9	Muffle Furnace	CASSIA SIAMIA	1	Plug and use
10	CPU	Dell	1	Plug and use
11	Monitor	Dell	1	Plug and use
12	Nitric Acid MP-AES Standards	Merck	1	Can be used once analysis starts
13	Water Purification System Milli-Q(Reference 10 Kit)	Milli-Q	1	Will be installed soon
14	Water Purification System Milli-Q(Synergy Kit)	Milli-Q	1	Will be installed soon
15	MP-AES Accessory kit	Agilent	1	Under installation
16	UPS-HITACHI	Hitachi	1	Under installation

S.NO	Item Description	Manufacturer	Quantity	Remarks
17	RO Protector,Argon Bottle,MilliPore Filter	Millipore	1	Will be installed soon
18	UV-Spectrometer	Lab India	1	Plug and use
19	Shimadzu Analytical Balance	Shimadzu	1	Plug and use
20	MP-AES Auto Sampler	Agilent	1	Under installation
21	Digital Hot Plate	Sapphire Scientific	1	Plug and use
22	FOSS Digestor	Foss	1	Demo displayed
23	FOSS Tubes Straight 2 BOX,Tube Rack,FOSS Material	Foss	1	Demo displayed
24	Oven	CASSIA SIAMIA	1	Plug and use
25	Battery-20 Piece	Exide	1	Under installation
26	Weighing Balance Top load	Shimadzu	1	Plug and use

Annexure 7.3. Details of all equipments installed/sent till date at Sambalpur

S.NO	Item Description	Manufacturer	Quantity	Remarks
1	Shakers	CASSIA SIAMIA	1	Plug and play
2	MP-AES Instrument	Agilent	1	Installation under process
3	Nitrogen Generator	Agilent	1	Installation under process
4	MP-AES Dryer	Trident	1	Installation under process
5	Compressor Tank	Hitachi	1	Installed
6	HITACHI Compressor	Hitachi	1	Installed
7	Suction Motor For MP-AES	Agilent	1	Installed
8	UPS Battery Black Steel Stand	Agilent	1	Installed
9	Muffle Furnace	CASSIA SIAMIA	1	Plug and use
10	CPU	Dell	1	Plug and use
11	Monitor	Dell	1	Plug and use
12	Nitric Acid MP-AES Standards	Merck	1	Can be used once analysis starts
13	Water Purification System Milli-Q(Reference 10 Kit)	Milli-Q	1	Will be installed soon
14	Water Purification System Milli-Q(Synergy Kit)	Milli-Q	1	Will be installed soon
15	MP-AES Accessory kit	Agilent	1	Under installation
16	UPS-HITACHI	Hitachi	1	Under installation
17	RO Protector,Argon Bottle,MilliPore Filter	Millipore	1	Will be installed soon
18	UV-Spectrometer	Lab India	1	Plug and use
19	Shimadzu Analytical Balance	Shimadzu	1	Plug and use
20	MP-AES Auto Sampler	Agilent	1	Under installation
21	Digital Hot Plate	Sapphire Scientific	1	Plug and use
22	FOSS Digestor	Foss	1	Demo displayed
23	FOSS Tubes Straight 2 BOX,Tube Rack,FOSS Material	Foss	1	Demo displayed
24	Oven	CASSIA SIAMIA	1	Plug and use
25	Battery-20 Piece	Exide	1	Under installation

S.NO	Item Description	Manufacturer	Quantity	Remarks
26	Weighing Balance Top load	Shimadzu	1	Plug and use



International Crops Research Institute for the Semi-Arid Tropics

The **International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)** is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, of whom 644 million are the poorest of the poor. ICRISAT innovations help the dryland poor move from poverty to prosperity by harnessing markets while managing risks – a strategy called Inclusive Market-Oriented Development (IMOD).

ICRISAT is headquartered in Patancheru near Hyderabad, Andhra Pradesh, India, with two regional hubs and five country offices in sub-Saharan Africa. It is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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