

Odisha *Bhoochetana* – A Flagship Initiative of Developing Roadmap to Crop Productivity & Livelihoods Improvement in Odisha State

Background

The Government of Odisha supported the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) during 2018 to 2021 for the Odisha *Bhoochetana* project aimed at improving crop productivity and rural livelihoods through science-based management of natural resource in the State. ICRISAT worked along with Odisha University of Agriculture & Technology (OUAT), state Department of Agriculture, around 20 local NGO partners and farmers in pilot sites across 30 districts in the state. Under the project, efforts were directed towards generating knowledge about the status of soil health, demonstrating the projected benefits with need-based fertilizer management, capacity building of stakeholders and upgradation of infrastructure in the state to meet future needs of analyzing large number of soil/plant/water/fertilizer samples in the state itself.

Issue(s)

There was a lack of systematic soil health mapping in the state especially w.r.t. the deficiencies of secondary and micronutrients. And in absence of this knowledge, policy makers were not in a position to take informed decisions to design appropriate policies as well the extension agents, farmers and stakeholders were not equipped with the knowledge and tools to promote good management practices for higher productivity and sustainability. There was a lack of evidence of projected benefits with adoption of need-based plant nutrient management as well as with cultivation of improved crop cultivars. The generation of knowledge also needed to be passed on to the line-staff in state departments for taking it into farmers' doorsteps and translating into impacts. The state also needed state-of-the art laboratories to be self-reliant in analytical infrastructure for analyzing soil/plant/water/fertilizer samples with highest precision and speed.

Technology/Tools development

A thorough soil health mapping of the state was undertaken with collection of 40265 soil samples using stratified random sampling method to represent 3957 villages in 310 blocks across 30 districts of the state. The analysis results showed widespread deficiencies of micro and secondary nutrients along with deficiencies of primary nutrients and low soil organic carbon (Figure 1). In view of this knowledge, the fertilizer recommendations were developed by OUAT and ICRISAT experts to incorporate deficient micro and secondary nutrients along with primary nutrients. Farmers were made aware of their soil fertility status and need-based fertilizer recommendation through distribution of Soil Health Cards to 40265 sampled farmers (Figure 2). For non-sampled farmers, the fertilizer recommendations were developed based on % deficiency in the village/block (<https://doi.org/10.1080/03650340.2018.1560426>). For secondary and micronutrients, full dose was added in case of >50% deficient fields for a nutrient in a village/block, half dose in case of 25-50% deficiency, one-fourth dose in 10-25% deficiency and no dose in case of <10% deficient fields in a village/block. The recommended

yearly full doses for soil application of deficient secondary and micro/secondary nutrients were – 1 kg ha⁻¹ for boron, 5 kg ha⁻¹ for zinc in case of paddy and 2.5 kg ha⁻¹ for zinc in pulses and other cereals and 2 kg ha⁻¹ in oilseeds (<http://idc.icrisat.org/idc/wp-content/uploads/2020/04/ICRISAT-Odisha-BC-AR-2018-19-1.pdf> ; Odisha Bhoochetana Annual Report 2018-19). Recommendation for application of sulphur was at 30 kg ha⁻¹ (200 kg gypsum) for cereals and 45 kg ha⁻¹ for oilseeds in deficient soils.

For wider dissemination to stakeholders, Soil health Maps were developed to delineate deficient/sufficient areas, and worked-out need-based inputs requirement (<http://odmaps.s3.ap-south-1.amazonaws.com/map.html>). The soil analysis results of all 40265 soil samples from Odisha were compiled and published as Soil Atlas entitled, 'Mapping the Nutrient Status of Odisha's Soils', as a guide for policy makers and extension functionaries in the state (<http://idc.icrisat.org/idc/wp-content/uploads/2020/12/Odisha%20Soil%20Atlas%20dated%202.12.2020.pdf>) (Figure 3). In addition, 90 Tablets are loaded with results of soil analyses, recommendation and best agricultural practices, which will remain with senior officials in the department of agriculture as a quick guide for required policy decisions and planning scaling-up.

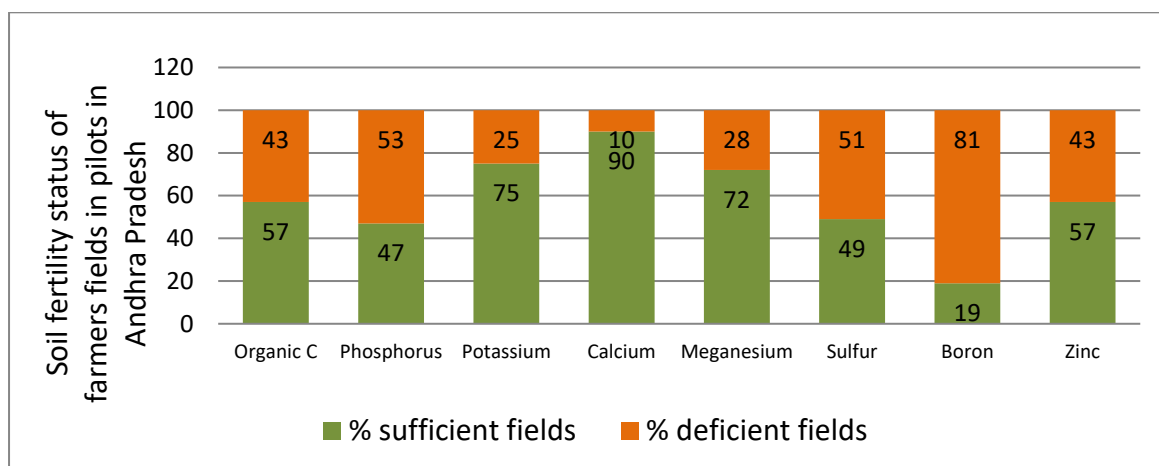


Figure 1. Soil fertility status of farmers' fields in Odisha state.



Figure 2. Release of soil health cards developed for 40265 sampled farmers by the Director of Agriculture, Odisha.



Figure 3. Release of the Odisha Soil Atlas by Dr Arun Kumar Sahu, Minister of Agriculture & Farmers' Empowerment, Odisha state on 5 December 2020.

Analytical infrastructure development

To cater to the the state's need for precision analysis of large number of soil, water, fertilizer and plant samples in a short time, two referral soil testing laboratories are successfully upgraded at Bhubaneshwar and Sambalpur, Odisha and guided by ICRISAT team for successful operations. Hon'ble Minister for Agriculture and Farmers' Empowerment, Govt. of Odisha inaugurated Bhubaneshwar laboratory on 05 Dec 2020, and also other laboratory in Sambalpur was inaugurated virtually the same day by the minister (Figure 4).

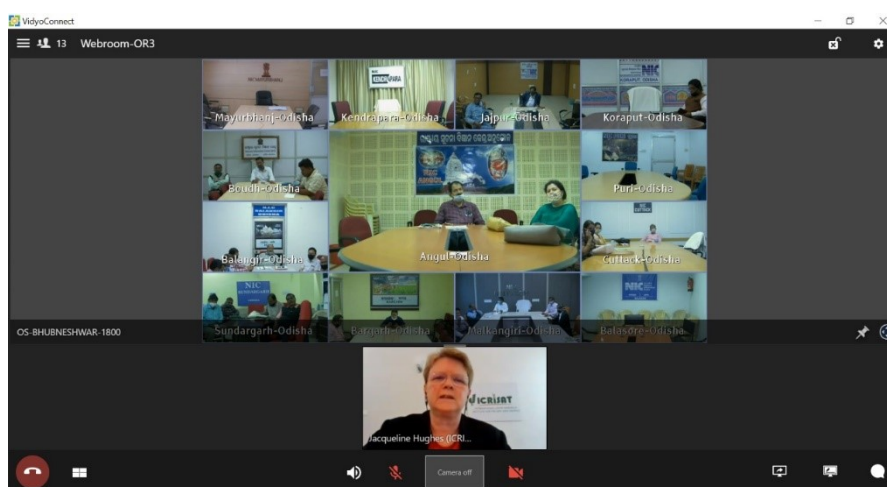


Figure 4. A snapshot of virtual meet during inauguration of the two referral laboratories in Odisha.

Demonstrations at learning sites

The representative learning sites were chosen in each of the district to generate proof around benefits of need-based application of deficient micro/secondary nutrients and best practices of cultivating improved varieties. So, a total of 9387 demonstrations were conducted across 30 districts during 2018-19 and 2019-20 - 1762 demonstrations during *kharif* 2018, 2624 demonstrations during *rabi* 2018-19, 1920 demonstrations during *kharif* 2020 and 3081 demonstrations during *rabi* 2019-20 (<http://idc.icrisat.org/idc/wp-content/uploads/2021/04/Odisha-BC-Completion-Report-ICRISAT1.pdf>).

Results showed that the applications of deficient micro/secondary nutrients (like boron, zinc, sulphur) recorded a productivity benefit between 10%-60% with major crops like paddy, maize, pigeonpea, groundnut and finger millets during kharif seasons. While during rabi seasons, the micro/secondary nutrients applications recorded the yield benefit to the tune of 7%-50% with major crops like paddy, blackgram, greengram, chickpea, maize and mustard.

In demonstrations of improved varieties during kharif seasons, a yield benefit between 10%-70% was observed with improved crop varieties of finger millet (GPU 28, GPU 48 and MR 1), groundnut (Devi), maize (HT 5402, VNR 4343 and Adventapac 751 Elite), paddy CR 1018, Ranidhan & others). Similarly, during rabi seasons, the yield benefit varied between 10%-40% with improved crop varieties of blackgram (PU 31), greengram (IPM 2-14, IPM 2-3), chickpea (JAKI 9218, JG 11, JG 14 and NBeG 3), groundnut (Devi), mustard (Anuradha, DRMR 1153-12, DRMR 150-35), and paddy (Lalat, Parijat and MTU 1001).



Figure 5. A demonstration on application of deficient micronutrients under Odisha *Bhoochetana* project.

Strengthening capacities of stakeholders

Odisha *Bhoochetana* project not only performed well in technology development and dissemination, but also in orientation and developing capacities of stakeholders to take forward the benefits to large number of farmers in the state. In this context, 60 senior department of agriculture (DoA) officials from 30 districts were oriented about the soil health results and benefits realized in demonstrations across the state during July 2019. With the support of these 60 DoA senior officials, district level training programs were conducted for DoA officials a total of 2576 officials were oriented/trained across 30 districts during September-December 2019. For upgradation of laboratories and to run these on business model, a five-day training cum exposure program was organized during 27th to 31st August 2018 at CRAL laboratory, ICRISAT for six participants from soil testing laboratories in Bhubaneswar and Sambalpur; and also a 4-day training during 5-8 April 2021 for both laboratory staff at the respective sites. In the pilot sites across 30 districts, around 29000 farmers capacities were strengthened on improved management practices like need-based nutrient management and improved crop varieties.



Figure 6 & 7. (Left): A snapshot of orientation/training for senior DoA officials at ICRISAT, July 2019; (Right): A snapshot of hands-on training to laboratory staff in Sambalpur, April 2021.

Outcomes/Impacts

- A detailed soil health mapping (through collection & analysis of 40265 samples) done to serve as a basis for planning and implementing judicious fertilizer use for higher productivity and sustainability
- Tools like online GIS maps (along with recommendations), Soil Atlas, and Tablets (loaded with analysis results and recommendations) provided to DoA to facilitate scaling-up
- A 10-60% yield benefit, in general, with need-based inputs realized by participating farmers in pilots across 30 districts
- Trained more than 2600 officials of the Department of Agriculture for scaling-out in all 30 districts
- Trained around 29000 farmers in the pilots as lead farmers
- Skills of 21 NGO partners strengthened
- The two laboratories upgraded in the State to state-of-the-art referral laboratories of international standards are state assets to cater to future requirements of swift and precise quality analyses of a sizeable number of soil, water, fertilizer, and plant samples.

This initiative has generated the knowledge and tools required for planning and scaling-up the need-based balanced fertilizer management for productivity and livelihoods improvement for large number of farmers in the state.

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