Household production of biochar using diverse feedstock (World Agroforestry)

Sustainable Biochar Production Through Agroforestry Systems And Its Application (ອິນເດຍ)

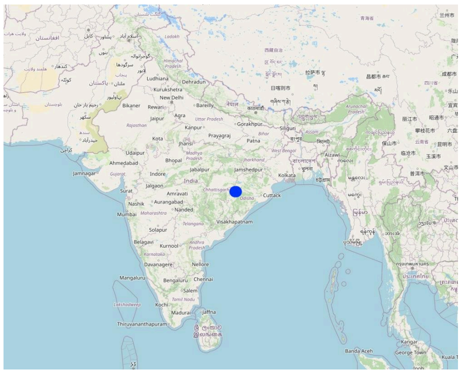
ຄ□ອະທິບາຍ

Biochar is a carbon-rich, solid material derived from a wide range of biomass or organic waste through a thermochemical method. It is an organic charcoal material that is the final product of pyrolysis, or high-temperature burning of agricultural biomass without oxygen. Surplus crop residues, agricultural waste, and wood from sustainable sources are used as feedstock (raw material). Such biochar production is linked with agroforestry plantation and agriculture to improve soil health and ensuring sustainable feedstock availability.

Introduction and Background
Intensive cropping systems coupled with monocropping and high usage of synthetic fertilizers have led to the degradation of soils and depletion of nutrients directly affecting agricultural productivity and farmers' income. Farmers in the Balangir district of Odisha are facing similar challenges. To address these issues and promote sustainable farming practices, a biochar production initiative was introduced by utilizing crop residues and waste material from forests to produce biochar, a carbon-rich material that enhances soil fertility and soil structure. The initiative is a part of the Pro-Soil Project of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India and implemented by the International Centre for Research in Agroforestry (ICRAF). The technology (a kiln for biochar production) and technical inputs for biochar production were sourced from the Indian Institute of Soil Science, Bhopal. Biochar is a type of charcoal produced from biomass like agricultural or forest waste or organic materials through a process called pyrolysis. The application of sustainable biochar technology in agroforestry systems can lead to better soil structure, increased water retention, reduced nutrient leaching, and improved crop yields. Moreover, it aids in mitigating greenhouse gas emissions by locking carbon into soil for an extended period.
In the project region farmers used crop residues such as rice straw, wheat straw and residue of other crops along with non-usable biomass from local forests, such as branches, twigs, and leaves, to supplement the feedstock for the pyrolysis. Since the District has large forest areas, the availability of forest waste is no problem. The biochar produced was applied into existing crops fields as well as into agroforestry system. Aiming to promote agroforestry, the project promoted the integration of trees (both fruits and timber) and shrubs into existing agricultural practices. Agroforestry offers multiple benefits such as improved soil health, biodiversity, and carbon sequestration. When sustainable biochar production is integrated into these systems, it can create a sustainable cycle where agricultural waste is converted into biochar, which then enhances soil fertility and sequesters carbon when added back into the soil.
The project has actively involved women farmers, entrepreneurial youth, and farmers' groups in the collection, production and application process of biochar thus promoting community participation and creating awareness about the benefits of biochar.

Implementation
The biochar kiln technology, obtained from the Indian Institute of Soil Science, in Bhopal, is employed to convert biomass into biochar through pyrolysis. This technology ensures efficient and controlled production of high-quality biochar. The collected biomass undergoes a controlled pyrolysis process inside the biochar kiln, where it is burned in the relative absence of oxygen. Technical specialization during production includes kiln temperature control, feedstock preparation, and the management of pyrolysis gases to ensure efficient biochar production. This results in the conversion of biomass into biochar, also leaving behind bioenergy-rich gases. Quality control measures are implemented to ensure the production of biochar with optimal characteristics, including high carbon content, porosity, and stability. The Biochar kiln used was designed with the aim to optimize temperature control and ensure efficient conversion of biomass. An efficient loading mechanism allows easy and controlled feeding of biomass into the kiln. This ensures a consistent flow of material during the pyrolysis process. Although local kilns are usually not equipped with temperature control

ສະຖານທີ່□



ສະຖານທີ່: Odisha, ອິນເດຍ

ຈຳນວນ ພື້ນທີ່ ທີ່ໃຊ້ ເຕັກໂນໂລຢີ ທີ່ໄດ້ວິເຄາະ: 2-10 ພື້□ທີ່□

ການຄັດເລືອກພື້ນທີ່ ທີ່ອີງໃສ່ຂໍ້ມູນທາງພູມີສາດ
- 83.46593, 20.81621
- 83.35058, 20.81108
- 83.35058, 20.81108

ການແຜ່ກະຈາຍຂອງເຕັກໂນໂລຢີ: ນ□□ ຼູ ນຈຸດສະເພາະ / □ ນ□□□ ຼູ ນື້ທີ່ຂະ□ າດ□ຍ

ຢູ່ໃນເຂດປ່າສະຫງວນທີ່ບໍ?: ບ□□□ ມ□ນ

ວັນທີຂອງການປະຕິບັດ: 2021

ປະເພດຂອງການນຳສະເໜີ
- □ ດຍ□ນນະວັດຕະກ□ຄິດຄົ□ຂອງຜູ□□ □ດິນ
- ເປັນສ□ນ□ □ຂອງລະບົບພື້□ເມືອງ (>50 ປີ)
- □ ນ□ ລຍະກ□ລອງ / ການຄົ□ຄວ□
- □ ດຍ□ນ□ ຄງການ/ ການຊ່ວຍເຫຼືອຈາກພາຍນອກ

mechanisms to regulate the pyrolysis temperature, the temperature in the kilns may alternatively be regulated through the rate of feeding biomass into the kilns. Such kilns usually have some safety features and proper ventilation so to prevent accidents.

To implement this technology the ICRAF conducted training sessions for farmers on the proper preparation and application of biochar. The trainings were focused on the following aspects:
-The collection and drying process for agriculture and forest waste
-The management of operations for the biochar kiln including the loading of raw material (feedstock) into the kiln, its burning, operation-timing, period check, volumes of raw material to be fed etc.
-Precautions to be taken during the process
-The quality check of prepared biochar charcoal and the process for pulverizing it
-Dosage recommendations for different crops as per local conditions
-The mixing of biochar with cow dung and cow urine before application
-Integration with existing farming practices and the long-term benefits of biochar on soil health

Impact and Knowledge Transfer
The biochar acts as a soil conditioner, enhancing water retention, nutrient availability, and microbial activity. The benefits and impacts on improved fertility, increased water retention, and reduced nutrient leaching, lead to higher crop yields and resilience against climate variability, carbon sequestration aids in reducing greenhouse gas emissions, contributing to global efforts to combat climate change, and utilizing agricultural residues reduces air pollution from open burning and provides a sustainable solution for organic waste disposal. Land users appreciated the enhanced soil productivity and environmental benefits brought by biochar. Overall, the Sustainable Biochar Production Technology represents a promising approach in sustainable agriculture and environmental stewardship.

The project team, in collaboration with local agricultural extension services and the Indian Institute of Soil Science, monitored the impact of biochar application on soil health parameters. This involved regular soil testing, crop yield assessments and feedback from participating farmers. In fact, they also measured the impact of biochar made from different feedstock (raw materials). Success stories were shared with neighboring communities, public stakeholders and researchers and encouraged the further adoption of sustainable soil management practices.

The biochar production initiative in the Balangir District of Odisha in India demonstrates a sustainable approach to addressing soil health issues using locally available resources. Through the collaboration between ICRAF and GIZ, this project not only improves soil fertility but also empowers local communities by providing them with sustainable solutions for agricultural challenges. The success of this intervention serves as a model for future initiatives aimed at promoting environmentally friendly and community-driven approaches to agriculture.

Biochar ready for application to soil (World Agroforestry)

ການ□ □ ຍກັເທ□ ນ□ ໂລຍ

ຈຸດປະສົງຕົ້ນຕໍ

- [x] ປັບປຸງ ການຜະລິດ
- [x] ຫຼຸດຜ່ອນ, ປ້ອງກັນ, ຟື້ນຟູ ການເຊື່ອມ□ ຊຸມຂອງດິນ
- [x] ການອະນຸລັກ ລະບົບນິເວດ
- [ ] ປົກປັກຮັກສານ□ / ນ□ ພິ□ ທີ່□ ປະສົມປະສານກັບ ເຕັກ□ ນ□ ໂລຢີ□
- [x] ປົກປັກຮັກສາ / ການປັບປຸງຊີວະນາ□ ພັນ
- [ ] ຫຼຸດຜ່ອນຄວາມສ່ຽງ ທາງ□ ພິພັດທ□ ມະຊາດ
- [x] ປັບຕົວຕໍ່□ ການປ່ຽນ□ ປງຂອງດິນຟ້າອາກາດ / ທີ່ຮຸ□ ຍ□ ຮງ□ ລະຜົນກະທົບ
- [ ] ຫຼຸດຜ່ອນຜົນກະທົບ ຈາກການປ່ຽນ□ ປງຂອງດິນຟ້າອາກາດ
- [x] ສ້າງຜົນກະທົບ ທາງເສດຖະກິດ ທີ່ເປັນປະ□ ຫຍດ
- [ ] ສ້າງຜົນກະທົບ ທີ່ເປັນທາງບວກ □ ທາງ ສັງຄົມ

ການນໍາໃຊ້ດິນ

ການນ□ ໃຊ້ດິນ ປະສົມພາຍ□ ນີ້ນທີ່ດຽວກັນ: ບ□□□ ມ□ນ

ດິນທີ່ປູກພືດ

- ການປູກພືດປະຈໍາປີ: ທັນຍາພືດ-ເຂົ້າຟ່າງ, ທັນຍາພືດ-ເຂົ້າ□ ອື
- ເປັນ□ ຢືນຕົ້ນ□ ລະ□ ພຸ່ມ ຈາກການປູກພືດ: ອາຫານສັດປະເພດເປັນຕົ້ນ (ຄລ□ຽນດຣາ, ຕົ້ນ□ກະຖິນ, □ ປຣ□ ສປ□ ລະອື່ນໆ), □ ຈາກ□ອື່ນໆ

ຈ□ນວນ ລະດູການ ປູກ□ ນີ້ປີ: 2
ມີການເຝີກປູກພືດ□ ບບັສຫວ່າງຂ□□ມ□ນ
ມີການເຝີກປູກພືດ□ ບບ□ ູນວຽນບ□□ມ□ນ

ປ່າໄມ້ / ປ່າ

- (ເຄິ່ງ) ປ່າ□ ທ□ມະຊາດ / ປ່າປູກ□ ມີການຈັດການຄຸ້ມຄອງ: ການເຕືອນ ຍາຍ□ ທີ່ຕັດ / □ ທີ່ຕາຍ□ ລ້ອອກ□ ປ

Tree types (ປະສົມປ່າປ່ຽນ□ ບໍ ປ່າດົງດິບ): n.a.
ຜົນຜະລິດ □ ລະການບໍລິການ: ເຕືອງປ່າຂອງດົງ, □ ຟືນ, □ ຈາກ□□ມ ລະ□ ອຸດົງ, ທົ່ງຫຍ້າ

ການຕັ້ງຖິ່ນຖານ, ພື້ນຖານໂຄງລ່າງ - ການຕັ້ງຖິ່ນຖານ, ອາຄານ

ການສະໜອງນ້ຳ

- [ ] ນ້ຳຝົນ
- [x] ປະສົມປະສານ ກັນລະຫວ່າງນ້ຳຝົນ ແລະນ້ຳຊົນລະປະທານ
- [ ] ນ້ຳ ຊົນລະປະທານ ພຽງຢ່າງດຽວ

ຈຸດປະສົງທີ່ກ່ຽວຂ້ອງກັບການເຊື່ອມໂຊມຂອງດິນ

- [ ] ປ້ອງກັນການເຊື່ອມໂຊມຂອງດິນ
- [x] ຫຼຸດຜ່ອນການເຊື່ອມໂຊມຂອງດິນ
- [x] ການຟື້ນຟູ / ຟື້ນຟູດິນທີ່ຊຸດໂຊມ
- [ ] ປັບຕົວຕໍ່ການເຊື່ອມໂຊມຂອງດິນ
- [ ] ບໍ່ສາມາດນຳໃຊ້

ການເຊື່ອມໂຊມ ທີ່ຕ້ອງໄດ້ເອົາໃຈໃສ່

ດິນເຊາະເຈື່ອນ ໂດຍນ້ຳ - Wt: ການສູນເສຍຊັ້ນໜ້າດິນ / ການເຊາະເຈື່ອນຜິວໜ້າດິນ

ການເຊື່ອມໂຊມ ຂອງດິນ ທາງກາຍະພາບ - Ps: ຊຸດຂອງດິນອິງຄະທາດ, ການຕັ້ງຖິ່ນຖານຂອງດິນ

ການເຊື່ອມໂຊມ ທາງຊີວະພາບ - Bl: ການສູນເສຍ ຈຸລິນຊີໃນດິນ

ກຸ່ມການຄຸ້ມຄອງທີ່ດິນແບບຍືນຍົງ

- ການປັບປຸງດິນ / ພືດຄຸມດິນ
- ການເກັບກັກນ້ຳ
- ການຈັດການສິ່ງເສດເຫຼືອ ການຄຸ້ມຄອງນ້ຳ / ສິ່ງເສດເຫຼືອ

ມາດຕະການ ການຄຸ້ມຄອງທີ່ດິນແບບຍືນຍົງ

ມາດຕະການ ທາງການກະສິກຳ - A1: ພືດ / ການປົກຫຸ້ມຂອງດິນ, A2: ອິນຊີວັດຖຸ ຫຼື ຄວາມອຸດົມສົມບູນຂອງດິນ , A3: ການບຳລຸງຮັກສາຊັ້ນໜ້າດິນ , A6: ການຈັດການສິ່ງເສດເຫຼືອ

ມາດຕະການ ທາງດ້ານພືດພັນ - V4: ການປູກທົດແທນ ແລະ ການຈັດສາຍພັນ ທີ່ຮຸກຮານ, V5: ອື່ນໆ

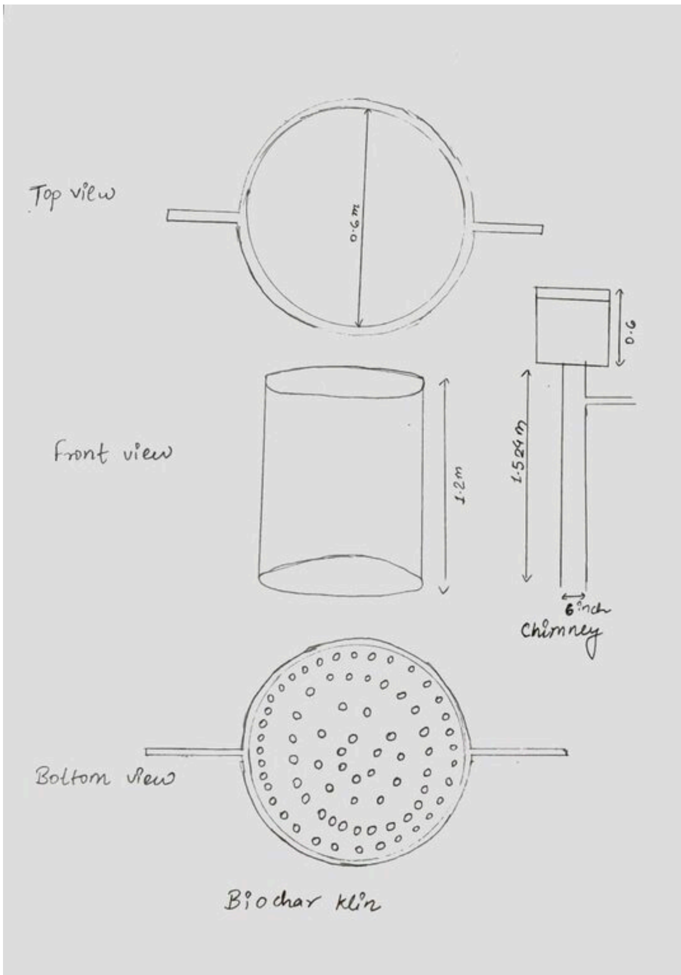
ມາດຕະການ ທາງດ້ານການຄຸ້ມຄອງ - M6: ການຈັດການສິ່ງເສດເຫຼືອ (ຂີ້ເຫຍື້ອ, ນຳມາໃຊ້ຄືນໃໝ່ ຫຼື ຫຼຸດຜ່ອນ)

ມາດຕະການອື່ນໆ - Climate resilient soil management by application of biochar using varied feedstock (rwa material) generated through agroforestry

ເທັກນິກການແຕ້ມຮູບ

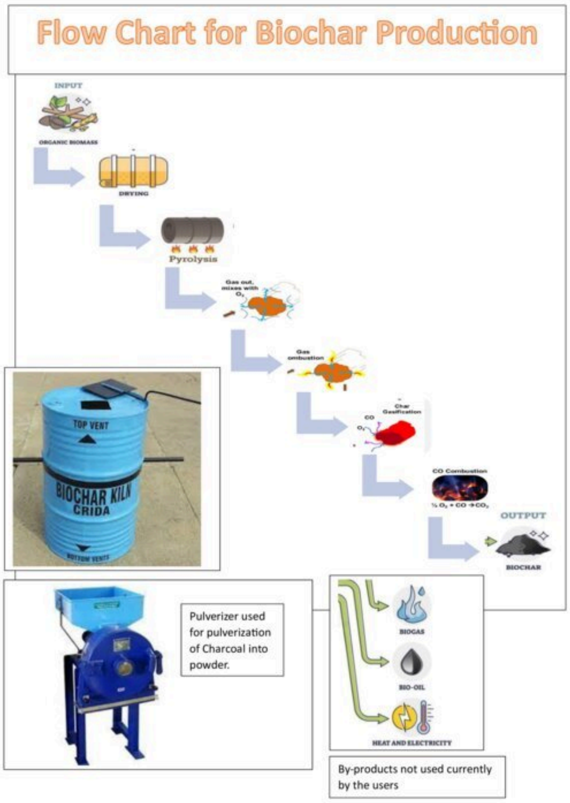
ຂໍກຳນົດທາງເທັກນິກ

The single barrel biochar klin was developed by the Indian Institute of Soil Sciences in Bhopal (IISS). The Kiln had already been designed and commercialised by the IISS. Land users can buy a metallic kiln unit from the IISS or get it fabricated from local fabricators based on the design specifications suggested in the drawing.



Author: Payal Dewangan

The flowchart provides a step by step guide for biochar production in the project area by land users



Author: Payal and Santosh

ການຈັດຕັ້ງ ລະ ານລຸງຮັກສາ: ກິດຈະກຳ, ວັດຖຸດິບ ລະຄ່າ ຊ້ຈ່າຍ

ການຄຳນວນ ປັດໃຈການຜະລິດ ແລະ ຄ່າໃຊ້ຈ່າຍ

- ຄິດ ລຄ່າ ຊ້ຈ່າຍ: ຕໍ່ຫົວ ວຍ ທີ່ ກໍດຕັ້ງປະຕິບັດ ເຕັກ ນ ່ສ(ຫົວ ວຍ:**200 L capacity** volume, length: **Litre**)
- ສະກຸນເງິນທີ່ ຊ້ສຳລັບການຄິດ ລຄ່າ ຊ້ຈ່າຍ: **INR**
- ອັດຕາ ລກປ່ຽນ (ເປັນເງິນ ດລາ): 1 USD = 80.0 INR
- ຄ່າ ຮງງານສະເລ່ຍ ຂອງການຈ້າງ ຮງງານຕໍ່ມື້204 Rupees

ປັດໄຈທີ່ສຳຄັນສຸດທີ່ສົ່ງຜົນກະທົບຕໍ່ຄ່າໃຊ້ຈ່າຍ

The investment towards the purchase of the kiln- and the pulveriser unit. In the documented project, the investment costs were borne by the project. Therefore, smallholder farmers may find it difficult to purchase the hardware units of kiln and pulveriser, given such investment costs.

ກິດຈະກຳການສ້າງຕັ້ງ

1. Purchase of biochar kiln unit (ລຍະເວລາ/ ຄວາມຖີ່Can be done any time during the year but need to be ready before the month of September)
2. Purchase of pulveriser (ລຍະເວລາ/ ຄວາມຖີ່Need to be purchased once and before the start of biochar production)

ປັດໄຈນຳເຂົ້າໃນການຈັດຕັ້ງ ແລະ ຄ່າໃຊ້ຈ່າຍ (per 200 L capacity)

ລະບຸ ປັດໃຈ ນຳເຂົ້າ ໃນການຜະລິດ	ຫົວໜ່ວຍ	ປະລິມານ	ຕົ້ນທຶນ ຕໍ່ ຫົວໜ່ວຍ (INR)	ຕົ້ນທຶນທັງໝົດ ຂອງປັດໃຈ ຂາເຂົ້າ ໃນການ ຜະລິດ (INR)	% ຂອງຕົ້ນທຶນ ທັງໝົດ ທີ່ຜູ້ນຳ ໃຊ້ທີ່ດິນ ໃຊ້ ຈ່າຍເອງ
ອຸປະກອນ					
Biochar Klin	Rs.	1.0	7000.0	7000.0	
Pulvariser unit	Rs.	1.0	20000.0	20000.0	
ຕົ້ນທຶນທັງໝົດ ໃນການຈັດຕັ້ງປະຕິບັດ ເຕັກໂນໂລຢີ				**27'000.0**	
ຄ່າ ຊ້ຈ່າຍທັງ ົດ ສຳລັບການສ້າງຕັ້ງເຕັກ ນ ່ລຢີ້ນສະກຸນເງິນ ດລາ				*337.5*	

ກິດຈະກຳບຳລຸງຮັກສາ

1. Collecting the crop residues and forest waste (ລຍະເວລາ/ ຄວາມຖີ່Needs to be collected and dried before the start of biochar production unit (September and June))
2. Preparation of Biochar (ລຍະເວລາ/ ຄວາມຖີ່Before the sowing of Rabi (winter) and Kharif (summer) seasons (Months of September/October and June/July))
3. Application of biochar in the field (ລຍະເວລາ/ ຄວາມຖີ່During the cropping season)

ປັດໄຈນຳເຂົ້າໃນການບຳລຸງຮັກສາ ແລະ ຄ່າໃຊ້ຈ່າຍ (per 200 L capacity)

ລະບຸ ປັດໃຈ ນຳເຂົ້າ ໃນການຜະລິດ	ຫົວໜ່ວຍ	ປະລິມານ	ຕົ້ນທຶນ ຕໍ່ ຫົວໜ່ວຍ (INR)	ຕົ້ນທຶນທັງໝົດ ຂອງປັດໃຈ ຂາເຂົ້າ ໃນການ ຜະລິດ (INR)	% ຂອງຕົ້ນທຶນ ທັງໝົດ ທີ່ຜູ້ນຳ ໃຊ້ທີ່ດິນ ໃຊ້ ຈ່າຍເອງ
ແຮງງານ					
Preparation of biochar	Person-day	2.0	200.0	400.0	100.0
Application of biochar in the field	Person-day	1.0	200.0	200.0	100.0
ຝຸ່ນ ແລະ ຢາຊີວະພາບ					

Farmyard manure	Rs.	20.0	5.0	100.0	100.0
Fertilizer	Rs.	50.0	7.0	350.0	100.0
ຕົ້ນທຶນທັງໝົດ ທີ່ໃຊ້ໃນການບໍາລຸງຮັກສາ ເຕັກໂນໂລຢີ				**1'050.0**	
ຄ່າ□ ລູ້ຍທັງ□ົດ ສໍາລັບການບົວລະບັດຮກສາເຕັກ□ ນ□ົ ສຢັ້ນສະກຸນເງິນ□ ດລາ				*13.13*	

ສະພາບ□ ວດລ້ອມທໍາມະຊາດ

ສະເລ່ຍປະລິມານນໍ້າຝົນປະຈໍາປີ
- [ ] < 250 ມີລີ□ ີ່ມ
- [ ] 251-500 ມີລີ□ ີ່ມ
- [ ] 501-750 ມີລີ□ ີ່ມ
- [ ] 751-1,000 ມີລີ□ ີ່ມ
- [x] 1,001-1,500 ມີລີ□ ີ່ມ
- [ ] 1,501-2,000 ມີລີ□ ີ່ມ
- [ ] 2,001-3,000 ມີລີ□ ີ່ມ
- [ ] 3,001-4,000 ມີລີ□ ີ່ມ
- [ ] > 4,000 ມີລີ□ ີ່ມ

ເຂດກະສິກໍາ-ສະພາບອາກາດ
- [ ] ຄວາມຊຸ່ມ
- [x] ເຄິ່ງຄວາມຊຸ່ມ
- [ ] ເຄິ່ງ□ ຫຼ□ ລ
- [ ] □ ຫຼ□ ລ

ຂໍ້ມູນຈໍາເພາະກ່ຽວກັບສະພາບອາກາດ
ປະລິມານນໍ້າຝົນສະເລ່ຍຕໍ່ປີເປັນມິລີ□ ີ່ມ: 1288.0
ຊື່ຂອງສະຖານີອຸຕຸນິຍົມ: Bhubaneshwar, Odisha
The District is located under the West Central Table Land Agro Climatic Zone characterized by hot and sub-humid climate

ຄວາມຄ້ອຍຊັນ
- [ ] ພື້ນທີ່ຮາບພຽງ (0-2%)
- [ ] ອ່ອນ (3-5 %)
- [x] ປານກາງ (6-10 %)
- [ ] ມ້ວນ (11-15 %)
- [x] ເນີນ(16-30%)
- [ ] ຊັນ (31-60%)
- [ ] ຊັນຫຼາຍ (>60%)

ຮູບແບບຂອງດິນ
- [x] ພູພຽງ / ທົ່ງພຽງ
- [ ] ສັນພູ
- [ ] ເປີ້ນພູ
- [ ] ເນີນພູ
- [ ] ຕີນພູ
- [x] ຮອມພູ

ລະດັບຄວາມສູງ
- [ ] 0-100 □ ີ່ມ a.s.l.
- [x] 101-500 □ ີ່ມ a.s.l.
- [ ] 501-1,000 □ ີ່ມ a.s.l.
- [ ] 1,001-1,500 □ ີ່ມ a.s.l.
- [ ] 1,501-2,000 □ ີ່ມ a.s.l.
- [ ] 2,001-2,500 □ ີ່ມ a.s.l.
- [ ] 2,501-3,000 □ ີ່ມ a.s.l.
- [ ] 3,001-4,000 □ ີ່ມ a.s.l.
- [ ] > 4,000 □ ີ່ມ a.s.l.

ເຕັກໂນໂລຢີໄດ້ຖືກນໍາໃຊ້ໃນ
- [ ] ລັກສະນະສວດ
- [ ] ລັກສະນະກົງ
- [x] ບໍ່□ ກ່ຽວຂ້ອງ

ຄວາມເລິກຂອງດິນ
- [ ] ຕື້ນຫຼາຍ (0-20 ຊັງຕີ□ ມ)
- [x] ຕື້ນ (21-50 ຊຕມ)
- [ ] ເລິກປານກາງ (51-80 ຊຕມ)
- [ ] ເລິກ (81-120 ຊມ)
- [ ] ເລິກຫຼາຍ (> 120 cm)

ໂຄງສ້າງຂອງດິນ (ເທິງໜ້າດິນ)
- [x] ຫຍາບ / ເບົາ (ດິນຊາຍ)
- [ ] ປານກາງ (ດິນ□ ຽວດິນ□ ຄນ)
- [x] ບາງລະອຽດ / ໜັກ (□ ຽວ)

ໂຄງສ້າງຂອງດິນ (ເລິກລົງ 20 ຊັງຕີແມັດ)
- [x] ຫຍາບ / ເບົາ (ດິນຊາຍ)
- [ ] ປານກາງ (ດິນ□ ຽວດິນ□ ຄນ)
- [x] ບາງລະອຽດ / ໜັກ (□ ຽວ)

ທາດອິນຊີຢູ່ເທິງໜ້າດິນ
- [ ] ສູງ (> 3 %)
- [ ] ປານກາງ (1-3 %)
- [x] ຕໍ່າ (<1 %)

ນໍ້າໃຕ້ດິນ
- [ ] ເທິງຊັ້ນ□ ດິນ
- [ ] < 5 □ ີ່ມ
- [x] 5-50 □ ີ່ມ
- [ ] > 50 □ ີ່ມ

ມີນໍ້າໜ້າດິນ
- [ ] ເກີນ
- [x] ດີ
- [ ] ປານກາງ
- [ ] ທຸກຍາກ / ບໍ່□ ມ

ຄຸນນະພາບນໍ້າ (ການຮັກສາ)
- [ ] ນໍ້າດື່ມດີ
- [x] ບໍ່□ ຍຸ່ງດື່ມ (ຮຽກຮອງ□ ຫ້ການ ບໍ່ບັດບົດ)
- [ ] ນໍ້າ□ ຊ້□ ນການຜະລິດກະສິກໍາ ພຽງຢ່າງດຽວ (ຊົນລະປະທານ)
- [ ] ຜິດປົກກະຕິ

ຄຸນນະພາບນໍ້າ□ າຍເຖິງ ທັງນໍ້າ□ ຕືນ □ ລະນໍ້າ□ ດິນ

ດິນເຄັມເປັນບັນຫາບໍ່?
- [x] □ ມ□ ນ
- [ ] ບໍ່□ ມ□ ນ

ການເກີດນໍ້າຖ້ວມ
- [ ] □ ມ□ ນ
- [x] ບໍ່□ ມ□ ນ

ຄວາມຫຼາກຫຼາຍຂອງຊະນິດ
- [x] ສູງ
- [ ] ປານກາງ
- [ ] ຕໍ່າ

ຄວາມຫຼາກຫຼາຍຂອງສິ່ງທີ່ມີຊີວິດ
- [x] ສູງ
- [ ] ປານກາງ
- [ ] ຕໍ່າ

ຄຸນລັກສະນະຂອງຜູ້ນໍາ□ ຊ້ດິນການນໍາ□ ຊ້ເຕັກ□ ນ□ ລຍ

ການວາງແນວທາງຕະຫຼາດ
- [x] ກຸ້ມຕົນເອງ (ພໍພຽງ)
- [ ] ປະສົມປົນເປ(ກຸ້ມຕົນເອງ/ເປັນສິນຄ້າ)
- [ ] ການຄ້າ / ຕະຫຼາດ

ລາຍຮັບທີ່ໄດ້ມາຈາກກິດຈະກໍາອື່ນໆ ທີ່ບໍ່ແມ່ນການຜະລິດກະສິກໍາ
- [x] □ ອຍກວ່າ 10 % ຂອງລາຍຮັບທັງ□ ົດ
- [ ] 10-50 % ຂອງລາຍຮັບທັງ□ ົດ
- [ ] > 50 % ຂອງລາຍຮັບທັງ□ ົດ

ລະດັບຄວາມຮັ່ງມີ
- [ ] ທຸກຍາກຫຼາຍ
- [x] ທຸກຍາກ
- [ ] ສະເລ່ຍ
- [ ] ຮັ່ງມີ
- [ ] ຮັ່ງມີຫຼາຍ

ລະດັບຂອງການຫັນເປັນກົນຈັກ
- [x] ການ□ ຊ້ ຮງງານຄົນ
- [x] ສັດລາກ□ ຖ
- [ ] ເຄື່ອງກົນຈັກ

ຢູ່ປະຈໍາ ຫຼື ເລລ້ອນ
- [ ] ບໍ່ເຄື່ອນ□ ຫວ
- [ ] □ ບບເຄິ່ງ-ເຄື່ອນຍ້າຍ
- [ ] □ ບບເລ່ຍຕາມທໍາມະຊາດ

ບຸກຄົນ ຫຼື ກຸ່ມ
- [x] ບຸກຄົນ / ຄົວເຮືອນ
- [x] ກຸ່ມ / ຊຸມຊົນ
- [ ] ການຮ່ວມມື
- [ ] ການຈ້າງງານ (ບໍລິສັດ, ອົງການ ລັດຖະບານ)

ເພດ
- [x] ຜູ້ຍິງ
- [x] ຜູ້ຊາຍ

ອາຍຸ
- [ ] ເດັກນ້ອຍ
- [x] ຊາວ□ ນຸ່ມ
- [x] □ ກາງຄົນ
- [ ] ຜູ້ສູງອາຍຸ

ເຂດພື້ນທີ່ການນໍາໃຊ້ຕໍ່ຄົວເຮືອນ
- [x] <0.5 ເຮັກຕາ
- [ ] 0.5-1 ເຮັກຕາ
- [ ] 1-2 ເຮັກຕາ
- [ ] 2-5 ເຮັກຕາ
- [ ] 5-15 ເຮັກຕາ
- [ ] 15-50 ເຮັກຕາ
- [ ] 50-100 ເຮັກຕາ

ຂະໜາດ
- [x] ຂະ□ າດນ້ອຍ
- [ ] ຂະ□ າດກາງ
- [ ] ຂະ□ າດ□ ຫຍ່

ເຈົ້າຂອງທີ່ດິນ
- [ ] ລັດ
- [ ] ບໍລິສັດ
- [ ] ຊຸມຊົນ / ບ້ານ
- [ ] ກຸ່ມ
- [ ] ບຸກຄົນ, ບໍ່ມີຕໍາ□ ດິ
- [x] ບຸກຄົນ, ທີ່ມີຕໍາ□ ດິ

ສິດທິການນໍາໃຊ້ທີ່ດິນ
- [ ] ເປີດກວ້າງ (ບໍ່ມີການຈັດຕັ້ງ)
- [ ] ຊຸມຊົນ (ທີ່ມີການຈັດຕັ້ງ)
- [ ] ເຊົ່າ
- [x] ບຸກຄົນ

ສິດທິການນໍາໃຊ້ນໍ້າ
- [ ] ເປີດກວ້າງ (ບໍ່ມີການຈັດຕັ້ງ)

- 100-500 ເຮັກຕາ
- 500-1,000 ເຮັກຕາ
- 1,000-10,000 ເຮັກຕາ
- > 10,000 ເຮັກຕາ

- ຊຸມຊົນ (ທີ່ມີການຈັດຕັ້ງ)
- ເຂດ
- ບຸກຄົນ

ການເຂົ້າເຖິງການບໍລິການ ແລະ ພື້ນຖານໂຄງລ່າງ

ສຸຂະພາບ	ທຸກຍາກ ✓	ດີ
ການສຶກສາ	ທຸກຍາກ ✓ (middle)	ດີ
ການຊ່ວຍເຫຼືອ ດ້ານວິຊາການ	ທຸກຍາກ ✓	ດີ
ການຈ້າງງານ (ຕົວຢ່າງ, ການເຮັດກິດຈະກຳອື່ນ ທີ່ບໍ່ແມ່ນ ການຜະລິດກະສິກຳ)	ທຸກຍາກ ✓	ດີ
ຕະຫຼາດ	ທຸກຍາກ ✓	ດີ
ພະລັງງານ	ທຸກຍາກ ✓ (middle)	ດີ
ຖະໜົນຫົນທາງ ແລະການຂົນສົ່ງ	ທຸກຍາກ ✓	ດີ
ການດື່ມນ້ຳ ແລະສຸຂາພິບານ	ທຸກຍາກ ✓	ດີ
ການບໍລິການ ທາງດ້ານການເງິນ	ທຸກຍາກ ✓	ດີ

ຄວາມຄິດເຫັນ

The district is located in the interior parts of eastern India and considered as a backward district with poor access to infrastructure and other facilities

ຜົນກະທົບ

ຜົນກະທົບທາງສັງຄົມ ແລະ ເສດຖະກິດ

ຜົນຜະລິດ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

For Wood Biochar or Wood Coconut Husk Biochar (WCB), or Crop Residue Biochar (CRB) the highest grain yield of the crop was recorded with the highest dose of biochar, fertilizer, and manure application. Also, it's application significantly improved the straw yield

ຄຸນນະພາບຂອງພືດ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

The application of Wood Biochar or Wood Coconut Husk Biochar (WCB), or Crop Residue Biochar (CRB) with manure also significantly improved the quality of the crop

ການຜະລິດອາຫານສັດ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

It was found with significantly improved straw yield the availability of fodder for the livestock also increased

ຄວາມສ່ຽງ ຕໍ່ຜົນຜະລິດ

ເພີ່ມຂຶ້ນ ✓ ຫຼຸດລົງ

It was observed that the crop in which the application of biochar was with the manure and fertilizer, the crop had better adaptation and standing properties in comparison to another crop without the application of biochar.

ການຈັດການຄຸ້ມຄອງທີ່ດິນ

ອຸປະສັກ ✓ ເຮັດໃຫ້ງ່າຍຂຶ້ນ

ລາຍຮັບ ຈາກການຜະລິດ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

The yield for the crop in which application was done was increased which led to an increase in income

ຜົນກະທົບທາງສັງຄົມ ວັດທະນະທຳ

ການຄໍ້ປະກັນ ສະບຽງອາຫານ / ກຸ້ມຢູ່ກຸ້ມກິນ

ຫຼຸດຜ່ອນ ✓ ປັບປຸງ

ຜົນກະທົບຕໍ່ລະບົບນິເວດ

ການຂຸດຄົ້ນ / ເກັບກັກນ້ຳ (ການໄຫຼຂອງນ້ຳ, ນ້ຳຄ້າງ, ຫິມະ ແລະອື່ນໆ)

ຫຼຸດຜ່ອນ ✓ ປັບປຸງ

Water retention from the soil increased because of the increase in soil organic matter and carbon content

ການໄຫຼຂອງນ້ຳໜ້າດິນ

ເພີ່ມຂຶ້ນ ✓ ຫຼຸດລົງ

The water holding capacity of the water increased leading to less surface runoff from the field.

ການລະເຫີຍອາຍ

ເພີ່ມຂຶ້ນ ✓ ຫຼຸດລົງ

ຄວາມຊຸ່ມຂອງດິນ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

With an increase in soil organic matter and improved soil texture the soil moisture increased

ການສູນເສຍດິນ

ເພີ່ມຂຶ້ນ ✓ ຫຼຸດລົງ

The semi-arid climate and limited rainfall, combined with sporadic and intense monsoons, can lead to soil erosion. When rainfall does occur, it can cause rapid runoff, carrying away the topsoil due to the lack of vegetation cover or inadequate soil conservation measures.

ວົງຈອນ ຂອງສານອາຫານພືດ

ຫຼຸດລົງ ✓ ເພີ່ມຂຶ້ນ

The application of biochar with manure and fertilizers not only increased the nutrients in the soil but also increased the nutrient uptake of plants from the soil.

ດິນເຄັມ

Biochar can act as a soil amendment to moderate soil pH depending on the initial pH level. Scientifically, biochar

	ເພີ່ມຂຶ້ນ	✓ ຫຼຸດລົງ	tends to be pH neutral, so its impact on soil pH depends on the existing soil condition. The impact of biochar on pH is often gradual and depends on various factors like the type and composition of biochar, soil characteristics and environmental conditions. Biochar acts more as a buffer, stabilizing soil pH over time rather than making drastic immediate changes.
ອິນຊີວັດຖຸ ນິດ / ຢູ່ລຸ່ມຊັ້ນດິນ C	ຫຼຸດລົງ	✓ ເພີ່ມຂຶ້ນ	
ການປົກຫຸ້ມຂອງພືດ	ຫຼຸດລົງ	✓ ເພີ່ມຂຶ້ນ	The plant biomass as well as the vegetative growth of the plant showed a significant positive reaction to the biochar application on crops
ມວນຊີວະພາບ / ຢູ່ເທິງຊັ້ນດິນ C	ຫຼຸດລົງ	✓ ເພີ່ມຂຶ້ນ	
ຄວາມຫຼາກຫຼາຍຂອງພືດ	ຫຼຸດລົງ	✓ ເພີ່ມຂຶ້ນ	
ການຄວບຄຸມສັດຕູພືດ / ພະຍາດ	ຫຼຸດລົງ	✓ ເພີ່ມຂຶ້ນ	Resistance of the crop increases with better uptake of K from the soil. Plants become more resistant to disease and pests.
ການລະເຫີຍອາຍກາກບອນ ລະອາຍພິດເຮືອນ	ເພີ່ມຂຶ້ນ	✓ ຫຼຸດລົງ	

ຜົນກະທົບນອກສະຖານທີ່

ການວິເຄາະຕົ້ນທຶນ ລະຜົນປະ ຫຍດ

ຜົນປະໂຫຍດເມື່ອທຽບກັບຄ່າໃຊ້ຈ່າຍໃນການສ້າງຕັ້ງ

ຜົນຕອບ ທາງ ນ ລະຍະສັ້ນ	ຜົນກະທົບທາງລົບຫຼາຍ	✓	ຜົນກະທົບທາງບວກຫຼາຍ
ຜົນຕອບ ທາງ ນ ລະຍະຍາວ	ຜົນກະທົບທາງລົບຫຼາຍ	✓	ຜົນກະທົບທາງບວກຫຼາຍ

ຜົນປະໂຫຍດເມື່ອທຽບກັບຄ່າໃຊ້ຈ່າຍບໍາລຸງຮັກສາ

ຜົນຕອບ ທາງ ນ ລະຍະສັ້ນ	ຜົນກະທົບທາງລົບຫຼາຍ	✓	ຜົນກະທົບທາງບວກຫຼາຍ
ຜົນຕອບ ທາງ ນ ລະຍະຍາວ	ຜົນກະທົບທາງລົບຫຼາຍ	✓	ຜົນກະທົບທາງບວກຫຼາຍ

The benefits of technology to soil health, crop productivity and crop quality is much higher than the cost of establishment and maintenance

ການປ່ຽນ ປງສະພາບດິນຟ້າອາກາດ

ການປ່ຽນແປງດິນຟ້າອາກາດ ເທື່ອລະກ້າວ

ອຸນຫະພູມປະຈໍາປີ ເພີ່ມຂຶ້ນ	ບໍ່ດີເລີຍ	✓	ດີຫຼາຍ	
ອຸນຫະພູມລະດູການ ເພີ່ມຂຶ້ນ	ບໍ່ດີເລີຍ	✓	ດີຫຼາຍ	ລະດູການ: ລະດູຮ້ອນ
ປະລິມານນໍ້າຝົນປະຈໍາປີ ຫຼຸດລົງ	ບໍ່ດີເລີຍ	✓	ດີຫຼາຍ	
ປະລິມານນໍ້າຝົນຕາມລະດູການ ຫຼຸດລົງ	ບໍ່ດີເລີຍ	✓	ດີຫຼາຍ	ລະດູການ: ຄວາມຊຸ່ມ / ລະດູຝົນ

ອາກາດ ທີ່ກ່ຽວພັນກັບຄວາມຮຸນແຮງ (ໄພພິບັດທາງທໍາມະຊາດ)

ໄ ລ	ບໍ່ດີເລີຍ	✓	ດີຫຼາຍ

ການຍອມຮັບ ລະການປັບຕົວ

ອັດຕາສ່ວນຂອງຜູ້ຊົມໃຊ້ທີ່ດິນໃນເຂດພື້ນທີ່ທີ່ໄດ້ຮັບຮອງເອົາເຕັກໂນໂລຢີ

- [x] ກລະນີດຽວ / ການທົດລອງ
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

ຈໍານວນຄົວເຮືອນ ແລະ / ຫຼືບໍລິເວນກວມເອົາ

100

ທັງໝົດນັ້ນ ມີໃຜແດ່ທີ່ສາມາດປັບຕົວຕໍ່ເຕັກໂນໂລຢີ, ມີຈັກຄົນທີ່ໄດ້ຮັບການກະຕຸກຊຸກຍູ້ ແລະ ອຸປະກອນ?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

ໄດ້ມີການດັດແປງເຕັກໂນໂລຢີ ເພື່ອປັບໃຫ້ເຂົ້າກັບເງື່ອນໄຂການປ່ຽນແປງບໍ່?

- [x] ມ ນ
- [ ] ບ ມ ນ

ໄດ້ປ່ຽນແປງເງື່ອນໄຂຫຍັງແດ່?

- [ ] ການປ່ຽນ ປງສະພາບດິນຟ້າອາກາດ / ຮຸນ ຮງ
- [ ] ຕະຫຼາດມີການປ່ຽນ ປງ
- [x] ມີ ຮງງານທີ່ວ່າງ, ເນື່ອງຈາກການເຄື່ອນຍ້າຍ ຮງງານ

Refinements in pyrolysis methods and technologies to produce biochar with specific characteristics suited to diverse soil types and climate conditions. This includes adjusting temperature, duration, and feedstock to optimize biochar properties like porosity and water retention capacity. Innovations in application techniques to improve the efficiency and effectiveness of biochar incorporation into agricultural systems. This involves exploring precision application methods, such as localized placement or mixing with organic amendments, to ensure better distribution and utilization of biochar in the root zone. Emphasis on integrating biochar technology into climate-smart agricultural practices, focusing on sustainable intensification while adapting to changing climatic conditions. This involves promoting practices that enhance resilience to drought, water conservation and soil fertility improvement.

ບົດສະຫຼຸບ ລະຜົດຮຽນທີ ຮັບ

ຄວາມເຂັ້ມແຂງ: ທັດສະນະມູມມອງ ຂອງຜູ້ນໍາໃຊ້ທີ່ດິນ

- The soil moisture, soil texture, water retention and water-holding capacity of the soil increases. The uptake of nutrients increases which leads to less application of fertilizers in the field
- There was an increase in crop yield, straw yield, vegetative mass growth, more grains or fruits per plant, and fewer pests & disease attacks on the plants were noticed
- The better use of crop residue from the field increase the soil fertility and promoted better crop growth

ຄວາມເຂັ້ມແຂງ: ທັດສະນະມຸມມອງ ຂອງຜູ້ປ້ອນຂໍ້ມູນເອງ

- The use of biochar helps to combat the climate crisis by sequestering atmospheric carbon into soil as well as processing agricultural and other waste into useful clean energy
- The application of biochar significantly changes the soil's properties (texture, porosity, bulk density, particle density, surface area, pore size distribution, cation exchange capacity, pH, and water-holding capacity) which, directly influence plant growth
- High porosity and a large surface area of biochar provide space for micro-organisms that are beneficial for the soil and help in binding important anions and cations, improving soil health and enhancing crop productivity
- Reduced nitrous oxide and methane emissions when biochar is applied to the soil

ຈຸດອ່ອນ / ຂໍ້ເສຍ / ຄວາມສ່ຽງ: ທັດສະນະມູມມອງ ຂອງຜູ້ນໍາໃຊ້ທີ່ດິນ ວິທີການແກ້ໄຂແນວໃດ

- Need large quantities of wood and crop residue for biochar production on a larger scale A better planning for crop residue management and access to communities to collect forest waste from forest can easily address this problem

  Exploring alternative biomass sources like agricultural residues, crop waste, or dedicated energy crops can reduce reliance on wood or coconut shells, promoting sustainable sourcing. Also, advancements in pyrolysis technologies to optimize biochar production from smaller quantities of biomass, improving efficiency and reducing the overall demand.
- Do not have knowledge about how this biochar can be sold in the market for additional income Creating more awareness among the farmers about biochar will create a market demand for it.

  Conducting market assessments and creating awareness among potential buyers about the benefits of biochar for soil improvement, carbon sequestration, and agricultural productivity. Exploring the development of value-added products or applications derived from biochar, such as soil amendments, filtration systems, or compost blends, to diversify market opportunities.

ຈຸດອ່ອນ / ຂໍ້ເສຍ / ຄວາມສ່ຽງ: ທັດສະນະມຸມມອງ ຂອງຜູ້ປ້ອນຂໍ້ມູນເອງວິທີການແກ້ໄຂແນວໃດ

- The availability of suitable wood and coconut for biochar production can be limited, and there may be competition between biochar production and other uses of biomass, such as food and fuel production The innovation in technology where biochar can be produced with lesser amount of feedstock will be a great solution
- If not managed sustainably, the production of biomass feedstock for biochar can lead to deforestation or the conversion of natural ecosystems into monoculture plantations, which can have negative ecological consequences The promotion of agro-forestry is important to ensure the availability of feed stock while also ensuring the increased coverage of forest.
  The training of land users and other stakeholders around sustainable biochar production.

ເອກກະສານອ້າງອີງ

ການລວບລວມ
Santosh Gupta

Editors
Kim Arora
Stephanie Jaquet
Tabitha Nekesa
Ahmadou Gaye
Siagbé Golli

ການທົບທວນຄືນ
Udo Höggel
Sally Bunning

ວັນທີຂອງການປະຕິບັດ: April 24, 2023

ປັບປຸງລ່າສຸດ: April 11, 2024

ບຸກຄົນທີ່ສໍາຄັນ
Santosh Gupta - ຜູ້ຊ່ຽວຊານ ດ້ານການຄຸ້ມຄອງ ທີ່ດິນ ແບບຍືນຍົງ

ການບັນຍາຍລາຍລະອຽດ ໃນຖານຂໍ້ມູນ ຂອງ WOCAT
https://qcat.wocat.net/lo/wocat/technologies/view/technologies_6735/
ວິດີໂອhttps://player.vimeo.com/video/288

ຂໍ້ມູນການເຊື່ອມໂຍງຂໍ້ມູນການຄຸ້ມຄອງການນໍາໃຊ້ດິນແບບຍືນຍົງ
Approaches: Developing professional standards in the installation, maintenance and management of pump units
https://qcat.wocat.net/lo/wocat/approaches/view/approaches_2515/

ເອກກະສານ ແມ່ນໄດ້ອໍານວຍຄວາມສະດວກໂດຍ

ສະຖາບັນ
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (GIZ) - ເຢຍລະມັນ
- Ecociate Consultants (Ecociate Consultants) - ອິນເດຍ
- International Centre for Research in Agroforestry (ICRAF) - ເຄັນຢາ

ໂຄງການ
- Soil protection and rehabilitation for food security (ProSo(i)l)

ການອ້າງອີງທີ່ສໍາຄັນ
- IBI publication at International Biochar Initiative: https://biochar-international.org/resources/ibi-publications/

ເຊື່ອມໂຍງກັບ ຂໍ້ມູນຕ່າງໆ ທີ່ກ່ຽວຂ້ອງທີ່ມີ
- About Balangir District: https://balangir.nic.in/about-district/
- Water Resources of Balangir District (Minor Irrigation Division, Balangir): https://balangir.nic.in/water-resources/
- Senior Geologist, Ground Water Survey & Investigation Division, Balangir: https://www.rtiodisha.gov.in/Pages/printAllManual/office_id:2710/lang: