1st Agri Net Zero Model

developed under IBM - IORF

SUSTAINABILITY PROJECT

2nd Year Clean Food 'Net Zero' Program Mandya, Karnataka

Case Study: 25.2 ha, in Phase III (2023-24)

Developed By

Inhana Organic Research Foundation (IORF)

168 Jodhpur Park, Kolkata – 700068, West Bengal, India

Email : inhana.rftprojects@gmail.com

Website : www.inhana.in

IBM-IORF Sustainability Project : Soil Health Management in 25 ha (25%) of Project Area utilising Novcom Coir Pith Compost.

From Phase- II of the IBM-IORF Sustainability Project, at Mandya, Karnataka; IBM had provided extra project allocation towards **Soil Health Management using Novcom Coir pith Compost in about 25 ha Project Area towards the objective of Developing Clean Food 'NET ZERO'. This is perhaps the Best Model for Climate Action (both Mitigation and Adaptation)** utilizing **bio-converted landfill waste; which impacts the crucial SDG-2**. Moreover with this single additional intervention the outcome will be phenomenal. Single project will accomplish the objectives of Seven SDG's- 1,3,11,12,15, apart from SDG-2 and 13.

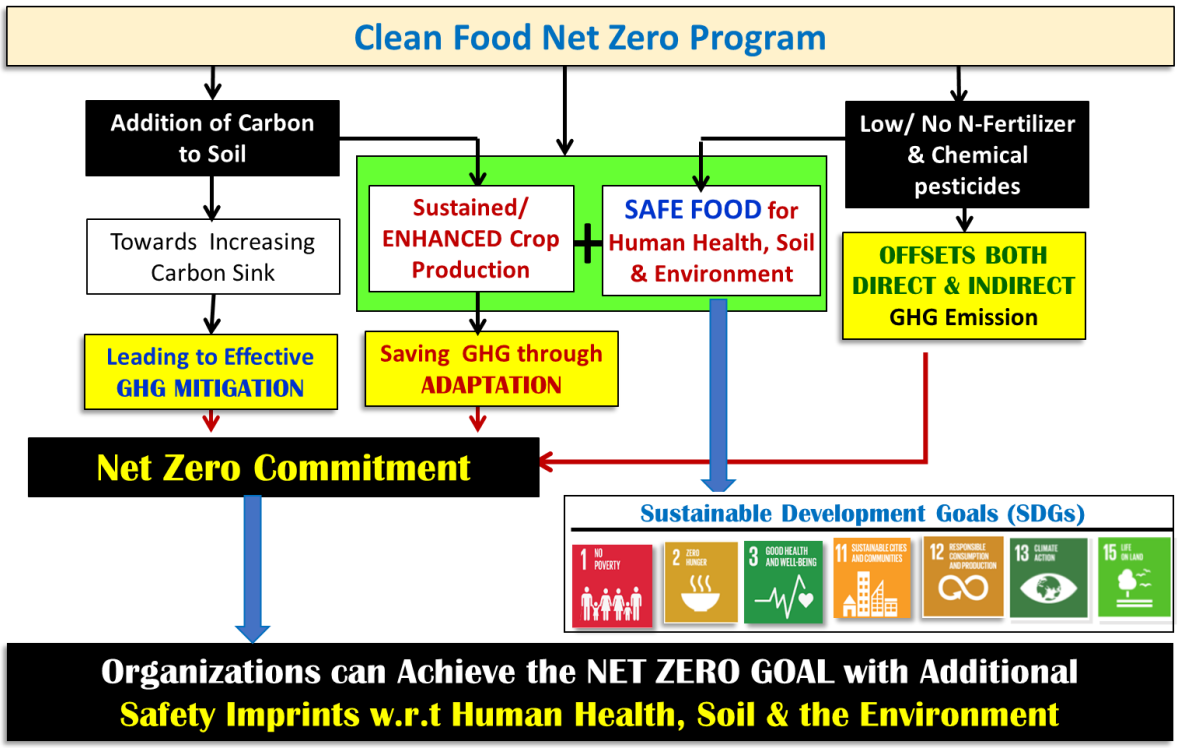
The program helped to develop a Unique Model for conversion of Waste to Wealth, i.e., a potential GHG Emitter and Pollutant to a Safe and Quality Organic amendment for Safe and Sustainable Crop Production, through the utilization of Novcom Composting Technology. This is important especially in the context of Methane (CH4) Mitigation, which is at the enter stage of discussion in any Climate Action Program This is because Offsetting Methane is the fastest way of bringing down the rate of Global Temperature Rise but one of the Hardest Program to Execute.

Moreover, Methane with GWP value of 75 with an atmospheric time period of 24 years is one of the most dangerous GHG, considering that it can generate three potential GHG's; i.e., Carbon-di-oxide, Water vapour and Ozone. And Coir pith is a very strong Methane Emitter which emits more than 6.0 ton CO2-eq. per ton. The IBM-IORF Sustainability Project has already demonstrated >99% Omission of Methane from Source through adoption of Novcom Composting Technology.

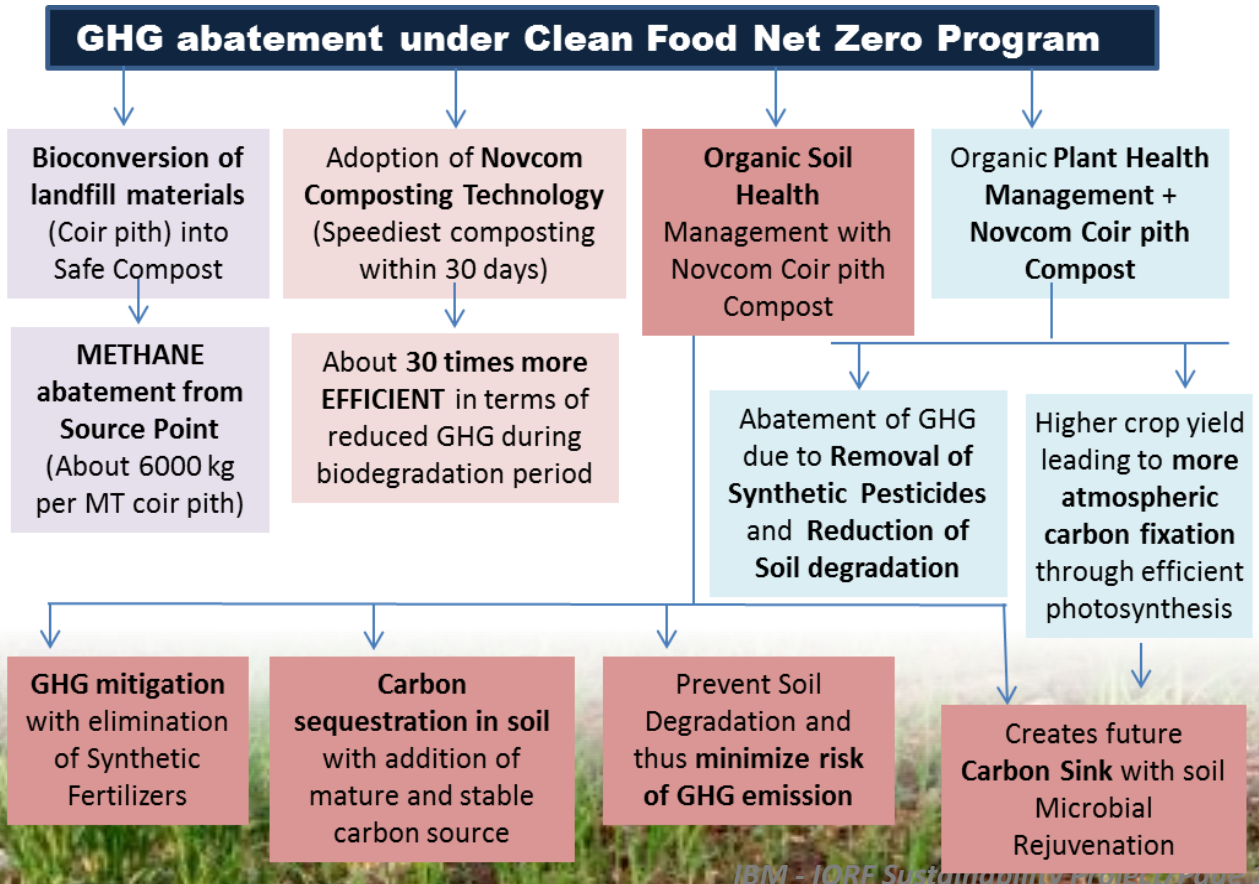
This is important not only w.r.t. the Climate Commitment in line with SDG-13; but is also crucial in the pretext of Degraded Soil Reclamation and Sustenance/ Improvement of Crop Yields; which forms the key for livelihood sustenance of the Project Farmers in Mandya, Karnataka. This program will also ensure mitigation of Nitrous Oxide (N2O) which emits from Urea application to a tune of 1.3 ton CO2-eq. per hectare.

Finally Clean Food 'NET ZERO', perhaps the Best Endeavor in respect of Climate Action and the Highest Form of Sustainability in a Tangible Manner. 'NET ZERO' signifies that it is not just Stoppage of Omission from Source (that is otherwise considered un-abatable) but also Sequestration of about 2.0 ton Carbon per hectare. The program can ensure a Total of about 250 MT CO_2-eq. Negative Carbon Footprints per ha.

How Clean Food Net Zero Program can at a time attend the Net Zero Commitment & Sustainable Development Goals (SDGs) ?



Inhana Clean Food Net Zero (CFNZ) Program for GHG Mitigation at Karnataka



Under Clean Food 'Net Zero' program at Mandya, Karnataka under IBM-IORF Sustainability Project with the adoption of IRF Technology, bio- conversion of coir pith (Landfill WASTE from coir industry) was taken up through utilization **of Novcom Composting Technology in order to transform it into Safe and Mature Novcom Coir pith compost. This was to serve the dual objective of soil health management and elimination of N- fertilizers. This approach actually provided three way benefits in respect of GHG mitigation.** Firstly, bioconversion of landfill materials, cut off the METHANE emission potential directly from SOURCE POINT. Secondly, bioconversion of the material through Novcom Composting Technology, reduced the GHG emission by about 30 times than the average GHG emission recorded under any biodegradation process. Thirdly, Novcom coir pith was utilized for soil health management towards elimination of synthetic fertilizers specially N fertilizers, which on one hand stopped N_2O emission while also enabling soil carbon sequestration.

Organic Plant Health Management under IRF Technology, ensure elimination of synthetic pesticides that enabled reduction of indirect GHG emission. Moreover, adoption of IRF Technology improved crop productivity, which meant higher atmosphere carbon fixation through efficient photosynthesis.

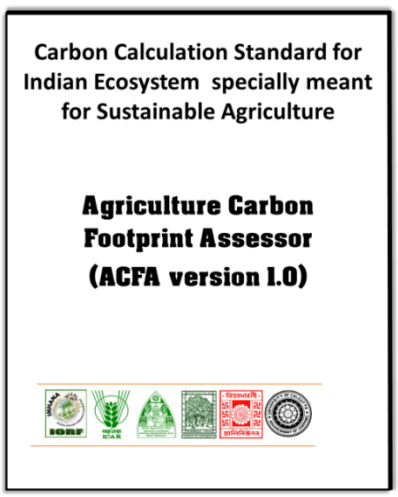
Comparative study of GHG Emission under Conventional farmer's Practice and Clean Food 'Net Zero' Program

Adoption of CFNZ Model in the 25 ha Project Area has enabled GHG Abatement of approx. 6300 MT CO2 eq. through Stoppage of GHG emission from Source Point and GHG mitigation through elimination of Synthetic Fertilizers. Moreover, Adaptation to Climate Change is exhibited through higher crop yields; that also indicated higher atmospheric C- capture; along with SAFEST FOOD production.

GHG Footprint evaluation in respect of seven major crops production under Clean Food Net Zero program (CFNZ) in 25.2 ha. area in Mandya, Karnataka, was done through ACFA (Version 1.0) tool and it was found that replacing conventional farmers' practice with CFNZ Program has the potential to mitigate about 250.39 Mt CO_2 equivalent per ha..

What is 'ACFA (Agriculture Carbon Footprint Assessor)'?

ACFA, Agriculture Carbon Footprint Assessor is a tool for Assessment of Carbon Footprint in Agriculture (An Evaluation Protocol based on "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories" and latest IPCC Assessment Report 6 (AR6), released in August 2021.)



What are new in 'Agriculture Carbon Footprint Assessor (ACFA)'?

- Specifically developed for assessing the GHG footprints from Sustainable Agricultural Practices.
- Considered **ALL THE POSSIBLE** alternative Specific Input components under these calculations.
- These calculations involve more detailed and specific data and specific emission factors of individual inputs that can provide more accurate estimates of GHG Footprint.
- Inhana felt the need for development of more precise & accurate tool for assessing the greenhouse gas inventories (as per IPCC Guideline) that are crucial for understanding the contributions of different agricultural activities to climate change and for tracking progress toward emission reduction targets. Hence, the calculations have been made as per IPCC Tier 3 methods that are the most advanced and precise, involving specific measurements and more sophisticated models.
- In the calculations for **'Agriculture Carbon Footprint Assessor',** Inhana has taken the specific values of process emission for different on-farm composts/organic soil inputs. Even Specific scope for Agricultural Waste Compost & Land fill compost is separately being kept under these calculations.
- While No scope of input biological parameters (most important quality components for sustainable soil health management) of on – farm compost in All other available calculators, Inhana trying to establish the correlation with the sequestration potential of compost with its microbial strength (As per Inhana Logic) in **'Agriculture Carbon Footprint Assessor (ACFA)'.**
- **ACFA** considers all the possible input specific embodied energies.
- In ACFA overall scope for specific/ detailed inputs for resource recycling towards Sustainable Farming is **much innovative as well as relevant.**
- In the calculations of ACFA, focused & considered the **micro- environment factors into the assessment** so that it can enhance the accuracy and relevance of the results and facilitate the development of targeted and context-specific climate action plans in a specific region.
- Additionally, ACFA can aid in measuring progress and the effectiveness of mitigation efforts within a particular micro-environment over time.
- **ACFA** will provide a comprehensive report that outlines the carbon footprint of the agricultural operation: breakdowns of emissions by activity or emission source, identification of hotspots, and potential mitigation strategies.
- **ACFA** will have more synchronization with Indian conditions and recommendation from the findings having impact on sustainability initiatives.

Components of Agricultural Operations considered for GHG Calculation

GHG Emission / mitigation are associated with most of the Agricultural Operations. In general more GHG emission occurs due to the farm level activities taken up under Conventional Agriculture. In contrast, under sustainable/ organic farming practice, both GHG emission and mitigation occurs. The relevant Agricultural Operations are listed below in a broader class for Conventional Farmers Practice, Sustainable Agriculture and in the Clean Food Net Zero (CNFZ) Model under IRF Technology.

Sl. No.	Farm Operations under Conventional Farmers Practice	Farm Operations under Sustainable Agriculture	Farm Operations under Clean Food Net Zero (CNFZ) Model under IRF Technology
1	Seed*	Seed*	Seed*
2	Seed Treatment	Seed Treatment - Alternate Bio agents.	Seed Treatment - Under IRF Technology.
3	Nursery Management	Nursery Management	Nursery Management
4	Land Preparation	Land Preparation	Land Preparation
5	Irrigation	Irrigation	Irrigation
6	Weed Management	Weed Management.	Weed Management.
7	Cultural Practice	Cultural Practice	Cultural Practice
8	Crop Nutrient management - Chemical Fertilizer Application	Crop Nutrient Management - Compost Application/ Bio fertilizers.	**Inhana Soil Health Management (Under CFNZ)** - Novcom compost application.
9	Crop Protectants (Chemical Crop Protectants)- Clemical Fungicides, Insecticides .	Crop Protectants - Bio pesticides, Bio fungicides.	Inhana **Plant Health Management (Under CFNZ)** - 1st & unique concept introduced under IRF Technology
10	Other Inputs (if any) - Synthetic Growth Promoters etc.	Other Inputs (if any) -Organic Growth Promoters	Other Inputs (if any) -On Farm Concoctions made under the guideline of IRF Technology
11	Harvesting	Harvesting	Harvesting

*Note: *No standard reference of individual seed GHG available so far for GHG emission due to Seeds.*

Excluding the Highlighted blocks (Operations related to Soil & Crop Management/ Protections) all inputs/ components remains almost same for any Agricultural Practices. On the other hand these highlighted blocks are the major components for GHG Emission/ Mitigation.

Table 1 : GHG emission in different crop cultivation under conventional farmers practice at Mandya, Karnataka

Sl. No.	Farm Operations	Ragi	Maize	Vegetables	Ginger	Sugarcane (2nd year)	Coconut
		kg CO_{2e}/ ha					
1	Seed Treatment, Bed Preparation & Nursery Mgt.	6.787	0.315	2.348	34.17	-	-
2	Land Preparation	110.54	110.54	120.714	120.714	-	-
3	Transplanting	13.565	0	13.565	13.565	-	-
4	Irrigation	56.91	71.14	256.1	142.28	170.74	156.51
5	Chemical Crop Nutrients Management	*958.48*	*1212.74*	*2271.59*	*1948.6*	*4021.57*	*1378.68*
6	Chemical Pest management	-	-	*17.943*	*40.135*	*64.137*	-
7	Weed Management	2.226	7.156	1.507	30.839	15.767	3.626
8	Cultural Practice	-	-	-	-	-	-
9	Carbon from Biomass	-	-	-	-	-	-3183.25
10	Harvesting	0.446	0.446	-	6.782	2.79	-
11	Total GHG Emission (kg CO_{2ee} / ha)	1149.0	1402.3	2665.8	2297.0	4210.9	-1644.4

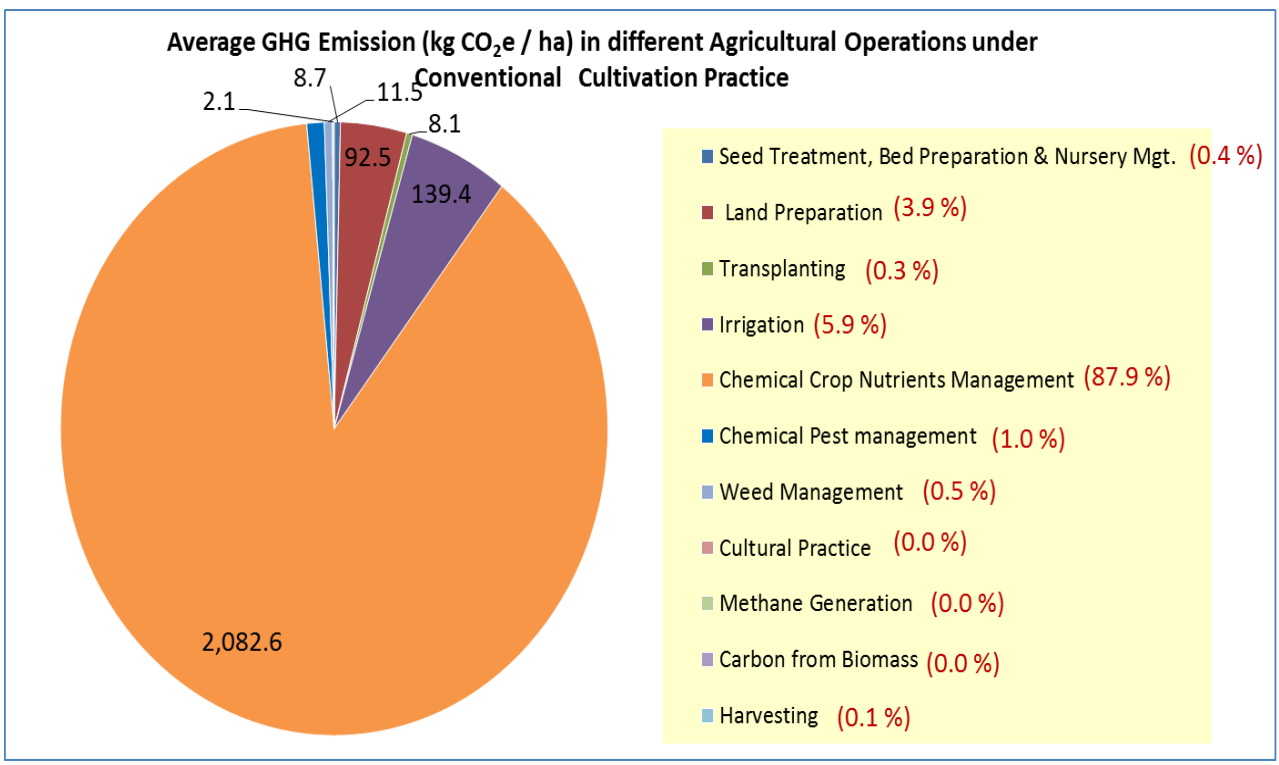


Fig 1 : Average GHG emission ($KgCO_2e$ /ha) of different agricultural operations at Mandya, Karnataka studied under IBM-IORF Sustainability Program

Table 2 : GHG emission in different crop cultivation under Clean Food Net Zero Program at Mandya, Karnataka

Sl. No.	Farm Operations	Ragi	Maize	Vegetables	Ginger	Sugarcane	Coconut
		kg CO_{2e}/ ha					
1	Seed Treatment, Seed bed Preparation & Nursery Mgt.	6.029	0.027	0.944	1.02	-	-
2	Land Preparation	110.54	110.54	120.714	120.714	-	-
3	Transplanting	13.57	0.00	13.57	13.57	-	-
4	Irrigation	56.91	71.14	256.1	142.28	170.74	156.51
5.	Inhana Soil Health Management (ISHM) with Novcom Coir pith Compost	-248872	-248872	-248872	-248872	-248872	-248872
6	Inhana Plant Health Management (IPHM)	3.77	3.77	6.47	7.54	4.31	3.77
7	Weed Management	0.67	0.67	1.507	1.507	1.507	0.67
8	Carbon from Biomass	-	-	-	-	-	-3183
9	C- Sequestration due to Land Use Change	-1130	-1130	-1130	-1130	-1130	-1130
10	Cultural Practice	-	-	-	-	-	-
11	Harvesting	0.446	0.446	0.000	6.782	2.790	0.000
12	Total GHG Emission (kg CO_2 / ha)	-249810	-249815	-249602	-249708	-249822	-249841

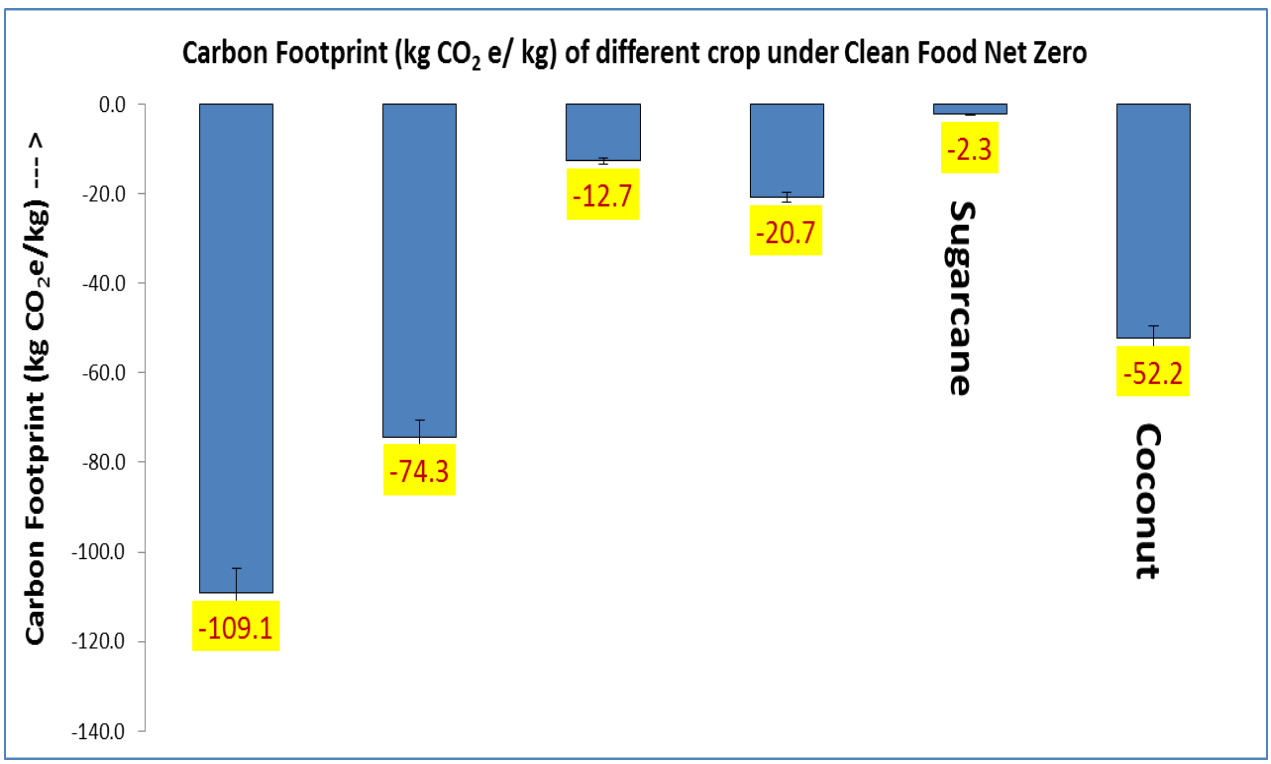


Fig 2 : Carbon footprint of different crop under Clean Food Net Zero Program, IBM-IORF Sustainability Project at Mandya, Karnataka.

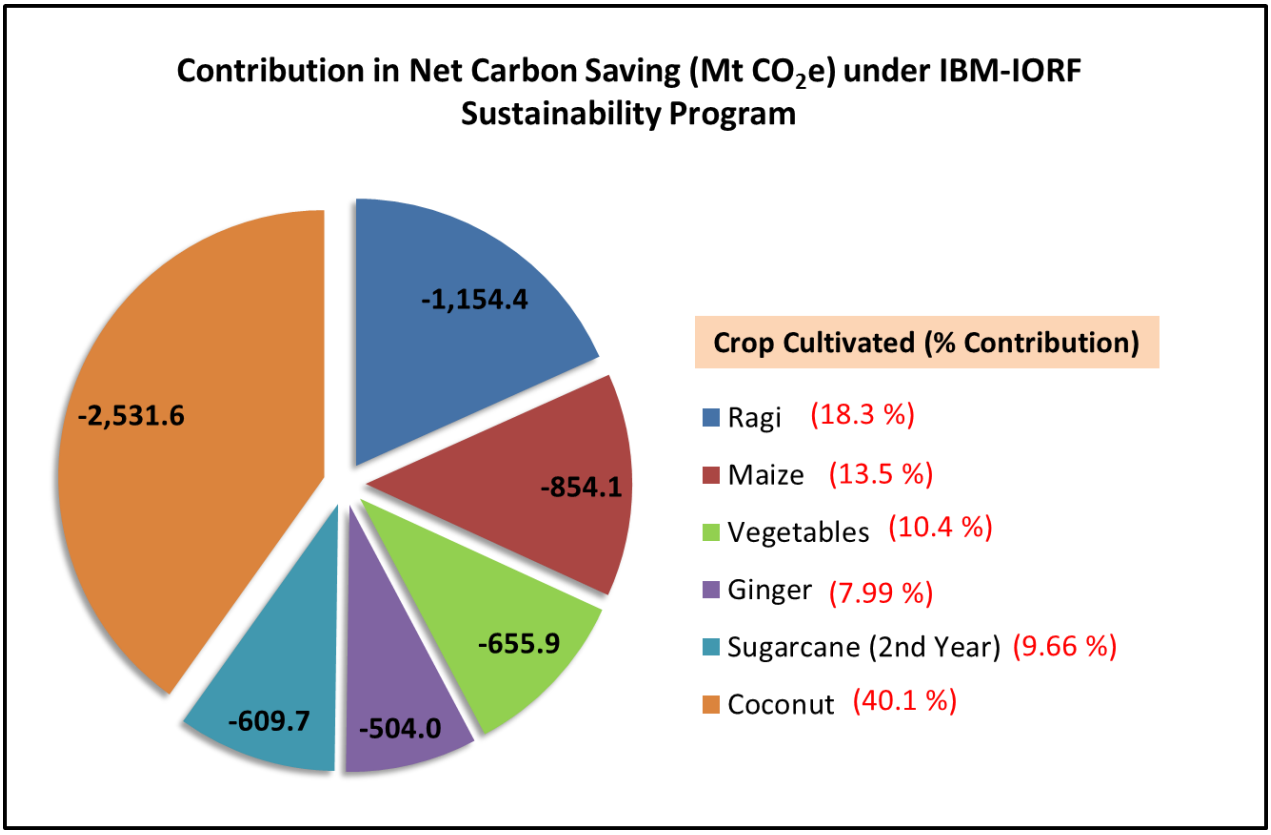
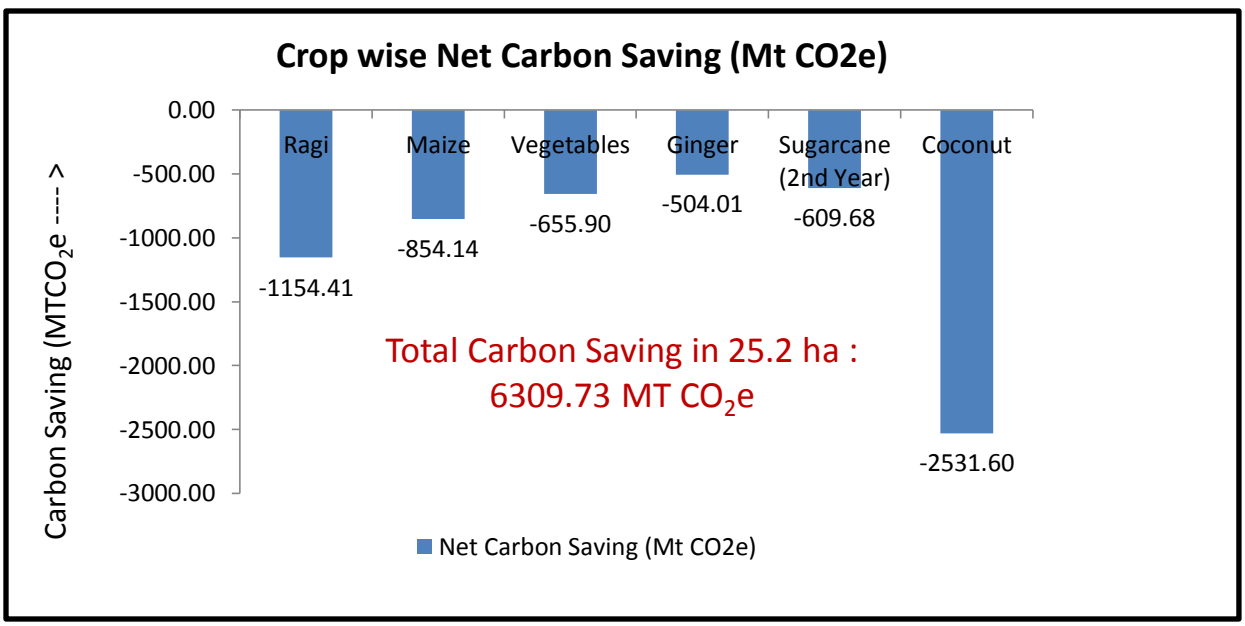


Fig 3 : Net Carbon Saving under under Clean Food Net Zero Program, IBM-IORF Sustainability Project at Mandya, Karnataka.

Net carbon saving under Clean Food Net Zero Program



Under Clean Food Net Zero Program, total GHG mitigation was 6309.73 MT CO_2e or 250.39 MT CO_2e /ha. Thus Clean Food Net Zero (CFNZ) program could be the best Demonstrative Model for IBM's Compliance and commitment of Net Zero GHG Emission by 2030

Conclusion

This is probably the **1st Ever Sustainable Agricultural Model** which can sustain crop productivity, create opportunities for employment and sustain farmer livelihood, provide Safe Food to all Without deteriorating the Soil and Environment; while providing the Road Map for attaining NET ZERO Goal and making significant impact w.r.t. Seven Crucial SDGs.

Agri Net Zero Model that was developed in PHASE 2 of the project continued as the major project objectivity primarily & majorly on the same crops for standardization & conclusive validation.

The project exhibited similar success in the second year establishing the effectivity of IRF Technology towards Plant Health Management, and Novom Composting Technology for Novcom coir pith compost towards Soil Health Management.
NET CARBON FOOTPRINT from **25.2 ha. CFNZ is (-)6309.374 MT CO2e has become certified by i-NO Carbon, UK. & Net Carbon Footprint from CFNZ Continuation Model 250.37 MT CO2e/ha.**

Ref: SACFA/0524/004

Period Certified: 01 April 2023
To: 31 March 2024

AGRI - NET ZERO

SUSTAINABLE AGRICULTURE CARBON FOOTPRINT CERTIFICATE

This document certifies that the agricultural GHG emissions of the project were calculated using the **Sustainable Agriculture Carbon Footprint Assessment (SACFA) Toolkit developed by i-NoCarbon Limited**.

Farm/Project Name & Location	IBM-IORF Sustainability Project at Mandya District, Karnataka, India. at Mandya District, Karnataka, India
Project Details	Clean Food – Net Zero (CFNZ) Project in 25.2 ha area using NOVCOM Coir Pith compost under Inhana Soil Health Management (ISHM) & Inhana Plant Health Management (IPHM), through Inhana Rational Farming (IRF) Technology of Inhana Organic Research Foundation(IORF), Kolkata, India (Phase III: 2023-24)

Chemical-Intensive Agriculture was practised in the above project area wherein Sustainable Agriculture under IRF Technology was introduced and the Carbon Footprint from on-farm activities were calculated using the **SACFA Toolkit** for both the practices:

Erstwhile Agricultural practice followed:	**Conventional (Chemical Fertilizers & Pesticides)**		
Erstwhile Carbon Footprint:	**(+)**	**0.594**	**mt CO_2e/ha**
Present Agricultural practice followed:	**Inhana Rational Farming (IRF) Technology**		
Present Carbon Footprint:	**(-)**	**(249.778)**	**mt CO_2e/ha**

Carbon Footprint Reduction / Sequestration	from	**25.20 ha**	**(-)**	**6,309.374**	**mt CO_2e**

This means that this IBM-IORF Sustainability Project has shown the potential of **REDUCING**

250.37 mt CO_2e/ha

for such De-carbonization Programme towards Net Zero compliance.

Vijay L Narasimhan
Authorised Signature

Date of Issue: 08 May 2024

i-NoCarbon Limited
Change Today for a Better Tomorrow!
Canbury-on-Thames, United Kingdo

This **SACFA Toolkit** has been developed based on the **Agriculture Carbon Footprint Assessor (ACFA)** Version 1.0 expounded by **Inhana Organization Research Foundation (IORF)** in association with **i-NoCarbon Limited (i-NC)** (based on relevant IPCC Guidelines and empirical/scientific research works).

This assessment was carried out remotely, using data provided by the client. All obligations of the accuracy of the data rest with the client.

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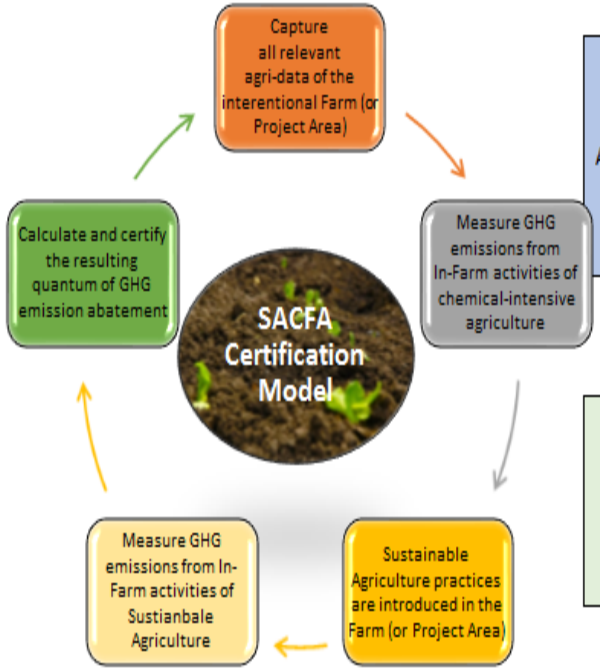
SACFA Toolkit

CARBON FOOTPRINT ASSESSMENT (SACFA)

Inhana Organic Research Foundation
IN HArmony with NAture

Welcome to the **i-NoCarbon Sustainable Agriculture Carbon Footprint Assessment (SACFA) Toolkit** for farmers and growers.
This toolkit has been released for use by licensee only. The fuller version comes with detailed carbon emission calculations.

Sustainable Agriculture Carbon Footprint Assessment (SACFA) Toolkit is a pioneering initiative in the domain of truly **Sustainable Agriculture**
- measuring the actual abatement of GHG emissions from a shift of agricultural practices.



Agriculture GHG emissions are "impossible to abate" due to our own food security.
As the global population increases, food production needs to increase from a fixed amount of agricultural land, which is often degraded.

Agriculture is the second highest emitting sector, accounting for > 20% of global GHG emissions.
Climate Change, in turn, adversely affects agricultural systems and food production!

The **SACFA Toolkit** has been developed based on the Agriculture Carbon Footprint Assessor (ACFA) Standards – version 1.0 expounded by Inhana Organization Research Foundation (IORF) in association with **i-NoCarbon Limited** (based on relevant IPCC Guidelines and empirical scientific research works).

Legends used in calculating worksheets

Instructions / Guidance	Cells for data input	Calculated figures	Output/Index Data

Please note that you can press [F1]

Disclaimer

The accuracy of the input data used in this Sustainable Agriculture Carbon Footprint Assessment (SACFA) Toolkit rests with the user. Only authorized personnel of i-NoCarbon are permitted to generate the SACFA Certificate from this toolkit. i-NoCarbon Limited will not be liable for any errors, omissions, or damages of any kind arising from the use of this calculator, including but not limited to direct, indirect, incidental, punitive or consequential damages.

Release Date
01 May 2024

Clean Food 'Net Zero' has been 2nd Year validated and certified using the SACFA toolkit.

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SACFA Toolkit

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GHG Emission from Conventional Agriculture

Carbon Footprint of agricultural practices under Chemical-intensive Agriculture or Organic Agriculture

The rationale behind GHG emissions calculations for the respective agricultural activities is provided separately in the sections "IPCC Ref" and "Non-IPCC Ref" under **References**.

For the numeric values of GHG Emissions, the +ve sign signifies a net emission while the -ve sign signifies a net sequestration/abatement for the respective agricultural activity.

Sl	Farm Operations under Chemical Farming	Chemical Intensive Agriculture	GHG (mt CO_2e/ha)
1	Seed Treatment, Bed Preparation & Nursery Mgt.		0.004
2	Land Preparation		0.057
3	Transplanting		0.005
4	Irrigation		0.137
5	Crop Management (under Farmer's Practice)		
	Crop Nutrients - Ferlilizers as per farmers practice	*Chemical Fertilizer Application*	1.660
	Crop Protectants - Pesticide as per farmers practice	*Chemical Fungicides, Insecticides Application*	0.011
6	Weed Management		0.007
7	Cultural Practice		-
8	Methane Generation		-
9	Carbon from Biomass		(1.288)
10	Harvesting		0.001
		Conventional Farmers' Practice (Chemical Fertilizers & Pesticides) Carbon Footprint (mtCO_2e/ha)	0.594

Sl	Farm Operations under Organic Farming	Conventional Organic Agriculture	GHG (mt CO_2e/ha)
1	Seed Treatment, Bed Preparation & Nursery Mgt.		
2	Land Preparation		
3	Transplanting		
4	Irrigation		
5	Crop Management (under Farmer's Practice)		
	Crop Nutrients - Ferlilizers as per farmers practice	*Compost/Bio-Fertilizer Application*	
	Crop Protectants - Pesticide as per farmers practice	*Bio-Fungicides, Bio-Insecticides Application*	
6	Weed Management		
7	Cultural Practice		
8	Methane Generation		
9	Carbon from Biomass		
10	Harvesting		
		Conventional Organic Practice Carbon Footprint (mtCO_2e per ha)	-

Total Carbon Footprint (+) / Sequestered (-)	0.594

Clean Food 'Net Zero' has been 2nd Year validated and certified using the SACFA toolkit.

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SACFA Toolkit

GHG Emission from CFNZ

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IN HArmony with NAture

Carbon Footprint of agricultural practices under truly Sustainable Agriculture of IORF

The rationale behind GHG emissions calculations for the respective agricultural activities is provided separately in the sections "IPCC Ref" and "Non-IPCC Ref" under **References**.

For the numeric values of GHG Emissions, the +ve sign signifies a net emission while the -ve sign signifies a net sequestration/abatement for the respective agricultural activity.

Sl	Farm Operations under CFNZ	INHANA Rational Farming (IRF) Technology of IORF	GHG (mt CO_2e/ha)
1	Seed Treatment, Bed Preparation & Nursery Mgt.	Under IRF Technology	0.001
2	Land Preparation		0.057
3	Transplanting		0.005
4	Irrigation		0.137
5	Crop Management (under CNFZ Model)		
	Inhana Soil Health Mgmt (ISHM) - Nutrient Mgt. Novcom Coir pith Compost	*Novcom Compost Application*	(247.564)
	Inhana Plant Health Management (IPHM)	*First & Unique concept introduced under IRF Technology*	0.004
6	Weed Management		0.001
7	Cultural Practice		-
8	Methane Generation		-
9	Carbon from Biomass		(1.290)
10	Harvesting		0.001
11	*C- Sequestration due to Land Use Change*		(1.130)
		Clean Food Net Zero IRF Tech Carbon Footprint (mtCO_2e/ha)	**(249.778)**

Clean Food 'Net Zero' has been 2nd Year validated and certified using the SACFA toolkit.