

Preparation for dissemination and training activities: Key messages on biochar-based fertilizer (BBF) production and application



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Kick-off Meeting on ETH Soil dissemination activities | Betelhem Mekonnen | 27.05.2024

Training material

“Biochar Based Bio-Fertilizers (BBF)

**BBF – the way to super charging
sustainable agricultural practice”**

Target group:

*All dedicated officers in charge of guiding
agricultural extension services at the zonal
and woreda levels in Oromia, Ethiopia.*





ETH-SOIL

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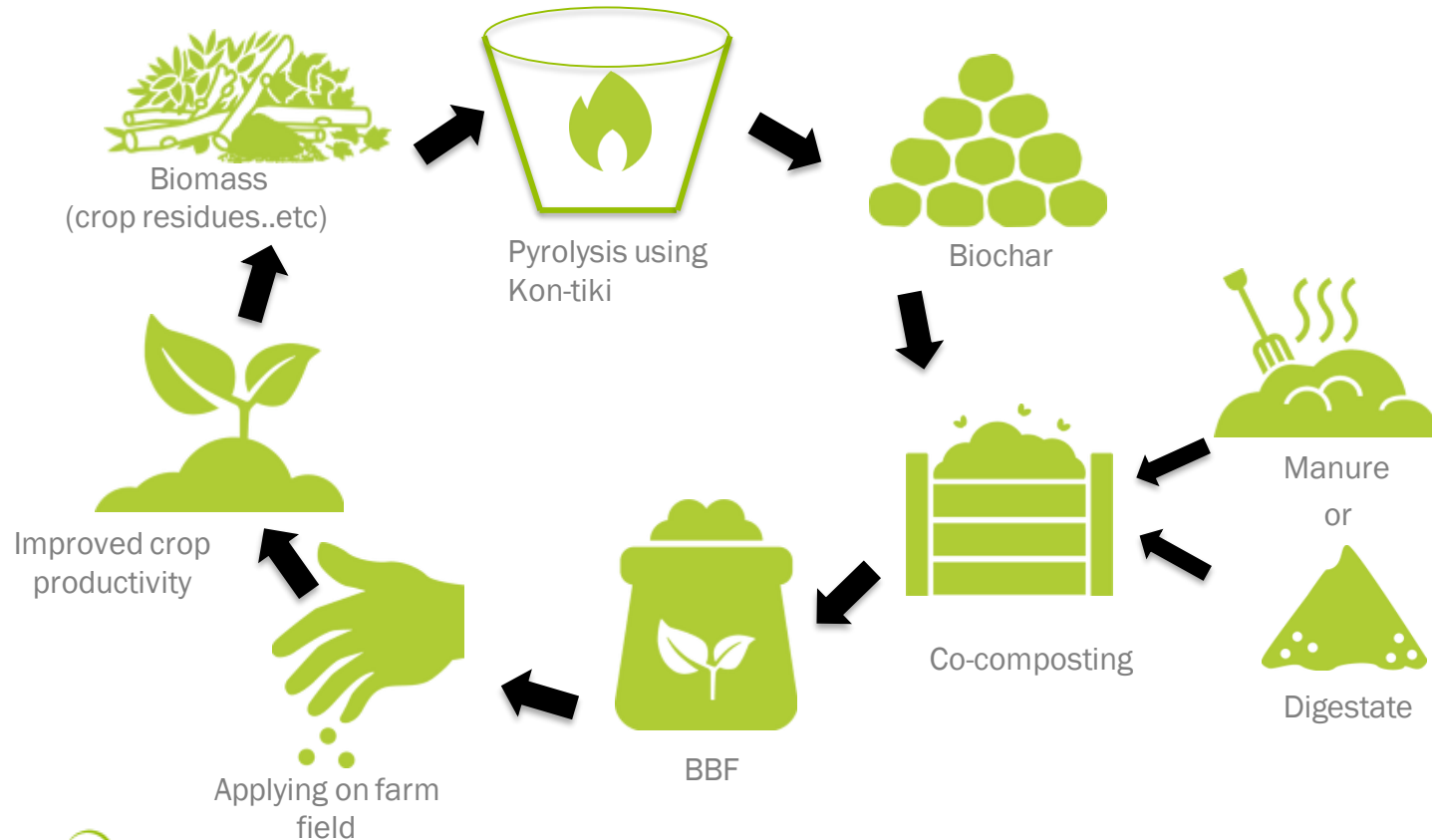
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Overview of BBF production and application



Feedstock selection for biochar production



Crop residues



Invasive plant species



Food processing waste

Sustainable feedstocks should be:

- easily accessible
- obtained without harming biodiversity; exclude deforestation
- resources with minimal or no competitive use
- low in nutrients and heavy metal content

Kon-tiki kilns



Metal Kon-tiki



Soil Kon-tiki

- Easy and cheap to construct
- Easy to operate
- Good conversion rate of biomass (25-30 % of the total biomass)
- Low emissions of Green-house-gases



Important aspects during Kon-tiki operation:

- Use dry feedstock: moisture < 25%
- Pre-process feedstock
- Add biomass in layers
- Monitor flame, smoke and ash formation
- Quench the biochar properly
- Wear protective clothing

Quality control of biochar production

- Depends on type of biomass and pyrolysis conditions

Characteristics of high quality biochar

- ✓ High surface area
- ✓ High pH
- ✓ High carbon content
- ✓ High cation exchange capacity
- ✓ Low in heavy metals and PAH



Visual and physical inspections

High quality biochar has:

- Fully carbonized appearance
- Neutral or slightly smoky smell
- Lightweight and gritty texture
- High porosity and absorb water quickly



Biochar Quality Laboratory Test



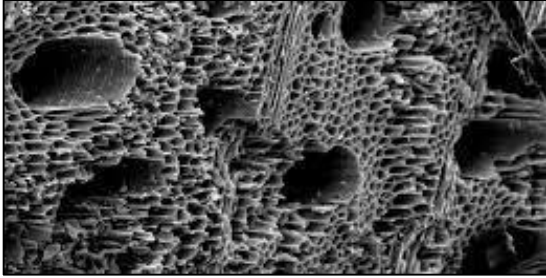
Umwelt

Prüfberichtsnummer: PR-24-FR-000061-01



				Feedstock		Caltrops . procera		Maize Cob		Sawdust		Wheat straw	
				Probenbezeichnung		TK-02575-001		TK-02575-002		TK-02575-003		TK-02575-004	
				Probennummer		124001690		124001691		124001692		124001693	
Parameter	Lab.	Akkr.	Methode	BG	Einheit	anl	wf	anl	wf	anl	wf	anl	wf
Eigenschaften der Pflanzenkohle													
Gesamtwassergehalt	FR	F5	DIN 51718: 2002-06	0,1	Ma.-%	31,2	-	67,6	-	51,7	-	57,5	-
Organ. Schadstoffe a. d. Toluolextrakt n. DIN EN 16181:2019-08(Extrakt.-verf. 2)													
Naphthalin	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	4,5	-	1,7	-	0,8	-	3,5
Acenaphthylen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	0,5
Acenaphthen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	0,2
Fluoren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,2	-	0,2	-	0,2	-	0,7
Phenanthren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,9	-	0,8	-	0,4	-	1,4
Anthracen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,2	-	0,2	-	0,1	-	0,3
Fluoranthren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,2	-	0,3	-	0,2	-	0,5
Pyren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,3	-	0,2	-	0,2	-	0,4
Benzo[a]anthracen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,2	-	< 0,1	-	< 0,1	-	0,2
Chrysen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,3	-	< 0,1	-	< 0,1	-	0,1
Benzo[b]fluoranthren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	0,1	-	0,1
Benzo[k]fluoranthren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	< 0,1
Benzo[a]pyren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	0,1	-	< 0,1	-	< 0,1	-	0,1
Indeno[1,2,3-cd]pyren	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	< 0,1
Dibenzo[a,h]anthracen	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	< 0,1
Benzo[ghi]perylene	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08	0,1	mg/kg	-	< 0,1	-	< 0,1	-	< 0,1	-	< 0,1
Summe 8 EFSA-PAK exkl. BG	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08		mg/kg	-	0,6	-	(n. b.) ¹⁾	-	0,1	-	0,5
Summe 16 EPA-PAK exkl. BG	FR	F5	DIN EN 17503, Verfahren 10.2.3: 2022-08		mg/kg	-	6,9	-	3,4	-	2,0	-	8,0

BBF Formulation



Biochar by itself is not a **fertilizer** rather it is a soil improver which serve as a catalyst for the nutrient exchange between the soil and plants.

Solid or liquid nutrient rich organic matter



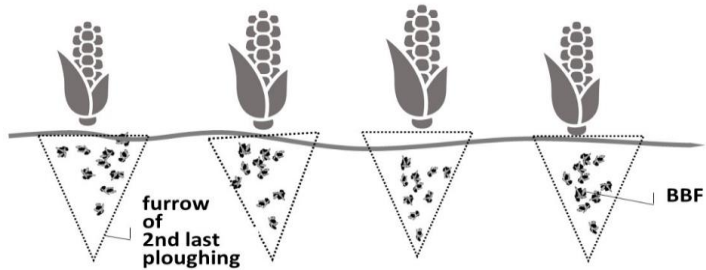
Why is BBF a better fertilizer?

- Provide sustainable, long-term fertility without environmental pollution
- Combine benefits of organic fertilizers with enhanced nutrient retention and slow-release properties
- Sequester carbon and improve soil structure
- Provides habitat for beneficial soil microorganisms

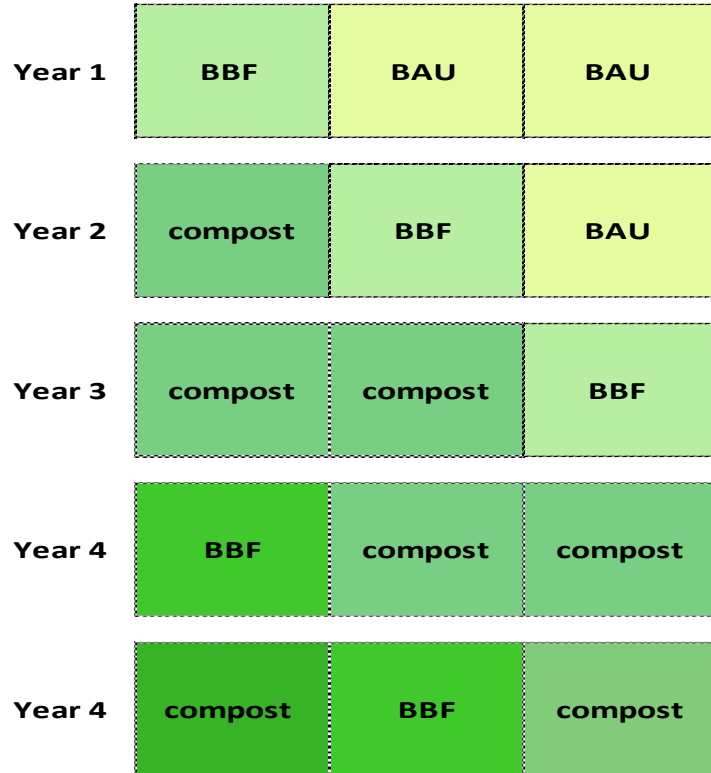


BBF application

- BBF should be placed typically between 5 to 30 cm soil depth, to nurture plants from sapling to maturity.



Economic consideration and Impact Monitoring



- Economic considerations may prohibit application of BBF to an entire field but they may allow initially treating only a part of the field.
- Comparison will be side by side, with one part of the field treated with BBF and the other part differently.



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