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# MBK Biochar Agronomic Framework – Climate-Smart Rice Systems

## Why Biochar in Rice Cultivation?

Rice production is a major source of **methane emissions**, particularly in flooded paddy systems. Incorporating MBK biochar can reduce GHG emissions, improve soil structure, enhance nitrogen use efficiency, and lower water requirements — all in line with **climate-smart agriculture** principles.

## Proven Benefits

| Benefit | Mechanism | Source(s) |
|---|---|---|
| Reduced methane emissions | Alters soil redox potential, lowering anaerobic microbial activity | Haefele et al. (2011); Linquist et al. (2012) |
| Water use reduction | Improves water holding capacity and infiltration in bunded systems | IRRI (2020), Biochar Intl. Trials |
| Nitrogen use efficiency | Retains ammonium, reduces volatilization, and minimizes runoff | Major et al. (2010); Biochar for Rice, FAO |
| Yield improvement | Enhances plant-available nutrients and root biomass | IBI Southeast Asia Field Trials (2018–2021) |
| Climate-smart co-benefits | Soil carbon increase, reduced emissions, improved resilience | UN FAO CSA Profiles (2019), Verra VM0042 Biochar Method |

## Target use Cases

- Paddy rice systems in Southeast Asia, California, and Latin America
- Methane-intensive cultivation regions (wetland rice)
- Irrigation-stressed districts in India and Africa

## Application Rate Guidelines (per acre)

| Rice System | MBK Biochar Rate | Amendment Timing |
|---|---|---|
| Paddy rice (flooded) | 2–6 tons/acre | Pre-planting or till |
| Upland rice | 3–8 tons/acre | Pre-plant or mid-cycle |

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## Integration Strategy

1. **Dry Incorporation**: Apply before the final puddling/tillage or dry seedling transplant.
2. **Combine with Fertilizer**: Blend with urea, DAP, or NPK for a synergistic effect.
3. **Avoid Excessive Waterlogging**: To maintain oxygen-rich soil zones that enhance GHG mitigation.

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## MRV & Registry Protocols

- Eligible under Verra VM0042, Gold Standard Biochar Methodology.
- MRV tools: Satellite and field-based GHG measurement tools (IRRI, MBK-partnered).
- Geo-tagged application, soil health, and yield tracking supported through MBK API platform.