

Technology for Acid Soil Management using Basic Slag based value added Products [EcoLime⁺]



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Introduction

In Odisha, soil acidity is a major issue affecting agricultural productivity. Around 57% of the total cultivated land in Odisha is affected by soil acidity. Most of these lands are used for agricultural purposes. Crops grown in these acidic soils, experiences a significant yield gap ranging from 10-30%. One of the primary barriers to addressing soil acidity is the cost and availability of liming materials. However, some industrial byproducts like basic slag and fly ash that are rich in free lime, higher pH, high in other nutrients could be used for acid soil management. Further, these materials help in reducing GHG emissions from agriculture as they also contain silicon and iron. ICAR-NRRI, Cuttack is focusing on triple-win situation: (i) management of acid soil; (ii) utilization of basic slag and fly ash; (iii) increase in agricultural productivity and reduction in GHG emission. Following extensive laboratory and multi-location field trials, the basic slag and fly ash-based value-added products “**NRRI-EcoLime+**” are developed and commercialized for large-scale adoption. Details about the technology and the Standard Operating Procedure (SOP) for its application are provided in this bulletin.

Details of the products, dosages and time of application

Products Name	Product Details	Dosage	pH	Crops
NRRI -EcoLime+	Different combinations of Basic Slag and/or Fly Ash (Pond Ash) and Compost	1-10 t/ha; Based on soil pH and product type	pH<6.5; Best result at pH < 5.5	Rice and Pulses

Product Quality Parameters should be Maintained before Application of **NRRI -EcoLime+**

Parameter	Range/Value	Comments
Size of the particles	Less than 4 mm	Easy mix-up with soil components
pH	Above 8.0	Must be Alkaline
N Content (%)	At least 0.25 %	On dry weight basis
Fe Content (%)	5-45	Should be in range
MgO (%)	6-20	Should be in range
CaO (%)	10-60	Should be in range
SiO ₂ (%)	5-60	Should be in range
Cr (Threshold)	Less than 150 ppm	Must be Below Safe limit (EU, 2002)
Pb (Threshold)	Less than 300 ppm	Must be Below Safe limit (EU, 2002)
Cd (Threshold)	Less than 3.0 ppm	Must be Below Safe limit (EU, 2002)
Moisture Content (%)	10-40	Weight by weight basis

Standard Operating Procedures (SOP) of the technology

Procurement

- Establish contracts with reliable suppliers
- Ensure that the basic slag and fly ash meet the specified criteria for quality
- Perform quality checks on samples before bulk procurement

Product

- **NRRI -EcoLime⁺**

Mode of application

- Apply the value-added products during field preparation
- Distribute evenly across the field at the recommended dosage
- Ensure incorporation into the soil to maximise effectiveness

Rate of application

- 1-10 t/ha
- Based on soil pH and product type

Schedule of application

- During field preparation, once in every alternate year
- After two consecutive years of application, rate, dosage and frequency of application should be fixed based on soil test data (pH, heavy metal content, etc.)

Preferable Field condition

- Works best in pH<5.5 (acid soil)
- Works best in weed free field
- Field may be moist but no ponding water to ease the mixing of products

Precautions

- Heavy metal (Cr, Pb, Cd) content in the products must be below permissible limit.

Field Testing and Validation

Multilocation field trials revealed an increase in yield of approximately 13% in rice and 18% in black gram following one year of applying basic slag-based value-added products. Additionally, there was around 10% improvement in soil pH, along with reductions in CH₄ emissions by 8-10% and N₂O emissions by 9-12%.

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