

Shamim Ara Begum^{1,2}, Mohammed Abdul Kader*^{1,3}, Steven Sleutel², Stefaan De Neve²

¹Department of Soil Science, Faculty of Agriculture, Bangladesh Agricultural University, Bangladesh

²Department of Soil Management, Faculty of Bioscience Engineering, Ghent University, Belgium

³School of Veterinary and Life Sciences, Murdoch University, Murdoch, 6150 Australia

* Correspondence: mdabdul.kader@bau.edu.bd

INTRODUCTION

- Nitrogen mineralization in rice field is influenced by many biotic and abiotic factors including rhizodeposition
- Very little is known on the influence of root growth and rhizodeposition on N turnover in paddy soils
- Nitrogen mineralization is commonly studied in soil neglecting the influence of roots and root exudates
- In this research we explicitly take into account this influence by using a novel sampling technique

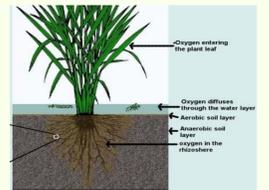


Fig 1: Rhizospheric environment of rice

MATERIALS & METHODS

Test crop: 2 winter rice cultivars (BRRI dhan 29 & BINA dhan 6)

Collection and measurement of rice root exudates

- Rice cultivars grown on sterile, organic matter-free cleaned sand in a rice growth room
- Maintaining the day temperature 28°C, 16/8 hour day/night duration, RH 72-80% & 350 $\mu\text{mol m}^{-2} \text{s}^{-1}$ light intensity
- kept over saturated with the standard Hoagland's nutrient solution
- Root exudates were collected every week till 95 days



Rice plants

Collection of root exudates

Filtration

Nitrogen mineralization from SOM from cropped soils

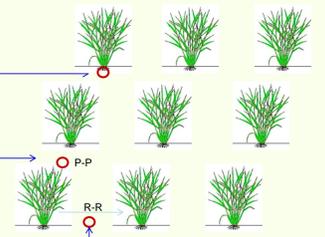
Two sites in Bangladesh

1. BAU farm (loamy, 2.14% OC)
2. Sutiakhali (clayey, 1.62% OC)

Rice growing condition

- a) Uncrop: random soil sampling
- b) Crop: three locations

- 1° Rhizosphere (0 cm)
- 2° Middle of the two plants (7.5 cm apart from rhizosphere)
- 3° Middle of two rows (12.5 cm apart from rhizosphere)



- Sampling at every **two weeks interval** throughout growing period

RESULTS

Biomass & root exuded C content

- Shoot & root biomass, shoot:root, shoot, root & root exuded C content of BINA dhan 6 > BRRI dhan 29

Table : Shoot and root biomass and C and cumulatively root-exuded C of two rice varieties cultivated for 100 days in a rice growth room pot experiment

Rice varieties	Biomass (g hill ⁻¹)		Shoot: root	Carbon (g hill ⁻¹)		Root exuded C (mg hill ⁻¹)	Root exudation rate (mg C hill ⁻¹ day ⁻¹)
	Shoot	Root		Shoot	Root		
BRRI dhan 29	26.12	4.15	6.9	9.68	1.40	106.4	1.12
BINA dhan 6	34.89	4.45	8.7	13.26	1.53	112.2	1.18
t-value	5.43	0.64	2.67	6.11	0.96	1.30	1.33
P-value	0.01	0.56	0.07	0.01	0.41	0.28	0.28

Effect of rice roots & root exudates on Nitrogen mineralization

Significant stimulatory effect at both

- Filed sites: BAU > Sutiakhali
- Rice varieties: BINA dhan 6 > BRRI dhan 29
- Sampling locations: Rhizosphere >> between plants ≈ between rows

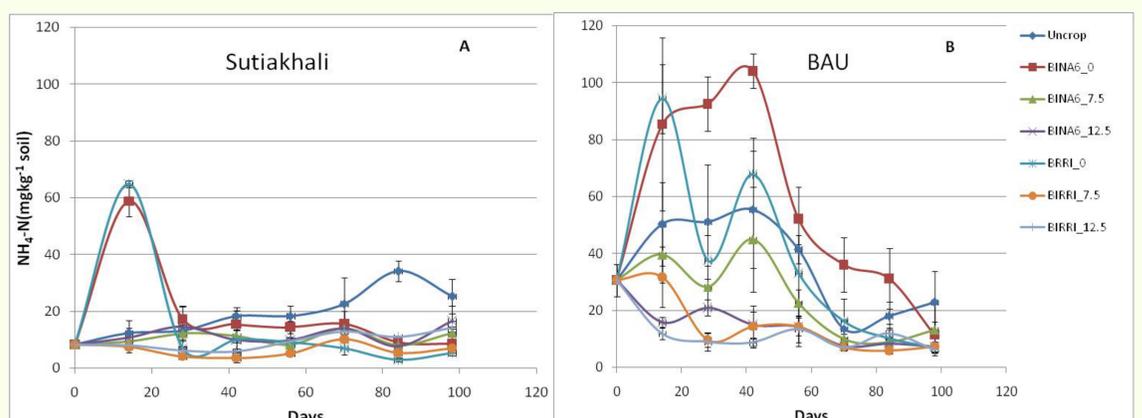


Fig 1. Mineral N levels in soils incubated with and without rice crop under field condition at Sutiakhali (A) and BAU farm (B), suffixes 0, 7.5 and 12.5 indicate sampling distances from the rice hill

CONCLUSIONS

- Root C-exudation seems relatively independent of rice variety and was about 1 mg C hill⁻¹ day⁻¹
- Rice plants promote soil mineral N release relative to uncropped soil at the BAU site but not at Sutiakhali
- Rice rhizosphere mineral N evolved at higher levels than in bulk soil, suggesting that exudation locally promoted soil N mineralization