

# Brown coal-urea blends for increasing plant biomass and nitrogen use efficiency



Biplob K. Saha<sup>1</sup>, Michael T. Rose<sup>2</sup>, Vanessa Wong<sup>3</sup>, Timothy R. Cavagnaro<sup>4</sup> and **Antonio F. Patti<sup>1</sup>** 

<sup>1</sup>School of Chemistry, Monash University, Clayton, Victoria, 3800, Australia

<sup>2</sup>NSW Department of Primary Industries, Wollongbar Primary Industries Institute, Wollongbar, NSW 2477, Australia

<sup>3</sup>School of Earth, Atmosphere & Environment, Monash University, Clayton, Victoria, 3800, Australia

<sup>4</sup>School of Agriculture, Food and Wine, The University of Adelaide, Waite Campus, South Australia, 5064, Australia

### Introduction

- The nitrogen efficiency of nitrogenous fertiliser is very poor and the transfer to plants seldom exceeds 50% of added N<sup>1</sup>.
- $\triangleright$  The low use efficiency of N is consequence of its losses by leaching, denitrification and volatilisation<sup>2</sup>
- > This lost N represents both an economic inefficiency and an environmental burden<sup>3</sup>
- > This study aims to increase N-use efficiency by blending brown coal with N fertilisers

## Materials and Methods

Table I: CN ratio, C and N contents of BCU blends used

Granules	C:N	C content (%)	N content (%)
Brown coal-urea I (BCU I)	1.0	40	22
Brown coal-urea 2 (BCU 2)	1.5	46	17



Plate 1: Experimental set up in the glasshouse

Two soils with contrasting pH (Dermosol pH-5.4 and Tenosol pH-7.2) were tested in this study. Silverbeet was used as a test crop in this pot trial.

Table 2: Treatments applied in this pot trial study

Treatments	
ΤI	Control (Soil only)
T2	Brown coal
Т3	Urea (N@100kg ha <sup>-1</sup> )
T4	Brown coal-urea I (BCU I) (N @ 100 kg ha <sup>-1</sup> )
<b>T</b> 5	Brown coal-urea 2 (BCU 2) (N @ 100 kg ha <sup>-1</sup> )
T6	Urea (N@50kg ha <sup>-1</sup> )
<b>T7</b>	Brown coal-urea I (BCU I) (N @ 50 kg ha <sup>-1</sup> )
T8	Brown coal-urea 2 (BCU 2) (N @ 50 kg ha <sup>-1</sup> )

#### References

(I) Raun, W. R. et al. Agron. J. 2002, 94, 815-820. (2) Dong, L. et al. Biol. Biochem. 2009, 41, 612-621. (3) Wang, Q. et al. Plant. Soil. 2010, 337, 325-339.

#### **Acknowledgements**

Grateful to Monash University for PhD scholarships and Brown Coal Innovation Australia (BCIA) for funding the research.

# Results and Discussion

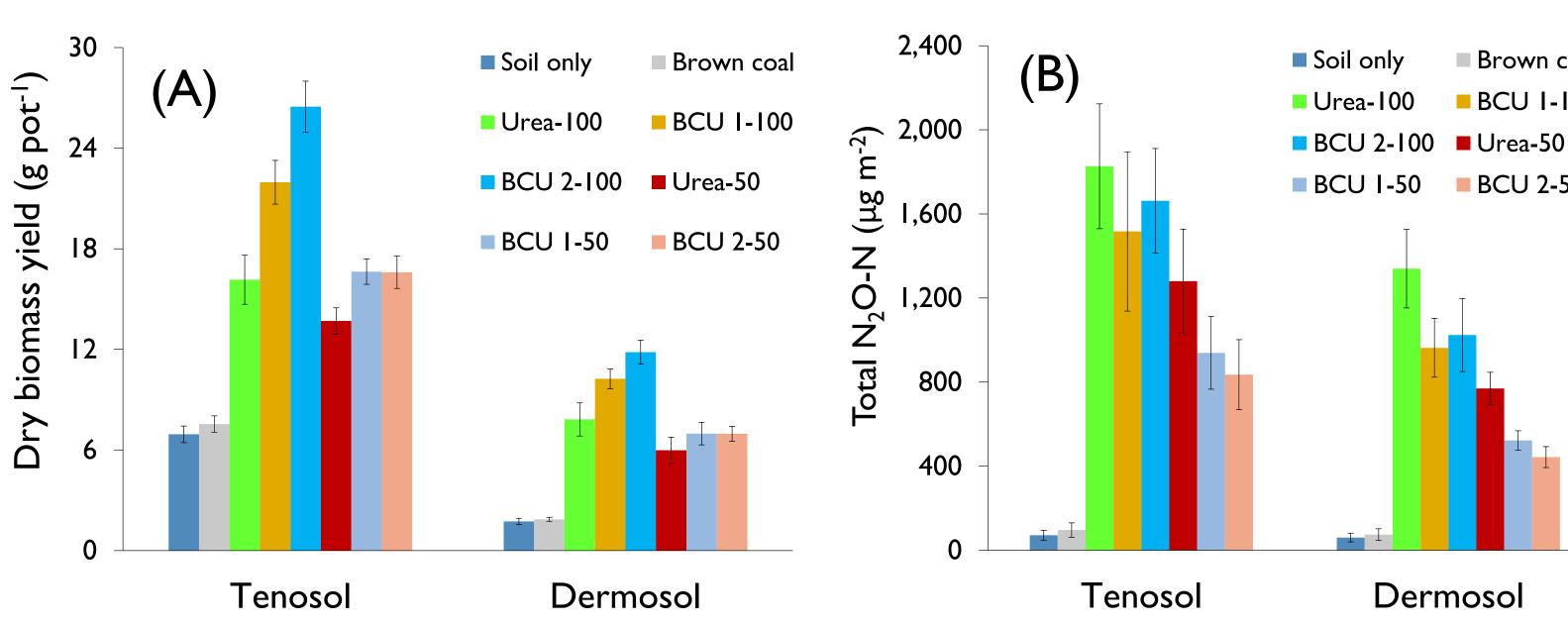


Figure 1: Biomass yield (A) of silverbeet and total  $N_2O-N$  emission (B) from soil (Bars indicate standard error, n=5).

- Biomass yield and N uptake by silverbeet were significantly higher with the addition of BCU blends in both soils compared to urea alone.
- Statistically identical biomass yields were obtained from the soils amended with 50 kg N ha<sup>-1</sup> from BCU and 100 kg N ha<sup>-1</sup> from urea.

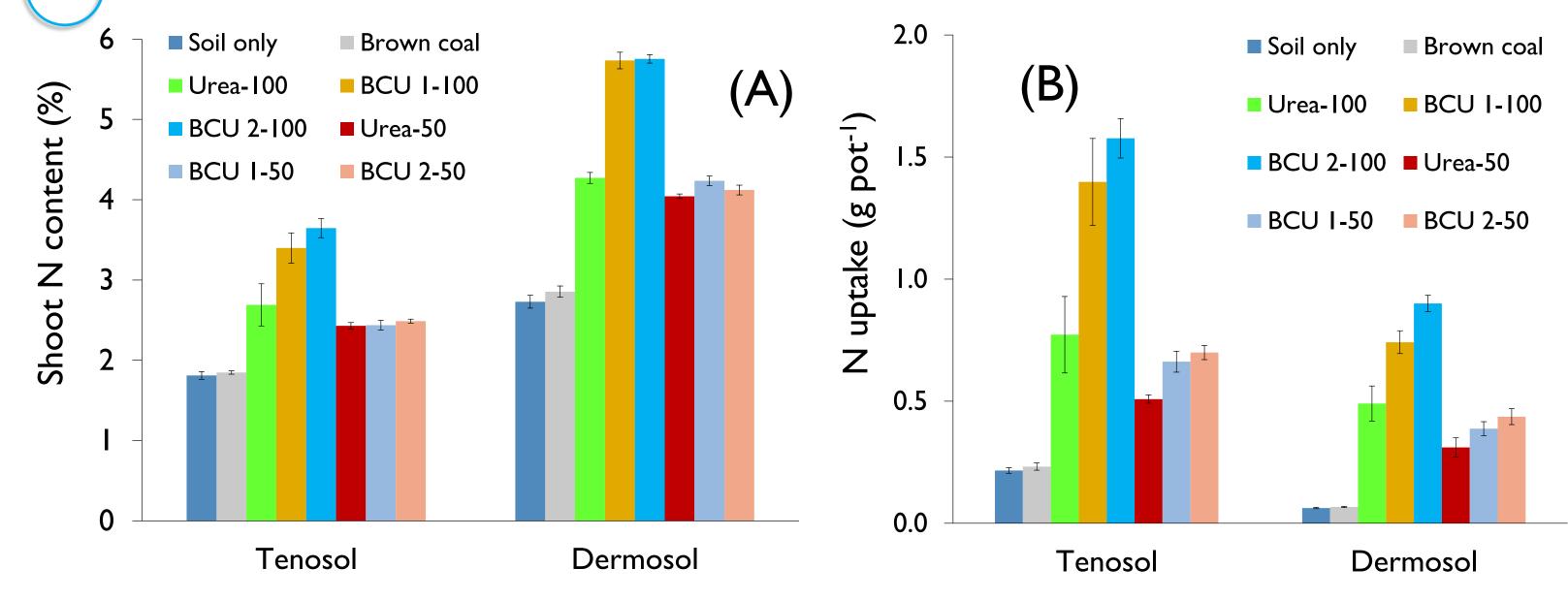


Figure 2: Shoot N content (A) and uptake (B) by silverbeet

## Conclusions

- The BCU blends suppressed the total N<sub>2</sub>O emissions by 29% and 13% from the Tenosol and Dermosol, respectively.
- Maintained higher available N in soil which facilitated more N uptake by plant.
- The increased N uptake resulted in 27% (Tenosol) and 23% (Dermosol) more biomass yield from BCU blends compared to urea alone.