Nitrogen cycling enhanced by conservation agriculture in a rice-based cropping system of the Eastern Indo-Gangetic Plain

Murdoch UNIVERSITY

Md Ariful Islam

Richard W Bell, Chris Johansen, M. Jahiruddin

Australian Government
Australian Centre for International Agricultural Research

Conventional rice-based cropping systems in Eastern Indo-Gangetic Plain

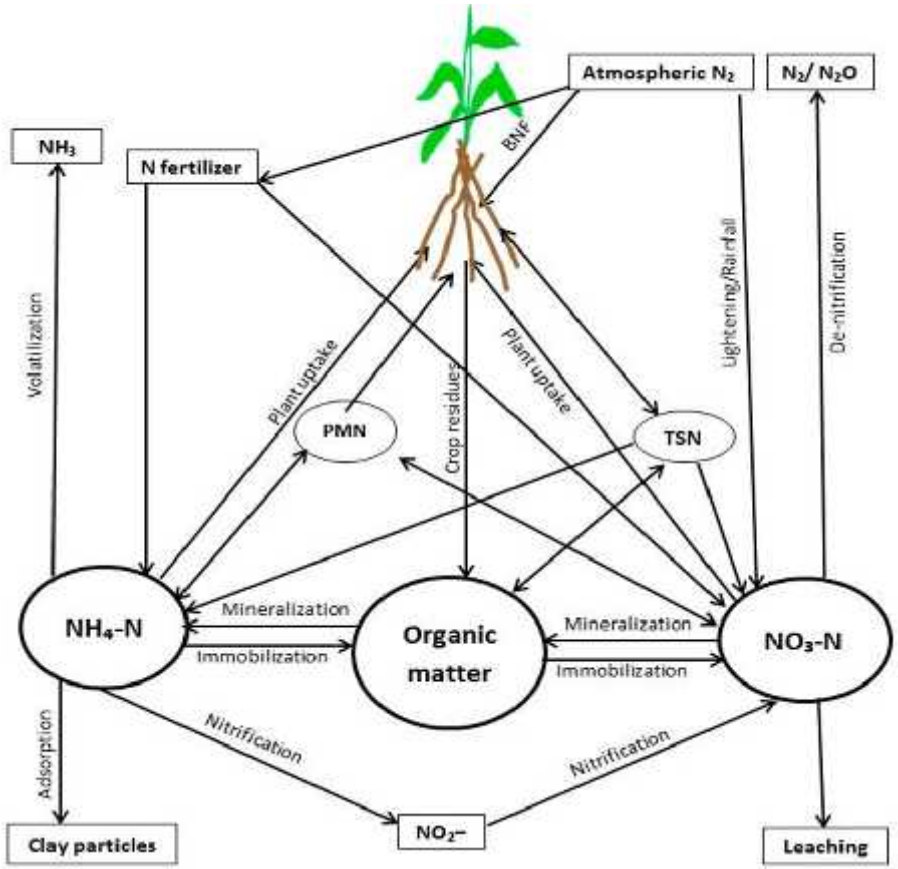
- 2-3 crops per year
- Puddling and ponded soil for rice crop
- Residue burnt/removed
- Intensive tillage for dryland crop

Conservation agriculture

- **Minimum soil disturbance**
- **Increased crop residue retention**

- **Change in N mineralisation in CA system**
- **Change in N balance**
- **Change in N forms**

Conservation agriculture



Research question

- **How does N cycle change in short-medium term with minimum soil disturbance and increased crop residue retention in a rice-based cropping system**

How it was tested?

Crop rotation	**Lentil-mungbean-rice**
Variety	**BARI Masur 6-BARI Mungbean 6-BINA Dhan 7**
Duration	**2.6 years (7 crops grown sequentially)**

November-March

March-May

June-October

How it was done?

Soil disturbance

Strip-planting (SP)

Bed planting (BP)

Conventional tillage (CT)

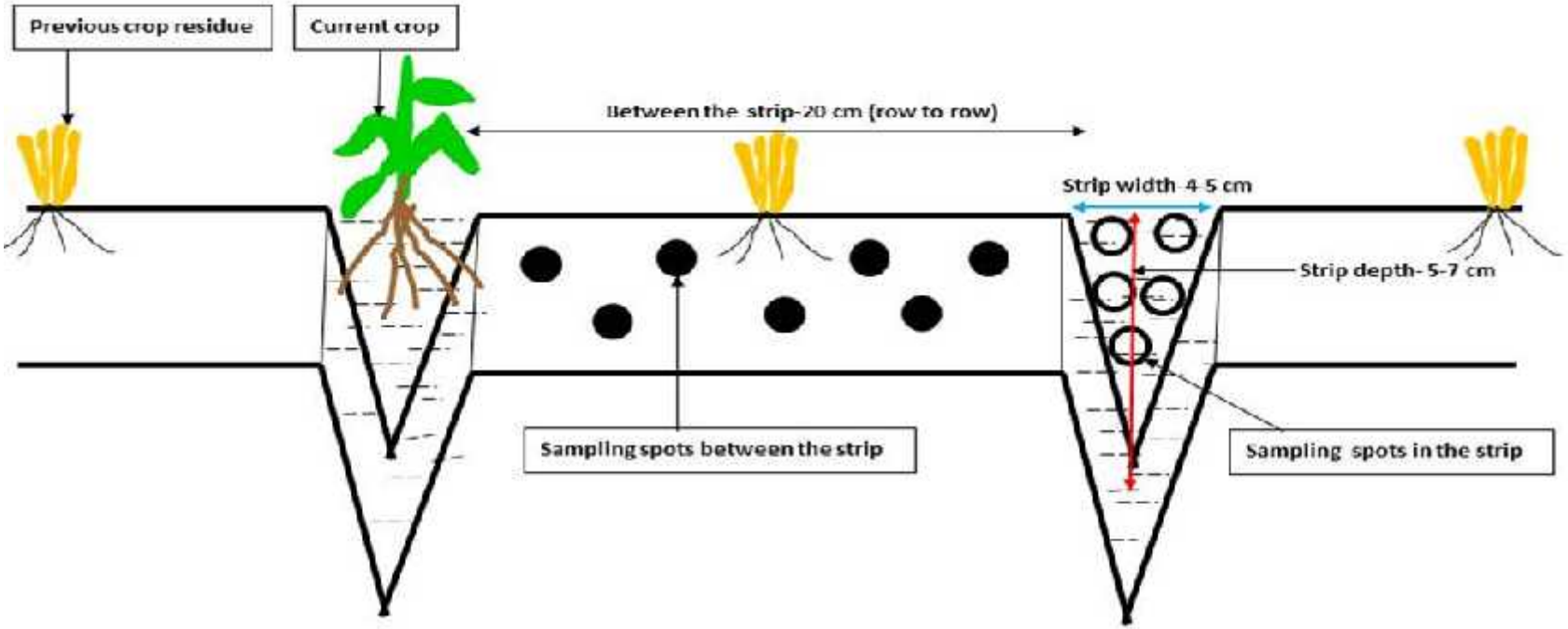
Residue levels

High residue (HR)

Low residue (LR)

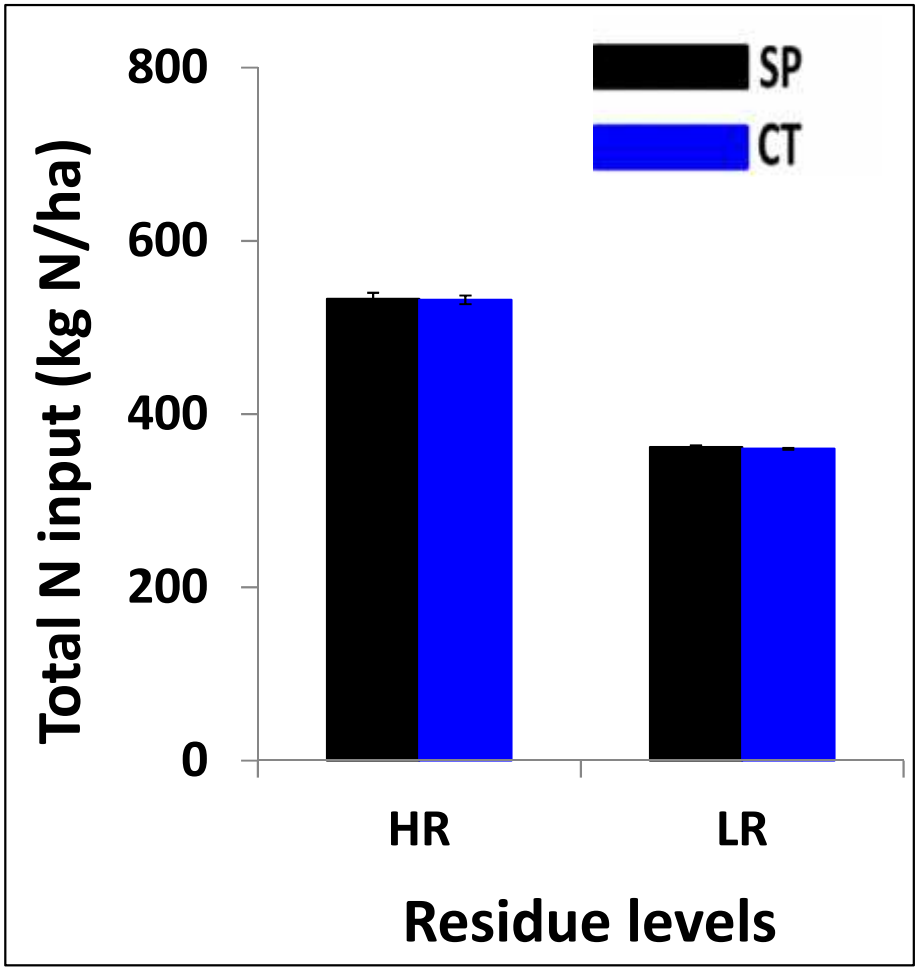
Strip Planting

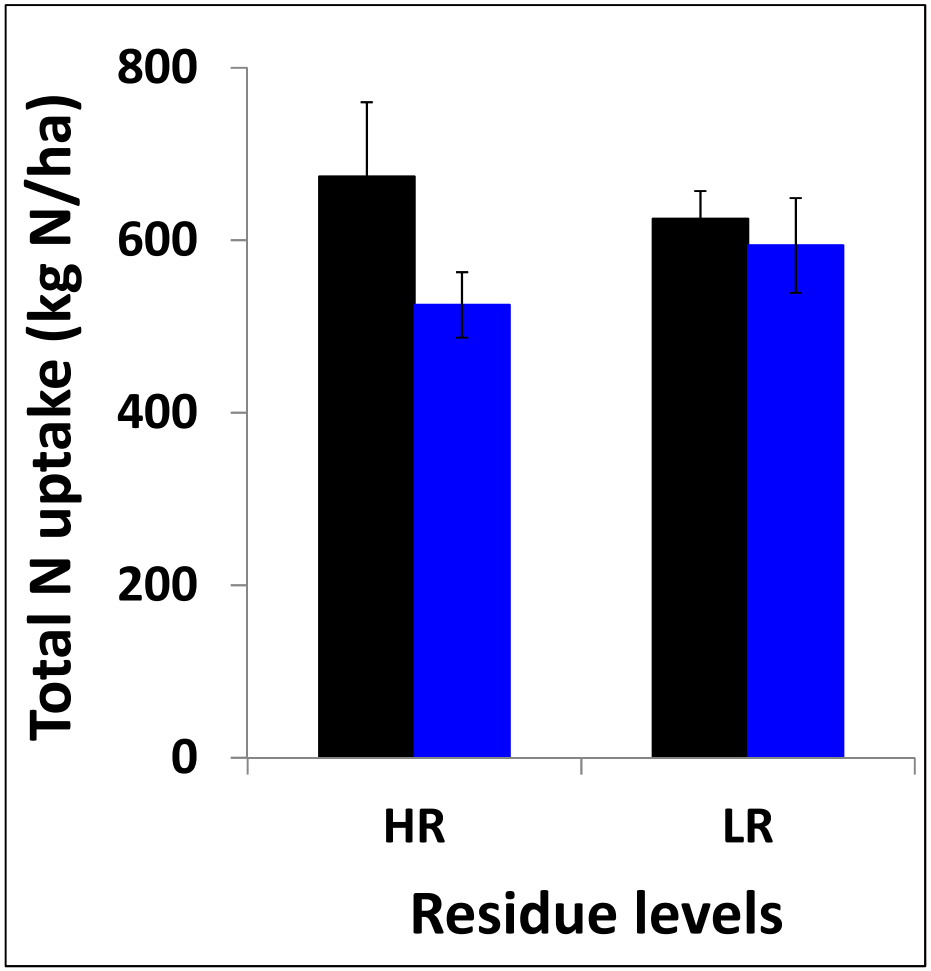
Strips 5-7 cm wide and 7 cm deep



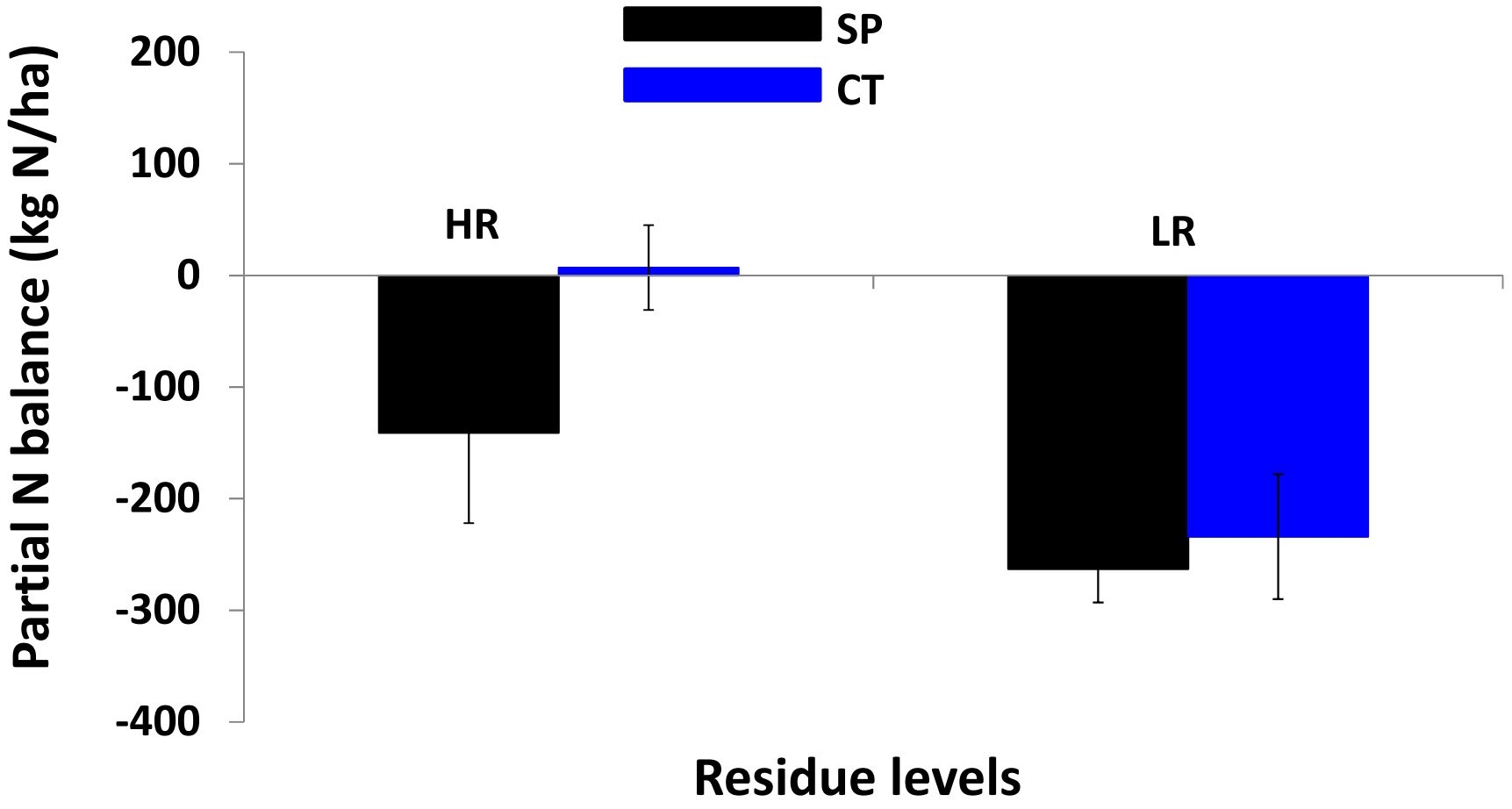
Strips 5-7 cm wide and 7 cm deep

Total N input and uptake (7 crops)





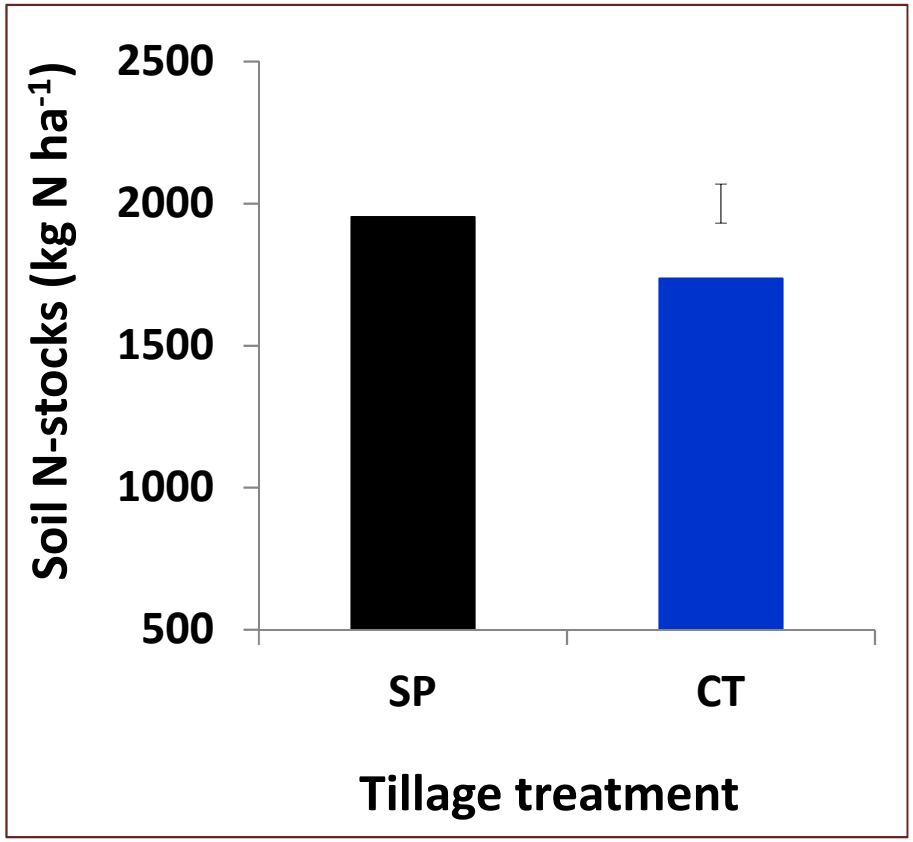
Partial N Balance after 7 crops
(inputs – outputs)

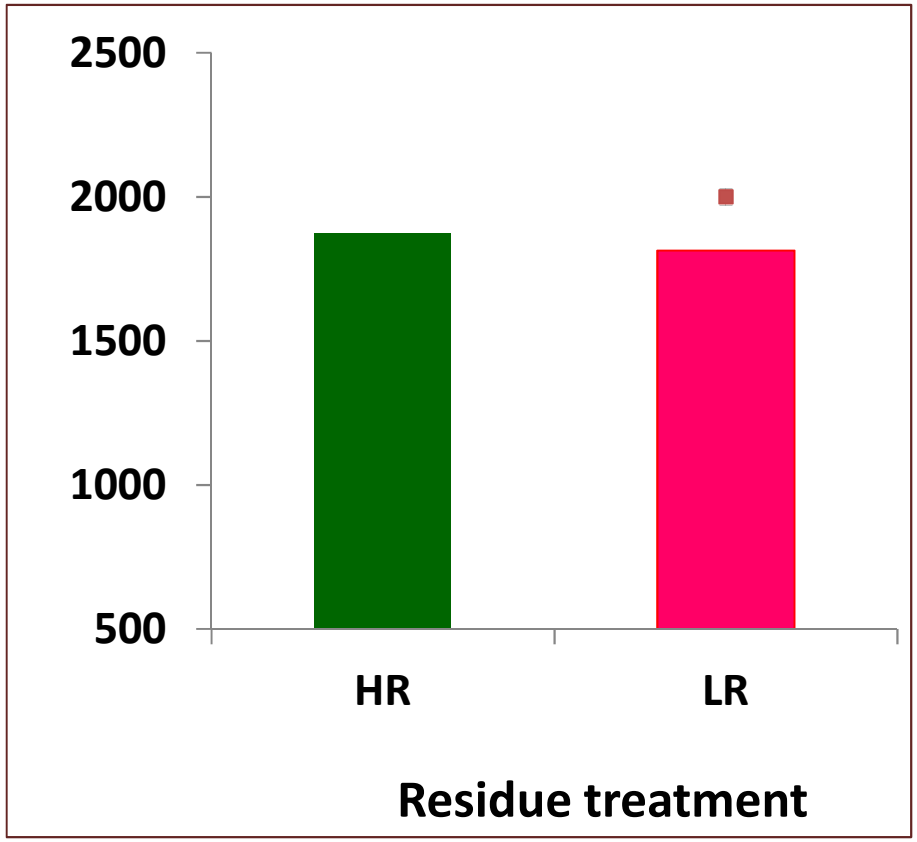


Soil N-stock

at 0-15 cm

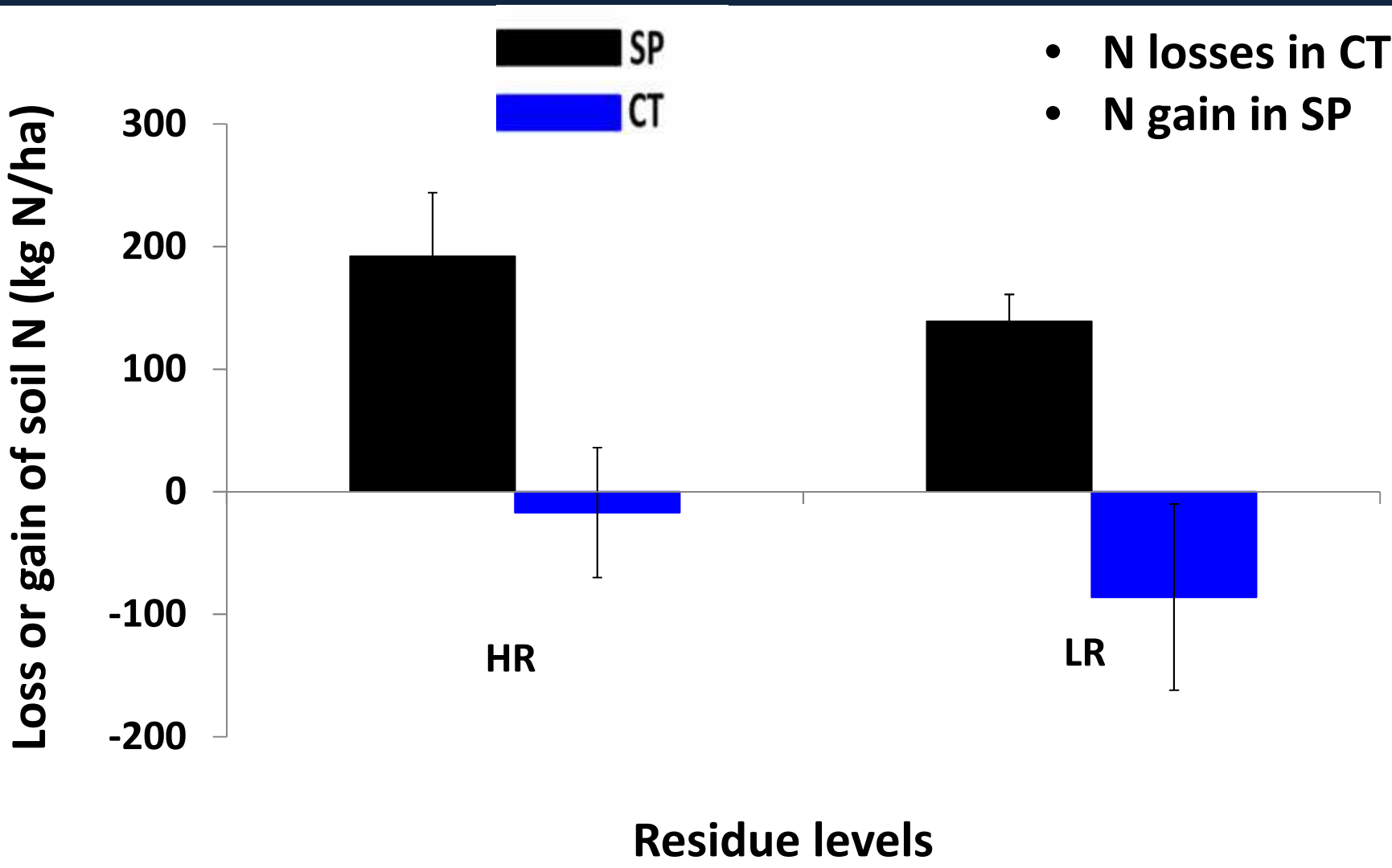
Initial N-stocks-1787 kg N ha^{-1}





Gain or loss of soil N

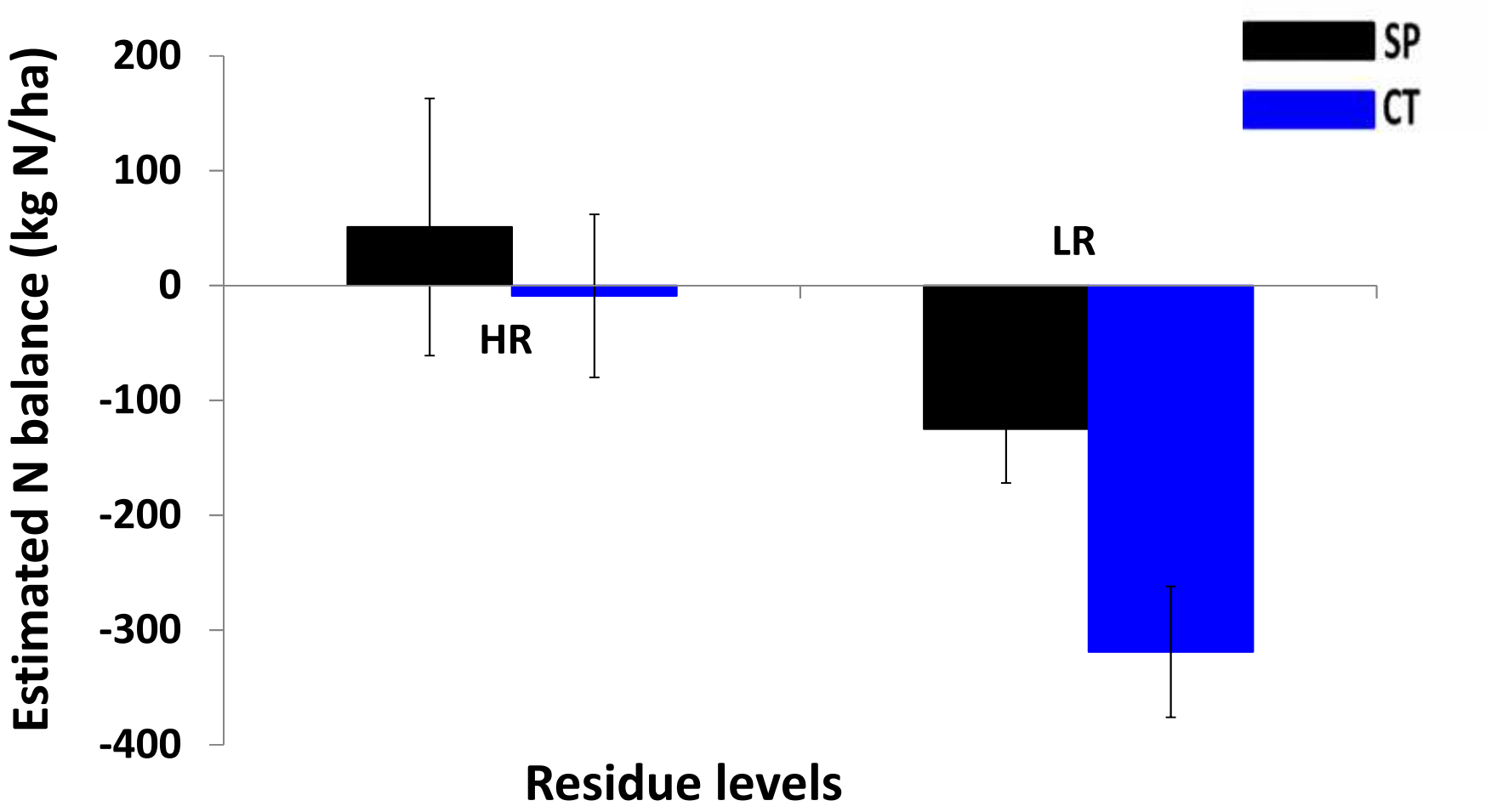
(Final, 2013 minus initial, 2010 N-stocks)



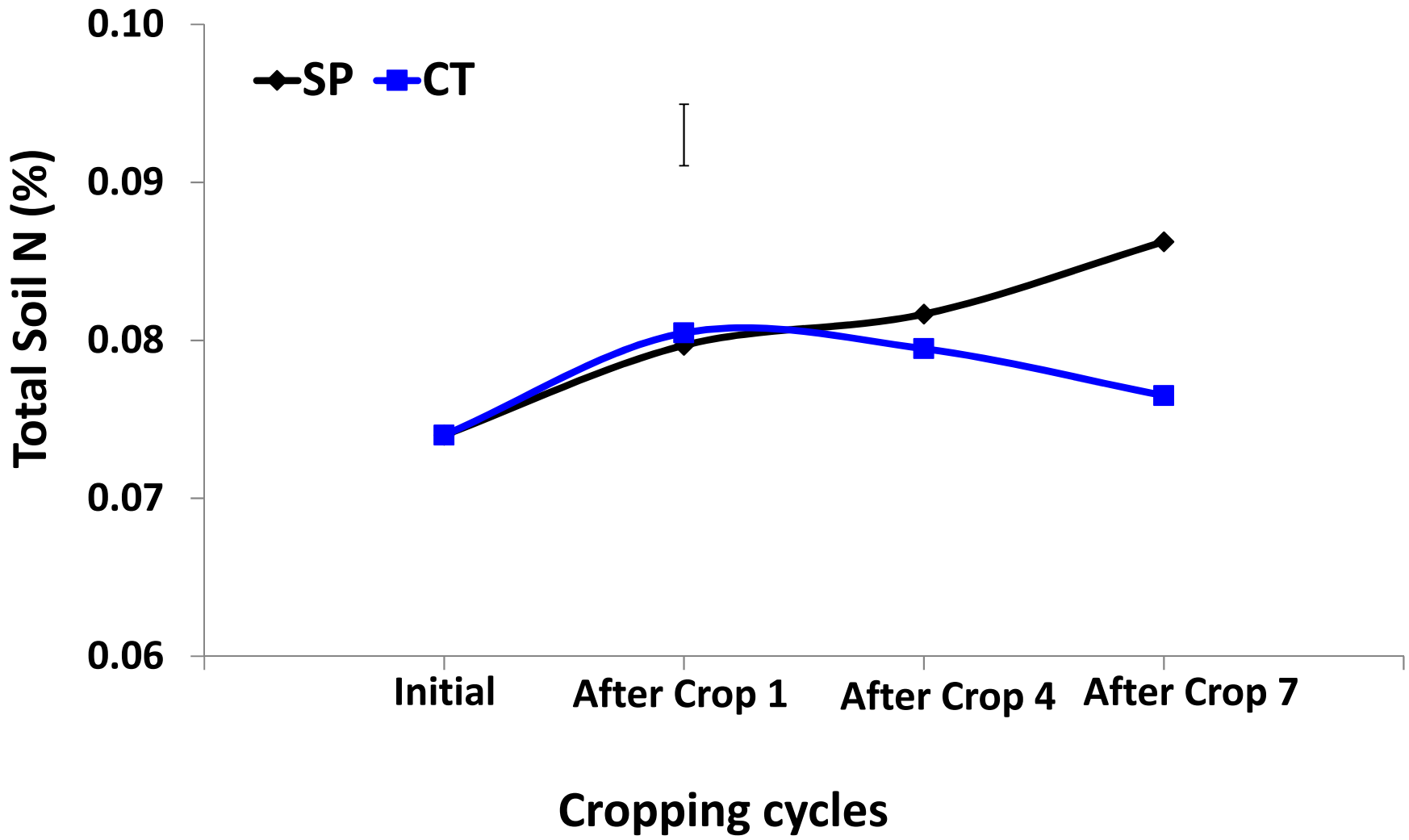
- N losses in CT
- N gain in SP

Estimated N Balance

(Final N stock and total inputs – Initial N-stocks and total outputs)

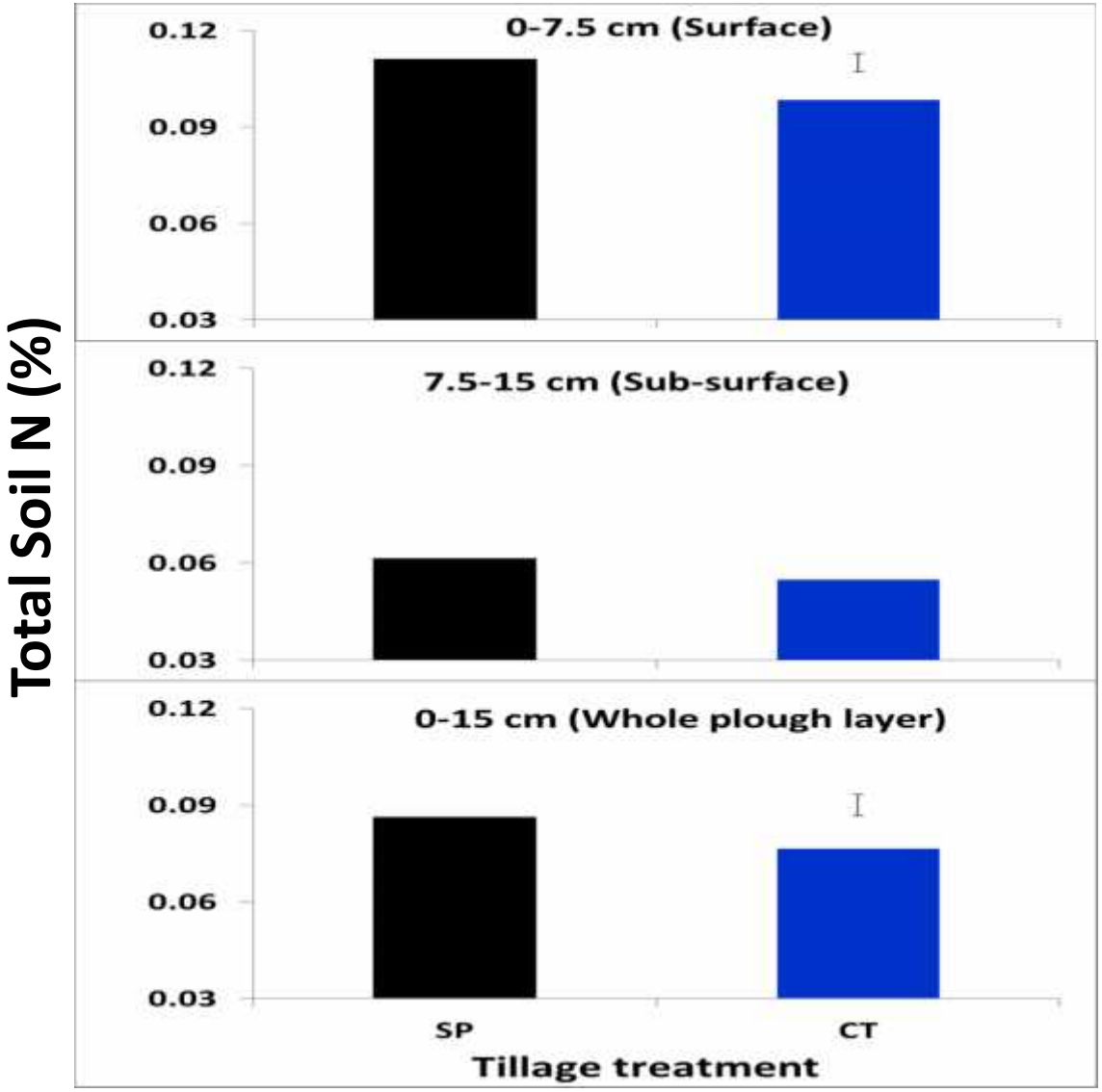


Soil N status overtime (at 0-15 cm)



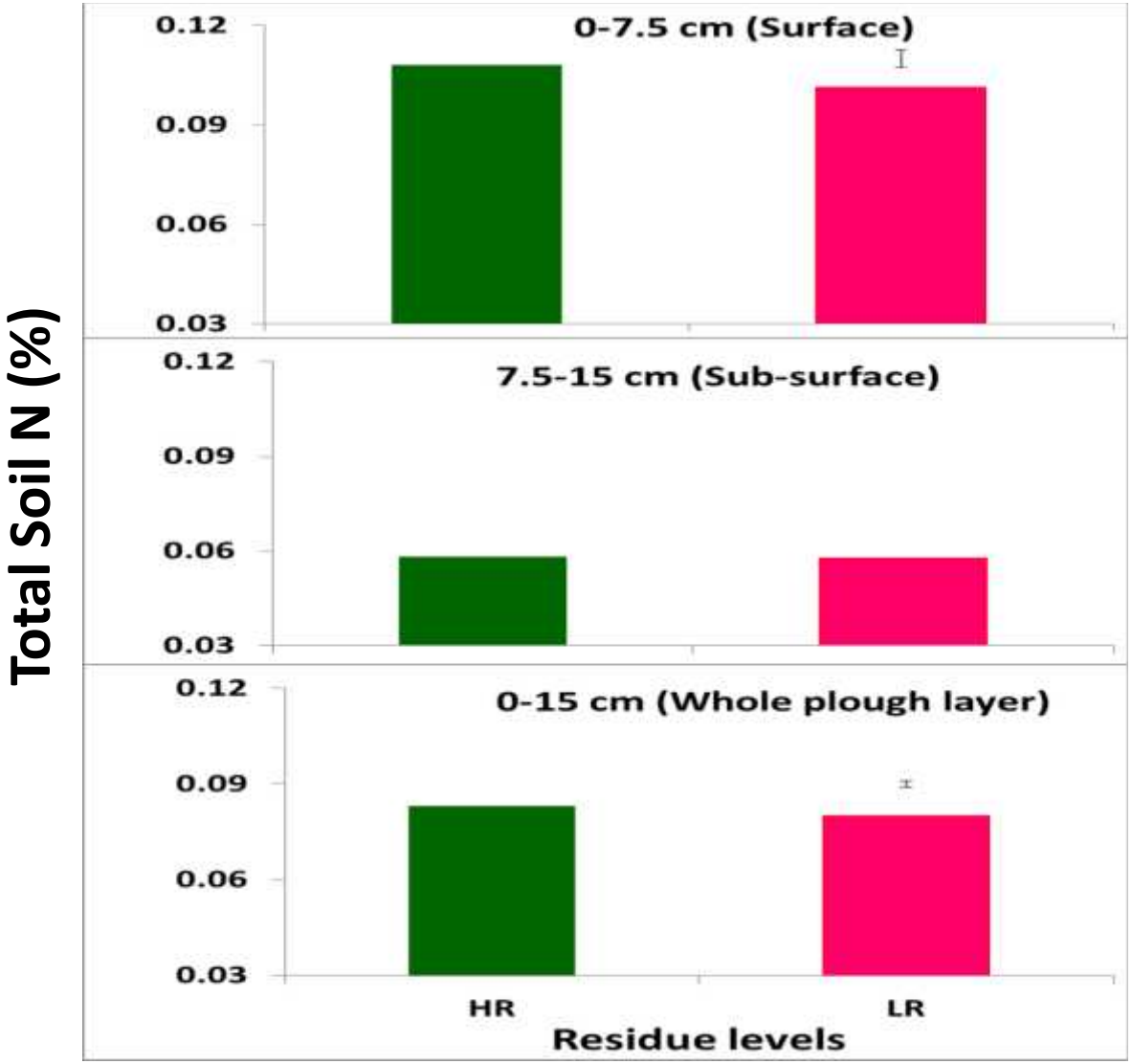
Total soil N (%)

Soil disturbance effects



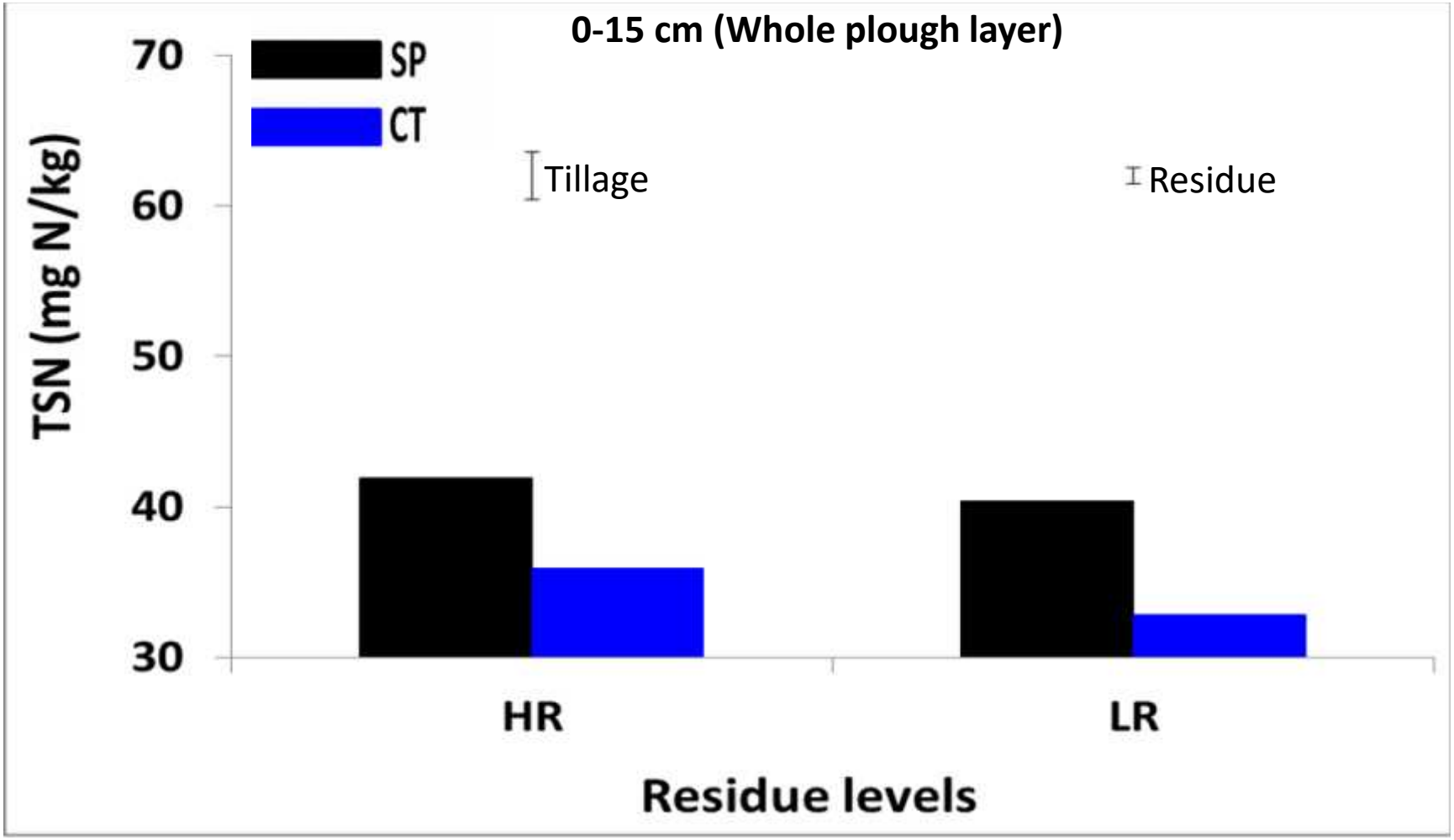
Total soil N (%)

Residue effects



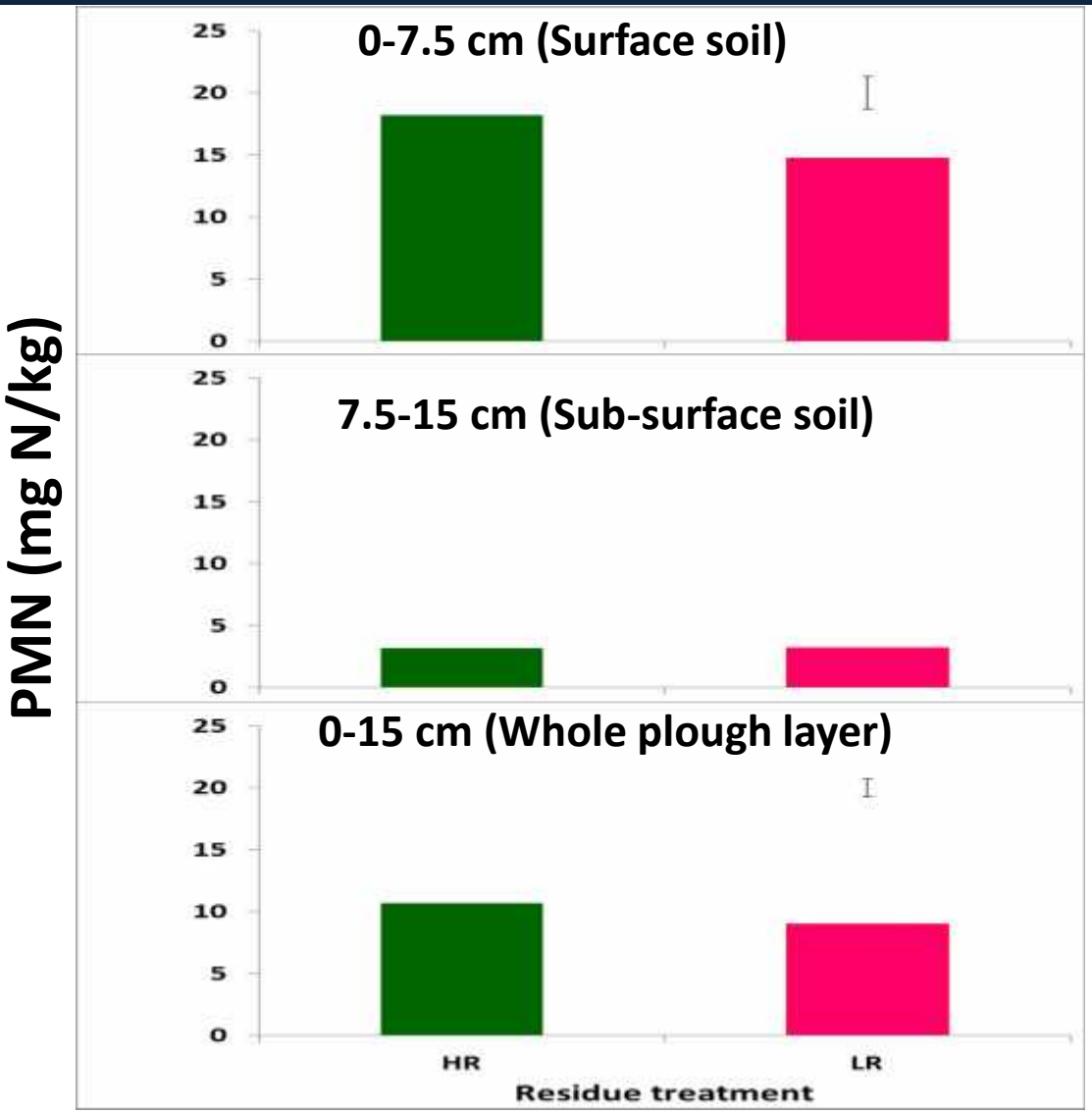
Total soluble N

(after Crop 7)

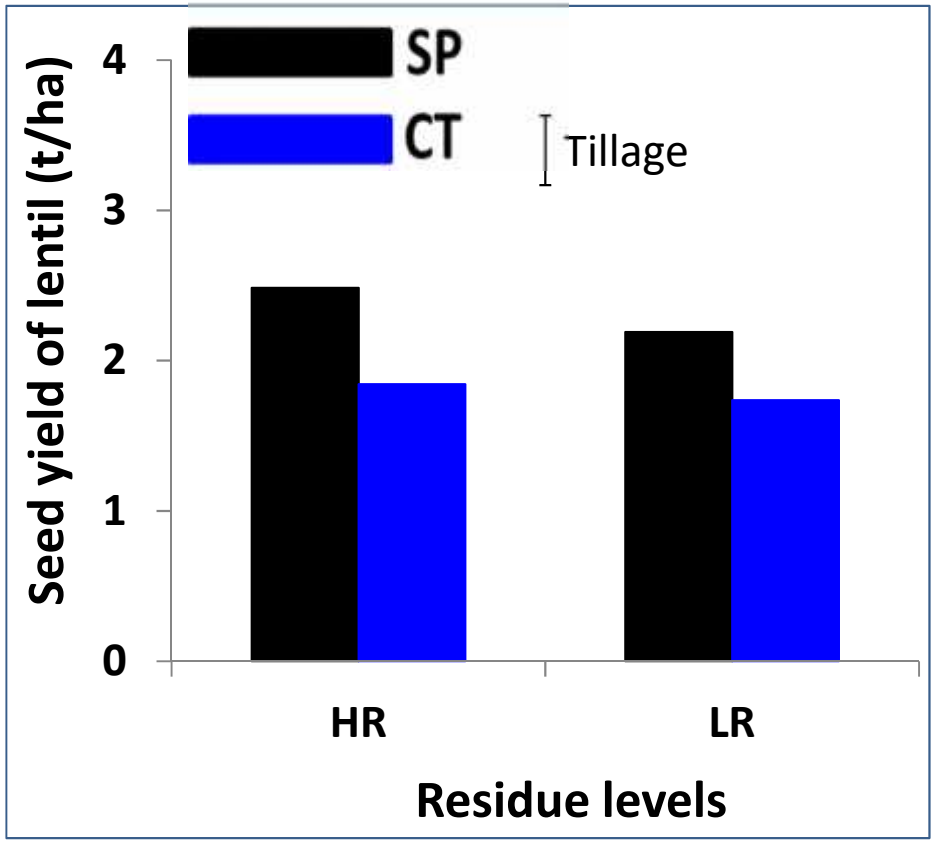


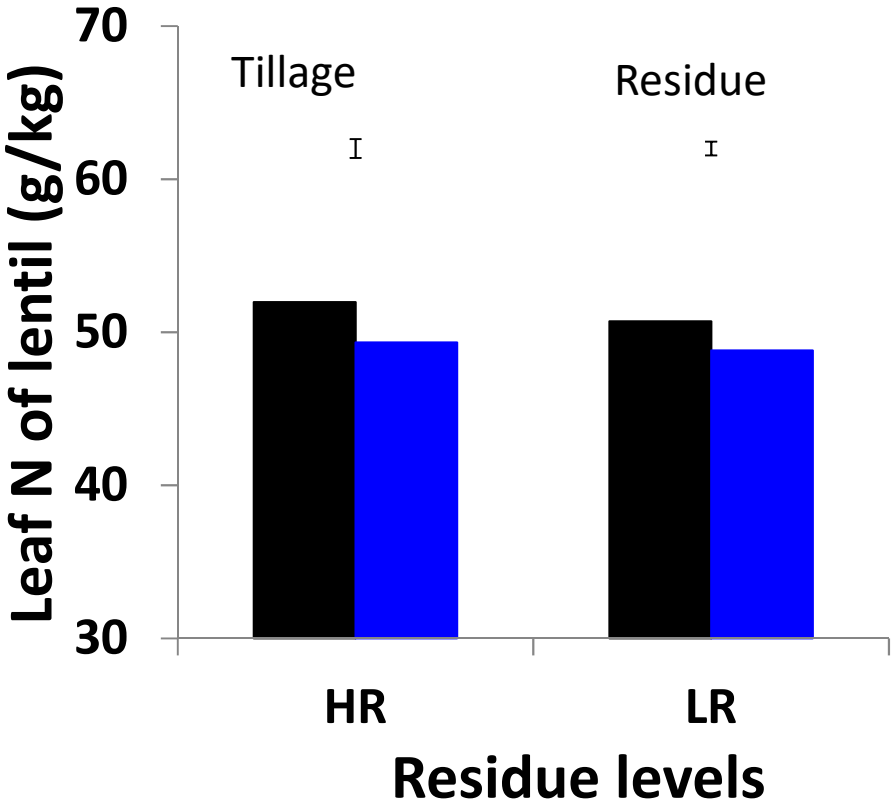
Potentially Mineralizable N

(at 60 DAS during Crop 7)



Yield and leaf N of Crop 7





Key Findings

- **Strip planting and HR increased the total soil N, N-stocks , N accumulation rate, plant N, and crop yield**
- **High residue retention produced a positive N balance**
- **Labile N – PMN and TSN increased in SP and HR**

Implications

- **Increase in soil N pool may decrease N requirements overtime in SP and HR**
- **Continue to study effect of soil disturbance and residue on N dynamics in this legume-dominant and in cereal dominant rice-based systems of Bangladesh**

Acknowledgements

Dr Wendy Vance

Australian Centre for International Agricultural

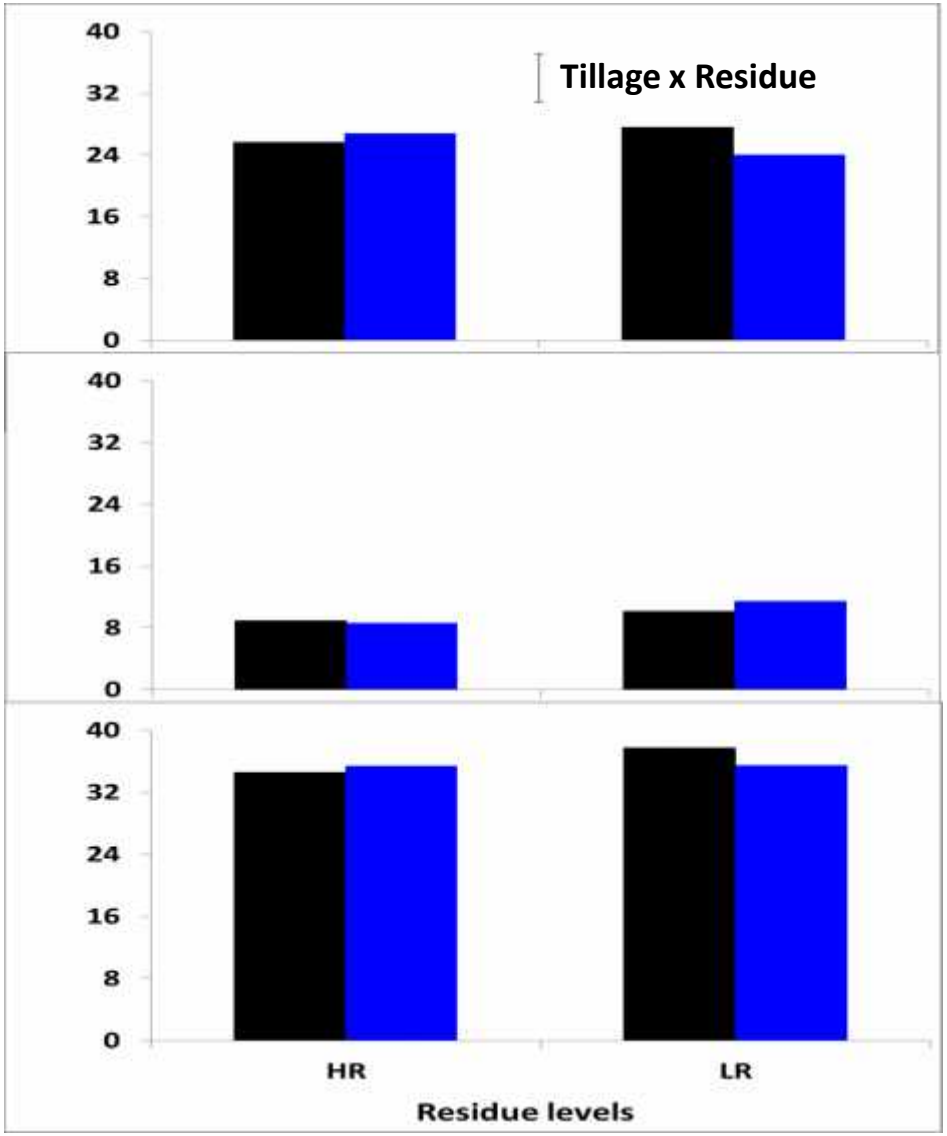
Research (Projects LWR/2005/001; 2010/080)

Bangladesh Agricultural Research Institute

Field staff-Abdul Kuddus Gazi and Md Neaz Mehedi

Questions

Mineral N
(at 60 DAS during Crop 7)

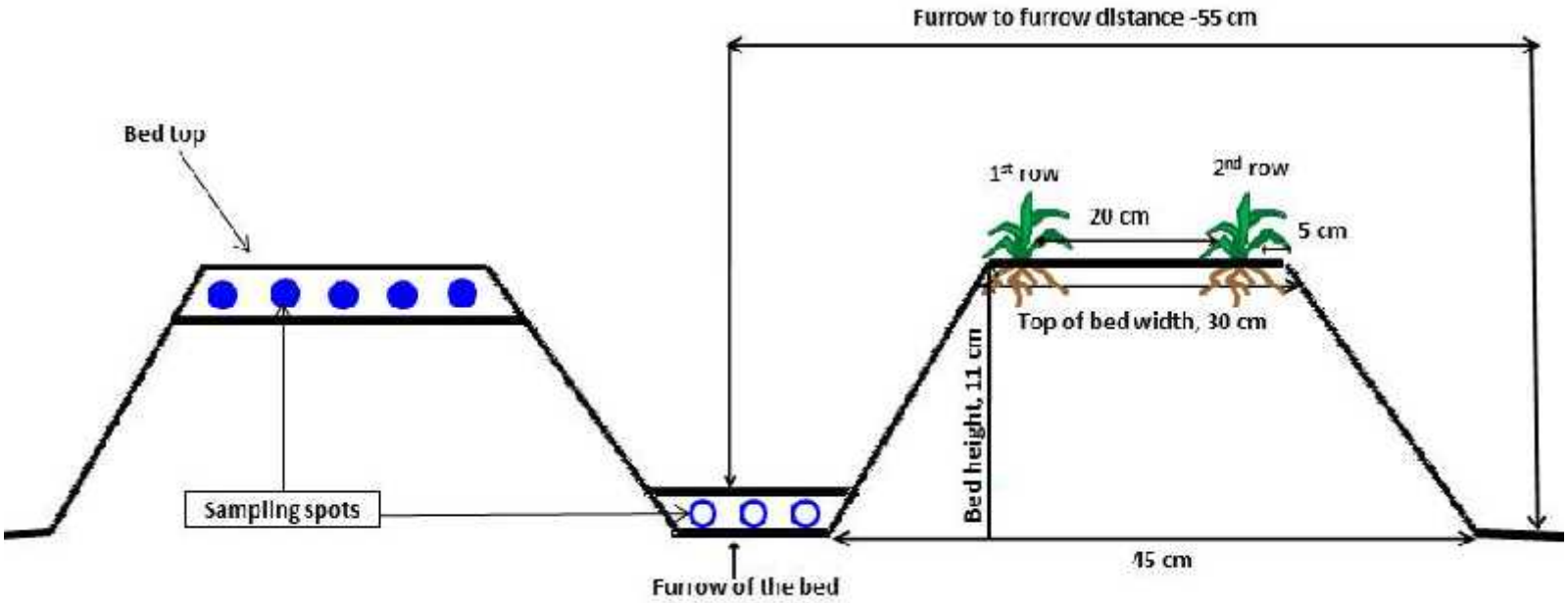


NH_4-N

NO_3-N

Mineral N (NH_4-N + NO_3-N)

Bed planting






Annual N accumulation rate at 0-15 cm