Determination of Biological Nitrogen Fixation Induced N_2O Emission from Arable Soil by Using a Closed Chamber Technique

Ambreen Shah[1,2]

1)Hohenheim University Stuttgart Germany
2)ProteinCrop (PMV) Viborg Denmark

Background: N_2O emissions after nodule formation in soybean were Inoculated & non-Inoculated soybean seeds were examined by using closed chamber technique and plant samples were analysed after harvesting.

The objectives were :

- Is it correct that Rhizobia fixes N2 in legumes' nodules and at the same time emits N_2O into atmosphere?
- Biological nitrogen fixation is an energy intensive process; the plant has to provide C containing compounds to rhizobia that could reduce the C content of host plant. Is it really so?

Results:

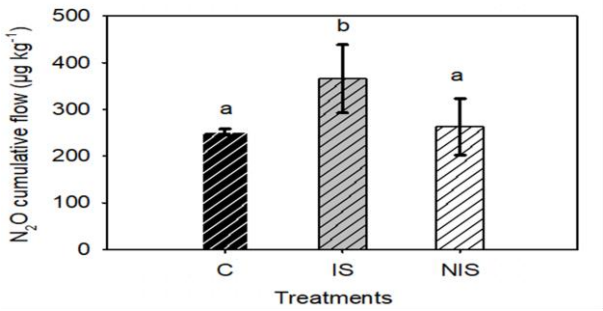

Fig. 1. Cumulative N_2O flux (µg kg^{-1}) of different treatments. Means of 3 replicates per treatment with standard error. Different lower case letters indicate a statistically significant difference at α = 0.05.

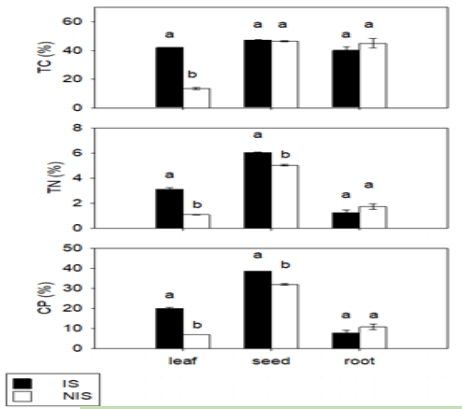

Fig. 2. TN%, TC%, and CP% of leaves, seeds, and roots after harvest. Different lower case letters indicate a statistically significant difference at α = 0.05.

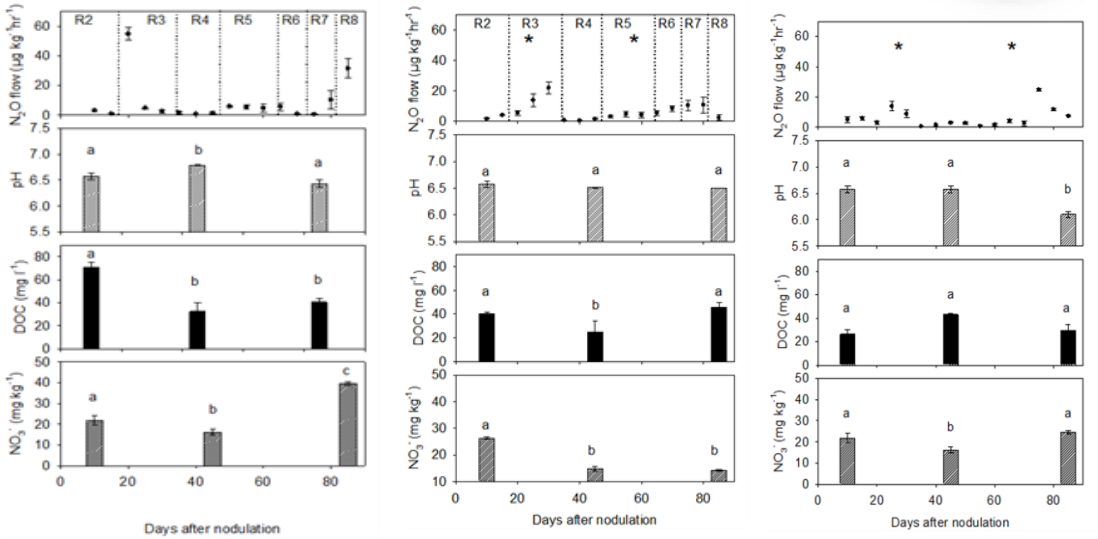

Fig. 3 a,b,c. Temporal dynamics of N_2O flow (µg kg^{-1} hr^{-1}), soil pH, DOC (mg l^{-1}) and NO_3^--N (mg kg^{-1}) of IS (a), NIS (b) & C (c) treatments. Different lower case letters indicate a statistically significant difference at α=0.05. R2: full flowering; R3: beginning pod; R4: full pod; R5: beginning seed; R6: full seed; R7: beginning of maturity; R8: full maturity. Means of 3 replicates with standard error. (* indicates fertilizer application).

- **Conclusion:** Significantly higher emissions are due to release of H2 during biological nitrogen fixation process stimulated the heterotrophs including B. japonicum, accelerating organic matter decomposition.
- The denitrifying capability of B. japonicum also enhances N_2O emissions.
- Nodule senescence and decomposition during late growing stages and residues decomposition after harvest can also produce substantial N_2O.
- The C/N ratio of soybean residues, either inoculated or noninoculated seeds, can sequester carbon but enhance N_2O emissions.