



Theme 1 Status and trends of global soil nutrient budget



State of the art on biological nitrogen fixation of leguminous crops in Argentina

Fernando SALVAGIOTTI^{1,2*}, Juan Martin ENRICO², Esteban KEHOE^{1,2}, Francisco PALMERO³, Carlos PICCINETTI⁴, Alejandro PERTICARI⁵

¹ INTA Oliveros, Oliveros, Argentina, ² CONICET, Argentina ³ Catedra Edafología, Universidad Nacional de Córdoba, Córdoba, Argentina, ⁴ IMYZA INTA Castelar, Buenos Aires, Argentina,

⁵ AER INTA Concarán, San Luis, Argentina.

INTRODUCTION

The contribution of nitrogen (N) from biological fixation of atmospheric N (BNF, kg N ha⁻¹) in legumes may reduce the environmental footprint of N fertilization and improve the profitability of production systems. On a global scale, BNF represents 16-20% of the total N of agricultural land, but the contribution differs in each region depending on the soils and production systems, so local estimations of BNF are important for making global N budgets. The objective of this work was to summarize the contribution of BNF of the main legumes crops in Argentina.

METHODOLOGY

The present study has collected published and unpublished information regarding BNF in soybean, peanut, alfalfa, field pea and vetch under field conditions. In all cases BNF was quantified using the ¹⁵N abundance methodology. Also, the effect of legumes in the long term is summarized

RESULTS

Table 1 – Median value and interquartile range (between parenthesis) for the proportion of N derived from biological N fixation (BNF), N derived from BNF in kg N per ha (N-BNF) and total N uptake in aboveground biomass for soybean, field pea, vetch, alfalfa and peanut in Argentina.

	BNF (%)	N – BNF (kg N ha ⁻¹)	Total N uptake (kg N ha ⁻¹)	Reference
Soybean	59 (46-71)	148 (98-197)	210 (170-268)	Collino, Salvagiotti, Peticari, Piccinetti, Ovando, Urquiaga, Racca, 2015
Field pea	64 (53 – 84)	51 (15-74)	84 (60-112)	Enrico, Piccinetti, Barraco, Agosti, Ecclesia y Salvagiotti, 2020
Vetch	61 (44 - 78)	89 (51-115)	151 (100-184)	Enrico, Piccinetti, Barraco, Agosti, Ecclesia y Salvagiotti, 2020
Alfalfa	53 (42 – 66)	872 (408-1396)	1645(772-2200)	Racca, Collino,D, Dardanelli, Basigalup, Gonzalez, Brenzoni, Hein,N, Balzarini. 2001
Peanut	52 (43-64)	138 (119-188)	293 (258-315)	Palmero, Haro, Salvagiotti. Tesis en curso,

Inoculation in field pea and vetch also showed a strong impact when evaluated at the sequence level since the following maize needs no N fertilization (after vetch) or a low N fertilizer rate (after field pea) to achieve the yield goal. In general, when crop sequences include legumes for grain production, the partial N balance (PNB= difference between N from FBN and export with grains) is negative or slightly positive. The inclusion of belowground structures in soybean slightly improves this balance, representing 10 and 5% of total biomass and N uptake, respectively. Long-term experiments showed that N balances are positive only when vetch is used as a cover crop, reflected in a rise in indicators related to soil nitrogen fertility.

CONCLUSIONS

Future studies in the region should complete vacancy information on other legumes like chickpea, common bean, and other pastures like lotus, melilotus, or clover. In soybean, a better understanding of the N demand and the BNF process in high-yielding crops deserves more research. Finally, the impact of BNF in the long-term management practices should be evaluated deeply.

REFERENCES

- Collino, D.J., Salvagiotti, F., Peticari, A., Piccinetti, C.F., Ovando, G., Urquiaga, S. & Racca, R.W. 2015. Biological nitrogen fixation in soybean in Argentina: relationships with crop soil, and meteorological factors. *Plant Soil* 1-14. DOI: 10.1007/s11104-015-2459-8.
- Enrico, J.M., Piccinetti, C.F., Barraco, M.R., Agosti, M.B., Ecclesia, R.P. & Salvagiotti, F. 2020. Biological nitrogen fixation in field pea and vetch: Response to inoculation and residual effect on maize in the Pampean region. *European Journal of Agronomy* 115, 126016.
- Kehoe, E.; Rubio, G.; Salvagiotti, F. 2022. Contribution of different sources and origins of nitrogen in above- and below-ground structures to the partial nitrogen balance in soybean. *Plant and Soil*. doi.org/10.1007/s11104-022-05418-0
- Kehoe, E., Enrico, J. M., and Salvagiotti, F.2020. Balance de nitrógeno a escala de sistema en secuencias con distinta participación de leguminosas. AACS. Actas XXVII Congreso Argentino de Ciencia del Suelo. Corrientes, Argentina
- Palmero, F., Haro R., Salvagiotti, F. 2022. Master Science Thesis. University of Buenos Aires.
- Racca, R.W., Collino, D.J., Dardanelli, J., Basigalup, D., Gonzalez, N.S., Brenzon, E., Hein, N. & Balzarini, M. 2001. Contribución de la fijación biológica de nitrógeno a la nutrición nitrogenada de la alfalfa en la región pampeana. Proyecto nacional del INTA n° 80-004: "Fijación biológica de nitrógeno en alfalfa para el desarrollo sostenible de los sistemas agrícola-ganaderos" (PRONALFA).

