



Nitrogen fertilization and their legacy (long-term fertilizing and presence of N₂ fixing plant) had inconsistent and often negative effect on plant growth in undeveloped post mining soils

Daquan Sun (1), Věra Müllerová (2), Masoud Mortazavi Ardestani (2), Jan Frouz (1,2)

(1) Biology Center, Institute of Soil Biology & SoWa, Czech Academy of Science, Na Sadkach 7, Ceske Budejovice, CZ 370C5, Czech Republic, (2) Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, CZ12800 Praha, Czech Republic

Nitrogen deficiency constrains plant recovery in primary succession. Supplement of N-fertilizer and introduction of N-fixing trees are considered as an important stimulus for the development of early vegetation. We performed pot experiments to determine the responses of N-fixing (legumes) and non-N fixing (grasses) plants to immediate N fertilization, legacy of N, and combination of these two with plant-soil feedback in post mining soil of various ages. N legacy was achieved either by long-term mineral N fertilization (legacy of inorganic N) (experiment 1) or growing of N₂ fixing plant (legacy of N-fixing) (experiment 2).

N-legacy and immediate N application had both positive and negative effects on plant growth particularly legacy effect was more often negative in legumes. Immediate N fertilization was positive for both plants in young soils; only positive to legumes in medium aged soils. Effect of immediate N was greatly affected by legacy of N-fixing when grasses and legumes were growing in the same pots. Legacy of inorganic N was only positive for grasses rather than legumes in medium soils when in mono-culture. In the presence of plant competition, legacy of N-fixing showed positive effects on grasses, depending on soil age and immediate N.

Repeated growing of plants in the same soil resulted in negative plant-soil feedback. Negative plant-soil feedback was not alleviated by immediate N and legacy of inorganic N for grasses and legumes in mono-culture. However, legacy of N-fixing can induce positive plant-soil feedback when grasses and legumes are growing together.

In conclusion, N supplement is more beneficial for grasses than legumes. Long-term N effect tends to be more positive for non-N fixing plants in medium aged soils.