

# NUTRIENT UPTAKE AND GROWTH STIMULATION OF GRASSES AND LEGUMES BY RHIZOSPHERE MICROORGANISMS

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## ABSTRACT

Selected *Rhizobium* bacteria and mycorrhiza fungi by single and combined inoculation stimulate the growth and the nutrient uptake (nitrogen, phosphorus, potassium) of alfalfa and alfalfa-grass more than that of red clover and red clover grass. The extra yield was higher on loamy sand than on sandy loam.

The proportion of legumes should be 60 to 66 % as a requirement to get positive inoculation effects and an effective  $N_2$ -fixation in legume-grass-mixtures.

## KEYWORDS

Rhizosphere microorganisms, legumes, grasses, growth stimulation, nutrient uptake

## INTRODUCTION

Selected *Rhizobium* bacteria, arbuscular mycorrhiza-forming (AM) fungi and associative bacteria have been shown to stimulate the growth of legumes, cereals maize and oil seed rape in field experiments on different soil types in temperate regions. A combination of microorganisms with different metabolic capacities ( $N_2$ -fixation, P-mobilization; production of phytohormones and antibiotics) can partly surpass the effect of single inoculations, or can produce a positive effect where single inoculations are ineffective (Höflich et al., 1994).

The aim of this research was to screen the possibilities and the conditions for better effects of rhizosphere microorganisms on the nutrient uptake and growth stimulation of alfalfa- and clover-grass-mixtures.

## METHODS

The study was carried out between 1984 and 1995 with alfalfa and red clover as pure sowing and as mixture with grasses in field experiments on loamy sand and sandy loam in the north-east of Germany.

Selected *Rhizobium* spp., *Pseudomonas* spp. and Mycorrhiza-fungi have been inoculated to the seeds as peat-preparation (Höflich et al., 1994).

## RESULTS AND DISCUSSION

The growth and the nutrient uptake (nitrogen, phosphorus, potassium) of alfalfa- and alfalfa-grass-mixtures can be stimulated by inoculation of effective *Rhizobium* bacteria and Mycorrhiza-fungi on loamy sand more than on sandy loam. The growth stimulation of red clover and red-clover-grass was less than that of alfalfa and alfalfa-grass.

The growth of grass - in contrast to cereals and maize - was not stimulated by inoculated microorganisms. Coinoculation of *Rhizobium* spp. with *Pseudomonas* spp. stimulated the growth of alfalfa but not of alfalfa-grass. The proportion of legumes should be 60 to 66 % as a requirement to get positive inoculation effects and an effective  $N_2$ -fixation in legume-grass-mixtures.

Effective rhizobium-legumes-symbiosis (for instance after rhizobium-inoculation) stimulated the development of legumes and reduced the spreading of grasses in legume-grass-mixtures. Higher

nitrogenase activity leads to higher nitrogen contents of alfalfa as well as of the grasses within the mixture. This has also positive effects on the protein yield per ha.

Requirements for a successful inoculation of rhizosphere microorganisms in legume-grass-mixtures are the consideration of  
- a stable effectivity of the microorganisms and  
- the specific effects of the grasses and soils.

## REFERENCES

Höflich, G., W. Wiehe and G. Kühn. 1994. Plant growth stimulation with symbiotic and associative rhizosphere microorganisms. *Experientia* **50**: 897-905.

