

Nematostatic N₂-fixing *Crotalaria juncea* for sustainable greenhouse vegetable production

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We implemented complete randomised block designs over a 3-year rotation in two farm sites of southern France to test the non-crop legume *Crotalaria juncea* for biological control of phytoparasitic root-knot nematode populations and green manure effect in greenhouse tunnel vegetable production (lettuce) suffering from recurrent and severe nematode infestation problems. *Crotalaria* intercrop cultivation was introduced as an alternative cover plant to *Sorghum*. *Crotalaria* plants were inoculated at sowing with a cocktail of rhizobium strains, grown for 60-65 days, cut and the residues incorporated into soil; lettuces were then planted and harvested after 75-day growth.

Several parameters were measured: *Crotalaria* plant growth, root nodulation, ¹⁵N natural abundance, N concentration and percentage of N₂ fixed in *C. juncea*; subsequent lettuce crop yield and nematode infestation (galls); microbiological impact of *Crotalaria* in soil and roots. Soil samples were analysed for C_{org}-N-P contents, DNA extraction to monitor bacterial diversity, estimation of microbial catabolic potentialities (substrate induced respiration) and trap cultures of mycorrhizas.

Statistical analyses show that *C. juncea* (1) grows rapidly in Mediterranean conditions producing a significant biomass (2) has a very positive green manure effect on lettuce production in both sites and within two successive campaigns (3) significantly reduce on lettuce gall scores. Mycorrhization index and rate of *C. juncea* are significantly higher than that of Ray-grass used as a reference mycorrhizogenous plant. Bacterial strains recovered from nodules show a larger diversity than that of the inoculated strains. One of the inoculated *Bradyrhizobium* sp. strain was still present in soil one year after inoculation. Measurements of natural abundance in ¹⁵N show that the proportion of nitrogen fixed is quite low over the whole plot (Ndfa=15%) although it varies a lot between blocks (from 3 to 30%). Nevertheless, this corresponds to about 50 Kg of fixed nitrogen per ha in 3 months. No transfer of fixed N₂ from *C. juncea* necromass to lettuce could be detected during this 1st year of experiment. Possible remnant effect of *Crotalaria* rotation will be further examined in the 2nd and 3rd year of experiment. A third site of experimentation is being settled in Murcia (Spain) in 2012 (tomato production).

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