



## White lupine as a beneficial crop in Southern Europe. II. Nitrogen recovery in a legume–oat rotation and a continuous oat–oat

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### ABSTRACT

One experiment lasting for two years was carried out at Pegões (central Portugal) to estimate the impact of mature white lupine residue (*Lupinus albus* L.) on yield of fodder oat (*Avena sativa* L. cv. Sta. Eulalia) as the next crop in rotation, comparing with the continuous cultivation of cereal, under two tillage practices (conventional tillage and no-till) and fertilized with five mineral nitrogen (N) rates, with three replicates. Oat as a first crop in the rotation provided more N to the agro-ecosystem ( $63 \text{ kg N ha}^{-1}$ ) than did lupine ( $30\text{--}59 \text{ kg N ha}^{-1}$ ). This was at a cost of  $100 \text{ kg}$  of mineral  $\text{N ha}^{-1}$ , whereas lupine was grown without addition of N. A positive response of oat as a second crop was obtained per kg of lupine-N added to the system when compared with the continuous oat–oat. The cereal also responded positively to mineral N in the legume amended soil in contrast with the oat–oat sequence where no response was observed, partly due to the fast mineralization rate of lupine residue and a greater soil N immobilization in the continuous oat system. Each  $\text{kg N ha}^{-1}$  added to the soil through the application of  $73 \text{ kg DM ha}^{-1}$  mature lupine residue (above- and belowground material) increased by  $72 \text{ kg DM ha}^{-1}$  the oat biomass produced as the second crop in rotation when  $150 \text{ kg mineral N ha}^{-1}$  were split in the season, independent of tillage practice. Mature legume residue conserved in the no-tilled soil depressed the yield of succeeding cereal but less than the continuous oat–oat for both tillage practices, where the application of mineral N did not improve the crop response.

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