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Carbon balance components of a black locust-based agroforestry site under Mediterranean climate

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10:30

Agroforestry systems (AFS) can provide many services, among which sequestering atmospheric carbon (C) dioxide (CO_2) into both tree biomass and soil organic matter for mitigating climate warming. Such high performances were documented in several studies, but data are still scarse for covering the broad range of agrosystems – climate combinations. More particularly, data of the different C stocks and fluxes among the different components of the AFS needs to be documented for robust estimates of C sink strength. This study aims at providing values of C stocks and fluxes of a black locust (Robinia pseudoacacia L.)-based agroforestry site in Mauguio, Southern France. The different compartments of the AFS were investigated: the black locust rows, the herbaceous strip planted of various grassland species along the trees and the intercropping, constituted by a rotation cereals/legumes. The crop rotations comprised durum wheat, barley, chickpea and pea, but we presented the data for the barley planting year in 2021. A forest plantation and a pure crop planting systems were also studied as control modalities. The three planting systems were repeated in three independent blocks. Aboveground tree biomass growth was estimated for the agroforestry and the forestry plots from allometric models. Black locust litter fall was quantified also in the agroforestry and forestry plots. For each planting systems, root biomasses, root C contents and root growth were estimated . Aboveground herbaceous biomasses and C contents were also measured in 1m2 squared plots at different seasons. Soil microbial biomass and soil CO_2 efflux were measured in all components and planting systems. All data currently under processing will be normalized per area unit. The effect of the planting system was assessed in order to determine the added value of the agroforestry system with respect to the pure planting systems.