Synthesis on the effects of grain legume insertion and cereal-grain legume intercrops in low input cropping systems in Southern France

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Key Lecture - Session 14
14/10 - 10:30-11:00

Eric Justes

Eric Justes (Male, born in 1965, Senior researcher at INRA, France), is an agronomist and modeller specialised in soil science, ecophysiology and agroecology with experience in legume insertion in arable cropping systems as sole or intercrops, i.e. species mixtures of cereal-grain legumes and catch/cover crops. His expertise covers water and nitrogen cycling, management in arable systems and design of innovative low inputs, organic and diversified cropping systems. He has published over 60 articles in ISI journals (https://www.researchgate.net/profile/Eric_Justes). He is currently head of the VASCO research team (VArieties and Cropping System for an agrOecological production at INRA, AGIR lab, Toulouse), coordinator of French and European projects and is involved in dissemination activities to agricultural advisors.

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Six cropping systems (CS) of three 3-year rotations based on durum wheat and sunflower inserting 0, 1 (pea or fababean) and 2 grain legumes (GL) (pea and soybean), and with or without cover crops (CC) were compared at INRA Toulouse from 2004. This experiment is still on going for a twelfth year. We demonstrated that 6 key points. 1) Pea as a preceding crop increased durum wheat grain production by 8% compared to sunflower as a preceding crop with a mean reduction of N fertilization of 45 kg N ha^{-1}. 2) Inserting GL in the rotations significantly affected the amount of C and N inputs to the soil that were lower than with cereals and consequently led to a decrease in soil organic-C (SOC) and –N contents. 3) N leaching simulated using the STICS model was higher when increasing the number of GL (from 22 to 52 kg N ha^{-1} after two rotation cycles of 6 years, for 0 to 2 GL respectively). 4) However, CC insertion i) reduced N leaching (from 15 to 18 kg N ha^{-1}), ii) mitigated SOC loss, and iii) did not affect durum wheat grain protein concentration or yield. 5) Daily measured N_2O emissions over the whole 3-year rotation were low but significantly higher under the CS including fababean than for the cereal-based CS (1.12 vs. 0.78 kg N_2O-N ha^{-1} year^{-1}) despite a lower N fertilization. Then, in such conventionally-tilled systems, properly designed cropping systems that simultaneously insert grain legumes and cover crops reduce N requirements of the following durum wheat, stabilize SOC content but do not decrease N_2O emissions at the rotation level.