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Effect of inter-row cultivation on soil CO_2 emission in a peach plantation

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We examined the effect of inter-row cultivation on soil CO_2 emission in a peach plantation planted in 1991. The soil is Ramann type brown forest soil /Mollic Cambisol/ developed on sandy loam. Every second row in the orchard is covered with undisturbed grass, and every other row is disked (depth: 12-15cm) with a two-three-week frequency. The humus content varies from 1,69% to 2,28% in the upper 20 cm layer, where the sand, loam and clay contents are 58%, 21% and 19 %, respectively. The average annual precipitation total is 570 mm (330 mm for the growing season) at the site.

During the vegetation period of 2009 soil CO_2 emission measurements were carried out with static chamber method in the differently managed rows. Parallel with CO_2 measurements soil volumetric water content and soil temperature were also determined. Soil microbiological properties water-extractable organic carbon (WEOC) and water-extractable nitrogen (WEN) as well as substrate-induced respiration (SIR) were determined from disturbed soil samples collected on the first measurement day.

The measured soil physical properties showed that different soil management practices influence soil water content, bulk density and soil temperature as well. Soil water content was higher in the grass covered row on 10 of the 13 measurement days, the difference – which reached 10 v% - was the highest on the warmest days. Soil temperature is also different in case of disked and grass covered rows, found to be lower in the grass covered rows on every measurement days. SIR, WEOC and WEN were all higher in the grass covered row (19.45 μg CO_2-C g^{-1} soil 36.91 μg g^{-1} soil, 139.36 μg g^{-1} soil, respectively) than in the disked row (4.88 μg CO_2-C g^{-1} soil 25.43 μg C g^{-1} soil, 61.25 μg N g^{-1} soil, respectively) in 2009.

Soil CO_2 emission also differed between the two rows, grass covered rows produced higher emission in all measurements days without exemption. The difference between CO_2 fluxes from the two cultivation methods were found to be statistically significant ($p = 0.05$) on each measurement day, except for the two driest days according to soil water content data. Nevertheless, soil emission data from the grass covered rows are more scattered due to the greater spatiotemporal variability in the lack of disturbance. Homogenization is a well known consequence of cultivation, which explains the moderate variation of emission in the disked row.