Soil Use and Management

Soil Use and Management

doi: 10.1111/j.1475-2743.2011.00367.x

The effects of cover crops and conventional tillage on soil and runoff loss in vineyards and olive groves in several Mediterranean countries

J. A. Gómez[1], C. Llewellyn[2], G. Basch[3], P. B. Sutton[4], J. S. Dyson[5] & C. A. Jones[6]

[1]*Institute for Sustainable Agriculture, CSIC, Apartado 4084, 14080 Cordoba, Spain,* [2]*National Soil Resources Institute, Cranfield University, Cranfield, Bedfordshire MK43 0AL, UK,* [3]*Universidade de Évora, Instituto de Ciências Agrárias e Ambientais Mediterrâneas, Largo dos Colegiais 2, 7000-554 Évora, Portugal,* [4]*Syngenta Limited, Jealott's Hill International Research Centre, Bracknell RG42 6EY, UK,* [5]*Syngenta Crop Protection AG, WRO 1007.8.31, PO Box, CH-4002 Basel, Switzerland, and* [6]*National Farmers Union, Agriculture House, Stoneleigh Park, Warwickshire CV8 2TZ, UK*

Abstract

Cover crops (CC) in vineyards and olive groves provide an alternative to conventional tillage (CT) for land management. Runoff, sediment and nutrient loss from six sites in France, Spain and Portugal were compared over 3–4 yr. In general, runoff loss was not significantly reduced by the CC alternatives: average annual runoff coefficients ranged from 4.9 to 22.8% in CT compared with 1.9–25% in the CC alternatives. However, at two sites, reductions in average annual runoff coefficients were greater for CC: 17.2 and 10.4% in CT, 6.1 and 1.9% in CC. Nutrient loss in runoff followed a similar pattern to runoff, as did pesticide loss on the one site; reductions occurred when runoff losses were significantly reduced by CC. The lack of differences at the other sites is thought to be due to a combination of soil conditions at the surface (compaction and capping) and sub-surface (low-permeability horizons close to the surface). In contrast, CC always resulted in reductions in soil erosion loss, plus similar reductions in nutrients and organic matter (OM) associated with sediment. Soil erosion loss ranged from 1.4 to 90 t/ha/yr in CT compared with 0.04–42.7 t/ha/yr in CC. Overall, reductions in runoff and associated nutrient and pesticide loss from vineyards and olives occurred with the introduction of CCs only when soil permeability was sufficiently high to reduce runoff. In contrast, reduction in soil erosion and associated nutrients and OM occurred even when the amount of runoff was not reduced. In the most extreme encountered situations (highly erodible soils in vulnerable landscape positions and subject to highly erosive rainfall), additional conservation measures are needed to prevent unsustainable soil loss.

Keywords: Soil erosion, soil conservation, runoff, nutrient loss, olive groves, vineyards