Integrated weed management in olive orchards: influence on biodiversity, crop production and quality

Verónica Pedraza[1], Juan Antonio Lezaun[2], Irache Garnica[2], José L. González-Andújar[1],

[1]Instituto de Agricultura Sostenible (IAS-CSIC), Campus Alameda del Obispo, Menéndez Pidal Ave. no number, 14004 Córdoba (Spain)
[2]Instituto Navarro de Tecnologías e Infraestructuras Agrarias (INTIA), Serapio Huici Ave. 22, 31610 Villava, Navarra (Spain)

The conventional soil management and weed control methods in olive orchards have caused, over the years, serious problems of water availability, erosion, the appearance of herbicide resistance, as well as a decrease in farmland biodiversity and the associated ecosystem services. In this context, this study highlights the importance of using integrated weed management techniques (IWM), which allows farmers to combine crop production with the protection of the agroecosystem and the conservation of the soil productive potential. A 2-year study with four IWM strategies in 3 plots and a randomized complete block design with 4 replications per strategy were established. Strategy CC included 'no tillage with chemical control' in the intra-row spacing and 'cover crops' in the inter-row spacing. The cover crops comprised spontaneous grasses (*Bromus* spp) in southern Spain and sown crucifers (*Sinapis alba*) in northern Spain. Strategy TL involved 'tillage' combined with pruning wood residues in both sampling areas of southern Spain and strategy NT 'no tillage with chemical control' in both areas of northern Spain. Effects on the weed community and olive crop were evaluated analyzing the richness, abundance, diversity (Shannon index) and equity (Pielou eveness index), as well as the olive yield and quality. Linear mixed effects models were used to test for differences between IWM strategies and were adjusted using the *lmer* function from the *lme4* library in the R environment. In all cases, the variable 'plot' was included as a random effect and the variables 'IWM strategy' and 'sampling area' were included as fixed effects. The statistical significant of the effects was obtained by the function *Anova* and *Tukey* test at a 5 % significant level. Results showed a greater richness, abundance and diversity in the CC intra-rows than TL, as well as a greater richness and diversity in the CC inter-rows in southern Spain. In the north of Spain, a greater richness was observed in the NT inter-rows, but diversity and equity indices only showed significant differences in the CC intra-rows the second year. Moreover, yield and quality results were not affected by the IWM strategy at any location. These preliminary results seem to indicate that the introduction of IWM in olive orchards makes it possible to reconcile crop production and beneficial weed flora at a manageable threshold if a sustainable agricultural system is to be achieved in the long-term.

Keywords: Cover crop, no-tillage, tillage, weed flora, yield