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DIFFERENT FARMING MANAGEMENTS IN APPLE ORCHARDS: EFFECT ON PLANT SPECIES COMPOSITION AND DIVERSITY



Kolářová M.¹, Tyšer L.¹, Soukup J.¹, Lososová Z.²

CULS Prague, Kamýcká 129, 165 21 Prague 6 – Suchdol, Czech Republic, mkolarova@af.czu.cz ² Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic



Our research was focused on the **apple orchards** which are the most common orchards in the Czech Republic and areas where orchards are widespread were chosen for the survey. The aims of the study were (1) to evaluate differences in the diversity of flora and vegetation in apple orchards subjected to the different management practices, and (2) to determine effect of management on changes in species composition and on proportion of native and alien species in orchard spontaneous vegetation. The survey was carried out in **three triads** of selected apple orchards in the Czech Republic in 2009. The orchards were situated in Moravia and in Central and Eastern Bohemia. In each Bohemian region **one conventional, one integrated and one organic orchard** were chosen. In Moravia, two organic and one integrated orchard were observed. Thirty permanent plots of 1×1 m were established in each of the studied orchards. Fifteen plots were situated in tree-rows and fifteen between rows of apple trees. Species composition and cover of vascular plants were sampled in the plots repeatedly throughout the growing season. We calculated the mean number of species per plot (alpha diversity) and the total number of species occured on all 30 plots in one orchard (gamma diversity). Plants were classified according to their residence time to three groups; natives, archaeophytes, and neophytes. Management type but also differences between regions had a significant effect on changes in species composition of studied vegetation. The effect of different region with the different local soil and climatic condition was found more important using CCA and Monte Carlo permutation tests than effect of management type.







Fig. 5: Alpha and gamma diversity of vascular plants in each type of studied orchards

Fig. 4: IP orchard in Slaný Fig. 2: IP orchard in Slaný Giv fou (ga inte fou and

A remarkable difference between average species richness within a plot (alpha) diversity) and total number of species found on all 30 plots in each orchard **diversity**) of conventional, (gamma integrated and organic orchards was found. The highest values of both alpha and gamma diversity were in organic orchards, followed by integrated and The significant conventional ones. differences in diversity measures were also found between all three compared regions. The lowest alpha and gamma diversity values were found for vegetation of central Bohemian orchards (locality Slaný); 5.8–7.6 species per plot (number of all species 37-44) while the highest alpha and gamma diversity values were found in Moravian region: 11.4–15.4 species per plot (number of all species 82–110). All the differences diversity measures between were statistically significant (P < 0.001; ANOVA).



Fig. 2: Ordination diagram of detrended correspondence analysis (DCA) with passively projected environmental variables onto the diagram. Only species having the highest weight in the analysis are displayed.



Detrended correspondence analysis reveals the main gradients in changes in species composition of spontaneous vegetation of apple orchards. Fig. 2 shows that the main gradient which is associated with first ordination axis of diagram goes from plots of conventional and integrated orchards on the left part of the diagram to plots of organic orchards situated in the right part. This gradient is partly associated also with difference in vegetation between rows and tree-rows plots. **The conventional and integrated plots** are characterized by common weed species e.g. *Stellaria media, Convolvulus arvensis,* and *Senecio vulgaris.* **Organic plots** host mainly common perennial species (*Crepis biennis, Geum urbanum, Rosa canina*).

Management type but also differences between regions had a significant effect on changes in species composition of studied vegetation. The effect of different region with the different local soil and climatic condition was found more important using CCA and Monte Carlo permutation tests than effect of management type (not shown).



There have been found **201 vascular species**; among them **127 natives**, **65 archaeophytes**, **and 9 neophytes**. The most common archaeophytes in our data set are *Capsella bursapastoris*, *Senecio vulgaris*, and *Cirsium arvense*; the most common neophytes are *Amaranthus retroflexus*, *Veronica persica*, *Oxalis fontana*, and *Conyza canadensis*. Proportion of native species varried between 49 and 87 % per plot, while archaeophytes and neophytes built 7–36 % and 0–14 % of species per plot, respectively. Only inconspicuous differences in proportion of native species were recorded between differently managed apple orchards. There was a significant difference in proportions of archaeophytes and neophytes under different management systems.

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