

RESEARCH PAPER

Impact of crop management on weed species diversity and community composition of winter wheat fields in Iran

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The aim of this study was to assess the effects of crop management practices on the diversity, structure, and composition of weed communities. A total of 30 fields (15 fields each) in low-input and conventional farming systems were surveyed in north-eastern Iran. In the conventional cropping system, both mineral fertilizers and herbicides were applied, while in the low-input cropping system, the fertilizer was mainly manure and herbicides were avoided. The results showed that the pool of species, species richness, number of unique species, and Shannon's diversity index were greater in the low-input system than in the conventional system. Both cropping systems had more broad-leaved species than grasses and more annual species than perennial species. All the multivariate methods of analysis that were applied revealed that the weed community composition was significantly different between the two management types. The low-input cropping favored herbicide-susceptible broad-leaved weeds, legumes, and weeds with biodiversity value, whereas a high proportion of herbicide-tolerant grasses was found in the conventional fields. The results suggest that low-input cropping can sustain high weed diversity and abundance.

Key words: biodiversity, farming system, herbicide, species richness, weed diversity.

Arable weed species play a key role in supporting biodiversity within agro-ecosystems. They are primary producers and are of central importance to the arable system's food web. The weeds serve as immediate food sources for herbivores and support prey species at higher trophic levels (Marshall *et al.* 2003; Hyvönen & Huusela-Veistola 2008). In addition to providing food for species at higher trophic levels, the weeds within fields have other ecosystem functions, including nutrient cycling and soil preservation (Tilman & Downing 1994; Altieri 1999). At the same time, weed control per se can be facilitated by weed species diversity. Accordingly, a reserve of weed diversity within fields can be of benefit for sustainable agriculture.

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The introduction of intensive agriculture in the mid-20th century led to vital changes in arable communities (McCloskey *et al.* 1996). Intensive agriculture is based on a greater use of mineral fertilizers and herbicides, leveling and draining, intensive tillage of the soil, and the introduction of crop varieties that are sown at high densities. In the long run, the application of such farming methods has been detrimental for the biodiversity of arable habitats (Hyvönen & Salonen 2002). This is especially true for arable weed communities because several cropping measures are directed specifically towards reducing weed diversity and abundance (Hyvönen & Huusela-Veistola 2008). Besides a decline in weed diversity, intensive cropping practices change the weed community composition. The long-term application of herbicides in cereal production reduces the abundance of broad-leaved species and weeds that are susceptible to herbicides, instead supporting more herbicide-resistant species and grass weeds (Moreby *et al.* 1994; McCloskey *et al.* 1996; Hyvönen & Salonen 2002). Many of these species, such as wild barley (*Hordeum spontaneum* C.Koch), now are considered to be serious agricultural pests in the wheat