Emergence and survival of *Rumex* OK-2 (*Rumex patientia* x *Rumex tianschanicus*) in grasslands under different management conditions

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Abstract

Emergence and survival of *Rumex* OK-2 was studied in the north of the Czech Republic (in an experimental garden in Liberec town) in 2013. Three frequencies of cutting were applied: no (0C), one (1C) and three (3C) cuts per year. Seeds of *Rumex* OK-2 were sown into the sward with different microsite conditions (no gap – gap; fertilizer application and no fertilizer application) in each treatment. The following plant characteristics were measured: number of emerged plants, number of surviving plants, plant height and numbers of leaves. Measurements were made three times per vegetation season (middle of June, end of July and end of September) before cutting. Plants of *Rumex* OK-2 emerged more in the treatments with gaps. Survival of *Rumex* OK-2 plants was connected with treatments with gap, especially in the second and the third cutting date.

Keywords: weeds, cutting frequency, competition, fertilizers application, gap

Introduction

Many broad-leaved *Rumex* species are considered to be the most troublesome weeds in grasslands and arable land worldwide (Zaller, 2004). These plants often colonize grasslands as well as permanent agricultural crops (Novák, 1994; Brant *et al.*, 2006), where they can survive for a long time (Martinková *et al.*, 2009). A new forage and energy-crop hybrid, *R. patienta* × *R. tianschanicus*, registered as cv. *Rumex* OK-2 (hereafter referred as *Rumex* OK-2) was introduced into the Czech Republic about ten years ago (Usťak, 2007). *Rumex* OK-2 is described as a perennial (up to 10 years) stress-tolerant plant, characterized by high ecological plasticity, with cold and winter hardiness, tolerance to salt stress and increased humidity (Kosakivska *et al.*, 2008). Before the introduction to the culture it was presented as a competitive species with a low possibility of invasibility (Usťak, 2007). However, it behaves as an invasive weed species, especially in road ditches covered by grasslands in the vicinity of the field where it was previously grown (Hujerová, 2013a). The response of mature plants to different cutting frequencies of *Rumex* OK-2 is very similar to that of *Rumex crispus* (Hujerová 2013b). In view of the above-mentioned knowledge we established a manipulative experiment where emergence and survival of *Rumex* OK-2 in grasslands under different management conditions were studied.

Methods and materials

A plot experiment was conducted in 2013 at the experimental garden of the Crop Research Institute, Grassland Research Station Liberec, in the northern part of the Czech Republic, under conditions of natural rainfall, temperature and daylight. Twenty seeds of *Rumex* OK-2 were sown into the sward in May 2013. Twelve factorial treatments were applied: i) three frequencies of cutting- no (0C), one (1C) and three (3C) cuts per year; ii) two levels of disturbance - gap and no gap; iii) two levels of nutrients - fertilizers application and no fertilizer application. The experiment was arranged in four complete randomized blocks with individual plot sizes of 0.5 m × 0.5 m. NPK fertilizer was applied in amounts of 100 kg N ha^{-1} 52 kg K

ha^{-1} and 27 kg P ha^{-1} in 0 15 m × 0.15 m areas allocated in the middle of each plot. Seeds were sown in the same area. We recorded number of emerged plants, number of surviving plants, plant height and numbers of leaves. Measurements were made three times per season (middle of June, end of July and September) before cutting. In the first cutting term the *Rumex* plants were not defoliated, because they were smaller than cutting height. One-way ANOVA and repeated measures ANOVA were used to evaluate number of emerged plants, number of surviving plants, plant height and numbers of leaves.

Results and discussion

The number of emerged *Rumex* OK-2 plants was significantly divided into two groups according to disturbance. In the treatments without gap, up to one plant per plot was found, whereas in plots with gap there were from seven to nine plants after one-and-a-half months after sowing date (Figure1).

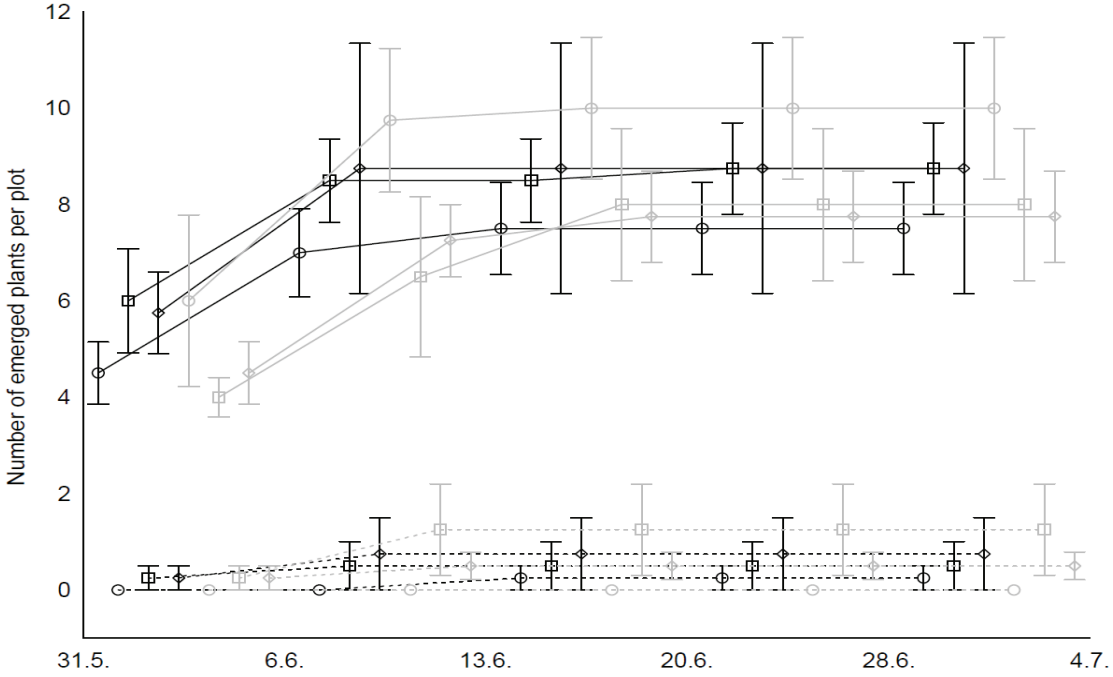

Figure 1. Development of emerged *Rumex* OK-2 plants during one-and-a-half months after sowing.
Legend: fertilized, non-fertilized, 0C, 1C, 3C, gap, --- no gap.

There were no emerged plants found in the no-gap, non-fertilized, no-cutting treatment (NGaNFC0). On the other hand the highest number of emerged plants was in the gap, non-fertilized, no cutting treatment (GaNFC0). It confirmed the results of Carvers and Harper (1964) for *Rumex crispus* and *R. obtusifolius* that seed germination is possible when a gap occurs in the established sward. In the first cutting term there were only a few surviving plants in treatments without gaps but several times more of them in treatments with gaps (Figure 2). However, the number of surviving *Rumex* OK-2 plants significantly decreased in the second cutting term because of high competitive ability of the existing sward. After the third cut only a few of the *Rumex* OK-2 plants survived in gap treatments. However, due to its fast spring growth and similar tolerance to cutting as *R. crispus* has (Hujerová, 2013b) we can expect it surviving, with possible flowering and consequent seed production in the next vegetation.

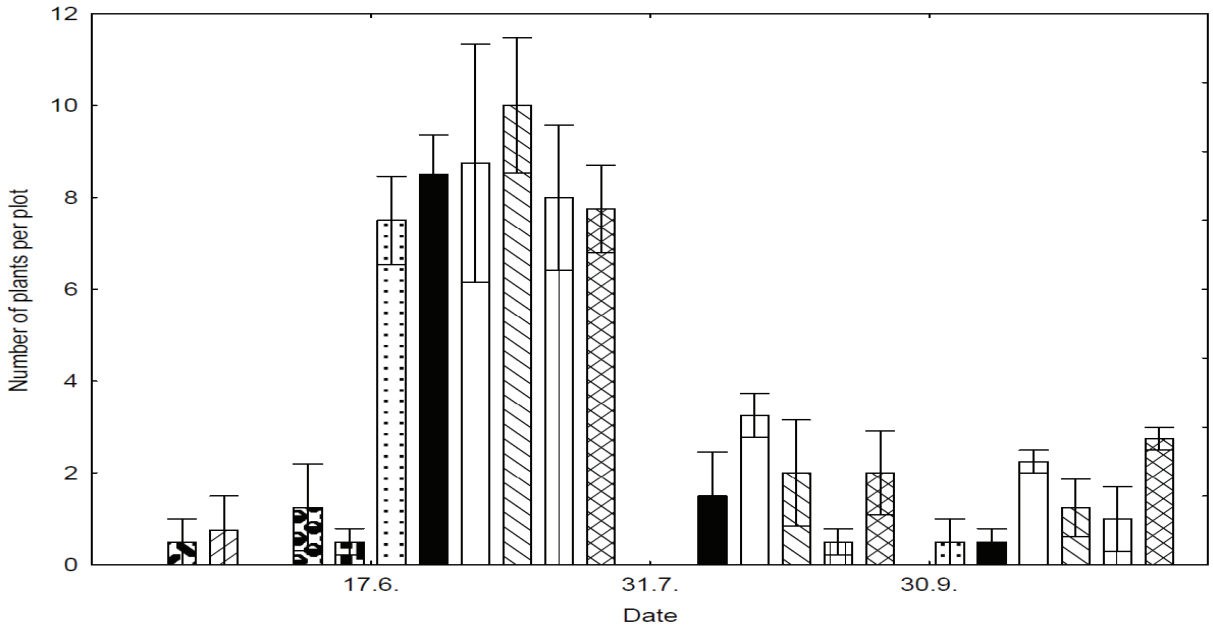

Figure 2. Number of survived plants *R.* OK-2 in three cutting terms. NGaFC1, NGaFC3, NGaNFC1, NGaNFC3, GaFC0, GaFC1, GaFC3, GaNFC0, GaNFC1, GaNFC3.

Conclusion

Sward disturbance is the main factor for *Rumex* OK-2 infestation into existing grasslands. Although in the course of the vegetation season plants of *Rumex* OK-2 are exposed to high competitive pressure of existing sward, some were still revealed at the end of vegetation season. These plants in the next vegetation seasons can become an important source of seeds and support its expansion into the surroundings. *Rumex* OK-2 has similar behaviour as other broad-leaved docks in Central Europe, so we can expect its further spreading.

Acknowledgments

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