Grass-clover mixtures: benefits for arable and livestock farms and biodiversity

Hoekstra N.J.[1], De Haas B.R.[1,2], Van der Schoot J.R.[3], Visser E.J.W.[2], De Kroon H.[2] and Van Eekeren N.[1]
[1]Louis Bolk Institute, the Netherlands; [2]Experimental Plant Ecology, Radboud University, the Netherlands; [3]Wageningen Plant Research, Lelystad, the Netherlands

Introduction: Grass-clover mixtures show many benefits for sustainable agriculture. In the Netherlands, organic arable and livestock farmers often work together in a so-called partner farm concept: the arable farms grow one-year grass-clover leys to widen their crop rotation and as fodder for a livestock farm in exchange for manure. The aim of this research was to investigate the effect of different grass-clover mixtures and monocultures in a one-year ley on both aboveground and belowground parameters in light of the benefits of the ley for livestock farms, arable farms and biodiversity.

Materials and methods: Monocultures and selected 2-, 3- and 4- species mixtures of a range of grass (*Lolium perenne*: Lp, *Lolium multiflorum*: Lm) and clover (*Trifolium pratense*: Tp and *Trifolium repens*: Tr) species were assessed in a one-year organic ley, without fertilisation. Aboveground measurements included yield, digestibility, nitrogen (N) content and the proportion of weeds and clover. Belowground parameters were soil penetration resistance, soil structure, rooting density and soil mineral N content. Earthworms were counted, weighed and assigned to functional groups. Normally distributed data were analysed with ANOVA, all other data were analysed with Kruskal-Wallis tests.

Results: Grass monocultures showed good weed suppression, high root density, and especially Lp had a positive effect on soil structure. Clover, conversely, showed high herbage DM yield (particularly Tp; Figure 1) and N yield, and Tr showed high digestibility. Moreover, clover had a positive effect on the soil mineral N, and earthworm abundance tended to be higher in clover monocultures. When (some of) the four species were combined in grass-clover mixtures they combined the positive effects of the species and often outperformed the (best) monocultures (Figure 1). Mixtures including Lm showed lower clover content (due to fast Lm growth in spring, slowing clover development), resulting in lower N content and N yield.

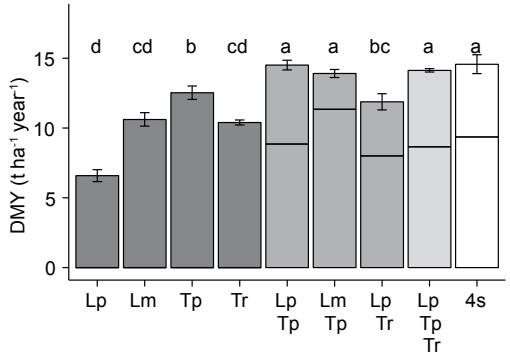

Figure 1. Mean cumulative herbage dry matter yield (t DM ha^{-1} $year^{-1}$) ± 1 SE for the different sward types. Lp: *Lolium perenne*, Lm: *Lolium multiflorum*, Tp: *Trifolium pratense*, Tr: *Trifolium repens*, 4s: four species mixture. The horizontal lines across bars show the predicted yield based on monoculture performance. Means with the same letters are not significantly different (P>0.05) (n=3).

Conclusion: For the livestock farm, the Lp:Tp mixture would appear to be the most beneficial, as it showed the highest herbage DMY, N yield and DOM yield. In contrast, for the arable farm both the Lp:Tr and the four-species mixtures performed best, due to the combination of high weed suppression, good soil structure, high root score and intermediate soil mineral N levels. For biodiversity, the clover monocultures, Lp:Tr and three-species mixtures scored best due to higher earthworm abundance and potentially positive effects on insects. Therefore, if all results are combined, the three-species mixtures (Lp:Tp:Tr) performed best on average.

2019 EGF EUCARPIA

Joint Symposium | Zurich, June 24–27

Improving sown grasslands through breeding and management

Edited by

O. Huguenin-Elie
B. Studer
R. Kölliker
D. Reheul
M. Probo
P. Barre
U. Feuerstein
I. Roldán-Ruiz
P. Mariotte
A. Hopkins

EUCARPIA

EGF

Volume 24
Grassland Science in Europe