Smart grassland systems:

The relationship between sward diversity and weed invasion resistance in experimental grassland communities

Louise Duignan[1,2], *Rochelle Fritch*[1] & *Helen Sheridan*[1]

1 UCD School of Agriculture & Food Science, 2 Sligo Institute of Technology

**Corresponding author: helen.sheridan@ucd.ie*

Smart grass
Biodiversity for production

Introduction

The invasion of agricultural grasslands by weed species may substantially lower their nutritional value to grazing animals. Once established, weed control may be dependent on the use of herbicides or physical removal. In Ireland, perennial ryegrass monocultures or perennial ryegrass/clover swards are typically used in intensively managed agricultural grassland systems. However, previous studies have demonstrated that increases in forage plant diversity are associated with reduced weed invasion and greater plant community stability (Finn *et al.*, 2013; Connolly *et al.*, 2009; Frankow-Lindberg *et al.*, 2009). This project aims to investigate the effects of increasing the botanical diversity of swards on unsown weed invasion.

Materials & methods

The experiment uses a constrained simplex-centroid design with nine plant species representing three functional groups (grasses, legumes and herbs), after Kirwan *et al.* (2007). These range from a perennial ryegrass monoculture to a nine species mixture, with 24 different mixtures. The study located at Lyons Farm, Co. Kildare, measured invasion of unsown plant species in experimental grassland plots at four different nitrogen levels (0, 45, 90, & 135 kg N ha^{-1} yr^{-1}). Experimental plots were mown to a height of 4 cm to simulate 28-day rotational grazing. Forage sub-samples were taken from three harvests during the growing season (April, June and August). Above-ground dry matter yield (DMY) of both sown and unsown species were measured. Prior to harvest, the community composition of unsown species in each plot was assessed with a 1 m^2 quadrat, placed at the centre of each plot. Weed invasion was measured as the proportion of total yield composed of unsown species biomass.

Results/Discussion

Overall, weed invasion varied between sward mixtures and harvest date in established plots (Figure 1). The June harvest had the highest levels of weed biomass in sward mixtures composed of all three functional groups, i.e. grasses, legumes and herbs. In contrast, the August harvest had the highest levels of weed biomass in mixtures composed only of grass species. The unsown plant community was dominated by common ruderal species, i.e. *Poa annua*, *Veronica persica*, *Capsella bursa-pastoris*, *Lamium purpureum*, *Epilobium spp.* and *Anagallis arvensis*.

Results from the August harvest suggest there is a relationship between weed biomass and light availability, as the highest levels of weed biomass were found in plots that contained only grass species and consequently would have the most

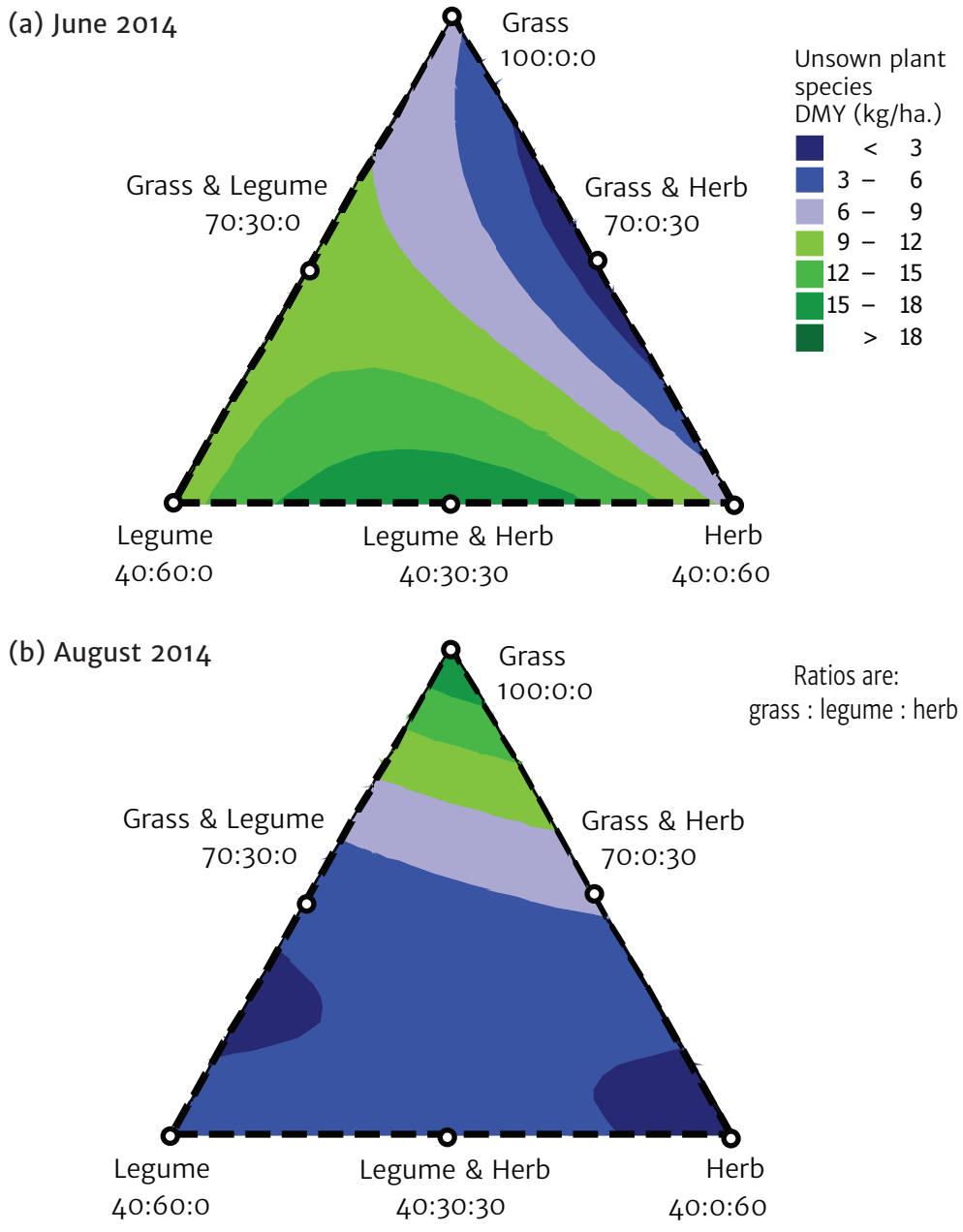

Figure 1. Contour plots from multiple regression analysis for unsown plant species dry matter yield (kg/ha.) for (a) June and (b) August harvests in the first year of establishment, n = 108.

open canopy of all sward mixtures. Results from the first year of this study suggest increased resource use in more diverse grassland communities may reduce invasion by weeds through niche complementarity.

References

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