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### Persistency of a Newly Sown Forb-Rich Sward Under Sheep Grazing

Trwałość nowo zasianej, bogatej w rośliny zielne runi w warunkach wypasu owcami

#### INTRODUCTION

Recent decisions addressing agricultural overproduction within the European Community (European Economic Community, 1988) has led to the de-intensification of farmland, increasing the scope for creating species-rich grassland swards. Consequently, forb species such as yarrow (*Achillea millefolium*), chicory (*Cichorium intybus*), salad burnet (*Sanguisorba minor*) and ribwort plantain (*Plantago lanceolata*) are increasingly being included in sowing mixtures to fulfil animal nutrition (Thomas *et al.*, 1952), animal health (Levy, 1966) and nature conservation objectives.

Good persistency and productivity of conventionally sown forbs can be achieved under cutting regimes (Hagggar and Jones, 1989). However, under grazing, many forb species are reported to have poor persistency (Lamkin, 1990) and are therefore of only short term value. If the effects of grazing on recently re-seeded grass/forb swards are to be better understood, then the relative importance of the components of the grazing mechanism is required.

An experiment carried out during winter 1992 on 6 week old glasshouse raised grass/forb swards containing yarrow, chicory, salad burnet and ribwort plantain in combination with S23 perennial ryegrass (*Lolium perenne*), and subjected to high and low intensities of defoliation, simulated treading and urine deposition showed that forb population was affected by the treatments in the following order: defoliation treading urination, with individual species responding differentially to treatments (Jones and Hagggar, 1993). In order to carry out a more realistic sheep-based study a replicated field experiment was set up in June 1993, aimed at determining how the components of grazing, viz: defoliation, treading and excreta, affects establishment and persistency of four commonly sown forb species used in seed mixtures for creating species-rich swards. However, as the experiment is still ongoing, only broad descriptions of the effects of treatments on the composition of the plant communities are presented.



## METHOD AND MATERIALS

Based on a seed mixture developed for organic leys (Hunters of Chester, 1984), on 2 June 1993, an area 48 m 16 m was sown with a grass/forb mixture containing yarrow, chicory, salad burnet and ribwort plantain at a rate of: 0.25, 1.0, 2.0 and 0.5 kg ha<sup>-1</sup> respectively with S23 perennial ryegrass at 4.5 kg ha<sup>-1</sup> into a prepared medium loam seedbed of the Nercwys series, pH 6.5 and low in available soil nutrients. The mixture was then allowed to establish for 16 weeks.

Species density (plants/m<sup>2</sup>) counts taken after 14 weeks showed the sward to contain on average 26.1, 41.6, 19.2 and 21.3 individuals of yarrow, chicory, salad burnet and ribwort plantain respectively. A week later the area was delineated into three equal replicate plots each 16 m 16 m, and further sub-divided into smaller plots of varying dimensions to accommodate the following treatments, viz: (i) defoliation only (through bars, no dung or urine) (3 m 3 m), (ii) defoliation and treading (no dung or urine) (2.5 m 4 m), (iii) defoliation + treading + urine (no dung) (2.5 m 4 m), (iv) full graze (223 m<sup>2</sup>), (v) cutting only (to coincide with sheep introduction to grazed plots) (0.8 m 2.5 m), (vi) ungrazed/uncut control (0.8 m 2.5 m). Each sub plot was then assessed for ground cover [%] (sown forbs, sown grass, indigenous forbs, bare ground) and density of sown species [plants/m<sup>2</sup>].

Starting on 5 October 1993, sheep (semi-docile Clun yearlings) were randomly allocated to each grazed sub plots and, where necessary, prevented from fouling using bags and harnesses (Cammell 1977). Sheep were then allowed to graze the plots until the sward height (first hit by a sward stick on the vegetative part of either a grass or a forb species) had been reduced to 4 cm from an initial height of around 10 cm. The plots were then rested for a minimum of four weeks and afterwards re-assessed for any changes to the plant communities. To date, sheep have been introduced onto the plots on three occasions, viz: 5 October 1993, 23 May and 27 September 1994. Further assessments are planned for spring 1995.

## RESULTS AND DISCUSSION

As with the glasshouse study, forb establishment was affected by the treatments in the following order: defoliation treading urination (Table 1), with ribwort plantain being the most resilient species across the range of treatments, being able to quickly recover and regenerate vegetative growth via buds on the stem (Grime *et al.*, 1988).

Defoliation *per se* resulted in little damage to the sward with any changes being mainly a function of sheep preference and selectivity. Defoliation in combination with treading however proved to be very damaging to both forbs and grasses, which, with the exception of ribwort plantain, resulted in much plant mortality. Damage was probably exacerbated by wet conditions at the time of grazing (Edmonds 1963), although Allcock (1973) showed that sward damage can be severe even under dry conditions. The combined effects of defoliation, treading and urination proved to be particularly damaging to the forbs although again ribwort plantain was the least affected. Here, selectivity by sheep coupled with the effect of urine scorch (Richard and Walton 1975) and morphological damage in terms of broken stems and growing points resulted in a steep decline in the forb population. Damage to the grass however was less severe and recovery was aided by N returned in urine, which promoted greater growth, further suppressing any recovery of the forb species.

Under full graze, where the effect of dung was also considered, forb survival was greatest in rejected areas surrounding dung pats, which can be up to five times the fouled area itself particularly when grazed by cows (Batisman and Van Dijk, 1975) to fouled areas



Table 1. Changes to the plant communities of 16 week old grass/forb swards exposed to the differential components of sheep grazing

Zmiany zbiorowisk roślinnych w 16-tygodniowej wzbogaconej runi pod wpływem różnych elementów wypasu owiec

Treatment	Deviation from original population
Defoliation only	Little shift from original population but with ribwort plantain slowly becoming the dominant forb.
Defoliation + treading	Substantial reductions in forb content with the exception of ribwort plantain. Indigenous forbs particularly <i>Taraxacum officinalis</i> (dandelion), <i>Bellis perennis</i> (daisy), <i>Ranunculus repens</i> (creeping buttercup) and <i>Plantago major</i> (greater plantain) as well as weed grasses, particularly <i>Poa annua</i> (annual meadow grass) establishing in areas of bare ground.
Defoliation + treading + urine	Sward dominated by perennial ryegrass. Combined effects of: selectivity, urine scorch, morphological damage and increased grass competition have eliminated the forbs although populations of ribwort plantain still survive.
Full graze	Three distinct mosaics of plant communities have emerged comprising: (i) grass dominant areas, (ii) bare ground dominant areas with increasing populations of indigenous forbs particularly greater plantain and dandelion, (iii) areas where forbs are surviving particularly around dung pats.
Cut only	Plant community similar to original population but ribwort plantain content has increased.
Control (uncut)	Plant community similar to original population but with lower grass and higher ribwort plantain content.

The cut treatment largely reflected the original plant community but less grass, yarrow and chicory was found in the uncut control treatment mainly due to the dominance of ribwort plantain.

#### CONCLUSION

Results from this experiment show that forb survival was least in areas where defoliation by sheep was combined with the effects of treading and urine deposition. Rejected areas around dung pats on the other hand provided safe havens for the forbs and were left largely undamaged. In general, early introduction of grazing animals can be damaging to many non-graminaceous species establishing in forb-rich swards. Damage may be limited by mechanical defoliation during the first year of establishment followed by restricting grazing to the driest parts of the year in the second and subsequent years.

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## STRESZCZENIE

Obecna tendencja w kierunku deintensyfikacji łąk w krajach Wspólnoty Europejskiej pozwala na utworzenie runi gatunkowo bogatych. W nowych systemach uprawy coraz większy użytek czyni się z gatunków w mieszkankach, które spełniają warunki odżywcze dla zwierząt, ich zdrowia oraz cele ochrony przyrody. Duża trwałość i wydajność tradycyjnie wysiewanych runi może być osiągnięta przez koszenie. Pod wpływem wypasu owiec wynik jest inny. Artykuł przedstawia wpływ defolacji, deptania i rozjeżdżania 16-tygodniowej runi. Wczesne wprowadzenie wypasu zwierząt może być niszczące dla trawiastych gatunków, które się dopiero pojawiają. Należy w takim wypadku stosować raczej koszenie oraz wprowadzać ograniczenia częstotliwości wypasu w drugim roku i kolejnych latach użytkowania.

Wydanie publikacji finansowane przez Komitet Badań Naukowych