

PERFORMANCE OF TIMOTHY (*PHLEUM PRATENSE* L.) AND MEADOW FESCUE (*FESTUCA PRATENSIS* HUDS.) IN MIXTURES WITH LUCERNE OR RED CLOVER

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ABSTRACT

Results on the botanical composition of timothy and meadow fescue from 14 field trials in south and central Sweden are presented. Each trial had three years of ley. Treatments were two or three harvests a year, and 0, 100 or 200 kg ha⁻¹ nitrogen per season. Three seed mixtures were used: a mixture of timothy and meadow fescue, and either lucerne or red clover mixed with timothy and meadow fescue.

The results show that there is a significant correlation between harvesting system and nitrogen application on the percentage of timothy and meadow fescue. At two harvests, the proportion of timothy had a significant increase compared to the proportion of meadow fescue, which had a significant decrease at nitrogen application. At three harvests and nitrogen application, the proportion of meadow fescue had a significant increase compared to the proportion of timothy. At no nitrogen application, the proportions of timothy and meadow fescue was not significantly different at two harvests compared to three harvests.

KEYWORDS

Phleum pratense L., *Festuca pratensis* Huds., nitrogen application, harvesting system, cutting frequency, botanical composition, persistence, competition

INTRODUCTION

Timothy and meadow fescue are the most important forage grasses in Sweden (in 1992-93, ca. 70% of the certified forage grass seed amount) and are often sown in mixtures with or without a legume. Timothy and meadow fescue have different growth characteristics, which gives them different properties when competing against each other. Especially when nitrogen is added, timothy initially has a higher competitive advantage over meadow fescue in the first growth, which may be explained by a higher proportion of reproductive tillers with leaves placed higher in the canopy (Jørgensen and Juntila, 1994). Meadow fescue, on the other hand, has a higher regrowth capacity, due to a higher number of tillers and more intact growing points, which is an advantage when more than one regrowth harvest is taken (Aase, 1979; Nissinen and Hakkola, 1995). The proportion between timothy and meadow fescue is important since timothy has a higher nutrient quality and a larger DM production than meadow fescue.

The aim of the trial was to investigate the performance of lucerne compared to red clover in a seed mixture with timothy and meadow fescue. In addition, harvesting systems and nitrogen application were included. The present paper has focused on the effects on the botanical composition of the yield.

METHODS

Field trials were conducted between the years 1982-1986 at five sites in south Sweden (55°40'N - 56°54'N) and seven sites in central Sweden (58°05'N - 60°23'N). The harvesting system was two harvests (S2), with average cutting dates on 15 June and 1 September, and three harvests (S3), with average dates on 5 June, 17 July and 1 September. Nitrogen rates per year were 0 (N0), 100 (N1) and 200 (N2) kg ha⁻¹. In treatment S2, nitrogen was equally spread in early spring and immediately after the first harvests, and in treatment S3, 40% of the nitrogen was given in early spring and 30% immediately after the first and second harvests. The seed mixtures were lucerne (*Medicago sativa* L.) cv Lesina 15 kg ha⁻¹, timothy (*Phleum pratense*

L.) cv Vanadis 5 kg ha⁻¹ and meadow fescue (*Festuca pratensis* L.) cv Svalöf sena 4 kg ha⁻¹ (A), red clover (*Trifolium pratense* L.) cv Hermes II (diploid) 7 kg ha⁻¹, timothy 10 kg ha⁻¹ and meadow fescue 7 kg ha⁻¹ (B), and timothy 14 kg ha⁻¹ and meadow fescue 10 kg ha⁻¹ (C).

The trials were supplied with 30 kg ha⁻¹ phosphorus and 100 kg ha⁻¹ potassium each spring. Harvested plot areas were about 15 m². Subsamples for botanical composition of species were taken treatment-wise.

The trials had a split-split-plot design with harvest system as main plot, nitrogen rate as split-plot and seed mixture as split-split-plot. There were two replicates. Least significant means and differences were determined on treatment-wise values using the GLM procedure in the SAS statistical package (SAS Institute, 1989). Results consist of weighted least significant means of the harvests of 14 first-year crops, 11 second-year crops and 8 third-year crops.

RESULTS AND DISCUSSION

Harvest system and seed mixture significantly influenced the percentage of meadow fescue and timothy, all years of ley. Nitrogen application significantly affected the percentage of timothy, but not the percentage of meadow fescue, all years of ley, consistent with previous findings (Jørgensen and Juntila, 1994). A significant correlation was found between harvest system and nitrogen application for the proportions of timothy and meadow fescue, all years of ley. Very few significant correlations were found between harvesting system or nitrogen application and seed mixture for the different ley years. In S2 compared to S3, in combination with nitrogen application, the proportion of timothy was significantly favoured and the proportion of meadow fescue was significantly unfavoured, all years of ley (Table 1). On the other hand, within ley years, the proportion of timothy was not significantly unfavoured in S3 as meadow fescue was in S2. This result is not consistent with Jørgensen et al., (1994) who report that meadow fescue became dominant under a two harvest system. Furthermore, Frame et al., (1973) reported an increasing contribution with time of timothy in mixture with meadow fescue cut four times. In S3 at no nitrogen application, results show that the proportion of timothy was unfavoured compared to meadow fescue with an increasing age of the ley (Table 1). According to Jørgensen and Juntila (1994), timothy has a lower shoot weight compared to meadow fescue, at no nitrogen application. At N0 within years of ley, the proportions of timothy and meadow fescue were not significantly different in S2 compared to S3.

In a young ley, the percentage of timothy and meadow fescue was significantly lower in the legume seed mixtures (Table 2). The percentage of timothy and meadow fescue was significantly higher in older leys in seed mixture B compared to A. The grass percentage in B approaches that in C, because red clover had a lower persistence than lucerne. In B, timothy plants seems to have a higher ability than meadow fescue to replace red clover plants that had died in older leys. In C, the percentage of timothy tends to decrease, and the percentage of meadow fescue to increase, with an older ley.

In conclusion, there is a strong correlation between harvest system and nitrogen application on the proportion of timothy and meadow fescue. At nitrogen application, the proportion of timothy is favoured

at two harvests and the proportion of meadow fescue is favoured at three harvests. On the other hand, the proportion of meadow fescue was clearly more negatively affected at two harvests than timothy at three harvests.

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Table 1

Botanical composition (%) of timothy (T), meadow fescue (MF), legume (L) and weeds (W) and total DM production (kg ha⁻¹) as least significant means of harvests and seed mixtures

| Year of ley | Nitrogen level | S2 | | | | | Total DM ^a | S3 | | | | | Total DM ^a |
|-------------|----------------|----|-----------------|----------------|----|-------|-----------------------|----|-----------------|----------------|-------|--|-----------------------|
| | | Tx | MF ^y | L ^v | W | | | Tx | MF ^y | L ^v | W | | |
| 1 | N0 | 27 | 27 | 39 | 8 | 8860 | 25 | 25 | 42 | 8 | 7510 | | |
| | N1 | 39 | 26 | 30 | 4 | 11360 | 29 | 32 | 33 | 6 | 9590 | | |
| | N2 | 45 | 24 | 26 | 5 | 12030 | 34 | 33 | 27 | 7 | 10440 | | |
| 2 | N0 | 25 | 32 | 37 | 6 | 9120 | 20 | 31 | 40 | 9 | 8440 | | |
| | N1 | 42 | 28 | 25 | 4 | 11050 | 23 | 40 | 31 | 6 | 9850 | | |
| | N2 | 53 | 23 | 20 | 5 | 12270 | 27 | 40 | 27 | 7 | 10650 | | |
| 3 | N0 | 25 | 29 | 36 | 10 | 8360 | 21 | 35 | 32 | 13 | 7680 | | |
| | N1 | 43 | 23 | 23 | 11 | 11550 | 25 | 39 | 26 | 9 | 9920 | | |
| | N2 | 52 | 15 | 22 | 12 | 12560 | 27 | 39 | 24 | 10 | 10930 | | |

^v The percentage of legumes is a mean of two seed mixtures with legumes and one seed mixture without legumes, cf. Table 2.

^x The LSD values at the 0.05 level of significance for comparing nitrogen levels within harvesting system are 7, 8 and 10 for first, second and third year leys, respectively. Corresponding values for comparing harvesting systems at the same or different nitrogen levels are 7, 9 and 12.

^y The LSD values at the 0.05 level of significance for comparing nitrogen levels within harvesting system are 6, 8 and 10 for first, second and third year leys, respectively. Corresponding values for comparing harvesting systems at the same or different nitrogen levels are 7, 9 and 10.

^z The LSD values at the 0.05 level of significance for comparing nitrogen levels within harvesting system are 660, 950 and 1490 for first, second and third year leys, respectively. Corresponding values for comparing harvesting systems at the same or different nitrogen levels are 810, 1010 and 1490.

Table 2

Botanical composition (%) of timothy (T), meadow fescue (MF), legumes (L) and weeds (W) and total DM production (kg ha⁻¹) as least significant means of harvests, harvesting systems and nitrogen levels

| Year of ley | Seed mixture | Species | | | | Total DM ^a |
|-------------|--------------|---------|-----------------|----|----|-----------------------|
| | | Tx | MF ^y | L | W | |
| 1 | A | 28 | 20 | 47 | 5 | 10550 |
| | B | 25 | 20 | 52 | 3 | 10750 |
| | C | 46 | 43 | 0 | 11 | 8600 |
| 2 | A | 21 | 21 | 54 | 5 | 11670 |
| | B | 33 | 26 | 36 | 5 | 10270 |
| | C | 41 | 49 | 0 | 9 | 8750 |
| 3 | A | 17 | 16 | 60 | 8 | 11490 |
| | B | 40 | 28 | 21 | 10 | 9890 |
| | C | 39 | 47 | 0 | 14 | 9110 |

^x The LSD values at the 0.05 level of significance for comparing seed mixtures are 3, 4 and 6 for first, second and third year leys, respectively.

^y The LSD values at the 0.05 level of significance for comparing seed mixtures are 3, 4 and 5 for first, second and third year leys, respectively.

^z The LSD values at the 0.05 level of significance for comparing seed mixtures are 410, 510 and 530 for first, second and third year leys, respectively.