Preliminary evaluation of perennial forage legumes for organic farming in Finland

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Abstract

In 1998-2001, 14 forage legume species (all together 24 varieties) were evaluated for their productivity in mixed organic swards. The aim was to find new alternatives for red clover. Yellow flowered lucerne (*Medicago falcata)* produced the highest dry matter yield (about 11 000 kg ha^{-1} $year^{-1}$). It is considered as a new potential forage legume to be studied also under grazing. Dry matter production of red clover (*Trifolium pratense)*, alsike clover (*Trifolium hybridum)* and lucerne (*Medicago sativa)* varied from 2 200 to 10 600 kg ha^{-1} $year^{-1}$. Alsike clover yielded about 10% less than the best variety of red clover. Goat's rue (*Galega orientalis)* increased its production during the second year (4 200-9 100 kg ha^{-1} $year^{-1}$). Surprisingly, circumstances were favourable also for birdsfoot trefoil (*Lotus corniculatus*), which yield variation (5 000-8 100 kg ha^{-1} $year^{-1}$) was close to that of white clover (*Trifolium repens*).

Keywords: *Trifolium pratense, Trifolium hybridum, Trifolium repens, Medicago sativa, Medicago falcata, Lotus corniculatus, Galega orientalis*

Introduction

In Finland, red clover (*Trifolium pratense*) is the most common forage legume. Its yield tend to decline in frequent cultivation due to root rot and *Sclerotia trifoliorum* (Ylimäki 1962). Bloating and phytoestrogen content may possess a problem for animals. A short and cool growing season (effective day degrees of 1200 ^{o}C and thermic growing season of 160 days in Central Finland) and a long snow cover (156 days) is a demand for most perennials. There is also a continous interest to find new alternatives for clovers. In two field trials in 1998-2001 were observed fodder ley legumes in mixed swards to find new legumes and best varietes for further investigations in organic grassland management in Finland.

Materials and methods

Two field trials were established in 1998 and 1999 in Eastern Finland (Juva 60°53′N 27°53′E). In the field trials were included red clover (*Trifolium pratence*, cv. 'Bjursele', 'Betty', 'Björn'), alsike clover (*Trifolium hybridum* cv. 'Frida', 'Jogeva'), white clover (*Trifolium repens*, cv. 'Jogeva', 'Sonja', 'Aberherald', 'Lena'), lucern (*Medicago sativa* cv. 'Vertus', 'Jogeva',' Algonguin', 'Peace'), yellow flowered lucerne (*Medicago falcata*, cv. 'Karlu'), Goat's rue (*Galega orientalis* Lam., cv. 'Gale'), birdsfoot trefoil (*Lotus corniculatus*, cv. 'Leo'), *Lupinus nootkatensis*, *Vicia sepium*, *Vicia cracca, Lathyrus Japonicus, Onobrychis viciefolia, Astragalus cicer* and *Melilotus officinalis*.
Harvesting system was two-cut system and the legumes were mixed with different mixtures of timothy (*Phleum pratense)*, smooth meadow-grass (*Poa pratensis*), tall fescue (*Festuca arundinacea*), orchard grass (*Dactylis glomerata*) and perennial ryegrass (*Lolium perenne*). Soil type was fine sand moraine and pH 5,6-6,6. Statistical design was randomized complete block with 1-2 replicates.

Results

Yellow flowered lucerne (*Medicago falcata)* produced the highest dry matter yield (about 11 000 kg ha^{-1} $year^{-1}$). It has produced as high yields also in a clay soil in Southern Finland (Mela *et al* 2000) and is considered as a new potential forage legume to be studied also under grazing (Sormunan-Cristian *et al* 2000). The mean dry matter yield of the best variety ('Algonguin') of lucerne (*Medicago sativa)* was almosta as high as of yellow flowered lucerne, but the variation was rather high (4 700 –9 500 kg ha^{-1} $year^{-1}$). Lucerne is sensitive for its' growing conditions in Finland.

The best variety of red clover (*Trifolium pratense)* was 'Bjursele', which is the most common variety used in Finland. New hybrid type variety 'Betty' had 600 kg ha^{-1} lower mean dry matter yield (7 500 kg ha year). Yields of alsike clover (*Trifolium hybridum)* varied from 4 700 to 9 300 kg ha^{-1} $year^{-1}$ and were in the same level as other red clover varieties than 'Bjursele'. Goat's rue (*Galega orientalis)* was also rather productive (4 200-9 100 kg ha^{-1} $year^{-1}$). Its' yield was higher in the second year and yields tend to increase, when it gets older. Goat's rue is 1-2 weeks earlier (Root and Syrjälä-Qvist 1993) and alsike clover is about one week earlier than red clover which helps the timing of harvest work.

Surprisingly, circumstances were favourable also for birdsfoot trefoil (*Lotus corniculatus*), which yield variation (5 000-8 100 kg ha^{-1} $year^{-1}$) was close to that of white clover (*Trifolium repens*). Mean dry matter yields of white clover were around 6 300 kg ha^{-1} $year^{-1}$ except variety 'Jogeva', which yielded 1000 kg ha^{-1} more. Birdsfoot trefoil is considered as a new promising pasture legume in Finland also because of its bloating prohibiting property (Dalrymple *et al* 1984)). *Lupinus nootkatensis, Vicia sepium, Vicia cracca, Lathyrus Japonicus, Onobrychis viciefolia, Astragalus cicer* did not manage at all. *Melilotus officinalis* disappeared after two winters.

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Table 1. Mean, maximum and minimum yields (kg ha^{-1} $year^{-1}$, dry matter) of mixed swards of different legume species and cultivars in two field experiments in Juva. (n = yields of two experiments with two replicates, 1-2 different grass mixtures / legume and two years)

Legume	n	Mean	Max	Min
Red clover ‘Bjursele’	16	8 130	10 570	6 360
Red clover ‘Betty’	12	7 460	9 040	6 400
Red clover ‘Björn’	12	5 970	7 900	2 160
Alsike clover ‘Frida’	12	7 240	8 330	5 780
Alsike clover ‘Jogeva’	12	5 840	7 720	5 000
White clover ‘Jogeva’	12	7 220	8 680	4 850
White clover ‘Sonja’	12	6 450	7 940	4 090
White clover ‘Aberherald’	12	6 140	7 930	4 150
White clover ‘Lena’	8	6 250	7 370	5 160
Yellow flowered lucerne ‘Karlu’	8	8 770	11 010	6 580
Lucerne ‘Vertus’	8	7 250	8 990	4 700
Lucerne ‘Jogeva’	4	6 870	7 960	5 620
Lucerne ‘Algonguin’	4	8 700	9 520	8 340
Lucerne ‘Peace’	4	6 600	8 380	4 690
Goat’s rue ‘Gale’	8	6 610	9 060	4 170
Birdsfoot trefoil ‘Leo’	8	6 190	8 140	4 970

Table 2. Yields (kg ha^{-1} cut^{-1}, dry matter) of mixed swards of different legume species and cultivars in two field experiments in Juva.

	Experiment 1, established 1998				Experiment 2, established 1999			
Legume / date of cut	6.7.99	30.8.99	4.7.00	30.8.00	10.7.00	23.8.00	3.7.01	16.8.01
Red clover ‘Bjursele’	4 430	2 970	5 530	2 150	6 870	2 410	6 980	2 460
Red clover ‘Betty’	4 370	2 460	5 690	2 330	4 290	2 770	6 030	1 900
Red clover ‘Björn’	3 510	2 390	4 100	1 980	3 140	1 570	5 580	1 600
Alsike clover ‘Frida’	4 200	2 230	5 290	1 740	5 940	2 280	6 120	1 170
Alsike clover ‘Jogeva’	3 840	2 070	4 090	1 480	5 090	1 560	5 080	1 060
White clover ‘Jogeva’	3 040	2 520	4 360	2 730	6 010	2 510	5 300	2 390
White clover ‘Sonja’	2 800	2 130	4 650	1 990	4 890	1 730	5 900	1 700
White clover ‘Aberherald’	3 090	2 150	3 880	1 830	4 590	1 730	5 460	1 820
White clover ‘Lena’	3 700	2 130	4 710	1 960				

Yellow flowered lucerne ‘Karlu’	4 050	2 610	5 670	3 520	7 510	3 360	5 690	2 670
Lucerne ‘Vertus’	3 670	2 490	4 860	3 140	5 240	2 700	4 970	1 910
Lucerne ‘Jogeva’	3 910	2 170	4 780	2 880				
Lucerne ‘Algonguin’					5 750	3 250	5 540	2 850
Lucerne ‘Peace’	3 220	1 990	4 490	3 490				
Goat’s rue ‘Gale’	3 570	1 490	5 840	1 990	4 590	1 930	5 050	1 960
Birdsfoot trefoil ‘Leo’	3 410	2 100	4 550	2 110	4 790	2 030	4 150	1 730