Preliminary evaluation of annually cultivated forage legumes for organic farming in Finland

P. Nykänen-Kurki[(1)], P. Leinonen[(2)] and A. Nykänen[(3)]
[(1)]MTT Agrifood Research Finland, Ecological Production, Karilantie 2A, FIN-50600 Mikkeli
[(2)]Elomestari Ltd., Huttulantie 1, FIN-51900 Juva
[(3)]MTT Agrifood Research Finland, Ecological Production, Huttulantie 1, FIN-51900 Juva

Abstract

In Finland, the most common legume in organic farming is *Trifolium pratense,* which cultivation needs to be broken regularly to maintain high productivity. Use of annuals also decreases peaks of field work and increases open field area for manure. In 1998-2001, 19 forage legume species *(Lupinus albus, Lupinus angustifolius, Lupinus luteus, Medicago littoralis, Medicago scutellata, Melilotus albus, Melilotus officinalis, Pisum arvense, Pisum sativa, Trifolium alexandrum, Trifolium hybridum, Trifolium incarnatum, Trifolium repens, Trifolium resupinatum, Trifolium subterraneum, Vicia faba, Vicia pannonica, Vicia sativa* and *Vicia villosa)* were evaluated at two sites of Eastern Finland (Mikkeli and Juva). One variety per species was included but three varieties of *Trifolium repens* (AberHerald, Espanso and Gigante) and four varieties of *Pisum* sp. (Arvika, Lisa, Sunna and Timo) were tested. Species were studied for their annual productivity in pure stands and in mixtures with cereals (barley and oats) and Italian ryegrass. Swards were cut either twice or once (whole grain silage stage of barley). *Vicia* and *Pisum* were most promising genera for further studies under cutting. Content of seed mixture under grazing needs more consideration. Representatives from genera *Vicia* and *Trifolium* will be in the first place for investigation.

Key words: *Lupinus, Medicago, Melilotus, Pisum, Trifolium, Vicia*

Introduction

Organic farming is based on a versatile crop rotation, in which legumes are a promotor of forage production and soil fertility. In Finland, that promotor is most often red clover grass mixture (Nykänen-Kurki *et al*., 2000). But red clover content of swards may decline already in the second year due to *Sclerotinia trifoliorum,* which sclerotia can maintain its viability for six to seven years in soil. Pathogen will not be destroyed but remarkably weakened by crop rotation, where red clover cultivation is broken regularly (Hannukkala 1999). There is also a need to decrease peaks of field work due to different harvesting time of annual forage production compared with perennial swards. Annual cultivation increases open field area for manure, too. Potential of 19 annually cultivated legume species for further research in Finland are discussed.

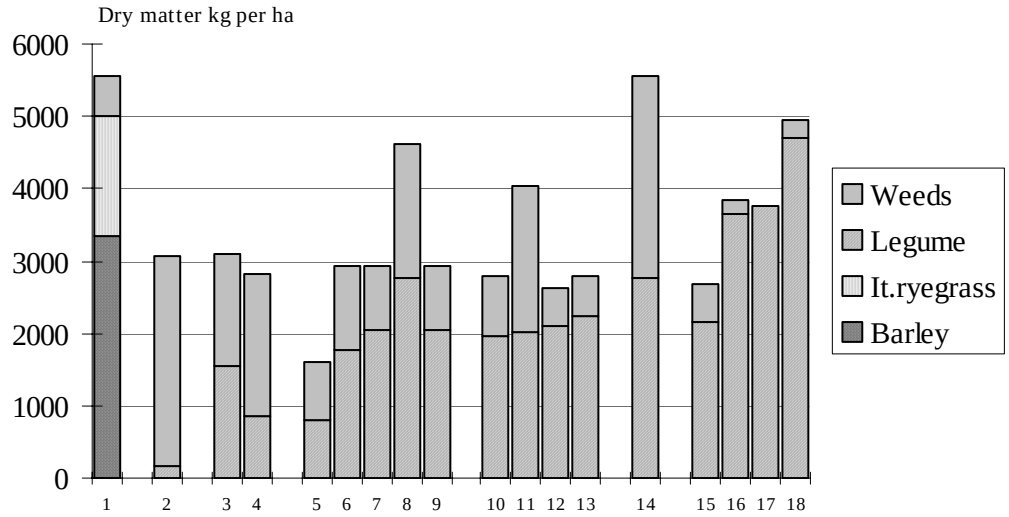
Materials and methods

In 1998-2001, 19 forage legume species *(Lupinus albus, Lupinus angustifolius, Lupinus luteus, Medicago littoralis, Medicago scutellata, Melilotus albus, Melilotus officinalis, Pisum arvense, Pisum sativa, Trifolium alexandrum, Trifolium hybridum, Trifolium incarnatum, Trifolium repens, Trifolium resupinatum, Trifolium subterraneum, Vicia faba, Vicia pannonica, Vicia sativa* and *Vicia villosa)* were evaluated at two sites of Agrifood Research in Eastern Finland (Mikkeli 61°40’N, 27°10’E and Juva 60°53′N 27°53′E). Following varieties were used: Kuusiku (*Melilotus albus*), Arvika, Lisa, Sunna and Timo (*Pisum* sp.), Frida (*Trifolium hybridum*), Contea (*Trifolium incarnatum*), AberHerald, Espanso and Gigante

Lodigiano (*Trifolium repens*), Accadia (*Trifolium resupinatum*), Kontu (*Vicia faba*), Ebena (*Vicia sativa*), Viola (*Vicia villosa*). Species were sown in the beginning of June on fine sand moraine with pH of 5,6-6,6 in Juva and on coarser fine sand with pH of 6,3 in Mikkeli. Statistical design was randomised complete block with 1-2 replicates. Species were studied for their annual productivity in pure stands and in mixtures with cereals (barley and oats) and Italian ryegrass. Swards were cut either twice or once (whole grain silage stage of barley).

Results and discussion

Vetches produced the best dry matter yield among pure sown legumes in Mikkeli (Figure 1). Yield of common and hairy vetch averaged 3700 kg ha^{-1} and their mixture 4500 kg ha^{-1}. That of Ladino type white clover *cv.* Gigante Lodigiano and Melilotus officinalis averaged 2780 kg ha^{-1}. Dry matter production of other *Trifolium* species averaged 2000 kg ha^{-1}. *Lupinus* did not work at all. *Chenopodium album* and *Elymus repens* dominated among weeds.

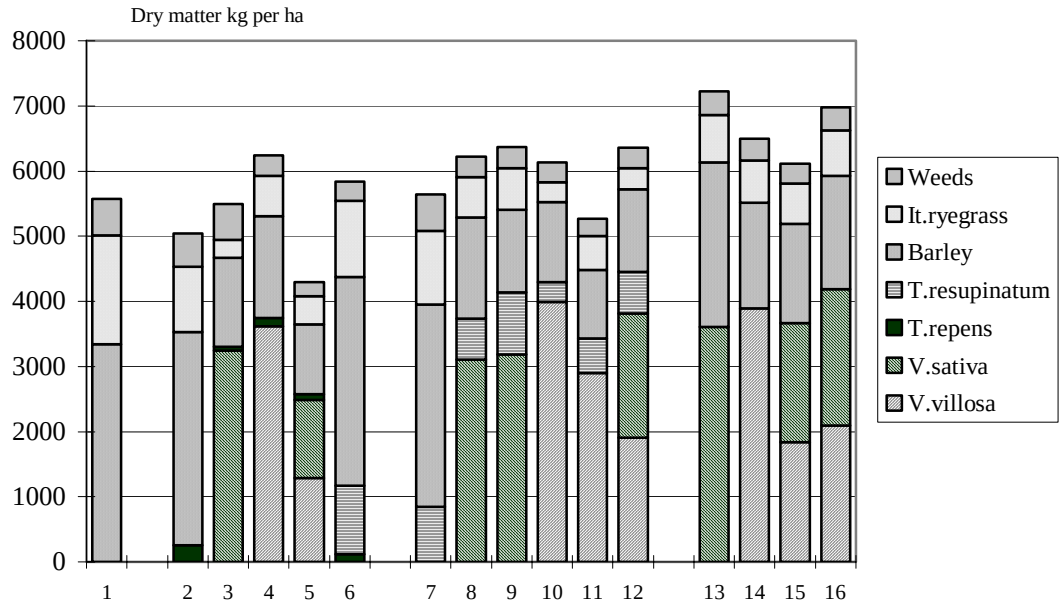


1= Control 2= *Lupinus albus* 3= *Medicago scutellata* 4= *Medicago littoralis* 5= *Trifolium repens* Huia 6= Espanso 7= AberHerald 8= Gigante Lodigiano 9= *T.incarnatum*+AberHerald 10= *Trifolium subterraneum* 11= *Trifolium alexandrum* 12= *Trifolium resupinatum* 13= *Trifolium incarnatum* 14= *Melilotus officinalis* 15= *Vicia pannonica* 16= *Vicia sativa* 17= *Vicia villosa* 18= *V.sativa+villosa*

Figure 1. Dry matter of pure sown annual legume stands in Mikkeli, 12 August, 1999.

Barley was producing in early summer and controlling weeds efficiently with Italian ryegrass. Italian ryegrass was needed as a companion for legumes in autumn. Vetches were dominating also in multi legume mixtures (Figure 2). In agreement with results from dairy cow (Kuusela *et al.* 2000) and lamb pasture trials (Sormunen-Cristian *et al*. 2002) barley Italian ryegrass vetch mixtures produced the best dry matter yield also under cutting (Figure 2). Their total yield averaged 6760 kg ha^{-1} and legume yield 3960 kg ha^{-1}. Legume production did not differ between common vetch, hairy vetch and mixture including both vetches. Increasing number of legumes seemed to improve neither legume nor total dry matter production. White clover developed too slowly to give a remarkable contribution to mixture (at the highest 250 kg ha^{-1}). The best contribution of Persian clover was 960 kg ha^{-1} (Figure 2). In one cut silage system, dry matter production averaged 5300 kg ha^{-1} in barley Italian ryegrass pea and in barley Italian ryegrass vetch mixtures (Figure 3). Legume production in the best pea mixture was

even better (3210 kg ha^{-1}) than that of the best vetch one (2520 kg ha^{-1}). Hairy vetch was productive still in autumn (Figure 3).



1= Control 2= *T. repens* Gigante Lodigiano 3= Gigante+*V.sativa* 4= Gigante+*V. villosa*
5= Gigante+*V.sativa*+*V. villosa* 6= Gigante+*T. resupinatum* 7= *T. resupinatum* 8= *T. resupinatum*+*V. sativa*
9= Gigante+*T. resupinatum*+*V. sativa* 10= *T. resupinatum*+*V. villosa* 11= Gigante+*T. resupinatum*+*V. villosa*
12= Gigante+*T. resupinatum*+*V. sativa*+*V. villosa* 13= *V. sativa* 14= *V. villosa* 15= *V.sativa*+*V.villosa*
16= *V.sativa*+*V.villosa*

Figure 2. Dry matter of annual multi seed mixtures in Mikkeli, 12 August 1999 .

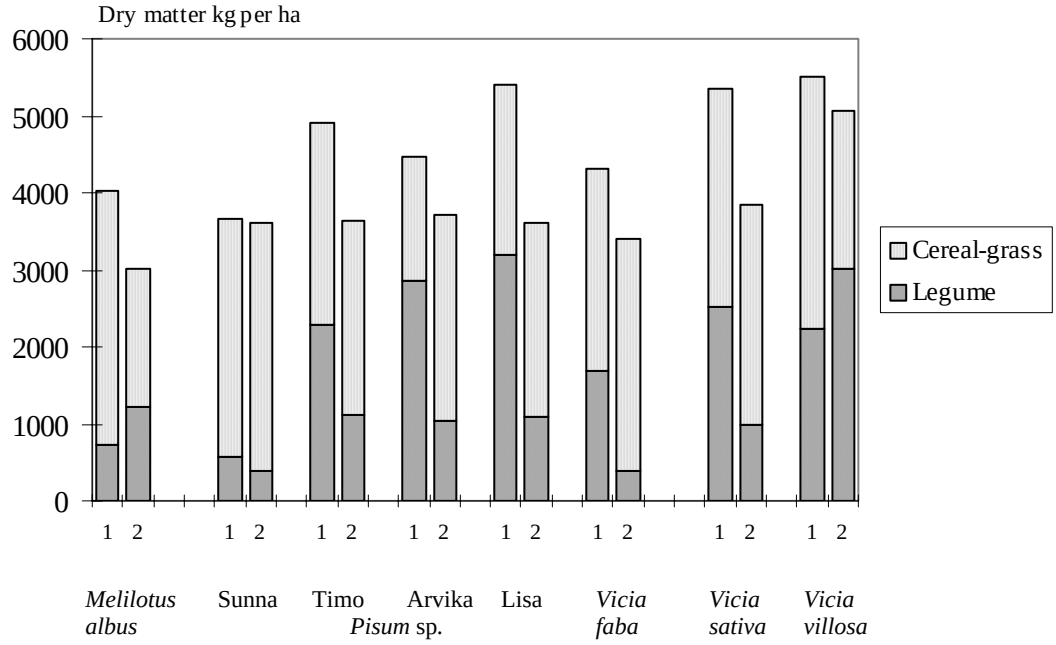


Figure 3. Dry matter of annual cereal Italian ryegrass legume mixtures in Juva in 2000. 1 = a cut on 17 August. 2 = cuts on 18 July and 25 September.

Conclusions

Cereal Italian ryegrass mixture performed well as a basis of all mixtures. *Vicia* and *Pisum* were most promising genera for further studies on annual forage production under cutting. Under grazing, contribution of mixture needs more consideration. Representatives of genera *Vicia* and *Trifolium* will be in the first place for the investigation.

References

Hannukkala, A. (1999). Apilan ja nurmipalkokasvien taudit. (Diseases of clover and other forege legumes). Tieto tuottamaan 84: 43-46. In Finnish.

Kuusela, E. and Nykänen-Kurki, P. (2000). Annual legume/grass pastures for organic dairy farming. Grassland Science in Europe 5: 545-547.

Nykänen-Kurki, P., P. Leinonen, E. Kuusela, A. Nykänen, R. Sormunen-Cristian and A. Granstedt (2000). Special features of organic grassland production. Publications of Agricultural Research Centre of Finland. Serie A 67: 97-105. (Abstract in English).

Sormunen-Cristian, R., P. Nykänen-Kurki and P. Leinonen (2002). Common vetch, hairy vetch, Ladino white clover and Persian clover in annual sheep pastures. In this publication.