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CLOVER CONTENT AND YIELD OF SWARDS ON ORGANIC FARMS - MAINTENANCE AND ESTIMATION.

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Abstract

Grassland production based on legumes is an essential part of the productivity and economy of the organic farming systems. The clover content is an important factor in organic grassland management to optimize the yield, feed value and pre-crop effect of ley.

The ley yield and clover content of one-, two- and three-year-old leys were determined on eight organic farms in 1998. Two-year-old leys produced the highest (6500 kg ha^{-1} dm) and three-year-old leys (4900 kg ha^{-1} dm) the lowest yields, with no significant differences between one- and two-year-old leys. The clover content (20-80% of dm) diminished to the same extent as the yields.

Because the ley samples from the organic farms gave strong evidence of decreasing yield level and clover content in the 3-year-old leys, we started to develop a technique to maintain the ley productivity in older swards. This technique includes oversowing of clover in the spring of the second ley year and utilization of lime-pelleted, pre-inoculated seed. Lime-pelleted, pre-inoculated clover seed oversown at different times in spring were compared with the aim of developing an oversowing method for Finnish conditions. The preliminary results do not show any differences, but studies are ongoing.

Key words: clover, organic farming, leys, oversowing

Introduction

Grassland production based on legumes is an essential part of the productivity and economy of the organic farming system. Proper management of grass legume swards is the key element for self-sufficient fodder production at the farm level (Granstedt 1995). The clover content of swards is an important factor in gaining nitrogen from atmosphere for the field and the farm. On Finnish organic farms the most common way of maintaining a high soil productivity is to grow perennial red-clover-timothy leys.

The optimal feeding value, higher yield and preceding crop effect in the older leys can be maintained by oversowing clover on the sward. Reseeding is facilitated by a strip rotovator (Hakkola 1995). Some farmers have sown clover on existing swards in early spring, but their benefits have been incidental. Although oversowing is a common practice in southern climates - for example in New Zealand (Jones and Thomas 1965, Wrightson Nutrition 1997) and pelleting methods are well-documented - there are no methods available for Finnish conditions.

Materials and methods

Field trials were conducted to study the variation of the yield level and clover content of 1-, 2- and 3-year-old leys. In 1998, we sampled ley from 8 organic farms twice in a growing season. Three fields per farm were included: 1-, 2- and 3-year-old-leys. Four representative ley samples (0.25 m^2) from each field were cut twice in a summer. The dry matter yield and the clover content as well as the total nitrogen content of the yield were measured.

Data on farm samples were analysed by complete randomised block design where each farm represented one block. The fields of certain farms were more alike than those of other farms. The analyses were made by the GLM procedure of the SAS software (SAS Institute Inc. 1989). Comparison of means was done using Tukey's T-test.

Field trials were established in 1998 on six farms (conventional and organic) to study the effect of pelleted, pre-inoculated clover seed on clover establishment and clover persistence in the sward. Two different seed treatments, inoculation and pelleting, with a non-sown control resulted in 12 plots per trial. The trials were cut twice per season and investigated for two years. Overwintering, clover density (plants m^{-2}) and yield were determined.

Results

The ley age trial on farms indicated that the highest yield was achieved from the 2-year-old leys in the first cut ($p<0.05$) but in the second cut there were no statistically significant differences (Figure 1). The total yield (cuts 1 and 2) was 6 200 kg/ha (dm) in the 1-year-old ley, 6 500 kg/ha (dm) in the 2-year-old ley and 4 900 kg/ha (dm) in the 3-year-old ley. The yields were higher in the second cut. The variation between fields and farms was also quite great. Previous investigations have shown that clover content and yield level of red-clover-grass leys decrease as the leys get older, the decline starting already after the first year of ley (Salonen and Hiivola 1963, Fagerberg and & Ekbohm 1995, Granstedt and Baeckström 2000). Heavy machinery and cattle may cause injuries to the clover plant followed by winter damage. Other reasons for poor overwintering of clovers in the northern countries according to Ylimäki (1962) include unfavourable weather conditions, such as soil frost heaving, standing water and ice on the surface of the ground.

The clover content was clearly lower in the 3-year-old ley than in the other leys (Figure 2). This difference was statistically significant in the first cut but not in the second cut. The average clover contents were 47%, 55% and 29% in the 1-, 2- and 3-year-old leys, respectively. The variation between fields and farms was great. Usually the clover content increases from the first to the second cut and may even be too high for the nutritional requirements of cattle. However, in our samples the clover content was higher in the first cut than in the second. The growing season before the second cut was wet and cool, which gave good growing conditions to grasses. The development and growth of red clover is normally slow at the beginning of the growing season, which explains the usual lower clover content in the first cut. The total nitrogen content between leys of different ages did not differ statistically or practically.

Oversowing of clover onto a grass sward in 1998 had no effect on the yield and clover density. In 1999, the oversown plots had approximately 10-30 clover plants /m^2 (Figure 3). Oversowing resulted in a slightly greater numbers of clover plants /m^2 compared to non-sown plots. There were no differences in yield between non-sown and over-sown plots. The difference between the years and farms was remarkable and we assume that weather conditions, as well as the timing of oversowing are critical.

Discussion

From the economic point of view it would be feasible to maintain a ley for three years. Based on our results and farmers' experience, there are still problems in reaching this. One technique is oversowing of clover in the spring of the second-ley year. Choise of an optimal variety of red clover or other clover species which may have better overwintering properties is important as well as developing techniques to include annual legume fodder crops in crop rotation, replacing the poor clover establishment in older clover leys.

Rapid estimations of clover content and yield of a ley in the field are required in farm studies. Traditional botanical analysis is time consuming, and a representative estimate of the yield and clover content requires more than 10 samples per field. The 'rod-point' technique presented by Little and Frensham (1993) is based on the proportion of clover "touches" of a rod thrown 100 times across the field seems to be a rapid alternative. However, it does not give the clover content of the DM yield. Many simple methods for yield estimation are available, but they need calibration.

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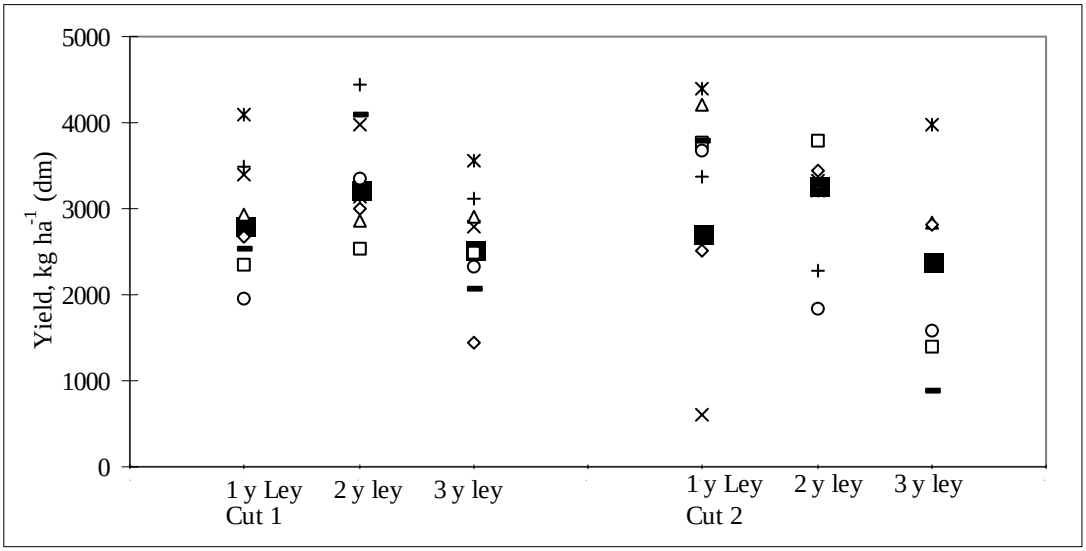

Figure 1. Yields (kg/ha dm) of leys of different ages on organic farms in 1998. (■ = median, other symbols = different farms, dm=dry matter)

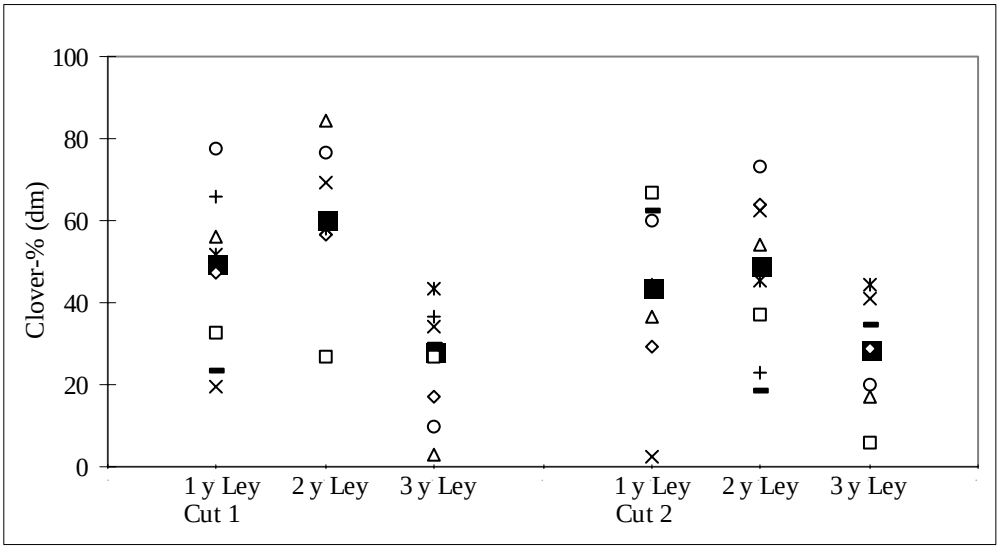

Figure 2. **C**lover contents of leys of different ages on organic farms in 1998. (■ = median, other symbols = different farms, dm=dry matter).

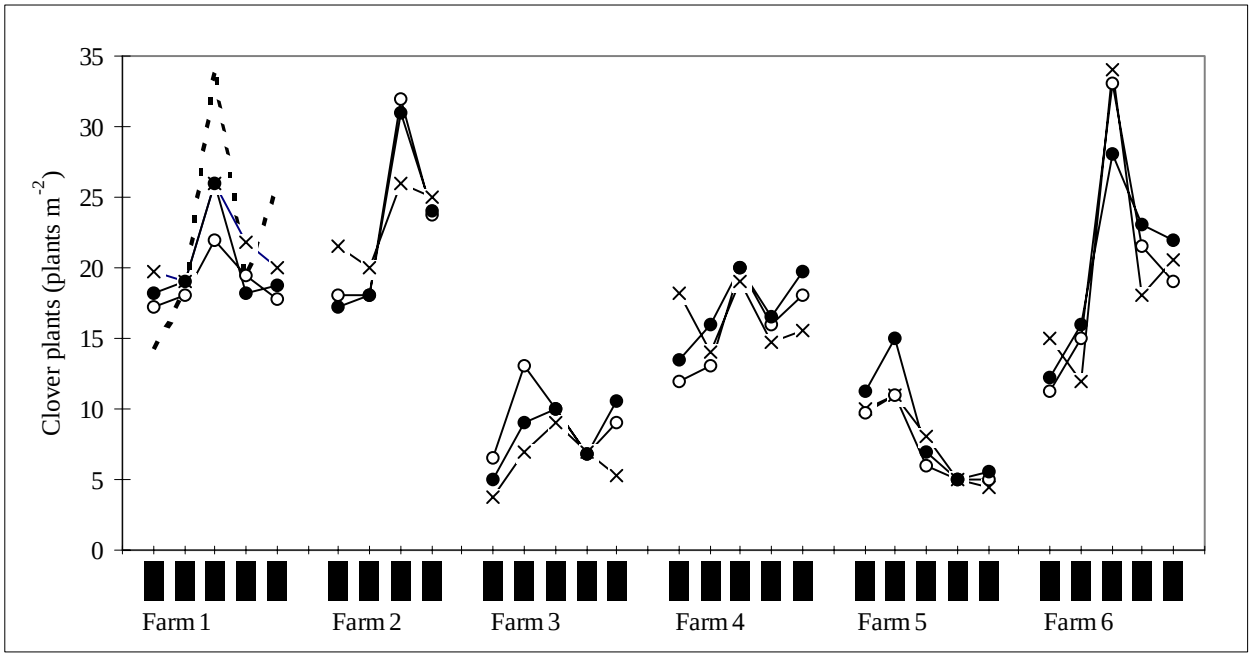

Figure 3. Numbers of clover plants on different farms in 1998 and 1999. Dates of counting: 98_1: 21.5., 98_2: 15.7., 99_1: 12.5., 99_2: 5.7., 99_3: 2.9. (× = no clover seed, o= plain clover seed, • = pelleted + inoculated seed, --- = light harrowing with seeding).