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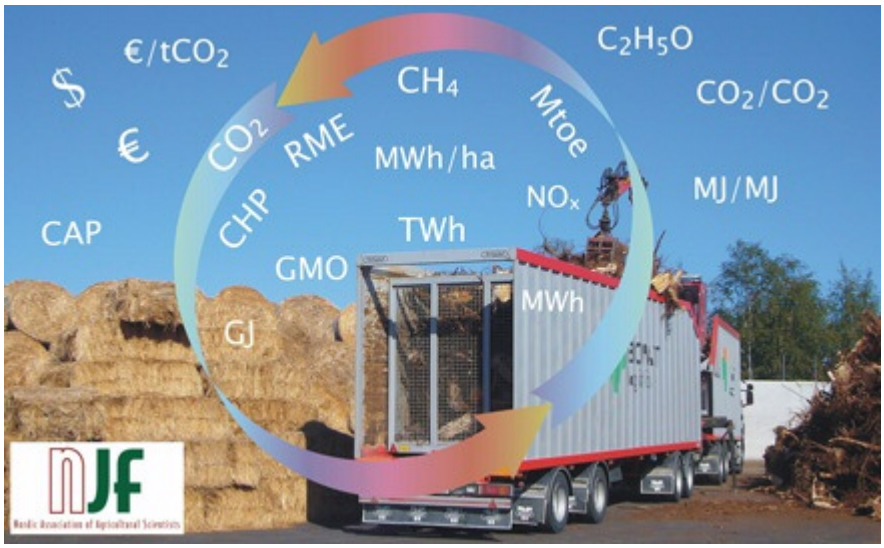

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Undersown catch crops as a source of biomass for energy

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Introduction

In northern latitudes Italian ryegrass (*Lolium multiflorum*) has been studied as a catch crop undersown in spring cereals in order to prevent nitrogen leaching in the autumn (Lemola et al. 2000, Känkänen et al 2003). The above ground biomass production of Italian ryegrass (IRG) after cereal harvest has been assessed when no nitrogen fertilizers was applied after the cereal crop. Therefore those studies likely underestimate the production ability of IRG. However, as high as 2330 kg DM ha^{-1} above ground biomass of IRG and 3590 kg DM ha^{-1} of *Trifolium resupinatum* and *T. hydbridum* mixture was reported in Southern Finland (Kauppila 1985). In southern latitudes undersown IRG is used in forage production. In Denmark the spring sown whole crop cereals are normally undersown and 2-2,5 tonnes grass is grazed or harvested in the autumn (Kristensen, 1992). Nissinen (1991) has shown that IRG is particularly well suited for production in the late summer while it produced from 60 to 105 kg DM ha d in Lapland. Nissinen (1991) estimated that in August IRG produced from 9.2 to 9.7 kg DM d^{-1} per each day degree above +5 ^{o}C.

Global warming is anticipated to make autumns warmer and this could increase the feasibility of harvesting IRG catch crop yield for energy or feed after the cereal harvest also in northern Europe. In addition, harvesting spring cereals for whole crop cereal silage would increase this possibility while the cereals would be harvested earlier than when harvested for grain. The objective of this study was to estimate the yield of IRG after the harvest of barley for whole crop silage in Finnish conditions. The biomass could be utilized e.g. for bioenergy production in biogas plants.

Material and methods

The data set for the study was obtained of the official Finnish variety tests on IRG and barley (*Hordeum vulgare*) when results were obtained from same growing season. However, IRG and barley were not in the same trial. Results were obtained from 74 experiments from six trial sites in Finland in 1977-2000. Results of early barley cultivars were used while only early cultivars are cultivated in the Central and North Finland from where most IRG results were obtained. We estimated the yield IRG produced after the full maturity (yellow ripeness) of early barley cultivars.

Results

The average date for sowing IRG was 20.5., and 17.7. for the first cut and 30.9. for the last cut. The average barley sowing date was 18.5. Yellow ripeness was reached on average on 13th of August. One or two cuts of IRG were taken after harvest of barley. The estimated dry matter (DM) yield of IRG after full maturity of barley ranged from 2150 to 4190 kg DM ha^{-1} and was on average 3170 kg DM ha^{-1} (sem=184 kg DM ha^{-1}). Average harvested grain yield of the early barley cultivars used in the study was 3880 kg ha^{-1} .

Discussion

The results suggest that a high yield could be obtained from undersown IRG after harvest of whole crop cereal silage. However, the used estimation probably overestimates the IRG yield while the undersown IRG stand would not be as strong right after cereal harvest than a forage production IRG stand used in the study. Undersown IRG may also decrease cereal seed yield by 450-600 kg ha^{-1} (Känkänen, 2001). Sowing IRG at the same time of spring cereals does not require high additional resources (Känkänen et al. 2001). Use of catch crops would result to better utilisation of fertilizer and particularly slurry nutrients in autumn. Esala (1991) showed that in spring wheat cultivation the recovery of in spring ^{15}N applied nitrogen was 15-25% in the dry summer and about 60-70% at best in summers with amble moisture conditions. IRG would need an additional nitrogen fertilizer application after cereal harvest to achieve its full yield potential. Use of legumes as undersown crops might be better in energy balance point of view. Yield of catch crops would produce suitable biomass for biogas refineries adding substantial amount to animal manure which might be the main biomass source for biogas production. Total acreage in barley and oat cultivation in Finland was 918 000 ha in 2006. Economic and energy balance studies would be needed to estimate the feasibility of this bioenergy production possibility.

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