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Resource effective control of Elymus repens

B. Ringselle[1], L. Andersson[1], G. Bergkvist[1] and H. Aronsson[2]

[1]Department of Crop Production Ecology, Swedish University of Agricultural Sciences, Box 7043, 750 07 Uppsala (bjorn.ringselle@slu.se), [2]Department of Soil and Environment, Swedish University of Agricultural Sciences, 750 07 Uppsala

Implications

Preliminary results show that there is room for improvement within existing control methods of couch grass (*Elymus repens* (L.) Gould). It may be possible to reduce the number of stubble cultivations during autumn by timing the treatment, and to reduce the cultivation depth by using a goose foot cultivator (5 cm) instead of a disc cultivator (10 cm), without sacrificing couch grass control efficiency. The first year of the experiment, the use of a goose foot cultivator resulted in less nitrogen leaching than cultivation by disc. A reduced number of stubble cultivations potentially reduces nutrient loss, fuel consumption and the workload of the farmer.

Our experiments with cover crops to control couch grass in cereals has yet to prove significant effects on couch grass control, but cover crops combined with goose foot hoeing did reduce nitrogen leaching by more than a third compared to cultivation by disc. Further data is necessary to see if the system can be used to effectively control couch grass without significant yield losses. Regardless, it can reduce nitrogen leaching and potentially provide other ecosystem services, e.g. control weeds other than couch grass.

Background and objectives

Developing new tools to manage weeds and pests is imperative to be able to create a sustainable agriculture. However, it is equally important to improve existing methods for better control and better resource management. This is especially true for the control of perennial weeds that without herbicides often require extensive mechanical control measures.

Couch grass (*Elymus repens*) is a perennial grass weed which causes yield losses in temperate areas. Once established in a field it spreads quickly through underground rhizomes. It is controlled either with glyphosate, or repeated stubble cultivations to fragment and starve the rhizomes.

The mechanical control methods have negative environmental and economic effects, such as increased nitrogen leaching, soil compaction, fuel costs and workload of the farmer. The aim of the project is to develop methods where couch grass is controlled without using herbicides and with insignificant nitrogen leaching.

More specifically we test the hypotheses that perennial ryegrass and red clover cover crops under-sown in spring barley/oat reduce couch grass growth during autumn (1), reduce nitrogen leaching (2) and that mowing in autumn will further reduce couch grass growth (3). Moreover we tested if two stubble cultivations during autumn were significantly better for couch grass control than one time-optimized stubble cultivation (4) and if nitrogen leaching is smaller after cultivation with a goose foot cultivator (5 cm depth) than with a disc cultivator (10 cm depth), with similar effect on couch grass (5).

Key results and discussion

The competitive effect of cover crops in cereals on couch grass has been studied with varying results. Often it significantly reduces couch grass (e.g. Cussans 1972, Melander et al. 2005, Bergkvist et al. 2010), but not always (e.g. Brandsaeter et al. 2012) and the yield reducing effect differ among studies. The size of the competitive effect of the cover crop depends on weather (Melander 2005) and management, but also on cover crop species. E.g. Red clover (*Trifolium pretense*) is beneficial in some aspects (e.g. it can fix

nitrogen to the benefit of the subsequent crop), but it may not be ideal for controlling couch grass, since it is a poor competitor for nitrogen.

In our experiments we have yet to see a significant reduction of couch grass shoots or rhizomes for any of the cover crop treatments compared to the control. However, cover crops combined with goose foot hoeing reduced nitrogen leaching by almost a third compared to traditional disc cultivations after harvest. The lack of significant results for the control of couch grass could be because the competitive pressure was not high enough in the experiments. The first experimental year, 2011, was quite dry and the cover crops did not establish very well. Since 2012 was a better year for cover crop growth, we will get results from better conditions as well. The interaction between cover crops and mowing did result in an interesting, but unsignificant reduction of couch grass shoots when ryegrass was combined with two mowings. Overall mowing twice did result in a small (about 27%) reduction in couch grass shoots in the follow-up year.

There was no significant difference in the amount of rhizome and shoot abundance in the subsequent crop between using one time-optimized stubble cultivation directly after harvest and doing one directly after harvest and repeating it again 20 days afterwards. This contradicts the general recommendation that repeated stubble cultivation is always preferred (e.g Håkansson 1974) when weather conditions allow. The single stubble cultivation did result in couch grass re-growing shoots during autumn. This could be problematic in years when the autumn is long and mild, but could potentially make control more effective in other years if the shoots are killed in winter.

Treatments with goose foot cultivator significantly reduced shoot abundance the subsequent year compared to the control (unlike the disc cultivator in this experiment). One goose foot cultivation resulted in less nitrogen leaching than two goose foot or two disc cultivations. The goose foot cultivator may not be able to replace the disc cultivator in all conditions (e.g. due to soil type restrictions), but further experiments will hopefully illuminate whether it could be a suitable control method of couch grass under some circumstances.

How was work carried out?

Three experiments, each lasting two years, started in 2011 (results presented here) and repeated with start 2012. Exp. 1 and 2 were conducted at three different locations in Sweden and Exp. 3 at one site, all with four replicates in randomized complete blocks. In Exp. 1 the effect of mowing was investigated in main-plots and cover crops in sub-plots. In Exp. 2 stubble cultivation was conducted at different times in relation to harvest of spring barley/oat as the single factor. In Exp. 3, using separately tile-drained plots, the effect of different combinations of tillage and cover crops on N-leaching and couch grass was investigated. Measurements taken were e.g. abundance of couch grass shoots, aboveground biomass (cover crops and couch grass), rhizome biomass, soil mineral nitrogen (Exp. 1 and 3) and N-leaching (Exp. 3).

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