11th EWRS (European Weed Research Society) Symposium 1999, Basel

Weed control in organic crop rotations for grain production

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The common organic farming system in Denmark is based on fodder crops, including grass-clover in the rotation in combination with dairy production. Stockless arable farming and production of pork and eggs in Danish organic farming is expected to increase, with a subsequent increase in the fraction of cereals and pulses in the crop rotations. Without the diversified crop rotations, preventive measures against weeds and weed control will become more difficult and the crops will be more dependent on import of nutrients from outside the farm. Catch crops will also play a role to minimise nutrient losses by leaching. The effects of different crop rotation elements on yield, nutrient leaching, weed infestation and soil nutrient availability are investigated in a long-term experiment carried out in Denmark since 1997 (Olesen et al., 1998).

Four different four-year crop rotations are compared at four different soil types. All crops in all rotations are represented each year. There are two replicates. Three factors are included in the experiment in a factorial design:

1. Fraction of grass-clover and pulses in the rotation (crop rotation).
2. Catch crop (without or with a catch crop of ryegrass or bi-cropped clover).
3. Fertiliser (without fertiliser or with animal manure as slurry).

Weeds in cereals and pulses without undersown catch crops are controlled by weed harrowing with spring tine weeders. On the lighter soil types, where the weed infestation is worst, the wheat is sown at double normal row distance and hoed mechanically. Large perennial weed plants (i.e. *Cirsium arvense* and *Artemisia vulgaris*) are removed by hand weeding. *Elymus repens* is controlled if present by repeated stubble cultivation after harvest in treatments without catch crops. The sugar beets are kept weed-free by a combination of pre-emergence flaming, mechanical and manual hoeing and hand weeding of large weeds.

In the first two years of the experiment, there were no differences in weed flora (species, numbers and biomass) within sites pertaining to crop rotation, but a tendency towards lower weed infestation in cereals without catch crops, where weed harrowing or hoeing had been performed. There was generally a larger weed biomass in the winter wheat compared with the other crops. There were more weeds (numbers and biomass) in the fertilised plots, in the winter wheat the tendency was significant at some sites. The crop biomass was also largest in the fertilised treatments. *E. repens* was found in 40-50% of the winter wheat plots on three locations in 1998, but not in as high a frequency in the other crops. *C. arvense* occurred at one location in some plots of all cereal crops in 1998. After harvest it had disappeared from nearly all of the plots with the treatment: catch crop, but only from very few of the plots with the treatment: no catch crop.

At this early stage, it is not possible to draw conclusions about the effect of the crop rotations on the weed flora. The catch crops seem to aid in reducing the occurrence of *C. arvense* in the cereals. But the undersown catch crops also reduce the possibilities of mechanical control of annual weeds in the cereals, resulting in a tendency of more weeds in treatments with catch crops. Fertiliser seems to enhance the weed biomass as well as the crop biomass.

A list of references cited is available on request.