EFFECTS OF FAT HEN AND BROAD-LEAVED DOCK ON CEREAL YIELDS

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Summary. Field experiments tested the effects of broad-leaved dock, *Rumex obtusifolius*, and fat hen, *Chenopodium album*) seedlings on yields of wheat and barley, and of root regrowths of broad-leaved dock on yields of wheat. Fat hen seedlings reduced the yields of wheat and also of barley, but only when barley was sown at half the recommended rate. Dock seedlings had no effect on the yields of either wheat or barley. Regrowth from dock roots had more effect on wheat yields than seedlings of either species, confirming that dock roots surviving pre-sowing cultivation are a threat to cereals grown without herbicides.

INTRODUCTION

Increasing enthusiasm for cereals grown without herbicides and conventional fertilisers has renewed interest in the effects of weeds. At Flock House Agricultural Centre, on a small farm managed along 'organic' principles, broad-leaved dock has become a major problem, especially in the cropping phase of pasture/crop rotations, because of its regrowth from roots left in the soil after cultivation. Although docks look unsightly in crops, their effects on crop yields is unknown. This work was initiated to examine the effects of dock seedlings and root regrowth on cereal yields. Fat hen, a common cereal weed, whose effects on cereal yields have been reported previously (3,4), was included in the experiments for comparison.

METHODS

Three experiments were carried out, one testing the effects of seedlings of broad-leaved dock and fat hen on spring wheat sown in October 1990, the second testing the effects of the same weed seedlings on barley sown in early November 1991, and the third testing the effects of broad-leaved docks regrowing from roots on wheat sown in October 1992.

In the first two experiments, relatively weed-free crops were established by using a soil sterilant (dazomet) before planting. After the crop was drilled, weed seeds which had been collected the previous summer were evenly distributed by hand and lightly raked in. In Experiment 1, wheat (cv. Otane) was sown at standard rate, or standard + 20% and in Experiment 2, barley (cv. Fleet) was sown at standard rate, or at 50% of standard rate. Experimental design in both cases was 4 replicates of a split-split-plot, with 2 crop sowing rates as main plots, weed species (dock or fat hen) as sub-plots, and weed seed rate as sub-sub-plots. Sub-sub-plot size was 2.5x2.5 m. Crop plant density was assessed in late November each year and weed numbers counted in late November each year. Immediately before crop harvest, vegetation was harvested from a 0.5 m^2 quadrat typical of each sub-sub-plot in order to measure the dry matter of its component species. In the second experiment, with barley, weed plant numbers were again assessed at this time. Grain was harvested by hand from a 1 m^2 area at the centre of each sub-sub-plot.

In the third experiment, broad-leaved dock tap roots were planted at 5 densities (0, 2, 5, 10, 20/m^2) into 2 m^2 plots in 4 replicates, immediately after sowing wheat (cv Norseman). Grain was harvested by hand from the central 1 m^2 area of each plot.

RESULTS AND DISCUSSION

In the first experiment, wheat plant populations at the standard sowing rate were 197/m^2, and at the standard + 20% rate were 232/m^2. The rates at which weed seeds were sown, the numbers of seedlings of fat hen and broad-leaved dock which established, and the biomass of the sown weed species at crop harvest are shown in Fig. 1.

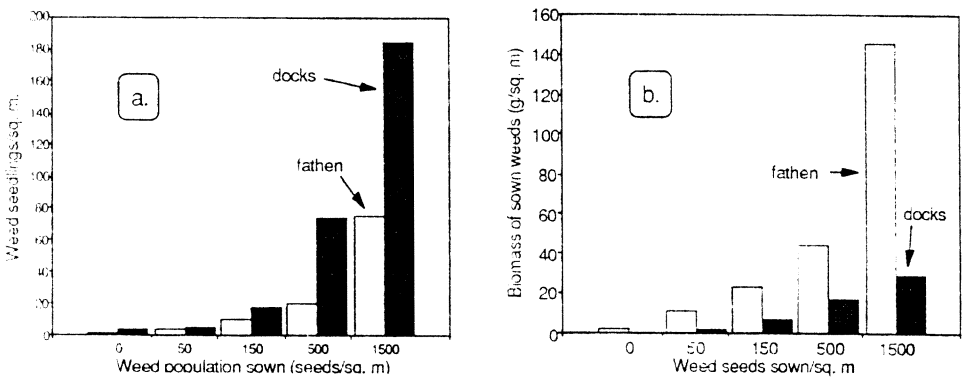

Figure 1. Experiment 1, wheat. Data averaged over both crop sowing rates and both fertiliser raason are no indication of the importance of weed biomass late in the season.

Dock seedlings established very well in this experiment, and fat hen seedlings rather less well. However, by crop harvest time, the dock plants were still quite small, whilst fat hen plants were much larger. Although not further discussed here, there were fewer weeds in November and lower weed biomass at harvest in the higher crop sowing rate. In spite of the soil sterilisation, a number of other species grew in the crop, especially large plants of chicory, *Cichorium intybus*, relicts of a previous crop. Partly because of this, analysis of variance of wheat yields did not show any effect of fat hen or dock. However, the correlation between fat hen biomass at harvest and wheat yield in each sub-sub-plot was very highly significant (r=0.33, 78 degrees of freedom, significant at p=0.01). There was no significant correlation between dock biomass and wheat yield, nor between fat hen or dock seedling numbers in November and wheat yield. This correlation could mean that in plots where the crop grew and yielded poorly, weeds grew better as a result. However, that the correlation with fat hen biomass was significant, while correlations with dock biomass or weed numbers were not, suggests that fat hen biomass adversely affected wheat yields, whilst docks had no affect. It also suggests that in determining the effects of weeds on crop yields, weed numbers early in the season are no indication of the importance of weed biomass late in the season.

In the second experiment, barley plant populations were 311/m^2 at the standard sowing rate and 150/m^2 at the 50% rate. Weed seed sowing rates, weed plant numbers in November and at harvest, and fat hen biomass at harvest are presented in Fig. 2.

More than twice as many weed seedlings established when the crop sowing rate was halved. Dock seedling establishment was poor in this experiment and at harvest dock plants were still

small, but whether this was due to the greater competition offered by barley, or to seasonal effects, cannot be determined. Dock biomass at harvest was negligible. Growth of unsown weed species, principally scrambling fumitory, *Fumaria muralis*, again meant that analysis of variance did not show any effects of weeds on barley yields. The correlation between fat hen biomass at harvest and barley yields was significant in the 50% crop sowing rate (r=0.43, with 30 degrees of freedom, significant at p=0.05). The same correlation in the standard sowing rate was not significant. This again suggests that fat hen biomass at harvest affected barley yields, but only where the barley was sown at 50% of the standard sowing rate; at the standard crop sowing rate, fat hen had no effect.

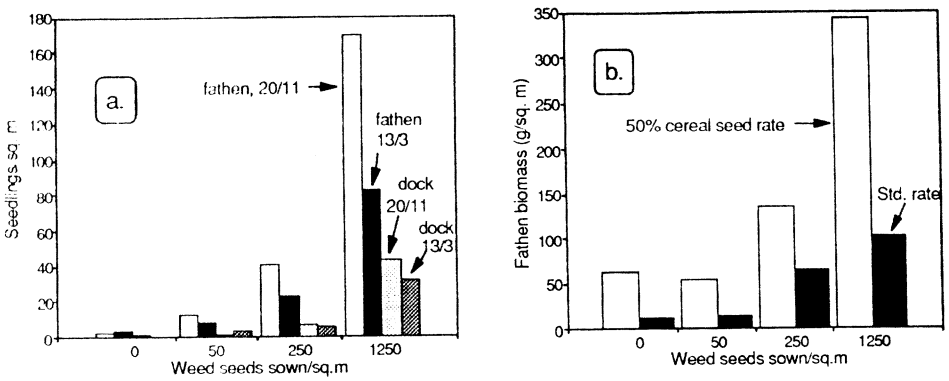

Figure 2. Experiment 2, barley. (a) Populations of sown weed species on 20 November and 13 March, averaged over both crop sowing rates. (b) Biomass of fat hen at crop harvest.

In the third experiment, regrowth from broad-leaved dock roots adversely affected wheat yields (Fig. 3). The best fit for the relationship was given when natural logarithms of mean wheat yield were plotted against planted dock root numbers. The correlation coefficient (0.98) was very highly significant (p=0.01).

As expected, fat hen was a more competitive weed of cereals than broad-leaved dock. Docks are not mentioned in the literature as weeds of cereals (e.g. 1). In barley, a more competitive crop than wheat (3), fat hen only reduced crop yields when the crop was sown at half the recommended rate. Increasing the density of barley diminished the competitive affect of weeds (2). Regrowth from the roots of broad-leaved dock reduced wheat yields, confirming that this species is more than an eyesore in cereal crops grown without herbicides. In wheat, each 100 g of fat hen dry matter/m^2 present at harvest reduced grain yields by 310 kg/ha, and in barley sown at half rate by 298 kg/ha. In wheat, each dock root/m^2 reduced grain yield by about 200 kg/ha.

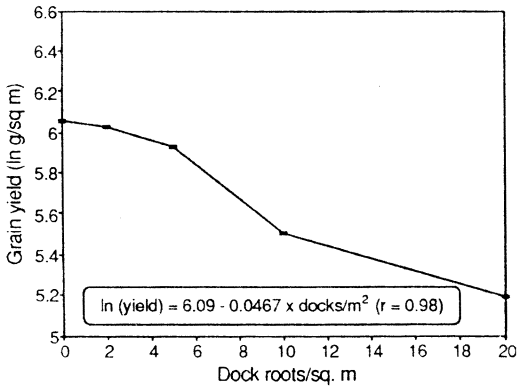

Figure 3. Experiment 3, wheat. Effect of transplanted broad-leaved dock roots on grain yield.

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