

CRUCIFEROUS OIL CROPS AS BREAK CROPS IN CEREAL-DOMINATED ROTATIONS (RESULTS OF SWEDISH FIELD EXPERIMENTS)

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INTRODUCTION

In many of the important agricultural regions of Sweden cereals occupy a dominating part of the field acreage. The average for a region might be as high as 70 per cent, but owing to specialization the percentage is considerably higher on single farms. Results of long-term experiments have shown that repeated cultivation, especially of barley and wheat, decreases the yield level. Then the question arises of the effect of one or two years with an alternative crop upon the yield level of the following wheat or barley. The cruciferous oil crops generally grown in Sweden are particularly interesting in this situation as break crops. They can be cultivated in a large part of the country and with the same machinery as cereals.

METHODS

Series of 3-4-year field experiments were carried out on fields where barley or wheat had been grown consecutively for several years before the start of the experiment. In one treatment this barley or wheat succession was continued, while in the other treatments it was broken with different crops for one or two years. The effect of the different break crops upon the yield of a following crop of barley or wheat (test crop) was measured. In addition, attack of take-all was registered in some experiments. In some of the series different levels of nitrogen fertilization to the test-crop were included in the experimental plan. The purpose was to establish whether any interaction existed between the two factors "preceding crop" and "nitrogen fertilization", e.g. in such a way that increased nitrogen addition reduced the disadvantages of a continued cultivation of barley or wheat.

In this paper the discussion is limited to breaks with spring-sown oil crops. The crops used were rape, turnip rape and white mustard, different in different experiments. However, in the presentation of the results no differentiation is made between these crops, they are all referred to as "oil crop".

About thirty field experiments were carried out for each of the three crops barley, winter wheat and spring wheat.

RESULTS

In Table 1 the results showing the effect of the oil crops as break crops are summarized. It appears that the yields of both barley and wheat were substantially increased after an oil crop break as compared with the situation when these crops were grown after barley or wheat. However, the yield increase was higher for wheat than for barley. If the spring wheat experiments were grouped according to geographical placing, the effect of the preceding crop turned out to be greater in the southern part of the country than in the central part. Moreover, for spring wheat the beneficial effect of an oil crop was greater on fields infested with cereal cyst nematode than on fields where this parasite did not occur.

TABLE 1

THE EFFECT OF A ONE-YEAR BREAK WITH AN OIL CROP ON THE YIELD OF BARLEY, WINTER WHEAT AND SPRING WHEAT

Preceding crop	Barley (29 exps.)		Winter wheat (31 exps.)		Spring wheat (33 exps.)	
	Kg/ha	Rel	Kg/ha	Rel	Kg/ha	Rel
Barley/wheat	3,090	100	4,500	100	3,540	100
Oil crop	+330	111	+810	118	+730	121

TABLE 2

THE RESIDUAL EFFECT OF A ONE-YEAR BREAK WITH AN OIL CROP ON THE YIELD OF BARLEY TWO YEARS AFTER THE BREAK (29 EXPS.)

Preceding crop sequence	Kg/ha	Rel
Barley - barley	2,730	100
Oil crop - barley	+210	108

Table 2 demonstrates that one year with an oil crop also positively influenced the yield of the second crop of barley. Results from other experiments indicate that this residual effect is also of the same magnitude, 5-10 per cent, for winter and spring wheat.

TABLE 3

THE EFFECT OF A TWO-YEAR BREAK WITH AN OIL CROP COMPARED WITH A ONE-YEAR BREAK ON THE YIELD OF BARLEY (29 EXPS.)

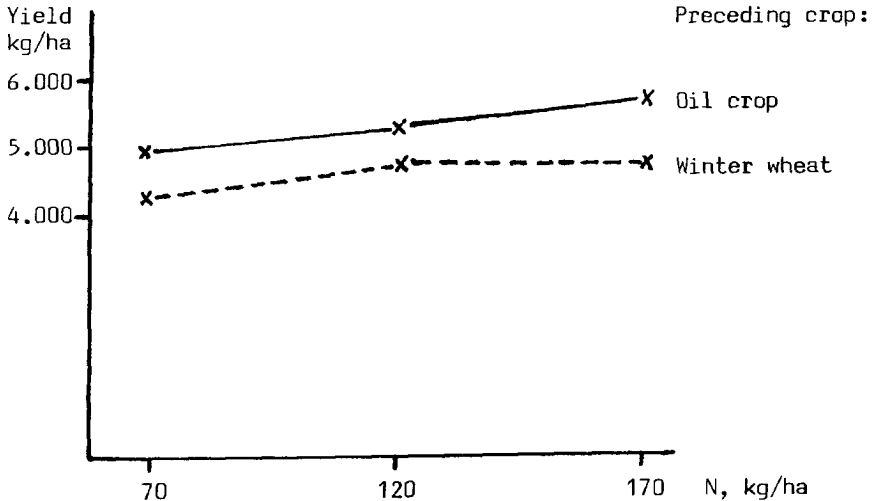
Preceding crop sequence	Kg/ha	Rel
Barley - oil crop	3,040	100
Oil crop - oil crop	+80	103

As can be seen from Table 3 the barley yield after a break with two consecutive oil crops was only slightly higher than after a one-year break.

The effect of varying the nitrogen fertilization to winter wheat after two different preceding crops is illustrated in Fig. 1. Among the three levels that were included in the experiments, 70, 120 and 170 kg/ha N, the intermediate one approximates the level recommended for winter wheat in Sweden. When the preceding crops were oil crop or winter wheat, the difference between them in yield of wheat was about the same at the three nitrogen levels, i.e. no interaction between the factors could be established. Similar results were obtained for spring wheat.

FIG. 1

THE YIELD OF WINTER WHEAT CULTIVATED AFTER TWO DIFFERENT PRECEDING CROPS, VIZ. WINTER WHEAT AND OIL CROP, AT THREE LEVELS OF NITROGEN FERTILIZATION (31 EXPS.)



Some figures concerning attack of take-all on winter wheat are given in Table 4. The incidence was less after an oil crop than after wheat. The same results were obtained for barley and spring wheat, a one-year oil crop break reduced the attack of take-all. However, the overall average incidence usually was low and it is uncertain how much of the yield differences can be explained by this factor.

TABLE 4

INCIDENCE OF TAKE-ALL, MEASURED AS PERCENTAGE DARK-COLOURED ROOT-MASS, ON WINTER WHEAT CULTIVATED AFTER WINTER WHEAT AND OIL CROP RESP. (31 EXPS.)

Preceding crop	Dark-coloured root-mass, %
Winter wheat	14.3
Oil crop	8.4

DISCUSSION

Even if oil crops occupy only a small part of the arable land in Sweden, their significance to farmers with cereal-dominated rotations should be clear. The economic value of the biological effects reported here is of such a magnitude that it might determine whether oil crops should be cultivated or not. The cultivation of other non-cereals, which might be possible as break crops, is often limited for different reasons. However, it should be mentioned that oats have proved to be a favourable break crop in a one-sided barley/wheat cultivation. Sometimes their effect has been on a level with that of oil crop. This, however, is not the case on fields with cereal cyst nematode.