EFFECT OF LEAF REMOVAL ON THE GROWTH OF WINTER OIL SEED RAPE (BRASSICA NAPUS, L.)

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INTRODUCTION

In the United Kingdom the area of oilseed rape has increased rapidly from 4,000ha in 1970 to 173,000 ha in 1982. Over this period the winter sown crop has largely replaced the spring crop and now accounts for approximately 95% of the total rapeseed area (Scarisbrick et al 1981).

The growth pattern of winter rape has been described in detail by Scott et al 1973, Mendham and Scott 1975, and Mendham et al, 1981. In these studies seasonal variations in seed yield were related to the amount of growth made by the onset of flowering, although in an earlier interpretation of the data Mendham and Scott (1975) had stressed the importance of plant size at the time of flower initiation. Again in spring oil seed rape Allen and Morgan (1972, 1975) found a close relationship between Leaf Area Index at after anthesis and two important yield components, pod number and seeds per pod. Reducing the supply of carbon assimilates during the period of pod development resulted in a reduction in pod number, seed per pod and seed weight (Tayo and Morgan, 1979).

It would therefore appear, that the rate and pattern of dry matter production during the vegetative phase of growth from emergence to anthesis has a major influence on yield potential. This paper describes the results of experiments designed to examine the effect of reducing the supply of carbon assimilates, by leaf removal at specific developmental stages during the vegetative phase of growth, on subsequent crop growth and yield development.

MATERIALS AND METHODS

Two experiments were carried out during each of the growing seasons 1979/80 and 1980/81. In each experiment, seed of the variety Jet Neuf was sown with a precision seeder and the crop singled at the two leaf stage to the target population. Defoliation treatments were carried out at pre-determined stages of growth by removing all fully expanded leaves and their petioles. Dates of defoliation and the corresponding stages of growth are presented in Table 1.

Table 1 Defoliation Treatments

Date of defoliation	Stage of development	Code
EXPERIMENT I – 1979–80		
–	Undefoliated control	A
26 October	Prior to flower initiation	B
7 December	Post flower initiation	C
4 March	Beginning of stem elongation	D
8 April	During stem elongation	E
28 April	End of stem elongation	F
EXPERIMENT II – 1980–81		
–	Undefoliated control	A
11 November	Prior tc flower initiation	B
27 March	Beginning of stem elongation	C
21 April	End of stem elongation	D

RESULTS

Leaf removal resulted in a significant reduction in seed yield in both experiments (Tables 2 and 3). This trends was observed over all defoliation treatments, although the level of yield losee recorded varied both between seasons and stage of growth. In Experiment I seed yield was reduced by between 19 and 28% compared to a range of between 29 and 45% in Experiment II. In both experiments, defoliation at the start of the stem elongation phase produced the lowest seed yield.

Table 2 Influence of defoliation on yield and yield components Experiment I (1979/80)

Component	TREATMENTS						
	A	B	C	D	E	F	SE ±
Seed yield g m^{-2} at 8% moisture	724.9	574.6	562.2	522.4	584.0	565.9	34.51*
No. of pods (x 10^2)/m^2	118.7	103.5	103.2	86.1	80.0	84.1	5.90**
No. of seeds/pod	17.4	15.3	15.7	16.2	17.2	17.8	0.76
Wt. of 1000 seed (g) (dry wt. basis)	5.66	5.34	5.19	5.02	5.78	5.99	0.148**
Oil content (% of dry matter)	43.7	41.8	42.2	42.1	44.2	44.3	0.30***
Oil yield g/m^2 (dry/wt. basis)	296.2	222.2	219.5	204.5	239.2	232.7	14.23**

A – Control
B – Defoliated 26:10:79
C – Defoliated 7:12:79
D – Defoliated 4:3:80
E – Defoliated 8:4:80
F – Defoliated 28:4:80

Table 3 Influence of defoliation on yield and yield components Experiment II (1980/81)

Component	TREATMENTS				
	A	B	C	D	SE ±
Seed yield g/m^2 (at 8% moisture)	617.1	441.2	342.5	436.9	35.26**
No. of pods (x 10^2)/m^2	83.4	73.4	51.2	57.0	5.90*
No. of seeds/pod	12.9	15.2	11.6	12.4	0.52**
Wt. of 1000 seed (g) (dry wt. basis)	5.02	4.73	5.33	5.79	0.238
Oil content (% dry matter)	44.7	43.8	44.4	43.7	0.49
Oil yield g/m^2 (dry wt. basis)	255.9	179.8	140.7	176.9	15.64***

A – Control
B – Defoliated 6:11:80
D – Defoliated 27:3:81
C – Defoliated 21:4:81

Flower initiation was delayed when leaves were removed before this stage of development has been reached. Furthermore, defoliation influenced both the time and duration of flowering. Data from Experiment II is presented in Table 4. Leaf removal at the end of the stem elongation phase reduced the duration of flowering in both experiments.

Table 4 The effect of defoliation on flowering and the flower duration Experiment II (1980/81)

Code	Stage and date of defoliation	Flowering date (50%)		Flowering duration (days)
		Beginning	End	
A	Control undefoliated	May 7	June 6	30
B	Before flower initiation; November 6, 1980	May 11	June 10	30
C	Beginning of stem elongation; March 27, 1981	May 8	June 8	31
D	End of stem elongation; April 21, 1981	May 7	June 1	25

Differences between treatments in seed yield at final harvest were largely account for by differences in pod number/m^2. Leaf removal during the period of active spring growth influenced pod number to a greater extent than autumn defoliations, before and after flower initiation.

The effects of leaf removal on seed number per pod and seed weight were less consisted. In Experiment I seed number per pod was not influenced, but in Experiment II this yield component was increased significantly following early defoliation prior to flower initiation. In both experiments a decrease in seed weight was observed with autumn defoliations, while spring defoliations slightly increased seed weight but not significantly so.

Seed oil percentage decreased with leaf removal up to the stem elongation phase, although differences were only significant in Experiment I. Differences between treatments in seed oil content tended to be small, therefore differences in oil yield were largely accounted for by differences in seed yields.

DISCUSSION

The results of this study have demonstrated the importance of maintaining an effective leaf canopy throughout the vegetative phase of growth. Limiting the supply of carbon assimilates at the time of stem elongation reduced seed yield to a greater extent than at any other stage of growth. This effect was largely due to a reduction in pod number. The degree of compensatory growth in the remaining pods appeared to be insufficient to overcome this reduction in pod number.

This evidence further demonstrates the importance of optimising growing conditions to achieve a large plant at the time of flowering. (Mendham et al, 1981). In addition to achieving a high Leaf Area Index at the time of anthesis (Allen and Morgan, 1972, 1975) such a plant would also be expected to have built up a supply of stored assimilates in the stem, petiole and roots which may be of considerable value during the phase of pod development. Further work is required to evaluate the contribution made by stored assimilates to pod and seed growth in different genotypes and under varying agronomic treatments.

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