

# The Effect of varietal diversification on lodging in oilseed rape

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## Introduction

Scotland has a number of advantages for growing oilseed rape. The longer day lengths from late spring to early autumn and lack of drought mean that Scotland often achieves yields higher than those in the rest of Britain (Walker and Booth, 1992). In 1992 the average yield of oilseed rape in Scotland was 2.84 t/ha compared with an average yield of 2.99 t/ha for the UK (Anon 1992a) and 2.56 t/ha for the rest of Europe (Anon, 1992b). However, these conditions, which are conducive to higher yield production, also encourage greater height which put the crop at risk from lodging which can be associated with losses in yield at harvest (Booth and Walker, 1994).

With oilseed rape, little or no effect on lodging is found by the use of plant growth regulators or lower nitrogen application rates (Daniels *et al.*, 1984). The available options for controlling lodging are therefore limited mainly to the development and use of stiffer strawed varieties (Fisher and Walker, 1992). These cultivars have the disadvantage of being lower yielding than their taller weak strawed counterparts (Walker and Booth, 1992).

Lodging can be reduced in cereal crops using varietal diversification ie growing a mixture of varieties together (Stutzel and Aufhammer, 1989). This current study aimed to build upon what is already known about reduction of lodging in winter oilseed rape crops through the use of varietal diversification (Booth and Walker, 1994).

## Materials and methods

The two varieties of winter oilseed rape used in the cultivar mixtures were Envol and Rocket. Rocket was the shorter of the two varieties and also had better stem stiffness, with a score of 8, (where 9 = good stem stiffness) in contrast to a score of 5 for Envol (Anon, 1994a). It should be noted, that with respect to disease resistance, Rocket is more resistant to light leaf spot than Envol, with a disease resistance score of 6 (where 9 = resistant) compared to 3 for Envol.

On 30 August 1993, winter oilseed rape mixtures were sown at the Scottish Agricultural College (SAC) oilseed rape trials site at Tillycorthie, Udney, Aberdeenshire. The seed rate was 6kg/ha and the plot size was 1.86m by 20m at harvest. The two varieties Envol and Rocket were sown in a range of 6 mixtures as follows: 100% Rocket, 100% Envol and 50:50, 5:95, 25:75, 10:90 Rocket : Envol respectively. Each mixture was replicated three times resulting in a total of 18 plots in

this field trial. Standard husbandry procedures were followed including the application of basal fertiliser to the plots on 23 August 1993 which consisted of 18 kg N, 90 kg P and 90 kg K per hectare. A nitrogen top dressing was applied as a 50:50 split application with 90 kg of nitrogen applied on both the 14 February and 11 March 1994. The crop was swathed on the 8 August 1994 and harvested on 17 August.

Scores of leaning and lodging were made from both ends of each plot. The scores were taken on the 20 June and then every 7 days from 11 July to swathing of the crop on 8 August. Leaning was judged to have occurred when plants were leaning up to 45 degrees. If the plants were leaning more than 45 degrees then they were deemed to have lodged.

Fresh weight per plot was measured at harvest and the dry weight of the seed was assessed by drying 100g of seed to a constant weight. Yields per hectare at 9% moisture content were then calculated.

## Results

There was very little evidence of lodging in any of the plots. Leaning occurred later in this trial than in the rest of the field. The progress and levels of leaning in various mixtures can be seen in Figure 1. At the beginning of the trial there was little difference in the degree of leaning between mixtures.

Plots with 100 % Rocket had considerably less leaning than other plots from 11 July. This was not significant until 1 August when the severity of leaning was significantly less in the pure Rocket stand than in all other plots.

The final score, taken one week before harvest, shows that progressively more severe leaning was observed as the percentage of Rocket included in the mixture decreased (Table 1). The 0% Rocket mixture had significantly more leaning than the 100% and 50% Rocket mixtures.

Table 1 : The relationship between leaning scores (9 = no leaning, 0 = completely lodged) recorded on 1 August.

% Rocket	Leaning score on 1 August
100	8.8
50	7.8
25	7.5
10	7.3
5	7.2
0	7.1
LSD ( $p \leq 0.05$ )	0.55

100% Rocket tended to be associated with lower yields than mixtures and the 100% Envol, but the differences were not significant (Figure 2). It can be seen that the mixtures with the Rocket: Envol proportions of 10:90 and 25:75 tended to perform better than the other mixtures and even the pure stands of the two varieties. The 50:50 mixture also produced high yields.

### Discussion

No lodging was observed in the field where the trial was grown and there was only limited evidence of leaning. This is unusual and may be related to the uncharacteristically dry weather conditions over the growing season which resulted in shorter average plant heights. This is reflected in the 5 year means of plant height. The average plant height, for the Recommended Variety List trial grown at SAC Aberdeen for the 5 year period 1990 to 1994, was 149 cm, 5 cm shorter than the average plant height for 1989 to 1993 at 154 cms. The lack of rainfall in July (Anon, 1994b) which coincided with pod-fill may also have lessened the susceptibility of the plants to lodging.

The pure Rocket stands had significantly less leaning than the pure Envol stands which reflects the straw stiffness and lodging resistance scores of the two varieties.

Booth and Walker (1994) found that mixtures of Rocket and Envol containing less than 50% Rocket showed improved resistance to leaning and lodging compared to pure stands in 1992. Although levels of leaning were low at the field trial site, in the present trial it can be seen that even 10 % introduction of Rocket to Envol stands appears to improve the resistance to leaning. In this trial, the 50:50 mix also had significantly less leaning than the pure stands of Envol. This may have been as a result of physical support of the taller weaker strawed Envol by the shorter stiffer Rocket. Less lodging in the 50:50 mix could simply be linked to fewer tall and lodging susceptible plants.

A comparison of the expected lodging and the actual lodging showed that, where the percentage of Rocket in the mixture was less than 50%, the actual mean lodging scores were as good if not slightly better than the expected given the proportion of the cultivars in the mixtures.

The yields obtained from the mixtures were consistently as good if not better than the pure stands. The improvement in yields from mixtures when compared with the yields from the pure stands of the components has been attributed to improved response to environmental stress (Stutzel and Aufhammer, 1989). As yields are not adversely affected, even with the inclusion of a lower yielding cultivar such as Rocket,

this is a positive reassurance for farmers tempted to include mixtures as part of an integrated approach to disease control and lodging control in winter oilseed rape.

Two factors that may have affected yield are disease and lodging. In years with more lodging and where the degree of lodging has an effect on yield, it may be possible to reduce the loss of yield by introducing mixtures. Other considerations which are important when using varietal diversification would be the matching of components for other traits such as harvest maturity which are also of concern to farmers.

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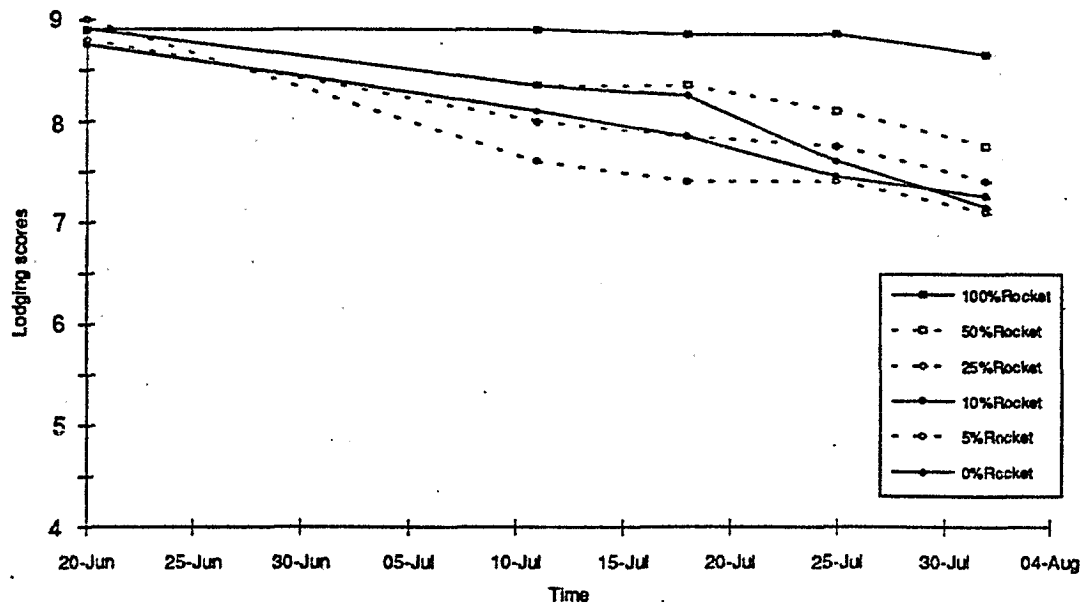


Figure 1 : Progress and severity of lodging in pure stands of component cultivars and in a range of mixtures ( 9 = no leaning, 0 = completely lodged)

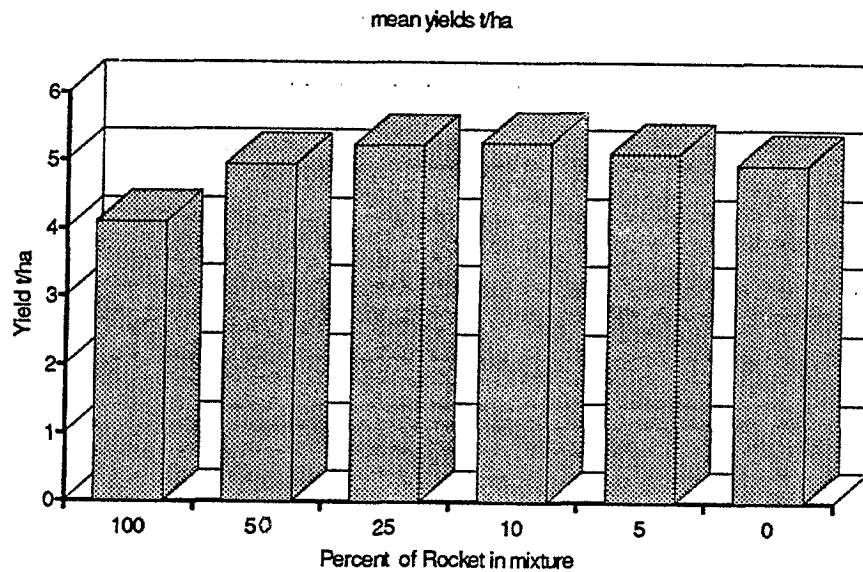


Figure 2 : Mean yields (t/ha at 9% mc) from pure stands of Envol and Rocket and mixtures of their components