Yield determining factors for oilseed rape in the UK

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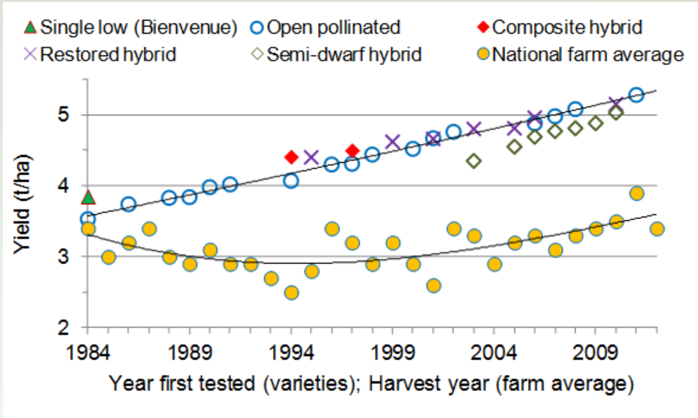
Introduction

The yield potential of the best new varieties of oilseed rape has improved steadily at the rate of about 0.05 t/ha/year in the ‘double-low’ era but farm yields declined at first, then showed great variability, before commencing a period of steady improvement and achieving a record yield for the UK of 3.9 t/ha in 2011 (Fig.1)

A desk study conducted by Knight *et al* (2012), using national data sets and evidence from agronomy studies, has concluded that, for oilseed rape, a combination of economics and EU policy had led to increasingly sub-optimal practise for variety selection, crop establishment and, in the mid-1990s, a period of spring rape cropping.

Shortening rotations and reduced use of nitrogen fertiliser are also implicated, with an initial period of yield decline and then yield limitation. Weather is thought to have strong influences on both the overall yield trend and annual yield variation.

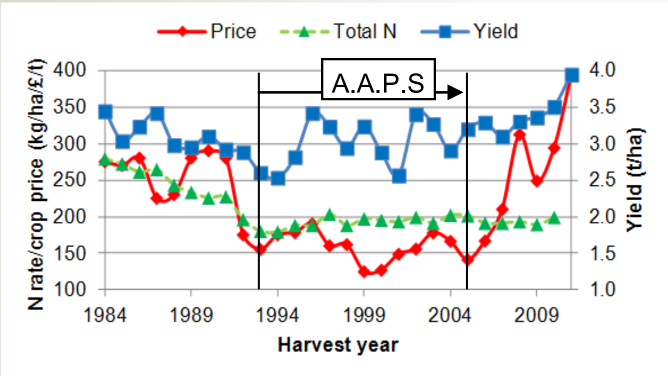
Figure 1: Comparison of variety improvement and farm yield trends for oilseed rape



N.B.: Trial yields are typically 15-20% above commercial yields.

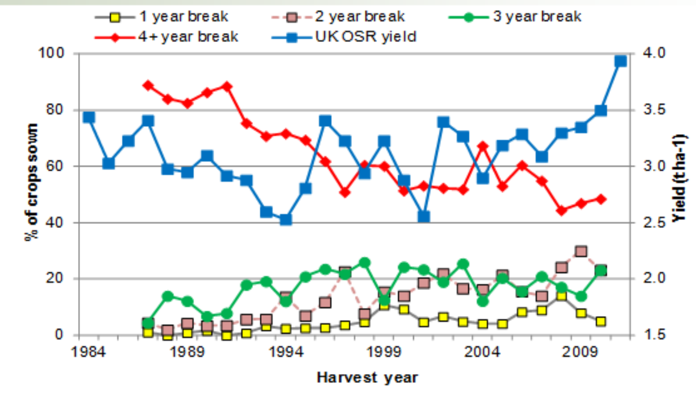
Summary of findings

Figure 2: Yield in relation to nitrogen use, crop price and EU policy



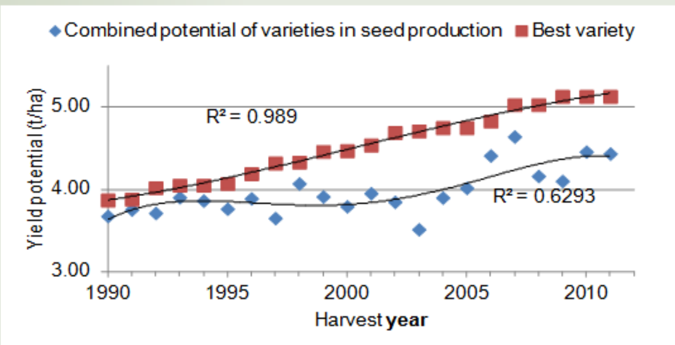
After an initial yield decline associated with reduced N, low crop prices and EU Arable Area Payment Scheme (AAPS) provided disincentives for intensive crop production until the mid-2000s. High crop prices are now driving yields up.

Figure 3: Increasing frequency of oilseed rape cropping



Reduction from a 4-year+ break to a 2-year break can result in a 6% yield loss. Robust crop protection is limiting even greater yield penalties. A further 9% yield loss has been associated with a move from ploughing to min-till cultivations, except where soil moisture loss, caused by ploughing, leads to delayed crop establishment.

Figure 4: Estimated yield penalty associated with sub-optimal variety selection



This is estimated from seed production data and life-time yield averages for varieties in proportion to their approved production weights. This does not account for imported, mainly hybrid seed or farm saved seed. An increasing divergence from theoretical yield potential is observed.

Table 1: Yield correlations with mean monthly data for rainfall

	AUG	*SEP*	*OCT*	*NOV*	*DEC*	JAN	FEB	MAR	APR	MAY	JUN	JUL
Rainfall	0.096	-0.262	-0.184	-0.043	-0.349	-0.159	0.065	-0.277	**-0.560**	0.080	0.105	0.014
Sunshine	-0.077	0.116	0.112	0.240	0.265	-0.213	-0.167	0.094	**0.556**	-0.016	0.095	0.018
Temperature												
Maximum	-0.011	0.024	**0.536**	-0.011	-0.473	-0.284	-0.064	-0.092	**0.523**	-0.137	0.090	-0.010
Mean	0.010	0.018	0.485	-0.024	**-0.505**	-0.237	-0.043	-0.177	0.395	-0.141	0.049	-0.068
Minimum	0.047	0.014	0.430	-0.038	**-0.512**	-0.178	-0.033	-0.260	0.135	-0.121	-0.029	-0.167
Sig. level:		5.0%	0.374	1.0%	**0.479**							

Figure 5: Coincidence of yield with April sunshine and rainfall patterns

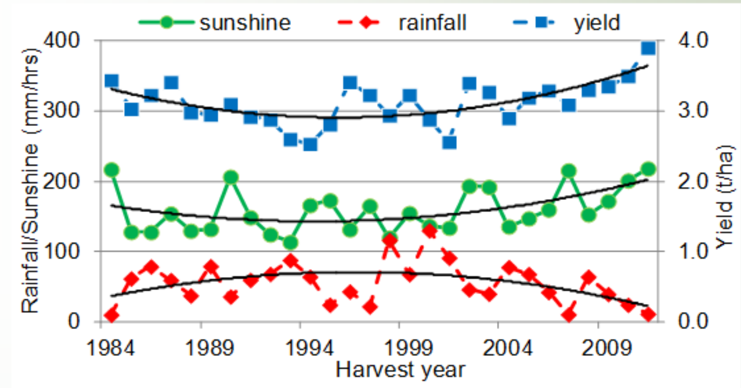
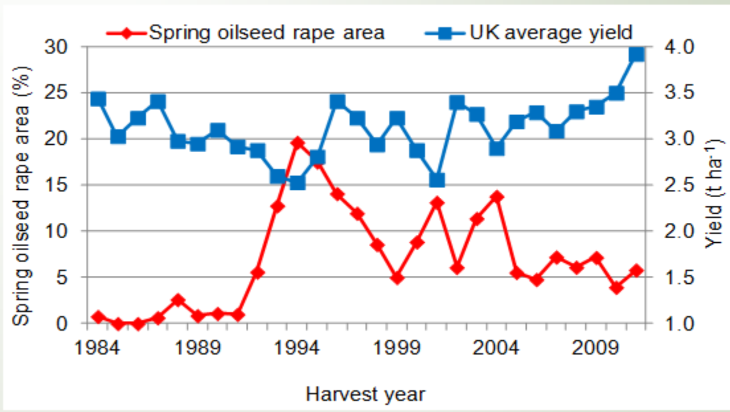


Figure 6: Influence of spring rape cropping on annual yield pattern



Weather and spring rape cropping account for much of the yield variation.

Conclusions

The initial yield decline in the 1980s is strongly associated with reduced N use and there are concerns now that the current static levels of N application are sub-optimal for modern varieties. From the mid 1990s low crop prices and the Arable Area Payment Scheme (Fig. 2.) created an environment that encouraged cost saving agronomic practices, including reduced tillage crop establishment, cultivation of spring rape (Fig. 6) and use of farm saved seed and varieties of less proven ability (Fig. 4). Shortening rotations (Fig. 3) and reduced tillage have both been shown to have yield penalties in agronomy trials conducted by NIAB TAG but increasingly robust crop protection has been limiting the impact of known pests and diseases.

Annual yield variation is correlated with weather patterns in October, December and, in particular, the normal flowering month of April (Figs, 4 and 5). Along with spring rape cropping these two factors account for most of the peaks and troughs.

Acknowledgements

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Reference

Knight S M, Kightley S P J, Bingham I J, Hoad S, Lang B, Philpott H L, Stobart R M, Thomas J E, Barnes A and Ball B. **2012.** *Desk study to evaluate the contributory causes of the current ‘yield plateau’ in wheat and oilseed rape.* HGCA Project Report **No. 502.**