A COMPARISON OF INPUT LEVELS IN OILSEED RAPE

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ABSTRACT

TALISMAN (Towards A Lower Input System Minimising Agrochemicals and Nitrogen) was started in autumn 1990 at three ADAS research centres. Standard and Alternative six-year rotations are being tested under Current Commercial Practice, applying full recommended rates and a Low Input Approach in which 50% of the nitrogen and up to 50% of the pesticide amounts are applied. The design allows the effect of reducing the rate of individual pesticide groups and nitrogen to be assessed separately. A total of six oilseed rape crops was grown in 1991 and 1994. Yields were decreased only where reduced rates of herbicides were used in three of the six crops and this was reflected in lower gross margins. Decreasing nitrogen by 50% gave a mean yield reduction of 0.41 t ha^{-1} and caused significant reductions in gross margins in two crops.

INTRODUCTION

TALISMAN (Towards A Lower Input System Minimising Agrochemicals and Nitrogen) was developed to follow-on from the Boxworth Project (Greig-Smith *et al.*, 1992) and was designed to measure the economic, agronomic and, to a lesser extent the environmental effects of adopting lower input cropping systems. Crop inputs, yield and gross margins for oilseed rape crops grown in this regime are presented in this paper.

EXPERIMENTAL

TALISMAN is located at three ADAS research centres; Boxworth, Cambridge (well-structured clay), Drayton, Warwickshire (clay) and High Mowthorpe, North Yorkshire (silty clay loam). Standard and Alternative rotations are being tested either under Current Commercial Practice (CCP) for pesticides and nitrogen or a Low Input Approach (LIA) where 50% of the nitrogen rate and a maximum of 50% of the pesticide rates applied to the CCP are used. The Standard Rotations are typical for individual sites; for Boxworth and Drayton winter oilseed rape is followed by two winter wheats, winter beans and a further two winter wheats. At High Mowthorpe the winter oilseed rape is preceded by winter barley. The Alternative Rotations are predominantly spring cropping, and therefore usually have a lower requirement for pesticides and nitrogen. This rotation does not contain oilseed rape and is not referred to in this paper.

Pesticides are applied at the manufacturers' label recommended rate to CCP, which provides a recognised standard against which comparisons can be made. Nitrogen rates are determined by the ADAS fertiliser planning service "Fertiplan", based upon previous cropping, soil type and yield prediction. Reductions in pesticides are made primarily by omitting applications to the LIA wherever possible. If predicted crop loss was estimated at greater than 10%, where a chemical was not used, then up to 50% of the CCP rate could be applied. In crop threatening situations a full rate of the pesticide could be applied to LIA treatments. At each site, cultivation, cultivar, sowing date and pesticide products are the same in both CCP and LIA.

TALISMAN is a split-plot design with rotation and nitrogen as main treatments and combinations of LIA and CCP rates of herbicides, fungicides and insecticides in sub-treatments (Table 1). This paper reports on the performance of oilseed rape crops within the Standard Rotation.

Table 1. Rates of pesticide applied to TALISMAN sub-treatments. (Current Commercial Practice (CCP) and Low Input Approach (LIA))

Sub-treatment code	Herbicide rate	Fungicide rate	Insecticide rate
CCC	CCP	CCP	CCP
LLL	LIA	LIA	LIA
LCC	LIA	CCP	CCP
CLC	CCP	LIA	CCP
CCL	CCP	CCP	LIA

RESULTS AND DISCUSSION

Winter oilseed rape was grown in 1991 at all sites and in 1994 at High Mowthorpe only. Spring oilseed rape was grown at Boxworth and Drayton in 1994 owing to loss of winter rape to slug attack.

Table 2. Pesticide units* and nitrogen rate (kg ha^{-1}) applied to oilseed rape at Boxworth, Drayton and High Mowthorpe, 1991 and 1994

	1991						1994					
	Boxworth		Drayton		High Mowthorpe		Boxworth		Drayton		High Mowthorpe	
	CCP	LIA	CCP	LIA	CCP	LIA	CCP	LIA	CCP	LIA	CCP	LIA
Herbicide	1	0.5	2	1	1	0.5	2	1	1	0.5	4	2
Fungicide	1	0	1	0	1	0	1	0	0	0	0	0
Insecticide	1	1	3	1	1	0	1.5	1	1	0.5	1	0.5
Total	3	1.5	6	2	3	0.5	4.5	2	2	1	5	2.5
Nitrogen kg/ha	230	115	230	115	220	110	100	50	100	50	228	114

* One pesticide unit = one full rate application of a single active ingredient

Overall, the number of pesticide units applied was similar in winter and spring crops of oilseed rape. In LIA, pesticide units compared to those used in CCP were decreased by 66% in 1991 and 52% in 1994 (Table 2). Yields were significantly ($P<0.05$) decreased in LLL at Boxworth in both years and at Mowthorpe in 1991; only at Boxworth in 1991 could this be attributed to decreasing any one pesticide group, that being herbicides (Table 3). Yields were decreased by a mean of 0.39 t ha^{-1} in winter crops and 0.42 t ha^{-1} in spring crops at LIA nitrogen. These yield decreases were significant ($P<0.05$) for only 3 of the 6 crops. Gross margins were significantly ($P<0.05$) lower at the LIA nitrogen rate in only 2 of the 6 crops (Table 4). There was no evidence of a cumulative effect of having applied 50% nitrogen annually to the 3 previous crops.

Herbicide applications in LIA were decreased by 50% at all sites in both years, this reduction was mainly achieved by applications at half rate. At Boxworth in 1991, both yield and gross margin (Tables 3 and 4) were significantly decreased by the use of half rate fluazifop-P-butyl in a non-competitive crop. This non-competitiveness was exacerbated by half rate nitrogen. A similar response was seen at Mowthorpe in 1991 and Drayton in 1994. At all three sites there has been a trend towards increasing weed number in LIA, this being greater at the LIA nitrogen rate.

The strategy for fungicide use adopted in LIA was to omit applications rather than use half rate (Table 2). In 1994, no fungicides were applied to CCP at High Mowthorpe and Drayton. Disease levels at all sites were low in both years and there were generally no significant ($P<0.05$) effects.

Insecticide applications were decreased by 44% and 56% of that used in CCP in 1991 and 1994 respectively. Where pest attacks reached threshold and a spray was applied to CCP, pest numbers tended to decrease in both CCP and LIA treatments. There were no significant ($P<0.05$) effects of pest on any parameter measured.

The preliminary results of this work suggest that there is some scope to reduce rates of fungicide and insecticide than herbicide. The reduction to 50% nitrogen had little effect on pesticide requirement.

Table 3. Mean yield of oilseed rape (t ha^{-1} at 91% DM) at Boxworth, Drayton and High Mowthorpe, 1991 and 1994

	1991			1994		
	Boxworth	Drayton	High Mowthorpe	Boxworth	Drayton	High Mowthorpe
Pesticide treatment						
SED (a)	±0.157	±0.259	±0.094	±0.131	±0.088	±0.198
CCC	0.83	2.59	3.52	0.91	0.23	3.52
LLL	0.51	2.31	3.15	0.55	0.36	3.32
LCC	0.49	2.33	3.38	0.63	0.31	3.44
CLC	1.24	2.38	3.42	0.62	0.39	3.68
CCL	0.87	2.80	3.46	0.74	0.34	3.95
Nitrogen						
SED (b)	±0.120	±0.095	±0.12	±0.100	±0.182	±0.140
CCP	0.84	2.55	3.91	0.94	0.49	3.80
LIA	0.74	2.41	3.07	0.44	0.16	3.31

(a) Boxworth 24 df; Drayton 16 df; High Mowthorpe 24 df
(b) Boxworth 3 df; Drayton 2 df; High Mowthorpe 4 df

Table 4. Mean gross margins of oilseed rape (£ ha^{-1}) at Boxworth, Drayton and High Mowthorpe, 1991 and 1994

	1991			1994		
	Boxworth	Drayton	High Mowthorpe	Boxworth	Drayton	High Mowthorpe
Pesticide treatment						
SED (a)	±41.9	±68.9	±22.7	±18.5	±15.4	±24.6
CCC	50	490	694	328	312	412
LLL	-1	478	652	338	354	434
LCC	-28	453	681	310	341	440
CLC	181	455	686	305	341	441
CCL	60	555	688	312	336	494
Nitrogen						
SED (b)	±31.9	±25.4	±28.8	±24.4	±32.0	±24.6
CCP	45	481	784	357	352	469
LIA	60	491	615	280	322	419

(a) Boxworth 24 df; Drayton 16 df; High Mowthorpe 24 df
(b) Boxworth 3 df; Drayton 2 df; High Mowthorpe 4 df

REFERENCES

Greig-Smith, P. W.; Frampton, G. K.; Hardy, A. R. (1992) *Pesticides, Cereal Farming and the Environment. The Boxworth Project.* HMSO, pp. 288.