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# Yields of the Field Experiments 1987

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## 87/R/RA/1 Factors Limiting Yield - W. Oilseed Rape

### Rothamsted Research

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87/R/RA/1

WINTER OILSEED RAPE

FACTORS LIMITING YIELD

Object: To study the effects of a range of factors on the incidence of pests and diseases and on the growth and yield of w. oilseed rape - Black Horse I.

Sponsors: C.J. Rawlinson, R.J. Darby, P.G.N. Digby, K. Evans, J.E. Leach, I.H. Williams, D.P. Yeoman.

Associate sponsors: P.B. Barraclough, D.S. Jenkinson, J. Lacey, S.P. McGrath, D.S. Powlson, A.J. Thomasson, A.H. Weir.

Design: A half replicate of 2 x 2 x 2 x 2 x 2 x 2 x 2 + a replicate of 2 x 2 x 4 + half replicates of 2 x 2 x 2 x 2 and 2 x 2 x 2 + 14 extra plots

Whole plot dimensions: 3.0 x 21.0.

Treatments: Combinations of:-

1. VARIETY                      Varieties:  
    ARIANA  
    BIENVENU
2. SOW DATE                      Dates of sowing:  
    14 AUG                      14 August, 1986  
    4 SEP                        4 September
3. N RATE                        Amounts of N fertilizer (kg N), as 'Nitro-Chalk',  
                                         in addition to a basal application of 50 kg N  
                                         as 'Nitram' to the seedbed:  
    150  
    250
4. N DIVIS                        Division of N fertilizer application:  
    SINGLE                        All on 16 Feb, 1987  
    DIVIDED                      50 kg on 16 Feb, remainder on 16 Mar
5. GROWREG                      Growth regulator:  
    NONE                         None  
    TRIAPEN                      Triapenthenol at 0.70 kg in 220 l on 10 Apr, 1987
6. INSCTCDE                      Insecticides:  
    NONE                         None  
    DE+TR                        Deltamethrin at 7.5 g in 220 l on 3 Oct, 1986 and  
                                         20 Nov and triazophos at 0.42 g in 220 l on  
                                         15 June, 1987

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7. FUNGCIDE            Fungicide in autumn, spring and summer:  
  
    NONE                None  
    PR+IP              Prochloraz in autumn and in spring at 0.50 kg in  
                            200 l on 17 Nov, 1986 and 10 Apr, 1987, iprodione  
                            in summer at 0.50 kg in 200 l on 15 June

plus combinations of the following (all given growth regulator,  
insecticides and fungicides as above):

1. VARIETYN            Varieties:  
  
    ARIANA  
    BIENVENU  
  
2. SOWDAT N            Dates of sowing:  
  
    14 AUG              14 August, 1986  
    4 SEP                4 September  
  
3. N RATE N            Amounts of N fertilizer (kg N), as 'Nitro-Chalk',  
                            in addition to a basal application of 50 kg N as  
                            'Nitram' to the seedbed. Applied as a single  
                            dressing on 16 Feb, 1987:  
  
    0  
    100  
    200  
    300

plus combinations of the following (all given insecticides and  
fungicides as above, combinations chosen are those not provided by  
the main factorial):

1. VARIETY P            Varieties:  
  
    ARIANA  
    BIENVENU  
  
2. SOWDAT P            Dates of sowing:  
  
    14 AUG              14 August, 1986  
    4 SEP                4 September  
  
3. N RATE P            Amounts of N fertilizer (kg N), as 'Nitro-Chalk',  
                            in addition to a basal application of 50 kg N as  
                            'Nitram' to the seedbed. Applied as a single  
                            dressing on 16 Feb, 1987:  
  
    150  
    250  
  
4. GROREG P            Growth regulator:  
  
    NONE                None  
    TRIAPEN            Triapenthenol at 0.70 kg in 220 l on 10 Apr, 1987

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plus combinations of the following (all Ariana given N as N RATE 150, SINGLE, fungicides as above and oxamyl at 5 kg to the seedbed):

1. SODATE OX            Dates of sowing:  
    14 AUG            14 August, 1986  
    4 SEP            4 September
2. GRORG OX            Growth regulator:  
    NONE            None  
    TRIAPEN        Triapenthenol at 0.70 kg in 220 l on 10 Apr, 1987
3. INSCT OX            Insecticides:  
    NONE            None  
    DE+TR        Deltamethrin at 7.5 g in 220 l on 3 Oct, 1986 and  
                    20 Nov, triazophos at 0.42 l in 220 l on 15 June,  
                    1987

plus two replicates (all sown 4 SEP and given N as N RATE 250, DIVIDED and insecticides and fungicides as above) of all combinations of:

1. VAR NUT            Varieties:  
    ARIANA  
    BIENVENU
2. FOL NUT            Foliar nutrients:  
    N            N at 3.2 kg (1.0 kg as ammonium nitrate, 2.2 kg as  
                    urea; solution applied at 12 l in 220 l on 16 Apr,  
                    1987, 12 June and 23 June)  
    N+MIC+S        N (as above) plus micronutrients: Mg at 480 g, Mn at  
                    162 g, Cu at 32.4 g, Fe at 3.6 g, B at 3.6 g, Zn  
                    at 1.68 g and Mo at 0.84 g (as 'BASF Foliar 36' at  
                    12 l), plus sulphur at 8.0 kg (as 'Thiovit')  
                    applied in 220 l on 16 Apr, 1987, 12 June and  
                    23 June

plus all combinations of (all given no other inputs):

1. VAR NIL            Varieties:  
    ARIANA        Ariana (duplicated)  
    BIENVENU      Bienvenu
2. SDAT NIL            Dates of sowing:  
    14 AUG        14 August, 1986  
    4 SEP        4 September

plus 4 plots for N15 studies and 2 plots for root studies not taken for yield.

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Basal applications: Manures: (0:18:36) at 700 kg. 'Nitram' at 140 kg. Weedkillers: Sodium trichloroacetate at 16 kg in 200 l. Metazachlor at 0.75 kg in 280 l. Metazachlor at 0.50 kg with fluazifop-P-butyl at 0.19 kg and a wetting agent ('Agral' at 0.20 l) in 200 l. Desiccant: Diquat at 0.60 kg ion with a wetting agent ('Agral' at 0.50 l) in 500 l.

Seed: Varieties, dressed gamma HCH, thiram and fenpropimorph, sown at 8.0 kg.

Cultivations, etc.:— Spring-tine cultivated: 8 Aug, 1986. PK applied: 11 Aug. Sodium trichloroacetate applied, basal N applied, oxamyl treatments to SOWDATE 14 AUG applied, harrowed: 13 Aug. Seed sown for SOWDATE 14 AUG: 14 Aug. Metazachlor applied to SOWDATE 14 AUG: 15 Aug. Oxamyl treatments applied and seed sown to SOWDATE 4 SEPT, harrowed in, metazachlor applied to these plots: 4 Sept. Metazachlor with fluazifop-P-butyl and the wetting agent applied: 4 Oct. Desiccant with wetting agent applied: 30 July, 1987. Combine harvested: 4 Aug. Previous crops: W. wheat 1985, w. barley 1986.

NOTE: Detailed observations were made during the season on diseases, pests, N in plants and soil, dry matter accumulation, leaf areas, root growth, light interception and lodging. Measurements were taken of N15 uptake and the fate of N in crop residues. Microflora of leaf and pods were assessed up to harvest and some seed analysed for mineral composition and glucosinolate contents. Percentage of oil in grain was measured.

GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

SOW DATE	14 AUG	4 SEP	Mean
VARIETY			
ARIANA	3.66	3.78	3.72
BIENVENU	3.91	4.10	4.00
Mean	3.78	3.94	3.86
N RATE	150	250	Mean
VARIETY			
ARIANA	3.65	3.78	3.72
BIENVENU	3.90	4.11	4.00
Mean	3.77	3.95	3.86
N RATE	150	250	Mean
SOW DATE			
14 AUG	3.58	3.98	3.78
4 SEP	3.96	3.91	3.94
Mean	3.77	3.95	3.86
N DIVIS	SINGLE	DIVIDED	Mean
VARIETY			
ARIANA	3.67	3.77	3.72
BIENVENU	4.07	3.94	4.00
Mean	3.87	3.85	3.86

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GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

\*\*\*\*\*Tables of means \*\*\*\*\*

N DIVIS	SINGLE	DIVIDED	Mean
SOW DATE			
14 AUG	3.75	3.82	3.78
4 SEP	3.99	3.89	3.94
Mean	3.87	3.85	3.86
N DIVIS	SINGLE	DIVIDED	Mean
N RATE			
150	3.74	3.80	3.77
250	3.99	3.91	3.95
Mean	3.87	3.85	3.86
GROWREG	NONE	TRIAPEN	Mean
VARIETY			
ARIANA	3.49	3.94	3.72
BIENVENU	3.60	4.40	4.00
Mean	3.55	4.17	3.86
GROWREG	NONE	TRIAPEN	Mean
SOW DATE			
14 AUG	3.31	4.26	3.78
4 SEP	3.79	4.09	3.94
Mean	3.55	4.17	3.86
GROWREG	NONE	TRIAPEN	Mean
N RATE			
150	3.48	4.06	3.77
250	3.61	4.29	3.95
Mean	3.55	4.17	3.86
GROWREG	NONE	TRIAPEN	Mean
N DIVIS			
SINGLE	3.60	4.14	3.87
DIVIDED	3.50	4.21	3.85
Mean	3.55	4.17	3.86
INSCTCDE	NONE	DE+TR	Mean
VARIETY			
ARIANA	3.64	3.80	3.72
BIENVENU	4.04	3.97	4.00
Mean	3.84	3.88	3.86
INSCTCDE	NONE	DE+TR	Mean
SOW DATE			
14 AUG	3.80	3.76	3.78
4 SEP	3.87	4.01	3.94
Mean	3.84	3.88	3.86

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GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

INSCTCDE	NONE	DE+TR	Mean
N RATE			
150	3.72	3.82	3.77
250	3.95	3.95	3.95
Mean	3.84	3.88	3.86
INSCTCDE	NONE	DE+TR	Mean
N DIVIS			
SINGLE	3.78	3.96	3.87
DIVIDED	3.89	3.81	3.85
Mean	3.84	3.88	3.86
INSCTCDE	NONE	DE+TR	Mean
GROWREG			
NONE	3.57	3.53	3.55
TRIAPEN	4.11	4.24	4.17
Mean	3.84	3.88	3.86
FUNGCIDE	NONE	PR+IP	Mean
VARIETY			
ARIANA	3.53	3.90	3.72
BIENVENU	3.82	4.19	4.00
Mean	3.68	4.04	3.86
FUNGCIDE	NONE	PR+IP	Mean
SOW DATE			
14 AUG	3.65	3.91	3.78
4 SEP	3.70	4.17	3.94
Mean	3.68	4.04	3.86
FUNGCIDE	NONE	PR+IP	Mean
N RATE			
150	3.55	3.99	3.77
250	3.80	4.09	3.95
Mean	3.68	4.04	3.86
FUNGCIDE	NONE	PR+IP	Mean
N DIVIS			
SINGLE	3.70	4.04	3.87
DIVIDED	3.66	4.05	3.85
Mean	3.68	4.04	3.86
FUNGCIDE	NONE	PR+IP	Mean
GROWREG			
NONE	3.33	3.77	3.55
TRIAPEN	4.03	4.32	4.17
Mean	3.68	4.04	3.86

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GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

FUNGCIDE	NONE	PR+IP	Mean		
INSCTCDE					
NONE	3.63	4.04	3.84		
DE+TR	3.72	4.04	3.88		
Mean	3.68	4.04	3.86		
SOWDAT N	14 AUG	4 SEP	Mean		
VARIETY N					
ARIANA	3.70	3.47	3.59		
BIENVENU	4.18	4.05	4.11		
Mean	3.94	3.76	3.85		
N RATE N	0	100	200	300	Mean
VARIETY N					
ARIANA	2.39	3.58	4.19	4.19	3.59
BIENVENU	2.84	4.20	4.60	4.81	4.11
Mean	2.61	3.89	4.40	4.50	3.85
N RATE N	0	100	200	300	Mean
SOWDAT N					
14 AUG	2.93	3.94	4.43	4.45	3.94
4 SEP	2.30	3.84	4.36	4.55	3.76
Mean	2.61	3.89	4.40	4.50	3.85
SOWDAT P	14 AUG	4 SEP	Mean		
VARIETY P					
ARIANA	4.14	3.86	4.00		
BIENVENU	4.25	4.56	4.41		
Mean	4.19	4.21	4.20		
N RATE P	150	250	Mean		
VARIETY P					
ARIANA	3.85	4.15	4.00		
BIENVENU	3.89	4.92	4.41		
Mean	3.87	4.53	4.20		
N RATE P	150	250	Mean		
SOWDAT P					
14 AUG	3.75	4.64	4.19		
4 SEP	3.99	4.43	4.21		
Mean	3.87	4.53	4.20		
GROREG P	NONE	TRIAPEN	Mean		
VARIETY P					
ARIANA	3.87	4.13	4.00		
BIENVENU	4.27	4.54	4.41		
Mean	4.07	4.34	4.20		



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GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

GROREG P	NONE	TRIAPEN	Mean
SOWDAT P			
14 AUG	4.06	4.33	4.19
4 SEP	4.08	4.34	4.21
Mean	4.07	4.34	4.20
GROREG P	NONE	TRIAPEN	Mean
N RATE P			
150	3.74	4.00	3.87
250	4.40	4.67	4.53
Mean	4.07	4.34	4.20
GRORG OX	NONE	TRIAPEN	Mean
SODATE O			
14 AUG	2.97	4.32	3.65
4 SEP	3.89	4.00	3.95
Mean	3.43	4.16	3.80
INSCT OX	NONE	DE+TR	Mean
SODATE O			
14 AUG	2.97	4.32	3.65
4 SEP	4.00	3.89	3.95
Mean	3.49	4.11	3.80
INSCT OX	NONE	DE+TR	Mean
GRORG OX			
NONE	2.97	3.89	3.43
TRIAPEN	4.00	4.32	4.16
Mean	3.49	4.11	3.80
FOL NUT	N	N+MIC+S	Mean
VAR NUT			
ARIANA	3.95	4.15	4.05
BIENVENU	4.70	4.24	4.47
Mean	4.32	4.19	4.26
SDAT NIL	14 AUG	4 SEP	Mean
VAR NIL			
ARIANA	2.31	2.25	2.28
BIENVENU	2.59	2.44	2.52
Mean	2.41	2.31	2.36
GRAIN MEAN	3.83		

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\*\*\* Standard errors of differences of means \*\*\*

Table	VARIETY	SOW DATE	N RATE	N DIVIS
s.e.d.	0.094	0.094	0.090	0.090

Table	GROWREG	INSCTCDE	FUNGCIDE	VARIETY
s.e.d.	0.090	0.090	0.090	SOW DATE
				0.133

Table	VARIETY	SOW DATE	VARIETY	SOW DATE
s.e.d.	N RATE	N RATE	N DIVIS	N DIVIS
	0.131	0.131	0.131	0.131

Except when comparing means with the same level(s) of

VARIETY	0.128		0.128	
SOW DATE		0.128		0.128

Table	N RATE	VARIETY	SOW DATE	N RATE
s.e.d.	N DIVIS	GROWREG	GROWREG	GROWREG
	0.128	0.131	0.131	0.128

Except when comparing means with the same level(s) of

VARIETY	0.128			
SOW DATE			0.128	
N RATE				0.131
GROWREG				0.131

Table	N DIVIS	VARIETY	SOW DATE	N RATE
s.e.d.	GROWREG	INSCTCDE	INSCTCDE	INSCTCDE
	0.128	0.131	0.131	0.128

Except when comparing means with the same level(s) of

VARIETY	0.128			
SOW DATE			0.128	

Table	N DIVIS	GROWREG	VARIETY	SOW DATE
s.e.d.	INSCTCDE	INSCTCDE	FUNGCIDE	FUNGCIDE
	0.128	0.128	0.131	0.131

Except when comparing means with the same level(s) of

VARIETY	0.128			
SOW DATE				0.128

Table	N RATE	N DIVIS	GROWREG	INSCTCDE
s.e.d.	FUNGCIDE	FUNGCIDE	FUNGCIDE	FUNGCIDE
	0.128	0.128	0.128	0.128

Except when comparing means with the same level(s) of

N RATE	0.131			
GROWREG			0.131	
FUNGCIDE	0.131		0.131	

\*\*\*\*\* Stratum standard errors and coefficients of variation \*\*\*\*\*

Stratum	d.f.	s.e.	cv%
BLOCK.WP	6	0.189	4.9
BLOCK.WP.SP	26	0.361	9.4

GRAIN MEAN DM% 87.1

PLOT AREA HARVESTED 0.00299