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## Yields of the Field Experiments 1973

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### 73/W/CS/16 - Irrigation and Eelworms - Potatoes

#### Rothamsted Research

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73/W/CS/16

IRRIGATION AND EELWORMS

Object: To study the cumulative and residual effects of dazomet and the effects of irrigation, nitrogen and potassium fertiliser on the yield and incidence of *Heterodera* spp. on potatoes grown continuously. The effects of growing susceptible and resistant varieties are also studied, either grown continuously or alternated - Woburn Butt Close.

Sponsors: F.G.W. Jones, K. Evans, T.M. Addiscott.

The eighth year, potatoes.

For previous years see 66/C/32(t), 67/C/25, 68/C/19, 69/W/CS/16(t), 70-71/W/CS/16 and 72/W/CS/16(t).

Design:

Series I: 3 blocks of 4 plots, residues of sequences of varieties on strips of 2 half plots, residues of fumigants on quarter plots and fertilisers on eighth plots.

Series IV: 3 blocks of 4 plots, sequences of varieties on strips of 2 half plots, dazomet on quarter plots.

Whole plot dimensions: 6.48 x 7.11. Area harvested: Series I and IV: 0.00092.

Treatments: To Series I. All combinations of:-

Whole plots: 1. Irrigation:

None	IRRIGN
Full	None
	Full

Strips of half plots: 2. Previous cropping with potatoes resistant (R) or susceptible (S) to potato cyst nematode (all susceptible in 1973):

PREVCROP

1966	1967	1968	1969	1970	1971	1972	
R	R	R	R	R	R	S	R/R/R/S
S	R	S	R	S	R	S	R/S/R/S
S	S	S	S	S	S	S	S/S/S/S
R	S	R	S	R	S	S	S/R/S/S

Quarter plots: 3. Residues of fumigants applied 1966-71:

FUMRESID

None	None
DD (1966-68): dazomet (1969-71)	DD/Daz.

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Eighth plots: 4. Nitrogen fertiliser (kg N):	N
164 supplied by basal (13:13:20)	164
328 supplied by basal (13:13:20) plus 'Nitro-Chalk'	328
5. Potassium fertiliser (kg K <sub>2</sub> O):	K <sub>2</sub> O
250 supplied by basal (13:13:20)	250
500 supplied by basal (13:13:20) plus muriate of potash	500

Treatments: To Series IV. All combinations of:-

Whole plots: 1. Irrigation:	IRRIGN
None	None
Full	Full

Strips of half plots: 2. Cropping sequence with potatoes resistant (R) and susceptible(S) to potato cyst nematode:

1966	1967	1968	1969	1970	1971	1972	1973	
R	R	R	R	R	R	R	R	R/R/R/R
R	S	R	S	R	S	R	S	R/S/R/S
S	S	S	S	S	S	S	S	S/S/S/S
S	R	S	R	S	R	S	R	S/R/S/R

Quarter plots: 3. Dazomet (kg) applied cumulatively to previous fumigant treatments:

	0	0
	224	224
Irrigation treatments 1973 (mm water):		

	Series I		Series IV
12 June	12.7	8 June	12.7
15 June	12.7	15-21 June	12.7
10 July	12.7	11 July	12.7
23 July	12.7	25 July	12.7
2 Aug	12.7	1 Aug	12.7
	-----		-----
Total	63.5		63.5

Basal applications: Manures: Magnesian limestone at 7.5 tonnes. (13:13:20) at 1280 kg, Series I and 1510 kg, Series IV. Weedkiller: Linuron at 1.2 kg with paraquat at 0.42 kg ion in 280 l. Fungicide with insecticide: Mancozeb at 1.3 kg with demeton-s-methyl at 0.25 kg in 390 l. Fungicide: Mancozeb at 1.3 kg in 390 l. Haulm desiccant: Diquat at 0.5 kg ion in 370 l.

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Varieties: Series I: Pentland Dell.  
Series IV: Pentland Dell (susceptible), Maris Piper (resistant).

Cultivations, etc.:-

Series I: Deep-tine cultivated: 25 Sept, 1972. Magnesian limestone applied: 3 Oct. Ploughed: 21 Dec. NPK applied: 28 Mar, 1973. N and K treatments applied: 10 Apr. Rotary cultivated, potatoes planted: 11 Apr. Weedkiller applied: 14 May. Grubbed: 1 June. Fungicide with insecticide applied: 5 July. Fungicide applied: 27 July. Haulm mechanically destroyed, diquat applied: 22 Aug. Lifted: 10 Sept.

Series IV: Deep-tine cultivated: 27 Sept, 1972. Magnesian limestone applied: 3 Oct. Dazomet applied, rotary cultivated: 6 Nov. Ploughed: 4 Jan, 1973. NPK applied: 27 Mar. Rotary cultivated, potatoes planted: 9 Apr. Weedkiller applied: 14 May. Grubbed: 1 June. Fungicide with insecticide applied: 5 July. Fungicide applied: 27 July. Haulm mechanically destroyed, diquat applied: 22 Aug. Lifted: 11 Sept.

- NOTES: (1) Soil samples were taken before planting and after lifting for egg and cyst counts of *Heterodera* spp. and larval invasion tests.
- (2) Weekly observations were made of water potential and stomatal resistance of leaves and water content of the soil to a depth of 60 cm on Series IV.
- (3) Plant samples were taken at fortnightly intervals to measure leaf areas, fresh and dry weights of haulm, fresh weights of roots and new tubers and to determine percentage P, K, Ca, Mg and Na in the haulm.
- (4) Series I. The whole area was infested by Potato Cyst Nematode and (in the absence of soil fumigation) all yields were poor. Therefore the potatoes were not graded and standard errors for total tubers are not presented.

Standard errors per plot. Total tubers, tonnes/hectare:

Series IV. Pooled whole and half plot: 4.65 or 34.6% (14 d.f.)  
Quarter plot: 4.30 or 32.0% (16 d.f.)

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TABLES OF MEANS

SERIES I

TOTAL TUBERS: TONNES/HECTARE

	PREVCROP				Mean
	R/R/R/S	R/S/R/S	S/S/S/S	S/R/S/S	
<b>IRRIGN</b>					
None	4.9	2.2	2.9	1.9	3.0
Full	2.6	1.0	1.8	0.7	1.5
<b>FUNRESID</b>					
None	2.9	1.3	1.9	1.3	1.8
DD/Daz	4.5	2.0	2.8	1.2	2.6
<b>N</b>					
164	2.9	1.0	2.1	1.1	1.8
328	4.5	2.3	2.6	1.4	2.7
<b>K20</b>					
250	3.8	1.6	2.4	1.4	2.3
500	3.6	1.7	2.3	1.1	2.2
Mean	3.7	1.6	2.3	1.3	2.2

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SERIES IV

	CROPSEQN				Mean
	R/R/R/R	R/S/R/S	S/S/S/S	S/R/S/R	
TOTAL TUBERS: TONNES/HECTARE					
IRRIGN					
None	21.1	11.3	6.1	14.4	13.2
Full	18.9	12.5	8.9	14.3	13.6
DAZOMET					
0	10.6	4.6	0.9	6.5	5.6
224	29.5	19.2	14.2	22.1	21.2
Mean	20.0	11.9	7.5	14.3	13.4

STANDARD ERRORS OF DIFFERENCES

CROPSEQN	DAZOMET	CROPSEQN* IRRIGN	CROPSEQN DAZOMET
2.68	1.24	3.80	3.21
Except when comparing means with same level of CROPSEQN			2.48

\* Within the same level of IRRIGN only

PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLE

IRRIGN					
None	73.0	59.5	47.2	70.7	62.6
Full	63.2	60.3	41.7	73.7	59.8
DAZOMET					
0	52.9	40.6	16.1	63.1	43.2
224	83.3	79.2	72.9	81.3	79.2
Mean	68.1	59.9	44.5	72.2	61.2

73/R/CS/24

PK AND TAKE-ALL

Object: To study the effects of different amounts of phosphate, potash and nitrogen fertiliser on the yields and incidence of take-all (*Gaeumannomyces graminis*) in continuous barley - West Barnfield II.

Sponsors: G.E.G. Mattingly, D.E. Slope.

The sixth year, barley.

For previous years see 68/C/16(t), 69/R/CS/24, 70/R/CS/24(t) and 71-72/R/CS/24.

Design: 4 randomised blocks of 10 plots split into 2.

Whole plot dimensions: 5.33 x 20.1. Sub-plot area harvested: 0.00273.

Treatments: All combinations of:-

Whole plots: 1. Phosphate (kg P2O5) as superphosphate:	P2O5
None	0
37.5 annually	37.5A
150 annually	150A
226 six-yearly, last applied autumn 1967	226-6YR
904 six-yearly, last applied autumn 1967	904-6YR
2. Potassium (kg K2O) annually as muriate of potash:	K2O
37.5	37.5
150	150
Sub plots: 3. Nitrogen (kg N) as 'Nitro-Chalk':	N
37.5	37.5
75.0	75.0
113	113
150	150

Basal applications: Weedkillers: Paraquat, 0.56 kg ion in 220 l and MCPA, mecoprop and dicamba ('Tetralix plus' 7.0 l in 220 l).

73/R/CS/24

Seed: Julia, sown at 160 kg.

Cultivations, etc.: - Paraquat applied: 26 Sept, 1972. Ploughed: 27 Nov.  
P and K treatments applied: 27 Feb, 1973. N treatments applied, seed  
sown: 15 Mar. 'Tetralax plus' applied: 16 May. Combine harvested:  
10 Aug.

NOTES: (1) Samples were taken in May and July for estimation of incidence of  
root rotting disease. Soil samples were taken in the autumn for  
P and K analyses.

(2) Due to an error at harvest the yields of grain from two plots

F205	K20	N
226R	37.5	113
	and	
150A	37.5	113

could not be separated. Estimated values were used in the analysis.

Standard error per plot. (Pooled, whole and half plot).

Grain, tonnes/hectare: 0.383 or 9.4% (35 d.f.)



73/R/05/24

TABLES OF MEANS

GRAIN: TONNES/HECTARE

	P205					
	0	37.5A	150A	226-6YR	904-6YR	Mean
K20						
37.5	2.80	4.16	4.83	3.30	4.50	3.92
150	3.34	4.58	4.78	3.69	4.59	4.20
N						
37.5	3.21	4.28	4.90	3.69	4.81	4.18
75.0	2.78	4.48	5.09	3.37	4.85	4.11
113	3.39	4.50	4.73	3.74	4.75	4.22
150	2.92	4.23	4.51	3.17	3.76	3.72
Mean	3.07	4.37	4.81	3.49	4.54	4.06

	N			
	37.5	75.0	113	150
K20				
37.5	3.99	4.08	4.04	3.51
150	4.34	4.17	4.38	3.95

73/R/CS/24  
GRAIN: TONNES/HECTARE

K20	37.5				150			
	0	37.5A	150A	226-6YR 904-6YR	0	37.5A	150A	226-6YR 904-6YR
P205								
N								
37.5	3.02	4.03	4.95	4.68	3.43	4.56	4.60	4.16
75.0	2.78	4.22	5.08	5.10	2.80	4.76	5.14	3.53
113	2.73	4.41	4.74	4.87	4.08	4.62	4.74	3.78
150	2.74	4.05	4.34	3.40	3.12	4.44	4.71	3.34

STANDARD ERRORS OF DIFFERENCES

P205	K20	N	P205	P205	K20	P205
			K20	N	N	K20
						N

0.136 0.087 0.122 0.192 0.272 0.174 0.404

Mean D.M. % 82.3

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STRAW: TONNES/HECTARE

	P205					Mean
	0	37.5A	150A	226-6YR	904-6YR	
K20						
37.5	2.11	2.78	3.38	2.01	3.02	2.66
150	2.59	3.29	3.79	2.45	3.38	3.10
N						
37.5	2.33	2.79	2.89	2.32	3.03	2.67
75.0	2.33	2.98	3.91	2.09	3.43	2.95
113	2.65	3.35	3.77	2.29	3.41	3.09
150	2.09	3.03	3.77	2.23	2.94	2.81
Mean	2.35	3.04	3.59	2.23	3.20	2.88

  

	N			
	37.5	75.0	113	150
K20				
37.5	2.48	2.70	2.94	2.51
150	2.86	3.19	3.24	3.11

73/R/CS/24

STRAW: TONNES/HECTARE

K20	37.5				150			
	0	37.5A	150A	226-6YR 904-6YR	0	37.5A	150A	226-6YR 904-6YR
P205								
N								
37.5	2.10	2.61	2.88	2.11	2.72	2.55	2.91	2.52
75.0	2.08	2.59	3.44	1.89	3.51	2.58	4.38	2.28
113	2.25	3.10	3.61	2.29	3.47	3.05	3.94	2.28
150	2.01	2.84	3.59	1.76	2.38	2.17	3.95	2.71

Mean D.M. % 88.0

73/W/CS/34

NEMATOCIDES IN CROP SEQUENCE

Object: To study the effects of a range of nematicides on incidence of *Heterodera rostochiensis* and yield of potatoes, residual effects of previous treatments are studied in sugar beet and barley - Woburn Great Hill II and III.

Sponsor: A.G. Whitehead.

The fifth year, potatoes, sugar beet, barley.

For previous years see 71/W/CS/34(t) and 72/W/CS/34(t).

Design: 4 series of 3 blocks of 10 plots.

Whole plot dimensions: 4.27 x 9.14. Area harvested: Potatoes - 0.00130, sugar beet - 0.00130, barley - 0.00260.

Treatments: The experiment has four series with the following cropping:-

	1969	1970	1971	1972	1973
Series I	P	P	P*	SB	B
Series II	P	P	P	P*	SB
Series III	P	B	P	P	P*
Series IV	P	B	P	P	P

P = potatoes, SB = sugar beet, B = barley.

\* Treatments applied to potatoes, later crops test residual effects.

Treatments to barley (Series I) and sugar beet (Series II): All combinations of:-

1. Nematicides:

Barley - NEMACIDE(71)  
Sugar beet - NEMACIDE(72)

Aldicarb  
Du Pont 1410  
Nemacur P (series I only)  
CGA 10576 (series II only)

Aldicarb  
Dupont  
Nemacur  
CGA

2. Rates of nematicide (kg a.i.):

RATE

2.8  
5.6  
11.2

2.8  
5.6  
11.2

together with one untreated plot per block

0.0

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Treatments to potatoes (Series III): All combinations of:-

1. Nematicides:	NEMACIDE(73)
Benomyl	Benomyl
Du Pont 1410	Dupont
Dowco 275	Dowco
2. Rates of nematicide (kg a.i.):	RATE
Single rate (2.8 Du Pont 1410, Dowco 275: 5.6 benomyl)	Single
Double rate (5.6 Du Pont 1410, Dowco 275: 11.2 benomyl)	Double
Quadruple rate (11.2 Du Pont 1410, Dowco 275: 22.4 benomyl)	Quad
together with one untreated plot per block	0.0

Basal applications:

Potatoes: Test and preparatory crop: Manures: (13:13:20) at 1830 kg.  
 Weedkiller: Linuron at 1.2 kg plus paraquat at 0.56 kg ion in 280 l.  
 Fungicide with insecticide: Mancozeb at 1.3 kg plus demeton-s-methyl at 0.25 kg in 390 l. Fungicide: Mancozeb at 1.3 kg in 390 l on the first occasion and in 370 l on the second occasion.  
 Sugar beet: Manures: Magnesian limestone at 5 tonnes. (0:14:28) at 730 kg, N at 190 kg as 'Nitro-Chalk'. Boron at 7.4 kg B2O3 (as 'Solubor') applied with insecticide. Insecticide: Demeton-s-methyl at 0.25 kg in 450 l. Weedkiller: Phenmedipham at 1.6 kg in 280 l.  
 Barley: Manures: (20:15:15) at 500 kg combine drilled. Weedkiller: Ioxynil at 0.53 kg and mecoprop at 1.6 kg in 280 l.

Seed: Potatoes: Pentland Crown.

Sugar beet: Klein E, sown at 8.0 kg.

Barley: Julia, dressed with ethirimol, sown at 160 kg.

Cultivations, etc.:-

Potatoes, Test crop: Ploughed: 18 Dec, 1972. NPK applied: 26 Mar, 1973.  
 Treatments applied, all plots rotary cultivated: 30 Mar. Potatoes planted: 3 Apr. Weedkiller applied: 9 May. Grubbed: 31 May.  
 Fungicide with insecticide applied: 6 July. Fungicide applied: 26 July, 13 Aug. Haulm mechanically destroyed: 12 Sept. Lifted: 20 Sept.

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Potatoes, Preparatory crop: Ploughed: 19 Dec, 1972. NPK applied: 26 Mar, 1973. Rotary cultivated, potatoes planted: 3 Apr. Weedkiller applied: 9 May. Grubbed: 31 May. Rotary ridged: 25 June. Fungicide with insecticide applied: 6 July. Fungicide applied: 26 July, 13 Aug. Haulm mechanically destroyed: 23 Aug. Lifted: 13 Sept.  
Sugar beet: Magnesian limestone applied: 17 Nov, 1972. Ploughed: 18 Dec. PK and N applied: 20 Mar, 1973. Power harrowed, seed sown: 21 Mar. Weedkiller applied: 15 May. Singled: 21-24 May. Boron and insecticide applied: 25 June. Lifted: 9 Nov.  
Barley: Ploughed: 18 Dec, 1972. Seed sown: 12 Mar, 1973. Weedkiller applied: 15 May. Combine harvested: 10 Aug.

NOTE: Soil samples were taken before applying treatments and after harvest for counts of cysts, eggs and larvae of *Heterodera rostochiensis*.

Standard errors per plot.

Potatoes, Total tubers, tonnes/hectare:	3.38 or 17.0% (18 d.f.)
Sugar beet, Roots (washed), tonnes/hectare:	2.37 or 5.9% (18 d.f.)
Total sugar, tonnes/hectare:	0.425 or 5.7% (18 d.f.)
Barley, Grain, tonnes/hectare:	0.318 or 6.6% (18 d.f.)

73/W/CS/34

TABLES OF MEANS

POTATOES SERIES III

	Single	RATE Double	Quad	Mean
TOTAL TUBERS: TONNES/HECTARE				
NEMACIDE(73)				
Benomy1	14.4	10.9	15.0	13.4
Dupont	29.4	31.9	31.3	30.8
Dowco	15.8	19.1	22.3	19.1
Mean	19.9	20.6	22.9	21.1

RATE 0.0 9.0  
Grand mean 19.9

STANDARD ERRORS OF DIFFERENCES

NEMACIDE(73)	RATE	NEMACIDE(73) RATE & RATE 0.0
1.59	1.59	2.76

PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLE

NEMACIDE(73)				
Benomy1	83.9	77.5	83.0	81.5
Dupont	87.1	86.2	86.6	86.6
Dowco	84.3	88.1	83.8	85.4
Mean	85.1	84.0	84.5	84.5

RATE 0.0 75.8  
Grand mean 83.6