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Results of the
Classical and other
Long-term Experiments
2016

R/EX/4 Exhaustion Land

Rothamsted Research

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16/R/EX/4

EXHAUSTION LAND

Object: To study the residual effects of manures applied 1856 - 1901, and of additional phosphate applied since 1986 (P test) and of additional potassium since 2007 (K test); on the yield of continuous s. barley up to 1991, w. wheat since – Hoosfield.

The 161st year, w. wheat.

For previous years see 'Details' 1977, 1973 and Yield Books for 74-14/R/EX/4

Treatments: All combinations of:-

Whole plots (P test)

1. **OLD RES** Residues of manures applied annually 1876 – 1901:

O	None
D	Farmyard manure at 35 t
N	96 kg N as ammonium salts
P	34 kg P as superphosphate
NPKNAMG	N and P as above plus 137 kg K as sulphate of potash, 16 kg Na as sulphate of soda, 11 kg Mg as sulphate of magnesia

2. **P** Maintenance P (20 kg P) applied annually from 2000 to maintain existing levels of available P in the soil. In 2009 maintenance P applications were changed from 20 kg P/ha to 15 kg P/ha. This was not recorded in the yield books for 2009-13. (P1) (P2) and (P3) are residues of P applied annually 1986–1992:

	2009-Present	2000-08	1986-92
O	None	None	None
P (P1)	15 kg P	20 kg P	44 kg P
P (P2)	15 kg P	20 kg P	87 kg P
P (P3)	15 kg P	20 kg P	131 kg P

NOTE: P treatments were applied at 61.5 kg P in error in 2000.

Plus

Whole plots (K test, previously N test until 1991)

1. **OLD RES** Residues of manures applied annually 1876 – 1901:

O	None
D	Farmyard manure at 35 t
N*	96 kg N as nitrate of soda
PK	34 kg P as superphosphate, 137 kg K as sulphate of potash
N*PK	N, P and K as above

2. **K** Potassium applied annually from 2007 as muriate of potash

O None
 K1 75 kg K₂O (62.2 kg K)
 K2 150 kg K₂O (124.5 kg K)
 Whole plots
 Nitrogen: 50 kg N as ammonium sulphate (to supply sufficient S) during first two weeks in March, 200 kg N as ammonium nitrate at GS31/mid-April (whichever comes first) and 50 kg N as ammonium nitrate at GS37 (not later than mid-May)

Experimental diary

Date		Application	Rate	Units
25/08/2015	p	Sprayed Firebrand	1	lt/ha
25/08/2015	p	Sprayed Samurai	4	lt/ha
01/10/2015	f	Applied MOP - Plots 103, 83, 63, 43 + 23	125	kg/ha
01/10/2015	f	Applied MOP - Plots 094-014, 092-012, 104-024, 093-013, 091-011	250	kg/ha
01/10/2015	f	Applied TSP - plots 101-021, 102-022, 103-023, 104-024, 091-011 + 092-012	75	kg/ha
09/10/2015	a	Ploughed; thrown south	-	-
09/10/2015	a	Topped all field and exp - Batwing	-	-
15/10/2015	a	Power harrowed - Seed bed preparation	-	-
15/10/2015	s	Drilled Crusoe trt Redigo	350	seed/m ²
18/10/2015	a	Ring Rolled all new drilling	-	-
19/10/2015	p	Sprayed WW - Liberater	0.6	lt/ha
19/10/2015	p	Sprayed WW - Stomp Aqua	1.75	lt/ha
12/11/2015	p	Sprayed Hallmark	40	ml/ha
03/12/2015	p	Applied TDS Major	5	kg/ha
12/12/2015	p	Sprayed Hallmark	40	ml/ha
21/03/2016	f	Applied Sulphate of Ammonia	238	kg/ha
04/04/2016	f	Applied Nitram @ 34.5%N	840	kg/ha
08/04/2016	p	Sprayed Moddus	150	ml/ha
08/04/2016	p	Sprayed BASF 3C Chlormequat750	1.25	lt/ha
08/04/2016	p	Sprayed Odin	500	ml/ha
08/04/2016	p	Sprayed Mirage 40ec	500	ml/ha
08/04/2016	p	Sprayed Bravo500	1	lt/ha
13/04/2016	f	Applied Kieserite - all plots	80	kg/ha
05/05/2016	p	Sprayed Keystone - wheat only	800	ml/ha
05/05/2016	p	Sprayed Keystone - wheat only	700	ml/ha
24/05/2016	p	Sprayed Vortex	1.5	lt/ha
24/05/2016	p	Sprayed VortexCorbel	250	ml/ha
09/07/2016	p	Sprayed Cello	550	ml/ha
09/07/2016	p	Sprayed Hallmark	50	ml/ha
22/08/2016	a	Cut Paths using Iseki and Mower	-	-
23/08/2016	a	Mopped Up remaining crop	-	-
25/08/2016	a	Harvested All Plots	-	-

26/08/2016 a Combined all crop using Tucano - -
 25/08/2015 p Sprayed Firebrand 1 lt/ha

Note: Samples of grain and straw were taken for chemical analysis. The yield strips on plots 031-034, 071- 074, 091- 094 (12 plots in total) were made smaller this year to avoid areas where the crop had already been sampled by S. McGrath et al.

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P TEST

Grain tonnes/hectare

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

P_RES	O	P1	P2	P3	Mean
OLD_RES					
O	2.48	7.72	8.51	9.12	6.96
D	5.66	10.35	10.85	11.49	9.59
N	2.33	8.07	9.90	9.59	7.47
P	4.23	9.89	10.93	11.27	9.08
NPKNAMG	3.96	7.98	11.11	11.83	8.72
Mean	3.73	8.80	10.26	10.66	8.36

Grain mean DM% 85.2

Straw tonnes/hectare

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

P_RES	O	P1	P2	P3	Mean
OLD_RES					
O	2.49	6.84	7.76	7.49	6.14
D	5.33	9.5	9.49	8.94	8.32
N	1.90	7.56	8.45	7.68	6.40
P	3.59	7.56	8.47	8.05	6.92
NPKNAMG	3.92	7.22	9.13	8.80	7.27
Mean	3.45	7.74	8.66	8.19	7.01

Straw mean DM% 92.1

Plot area harvested 0.00538, 0.00252.

K TEST

Grain tonnes/hectare

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

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K_Test	K0	K1	K2	Mean
OLD_RES				
O	9.14	10.50	10.48	9.82
D	8.76	10.92	10.86	9.83
N*	9.44	10.52	9.84	9.81
PK	10.54	10.51	10.18	10.44
N*PK	9.56	10.75	11.14	10.25
Mean	9.49	10.64	10.50	10.03

Grain mean DM% 85.5

Straw tonnes/hectare

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

K_Test	K0	K1	K2	Mean
OLD_RES				
O	6.70	8.34	8.40	7.53
D	6.55	8.05	8.12	7.32
N*	6.08	7.53	7.64	6.83
PK	7.22	7.08	7.19	7.18
N*PK	6.31	7.10	7.40	6.78
Mean	6.57	7.62	7.75	7.13

Straw mean DM% 96.6 Plot area harvested 0.00538