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Yields of the Field Experiments 2011

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Results of the
Classical and other
Long-term Experiments
2011

R/EX/4 Exhaustion Land

Rothamsted Research

Rothamsted Research (2012) *R/EX/4 Exhaustion Land* ; Yields Of The Field Experiments 2011, pp 24 - 27 - DOI: <https://doi.org/10.23637/ERADOC-1-221>

11/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 156th year, w. wheat.

For previous years see 'Details' 1977, 1973 and Yield Books for 74-10/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. (P1) (P2) and (P3) are residues of P applied annually 1986–1992:

| | 2000-11 | 1986-92 |
|--------|---------|----------|
| O | None | None |
| P (P1) | 20 kg P | 44 kg P |
| P (P2) | 20 kg P | 87 kg P |
| P (P3) | 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 |

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

| | |
|----|--------------------------------------|
| O | None |
| K1 | 75 kg K ₂ O (62.2 kg K) |
| K2 | 150 kg K ₂ O (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

| | | | Rate | Unit |
|-----------|---|--|------|-------|
| K Test | | | | |
| 07-Oct-10 | f | Basal P (triple superphosphate) - plots 02,04,06,08 and 10 | 75 | kg/ha |
| | | Muriate of Potash - plots 23,43,63,83,103 | 125 | kg/ha |
| | | Muriate of Potash - plots 24,44,64,84,104 | 250 | kg/ha |
| P Test | | | | |
| 07-Oct-10 | f | Triple Super Phosphate - plots 011-013,031-033,051-053, 071-073, 091-093 | 75 | kg/ha |
| 07-Oct-10 | f | Muriate of Potash - plots 011-014, 031-034, 051-054, 071-074, 091-094. | 250 | kg/ha |
| All Plots | | | | |
| 10-Oct-10 | a | Ploughed | | |
| 10-Oct-10 | a | Ploughed | | |
| 13-Oct-10 | a | Cultipressed | | |
| 15-Oct-10 | s | Drilled Xi 19 trt Anchor - 350 seeds / metre sq | 145 | kg/ha |
| 16-Oct-10 | a | Rolled | | |
| 17-Oct-10 | p | Sprayed Regatta - water volume = 200 lt/ha | 0.6 | l/ha |
| 14-Mar-11 | f | Applied Ammonium Sulphate Fertiliser | 238 | kg/ha |
| 28-Mar-11 | p | Sprayed Cherokee - Water volume = 118 lt/ha. Applied to WW area only | 1.25 | l/ha |
| 06-Apr-11 | f | Applied Kieserite | 80 | kg/ha |
| 13-Apr-11 | f | Applied Nitram | 580 | kg/ha |
| 05-May-11 | p | Sprayed Bravo 500, Tracker, | 1.0 | l/ha |
| | | Agriguard Chlormequat 720, | 2.25 | l/ha |
| | | Ally Max | 42 | g/ha |
| | | and Starane 2 - 200 lt/ha water | 0.75 | l/ha |
| 10-May-11 | f | Applied Nitram | 146 | kg/ha |
| 16-May-11 | a | Cut paths | | |
| 19-May-11 | p | Sprayed Opus, Comet 200 | 0.8 | l/ha |
| | | and Bravo 500 - 100 l/ha water | 0.6 | l/ha |
| | | | 1.0 | l/ha |
| 23-May-11 | a | Cut paths | | |

03-Jun-11 a Rotavated paths
 08-Jun-11 a Cut paths
 20-Jun-11 a Cut paths
 01-Aug-11 a Cut paths
 12-Aug-11 a Combined O+Es - Opened up trials with commercial combine ready for yields to be taken
 12-Aug-11 a Baled O+Es - Baled area discard area cut to open out trials
 16-Aug-11 a Straw weights
 16-Aug-11 a Combined - O+Es
 17-Aug-11 a straw baled

P TEST

GRAIN TONNES/HECTARE

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

| P_RES | O | P(P1) | P(P2) | P(P3) | Mean |
|---------|------|-------|-------|-------|------|
| OLD_RES | | | | | |
| O | 2.54 | 4.97 | 5.35 | 5.76 | 4.65 |
| D | 4.40 | 7.32 | 7.26 | 7.41 | 6.60 |
| N | 1.76 | 6.15 | 7.27 | 6.70 | 5.47 |
| P | 3.91 | 7.28 | 8.21 | 7.42 | 6.70 |
| NPKNAMG | 3.50 | 5.62 | 7.04 | 7.72 | 5.97 |
| MEAN | 3.22 | 6.27 | 7.03 | 7.00 | 5.88 |

GRAIN MEAN DM% 86.0%

STRAW TONNES/HECTARE

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

| P_RES | O | P1 | P2 | P3 | MEAN |
|---------|------|------|------|------|------|
| OLD_RES | | | | | |
| O | 0.71 | 1.42 | 1.27 | 1.69 | 1.27 |
| D | 1.38 | 2.02 | 1.95 | 1.95 | 1.83 |
| N | 0.66 | 1.82 | 2.00 | 2.27 | 1.69 |
| P | 1.15 | 2.32 | 2.09 | 2.17 | 1.93 |
| NPKNAMG | 1.07 | 1.64 | 1.75 | 2.11 | 1.64 |
| MEAN | 1.00 | 1.85 | 1.81 | 2.04 | 1.67 |

STRAW MEAN DM% 84.1%

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K TEST

GRAIN TONNES/HECTARE

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

| K_TEST | KO | K1 | K2 | Mean |
|---------|------|------|------|------|
| OLD_RES | | | | |
| O | 6.24 | 7.64 | 7.36 | 6.87 |
| D | 7.81 | 8.25 | 7.98 | 7.96 |
| N* | 6.69 | 6.75 | 7.39 | 6.88 |
| PK | 7.43 | 6.50 | 7.62 | 7.25 |
| N*PK | 7.00 | 6.61 | 7.80 | 7.10 |
| MEAN | 7.03 | 7.15 | 7.63 | 7.21 |

Standard errors of difference of means

| Table | OLD_RES | K_TEST | OLD_RES | |
|--------|---------|---------|---------|---------|
| rep. | 4 | unequal | K_Test | |
| d.f. | 5 | 5 | unequal | |
| s.e.d. | | 0.181 | 5 | min.rep |
| | 0.202 | 0.157 | | max-min |
| | | 0.128X | 0.286 | max.rep |

(No comparisons in categories where s.e.d. marked with an X
Grain mean DM% 86.6

STRAW TONNES/HECTARE

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

| K_TEST | K0 | K1 | K2 | Mean |
|---------|------|------|------|------|
| OLD_RES | | | | |
| O | 1.56 | 2.39 | 1.94 | 1.87 |
| D | 2.12 | 2.52 | 2.02 | 2.19 |
| N* | 1.62 | 1.75 | 2.33 | 1.83 |
| PK | 2.11 | 2.01 | 1.96 | 2.05 |
| N*PK | 1.55 | 1.76 | 2.55 | 1.85 |
| MEAN | 1.79 | 2.09 | 2.16 | 1.96 |
| REP | 10 | 5 | 5 | |

Standard errors of difference of means

| Table | OLD_RES | K_TEST | OLD_RES | |
|--------|---------|---------|---------|---------|
| rep. | 4 | unequal | K_Test | |
| d.f. | 5 | 5 | unequal | |
| s.e.d. | | 0.124 | 5 | min.rep |
| | 0.139 | 0.108 | | max-min |
| | | 0.088X | 0.197 | max.rep |

(No comparisons in categories where s.e.d. marked with an X
Straw mean DM% 85.1