# Results of the Classical and Other Long-term Experiments - 2017


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## Default Title

### Rothamsted Research

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ROTHAMSTED RESEARCH

# Results of the

# Classical and other

# Long-term Experiments

# 2017

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Results of the Classical and other Long-term Experiments 2017

## Contents

## Conventions

For each experiment the current treatments are shown with the factor and level names which are used in the tables.

For each experiment references are given to previous years. These refer to the '(Numerical) (Results)' previous editions of 'Yields of the Field Experiments'.

For the classical and some long-term experiments reference is made to 'Details' – separate publications, giving full descriptions of treatments until 1977 & 1973, with full titles 'Details of the Classical and Long Term Experiments up to 1977' and 'Details of the Classical and Long Term Experiments up to 1973'.

The following conventions are observed unless otherwise stated.

All areas are in hectares. All plot dimensions are in metres.

All rates of application of fertilizers, sprays etc. are per hectare.

All yields are per hectare.

For any other crop, details of abbreviations are given as necessary

**FERTILIZERS**

27%N or 34.5% N means nitrogen as calcium ammonium nitrate or ammonium nitrate.

| | |
|---|---|
| Anhydrous Sulphate of Soda | |
| Chalk | |
| Compost | |
| Double Top | 27% nitrogen and 30% $SO_3$ |
| FYM | Farmyard manure (from bullocks) |
| Headland Manganese 500 | 500 g/l 27.5% w/w manganese carbonate |
| Kieserite | $MgSO_4H_2O$ 17.7% magnesium and 23.3% sulphur |
| Maize Tops | |
| Manganese sulphate | $Mn_2 (SO_4)_3$ 27% manganese and 24% sulphur |
| Magnesium sulphate | $MgSO_4 H_2O$ 17.7% magnesium and 23.3% sulphur |
| Muriate of potash (MOP) | 60% $K_2O$ as Potassium Chloride (KCl) |
| Nitram | 34.5% N |
| Nitraprill | 34.5% N |
| Nitrate of soda | $NaNO_3$ 16% nitrogen and 27% sodium |



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| | |
|---|---|
| Nitro-Chalk | Calcium Ammonium Nitrate 27% N |
| Silicate of soda | $Na_2SiO_3$ 37% sodium and 23% silica |
| Sodium Sulphate | 35% Sodium |
| Sulphate of ammonia | $(NH_4)_2SO_4$ 21% nitrogen 24% sulphur |
| Sulphate of potash (SOP) | $K_2SO_4$ 50% $K_2O$ and 18.4% sulphur |
| Triple superphosphate (TSP) | 47% $P_2O_5$ |

Cereal straw is removed unless otherwise stated.

GS: Growth Stage.
tm): Tank mix; two or more products applied together.
tr: means seed dressing

## PESTICIDES USED

The following list of pesticides is based on The UK Pesticides Guide, CAB International and The British Crop Protection Council. CABI Publishing

KEY TO ABBREVIATIONS

| | | | | | |
|---|---|---|---|---|---|
| ad | Adjuvant | d | Desiccant | f | Fungicide |
| gr | Growth regulator | h | Herbicide | i | Insecticide |
| m | Molluscicide | n | Nematicide | tr | Trace elements |

| Trade Name | Function | Active ingredient |
|---|---|---|
| Atlantis | h | iodosulfuron-methyl-sodium + mesosulfuron-methyl (0.6:3.0 % w/w) |
| Aviator 235 Xpro | f | bixafen + prothioconazole (75:160g/l) |
| Balear 720 | f | chlorothalonil (720 g/l) |
| BASF 3C | gr | chlormequat (750 g/l) |
| Beret Gold | f | fludioxonil (25 g/l), seed dressing. |
| BioPower | ad | 6.7% w/w 3,6-dioxaeicosylsulphate sodium salt and 20.2% w/w 3,6-dioxaoctadecylsulphate sodium salt |
| Bravo 500 | f | chlorothalonil (500 g/l) |
| Buffalo Elite | ad | ammonium sulphate (40 % w/w), water conditioner. |
| Callisto | h | mesotrione (100 g/l) |



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| | | |
|---|---|---|
| Cello | f | prothioconazole + spiroxamine + tebuconazole (100:250:100 g/l) |
| Chex | ad | A soluble liquid concentrate containing water conditioning and acidifying agents, humectant, pH buffer and an anti-foam. Water conditioner. |
| Claw 500 | f | chlorothalonil (500 g/l) |
| Cogent (Intracrop) | ad | 32.67% w/w alkoxylated alcohols and 1.0% w/w trisiloxane organosilicone copolymers |
| Cortez | f | epoxiconazole (125 g/l) |
| Cyflamid | f | cyflufenamid (50 g/l) |
| Defy | h | prosulfocarb (800 g/l) |
| Deploy 1000 | ad | alcohol alkoxylate (1000 g/l). Non-ionic spreader. |
| Deter | i | clothianidin (250 g/l) |
| Envoy | f | epoxiconazole + pyraclostrobin (62.5:85 g/l) |
| Epic | f | epoxiconazole (125 g/l) |
| Excalibur | h | diflufenican + flupyrsulfuron-methyl (44.4:5.6 % w/w) |
| Eximus | h | pendimethalin (400 g/l) |
| Fezan | f | tebuconazole (250g/l) |
| Firebrand | ad | ammonium sulphate (500 g/l) |
| Hallmark with zeon tech | i | lambda-cyhalothrin (100 g/l) |
| Hatchet xtra | h | fluroxypyr (200 g/l) |
| Hurler | h | fluroxypyr (200 g/l) |
| Keystone | f | epoxiconazole + isopyrazam (99:125 g/l) |
| Kingdom | f | boscalid + epoxiconazole (140:50 g/l) |
| Kinto | f | prochloraz + triticonazole (60:20 g/l), seed dressing. |
| Mesurol | i | methiocarb (500g/l), seed dressing. |
| Moddus | gr | trinexapac-ethyl (250 g/l) |
| Nirvana | h | imazamox + pendimethalin (16.7:250 g/l) |
| Palio | h | florasulam + pyroxsulam (1.4:7.1 % w/w) |
| Raxil star | f | fluopyram + prothioconazole + tebuconazole (20.8:103.1:63.2 g/l), seed dressing. |



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| | | |
|---|---|---|
| Redigo Pro | f | prothioconazole + tebuconazole (15:20 g/l), seed dressing. |
| Refine Max | h | metsulfuron-methyl + thifensulfuron-methyl (6.7:33.3 w/w) |
| Samson Extra | i | nicosulfuron (60 g/l) |
| Samurai | h | glyphosate (360 g/l) |
| Simba SX | h | metsulfuron-methyl (20 % w/w) |
| Stabilan | gr | chlormequat (750 g/l) |
| TDS Major | m | metaldehyde (4% w/w) |
| Troy 480 | h | bentazone (480 g/l) |
| Vortex | f | epoxiconazole + fluxapyroxad + pyraclostrobin (41.6:41.6:61 g/l) |
| Sprinter-K | foliar feed | $K_20$, 30% w/w (44,4% w/v) |
| San 703 | f | chlorothalonil + cyproconazole (375:40 g/l) |
| 3C Chlormequat | gr | chlormequat (750 g/l) |

## Machinery Referred to in the Diary Notes

| Cultivators | Manufacturer | Width | Description |
|---|---|---|---|
| Plough | Kverneland | 1.5 m | 5 Furrow, 25 cm Furrows. |
| Cultipress | Simba | 3.3 m | Used after Ploughing. |
| Flexitine | Bunford | 3.3 m | Used for lifting Worked ground. |
| Powerharrow | Kverneland | 3.0 m | Used for creating seed bed. |
| Rotavator | Howard | 1.3 m | Mainly used for BK/1 Paths. |
| Rotavator | Concept | 1.2 m | Mainly Used for HB/2 Paths. |

| Drills | Manufacturer | Width | Description |
|---|---|---|---|
| Accord Combination Drill | Kverneland | 3.0 m | Power-harrow Mounted Pneumatic drill with Suffolk coulters 12.5 cm apart. |
| Maize Drill | Nodet Pneumasem 2 | 5 Rows | Rows spaced at 70 cm. |

| Chemical Applications | Manufacturer | Width | Description |
|---|---|---|---|
| Aero-spreader | Kuhn | 12 m | Tractor Mounted - General Fert Applications. |



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| | | | |
|---|---|---|---|
| Muck Spreader | International | 1.5 m | Trailed - FYM Applications. |
| Exacto-matic | Ransome, Nordsten | 3.8 m | Tractor Mounted - Fert Applications. |
| Sprayer | Knight | 24 m | Tractor Mounted - Chemical Application. |
| Quickpass | Yr-Crop | 1.5 m | Trailed - Fert Applicationsp. |
| Lowspread | Lowspread | 2.76 m | Tractor Mounted - Fert Applications. |

| **Harvesters** | **Manufacturer** | **Width** | **Description** |
|---|---|---|---|
| Rosenlew SR2010 | Sampo | (Cut) 2m | Cereal Combine Harvester with a Continuous Weighing System. |
| 3760 | John Deere | 2 Row | Maize Harvester, Cut and Mulch. Trailed Machine used after plot yields. |
| Tucano | Claas | 6 m | Commercial Combine used for harvesting discards after plot yields. |
| Box Mower | Wilder | 1.1 m | Box Mower Mainly used for yields on PG/5. |
| Mower | Unifarm | 1.83 m | Commercial Mower used to mow discards on PG/5. |
| Plot Combine | Haldrup | (Cut) 2m | Cereal Combine Harvester (used 2017 Onward). |

| **Other** | **Manufacturer** | **Width** | **Description** |
|---|---|---|---|
| Ring Rolls | Cousins | 3.3 m | Ring rolls for covering seed post drilling. |
| Topper 9 | McConnell | 2.72 m | Topper used for topping stubbles and grass areas. |
| Small Topper | Kilworth | 1.1 m | Topper used with Iseki Tractor - Used for cutting Paths. |
| 945 Conventional Baler | New Holland | - | Traditional Baler Used for baling straw samples. |
| Round Baler | Claas | - | Used for clearing unwanted leftover straw/grass from experiments. |

| **Tractors** | **Manufacturer** | **Weight** | **Description** |
|---|---|---|---|
| T7210 | New Holland | 8.1 t | Main cultivations tractor. |
| TL6030 Elite | New Holland | 5.5 t | Sprayer tractor. |
| 6830 | John Deere | 5.6 t | Drill and fertiliser application tractor. |
| TH4335 | Iseki | 1.1 t | Paths cutting tractor. |



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| | | | |
|---|---|---|---|
| T503 | Tym | 2.0 t | Fertiliser applications and Rotovating. |

Application code: This is used to identify the kind of application

a = application (cultivations, harvest, etc.), p = pesticide, f = fertilizer and s = seed.



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## 17/R/BK/1 BROADBALK

**Object**: To study the effects of organic manures and inorganic fertilisers on continuous winter wheat and wheat in rotation. From 1968 two three-year rotations were included: potatoes, beans, winter wheat and fallow, winter wheat, winter wheat. In 1979 the first rotation was changed to fallow, potatoes, winter wheat. In 1980 the second rotation reverted to continuous winter wheat. Since 1985 part of the second rotation was added to the first to extend the rotation to fallow, potatoes, winter wheat, winter wheat, winter wheat. In 1996 the fallow was replaced by winter oats and potatoes replaced by maize in 1997.
The 175th year, winter wheat, winter oats and forage maize.
For previous years see 'Details' 1967 and 1973, Station Report for 1966, pp. 229-231; Station Report for 1968, Part 2; Station Report for 1982, Part 2, pp 5-44 and Yield Books for 74-16/R/BK/1.

**Areas harvested [a]:**

| | Section | |
|---|---|---|
| Wheat: | 0 | 0.00305 |
| | 1 | 0.00561 |
| | 4,8,7 and 6 | 0.00463 |
| | 9 | 0.00488 |
| Oats: | 2 | 0.00463 |
| Maize: | 3 | 0.00189 |

[a] The new Haldrup combine has a slightly smaller cut width (2.0m) than the previous Sampo combine (2.1m). Consequently, from 2017 cereal yields were based on a 2.0m cut width. Maize yields are calculated using a row spacing of 0.7m. Maize yields for 2009-2016 were recalculated to account for the increase in row width from 0.6m to 0.7m in 2009. The corrected yields are given in the 2016 yield book.

**Treatments:**
In 2001 some of the treatments were changed. The treatments are now:
Whole plots

| **PLOT** | Fertilizers and organic manures<br>Treatments<br>Plot | From 2001 |
|---|---|---|
| 01 (FYM)N4 | 01 | N4 |
| 21FYMN3 | 2.1 | FYM N2 (1) |
| 22FYM | 2.2 | FYM |
| 03Nil | 03 | None |
| 05(P)KMg | 05 | (P) K Mg |
| 06N1 (P) KMg | 06 | N1 (P) K Mg |
| 07N2(P)KMg | 07 | N2 (P) K Mg |
| 08N3(P)KMg | 08 | N3 (P) K Mg |
| 09N4(P)KMg | 09 | N4 (P) K Mg |
| 10N4 | 10 | N4 |
| 11N4PMg | 11 | N4 P Mg |
| 12N1+3+1(P)K2Mg2 | 12 | N1+3+1 (P) K2 Mg2 (2) |
| 13N4PK | 13 | N4 P K |
| 14N4PK*(Mg*) | 14 | N4 P K* (Mg*) |
| 15N5(P)KMg | 15 | N5 (P) K Mg |



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| | | |
|---|---|---|
| 16N6(P)KMg | 16 | N6 (P) K Mg |
| 17N1+4+1PKMg | 17 | N1+4+1 P K Mg |
| 18N1+2+1PKMg | 18 | N1+2+1 P K Mg |
| 19N1+1+1KMg | 19 | N1+1+1 K Mg |
| 20N4KMg | 20 | N4 K Mg |

(1) FYM N3 since 2005
(2) N1+3+1 (P) KMg since 2006

Winter oats; Nitrogen and farmyard manure were not applied.

N1, N2, N3, N4, N5, N6: 48, 96, 144, 192, 240, 288 kg N as 33.5% N; to be applied at the same time as the second dressings in the split nitrogen plots for wheat and to the seedbed for forage maize.

Split N to wheat

N1+1+1, 1+2+1 etc: Rates as above. Timings: first two weeks of March, GS31 or mid-April (whichever comes first) and GS37/mid-May.

Split N to forage maize

N2+1, 2+2, 2+3,2+4: Rates as above. Timings: to the seedbed and post-emergence.
P: 35 kg P as triple superphosphate
(P): (none since 2001), to be reviewed in 2018/19.
K: 90 kg K as potassium sulphate.
K2: 180 kg K as potassium sulphate (plus 450 kg K autumn 2000 only)
K*: 90 kg K as potassium chloride
Mg: 12 kg Mg as kieserite.
Mg2: 24 kg Mg as kieserite (plus 60kg Mg, autumn 2000 only).
(Mg*): (none since 2001), to be reviewed in 2018/19
FYM: Farmyard manure at 35 t

**Previous treatment:**
Whole plots

| **PLOT** | | | Fertilizers and organic manures:- | |
|---|---|---|---|---|
| | Plot | Treatments until 1967 | Treatments from 1968 | Treatments from 1985 – 2000 |
| 01DN4PK | 01 | - | D N2 P K | D N4 P K |
| 21DN2 | 21 | D | D N2 | D N2 |
| 22D | 22 | D | D | D |
| 030 | 03 | None | None | None |
| 05F | 05 | P K Na Mg | P K (Na) Mg | PK Mg |
| 06N1F | 06 | N1 P K Na Mg | N1 P K (Na) Mg | N1 P K Mg |
| 07N2F | 07 | N2 P K Na Mg | N2 P K (Na) Mg | N2 P K Mg |
| 08N3F | 08 | N3 P K Na Mg | N3 P K (Na) Mg | N3 P K Mg |
| 09N4F | 09 | N*1 P K Na Mg | N4 P K (Na) Mg | N4 P K Mg |
| 10N2 | 10 | N2 | N2 | N2 |
| 11N2P | 11 | N2 P | N2 P | N2 P |
| 12N2PNA | 12 | N2 P Na | N2 P Na | N2 P Na |
| 13N2PK | 13 | N2 P K | N2 P K | N2 P K |



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| | | | | |
|---|---|---|---|---|
| 14N2PKMG | 14 | N2 P Mg | N2 P K Mg | N2 P K Mg |
| 15N5F | 15 | N2 P K Na Mg | N3 P K(Na) Mg | N5 P K Mg |
| 16N6F | 16 | N*2 P K Na Mg | N2 P K (Na) Mg | N6 P K Mg |
| 17N1+3FH | 17 | N2 (A) | N2 ½[P K (Na) Mg] | N1+3 ½[P K Mg] (A)+ |
| 18N0+3FH | 18 | P K Na Mg (A) | N2 ½[P K (Na) Mg] | N0+3 ½[P K Mg] (A)+ |
| 19(C) | 19 | C | C | (C) (since 1989) |
| 20N2KMG | 20 | N2 K Na Mg | N2 K (Na) Mg | N2 K Mg |

(A) Alternating each year
+ This change since 1980. Treatments shown are those to winter wheat; autumn N alternates. Maize received N3 ½[PK Mg] on both plots 17 and 18. These treatments shown incorrectly in 1999-2002 Yield books.
Winter oats; Nitrogen and dung were not applied.

| | |
|---|---|
| N1, N2, N3, N4, N5, N6: | 48, 96, 144, 192, 240, 288 kg N as sulphate of ammonia until 1967, except N* which was nitrate of soda. All as 'Nitro-Chalk' in spring from 1968 to 1985, as 34.5% N since 1986. |
| N0+3; N1+3: | None in autumn + 144 kg N in spring; 48 kg N in autumn + 144 kg N in spring. |
| P: | 35 kg P as triple superphosphate in 1974 and since 1988, single superphosphate in other years |
| K: | 90 kg K as sulphate of potash |
| Na: | 55 kg Na as sulphate of soda |
| (Na): | 16 kg Na as sulphate of soda until 1973 |
| Mg: | 30kg Mg annually to Plot 14 (applied at 26 kg 1990 to 2000), 35 kg Mg every third year to other plots since 1974 (applied at 30 kg in 1991, 1994, 1997 and 2000 and at 15 kg on half rate treatments). All as kieserite since 1974, previously as sulphate of magnesia annually. |
| D: | Farmyard manure at 35 t |
| (C ): | Castor meal to supply 96 kg N until 1988, none since |
| F: | Full rate P K (Na) Mg as above |
| H: | Half rate of above. |

Strips of sub-plots: Until 1967 wheat alone was grown on the experiment, with some bare fallowing. From 1968, the experiment was divided into 10 sections with the following cropping:

**SECTION**

| Section | 1 | 9 | 0* | 8+ | 6** | 5 | 3 | 7 | 4 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | | | | | | | | | | |
| 1968 | W | W | W | W | F | W | W | P | W | BE |
| 1969 | W | W | W | W | W | F | W | BE | P | W |
| 1970 | W | W | W | W | W | W | F | W | BE | P |
| 1971 | W | W | W | W | F | W | W | P | W | BE |
| 1972 | W | W | W | F | W | F | W | BE | P | W |
| 1973 | W | W | W | W | W | W | F | W | BE | P |
| 1974 | W | W | W | W | F | W | W | P | W | BE |
| 1975 | W | W | W | W | W | F | W | BE | P | W |
| 1976 | W | W | W | W | W | W | F | W | BE | P |



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| Section | 1 | 9 | 0* | 8+ | 6** | 5 | 3 | 7 | 4 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | | | | | | | | | | |
| 1977 | W | W | W | W | F | W | W | P | W | BE |
| 1978 | W | W | W | W | W | F | W | BE | P | W |
| 1979 | W | W | W | W | W | W | F | W | P | F |
| 1980 | W | W | W | W | W | W | W | F | W | P |
| 1981 | W | W | W | F | W | W | W | P | F | W |
| 1982 | W | W | W | W | W | W | W | W | P | F |
| 1983 | W | W | W | W | W | W | W | F | W | P |
| 1984 | W | W | W | W | W | W | W | P | F | W |
| 1985 | W | W | W | W | W | F | W | W | P | W |
| 1986 | W | W | W | W | W | P | F | W | W | W |
| 1987 | W | W | W | W | W | W | P | W | W | F |
| 1988 | W | W | W | F | W | W | W | F | W | P |
| 1989 | W | W | W | W | W | W | W | P | F | W |
| 1990 | W | W | W | W | W | F | W | W | P | W |
| 1991 | W | W | W | W | W | P | F | W | W | W |
| 1992 | W | W | W | W | W | W | P | W | W | F |
| 1993 | W | W | W | W | W | W | W | F | W | P |
| 1994 | W | W | W | F | W | W | W | P | F | W |
| 1995 | W | W | W | W | W | F | W | W | P | W |
| 1996 | W | W | W | W | W | P | O | W | W | W |
| 1997 | W | W | W | W | W | W | M | W | W | O |
| 1998 | W | W | W | W | W | W | W | O | W | M |
| 1999 | W | W | W | W | W | W | W | M | O | W |
| 2000 | W | W | W | W | W | O | W | W | M | W |
| 2001 | W | W | W | F | W | M | O | W | W | W |
| 2002 | W | W | W | W | W | W | M | W | W | O |
| 2003 | W | W | F | W | W | W | W | O | W | M |
| 2004 | W | W | F | W | W | W | W | M | O | W |
| 2005 | W | W | W | W | W | O | W | W | M | W |
| 2006 | W | W | W | W | W | M | O | W | W | W |
| 2007 | W | W | W | W | W | W | M | W | W | O |
| 2008 | W | W | W | F | W | W | W | O | W | M |
| 2009 | W | W | W | W | W | W | W | M | O | W |
| 2010 | W | W | W | W | W | O | W | W | M | W |
| 2011 | W | W | W | W | W | M | O | W | W | W |
| 2012 | W | W | W | W | W | W | M | W | W | O |
| 2013 | W | W | W | W | W | W | W | O | W | M |
| 2014 | W | W | W | W | W | W | W | M | O | W |
| 2015[++] | W | W | W | F | W | O | W | W | M | W |
| 2016 | W | W | W | F | W | M | O | W | W | W |
| 2017 | W | W | W | W | W | W | M | W | W | O |

W = winter wheat, O = winter oats (spring oats 2001), P = potatoes, BE = spring beans, F = fallow, M = forage maize

* Straw incorporated since autumn 1986. ** No sprays except weedkillers since 1985.

+ No weedkillers.

[++] Spring Wheat in 2015



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**NOTES:**

(1) For a fuller record of treatments see 'Details' etc.

(2) From autumn 1975 to autumn 1986, chalk was applied at 2.9t each autumn to all plots in sets of Sections on a three-year cycle. Year 1: Sections 1, 2, 3. Year 2: Sections 6, 7, 8, 9. Year 3: Sections 0, 4, 5. From autumn 1988 until autumn 1992 a five-year cycle was used. Year 1: Sections 1, 3. Year 2: Sections 2, 8. Year 3: Sections 7, 9. Year 4: Sections 4, 6. Year 5: Sections 0, 5 (omitted). No chalk was applied after autumn 1991 until autumn 2007 when differential amounts were applied to selected plots (see "Results 2008"). Chalk was applied again to selected plots in autumn 2013, see 14/R/BK/1 diary information.

(3) In 2003 and 2004 section 0 was used for an experiment (CS/595) investigating different herbicides to control *Equisetum arvense*.

(4) In 2013 the wheat variety changed from Hereward to Crusoe, but it was sown very late (22nd February 2013) because of the very wet autumn and winter of 2012-13.

(5) Spring wheat (var Mulika) and winter oats (var Gerald) were sown in March 2015, instead of in autumn/winter 2014, because the very wet soil conditions in autumn 2014 prevented sowing of a winter crop. The whole site was spring-tine cultivated in March 2015 instead of being ploughed. Section 8 was left in bare fallow in 2015 & 2016 and had two in-season cultivations (inversion ploughing) each year to control weeds.

**17/R/BK/1 Experimental Diary:**

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| **All Sections** | | | | |
| 20/09/2016 | a | Batwing Topped | - | - |
| 26/09/2016 | f | Applied TSP - to strips 18, 17, 14, 13 + 11 | 171 | kg/ha |
| 26/09/2016 | f | Applied MOP - to strip 14 | 181 | kg/ha |
| 27/09/2016 | a | Started Ploughing - Thrown South | - | - |
| 06/10/2016 | a | Cultipressed All Ground | - | - |
| 10/10/2016 | a | Ring Rolled all field | - | - |
| 12/10/2016 | a | Ring Rolled | - | - |
| 08/11/2016 | f | Applied Major Slug Pellets | 5 | kg/ha |
| 21/03/2017 | f | Applied Kieserite - to strips 5, 6, 7, 8, 9, 11, 12, 15, 16, 17, 18, 19 + 20; All Sections | 80 | kg/ha |
| 29/03/2017 | f | Applied SOP - to strips 5, 6, 7, 8, 9, 11, 12, 15, 16, 17, 18, 19 + 20; All Sections | 217 | kg/ha |
| 11/04/2017 | a | Flexitined surrounding fallow areas | - | - |
| 05/06/2017 | a | Cut out all paths | - | - |
| 26/06/2017 | a | cut all paths | - | - |
| 27/07/2017 | a | cut all paths | - | - |
| 25/08/2017 | a | Harvested paths | - | - |
| 29/08/2017 | a | Baled all discard and remaining swaths | - | - |
| 07/09/2017 | a | Baled all remaining commercial swath | - | - |
| 07/09/2017 | a | Completed Straw Weights | - | - |



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**W Wheat**

| | | | | |
|---|---|---|---|---|
| 27/09/2016 | f | Applied FYM - to strips 2.1, 2.2 excluding Section 2 | 35 | t/ha |
| 11/10/2016 | s | Drilled WW Crusoe trt Redigo Pro + Deter; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 350 | seeds/$m^2$ |
| 13/10/2016 | p | Sprayed Liberator | 1 | lt/ha |
| 13/10/2016 | p | Sprayed Defy | 3 | lt/ha |
| 14/03/2017 | f | Applied Nitram @ 34.5%N - to strips 12, 17, 18 + 19 excluding Sections 2 and 3 | 139 | kg/ha |
| 15/03/2017 | p | Sprayed Pacifica - Sections 0, 1, 4, 5, 6, 7 + 9 only | 500 | g/ha |
| 15/03/2017 | p | Sprayed Chex - Sections 0, 1, 4, 5, 6, 7 + 9 only | 250 | ml/ha |
| 15/03/2017 | p | Sprayed Bio Power - Sections 0, 1, 4, 5, 6, 7 + 9 only | 1 | lt/ha |
| 05/04/2017 | p | Sprayed Artemis - Sections 0, 1, 4, 5, 7, 8 + 9 only | 1 | lt/ha |
| 05/04/2017 | p | Sprayed Claw500 - Sections 0, 1, 4, 5, 7, 8 + 9 only | 51 | lt/ha |
| 05/04/2017 | p | Sprayed Moddus - Sections 0, 1, 4, 5, 7, 8 + 9 only | 125 | ml/ha |
| 05/04/2017 | p | Sprayed 3c Chlormewuat750 - Sections 0, 1, 4, 5, 7, 8 + 9 only | 1.25 | lt/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strip 19; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 139 | kg/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strips 7, 18; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 278 | kg/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strips 2.1, 8, 12; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 417 | kg/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strips 1, 9, 10, 11, 13, 14, 17, 20; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 556 | kg/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strips 15; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 696 | kg/ha |
| 07/04/2017 | f | Applied Nitram @ 34.5%N - to strips 16; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 835 | kg/ha |
| 25/04/2017 | p | Sprayed Keystone - Sections 0, 1, 4, 5, 7, 8 + 9 | 600 | ml/ha |
| 25/04/2017 | p | Sprayed Epic - Sections 0, 1, 4, 5, 7, 8, + 9 | 400 | ml/ha |
| 25/04/2017 | p | Sprayed Balear 720 - Sections 0, 1, 4, 5, 7, 8, + 9 | 700 | ml/ha |
| 08/05/2017 | f | Applied Nitram - to strips 12, 17, 18, 19; Sections 0, 1, 4, 5, 6, 7, 8 + 9 | 139 | kg/ha |
| 25/05/2017 | p | Sprayed, Cortez - sections, 0, 1, 4, 5, 7, 8, + 9 | 350 | ml/ha |
| 25/05/2017 | p | Sprayed, Vortex - sections, 0, 1, 4, 5, 7, 8, + 9 | 1 | lt/ha |
| 19/06/2017 | p | Sprayed, Fezan, (Tebuconazole)- Sections, 0, 1, 4, 5, 7, 8, + 9 | 750 | ml/ha |



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| | | | | |
|---|---|---|---|---|
| 28/08/2017 | a | harvested all WW plots for grain yield | - | - |
| 29/08/2017 | a | Chopped Straw using Claas Tucano back onto Section 0 | - | - |
| 02/09/2017 | a | Straw Weights on Sections 8 & 5 | - | - |
| 07/09/2017 | a | Straw Weights on Sections 1 | - | - |

**W Oats**

| | | | | |
|---|---|---|---|---|
| 11/10/2016 | a | Drilled Mascani trt Beret Gold; Section 2 only | 350 | seeds/$m^2$ |
| 08/11/2016 | p | Sprayed Excalibur - Section 2 only | 180 | gm/ha |
| 08/11/2016 | p | Sprayed Hallmark - Section 2 only | 50 | ml/ha |
| 10/05/2017 | p | Sprayed Cyflamid - Section 2 only | 150 | ml/ha |
| 10/05/2017 | p | Sprayed Envoy - Section 2 only | 1 | lt/ha |
| 10/05/2017 | p | Sprayed Stabilan - Section 2 only | 2 | lt/ha |
| 28/08/2017 | a | harvested all OW plots for grain yield | - | - |
| 07/09/2017 | a | Straw Weights on Sections 2 | - | - |

**Maize**

| | | | | |
|---|---|---|---|---|
| 27/09/2016 | f | Applied FYM - to strips 2.1, 2.2; Not Section 2 | 35 | t/ha |
| 12/04/2017 | a | Drilled Severus Maize trt Mesurol - Section 3 only | 10 | seeds/$m^2$ |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to strip 19; Section 3 only | 139 | kg/ha |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to strips 7, 18; Section 3 only | 278 | kg/ha |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to 2.1, 8, 12; Section 3 only | 417 | kg/ha |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to strips 1, 9, 10, 11, 13, 14, 17; Section 3 only | 556 | kg/ha |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to strips 15; Section 3 only | 696 | kg/ha |
| 08/05/2017 | f | Applied Nitram @ 34.5%N - to strips 16; Section 3 only | 835 | kg/ha |
| 24/05/2017 | f | Applied Nitram @ 34.5%N - to strip 19; Section 3 only | 139 | kg/ha |
| 24/05/2017 | f | Applied Nitram @ 34.5%N - to strip 18; Section 3 only | 278 | kg/ha |
| 24/05/2017 | f | Applied Nitram @ 34.5%N - to strip 12; Section 3 only | 417 | kg/ha |
| 24/05/2017 | f | Applied Nitram @ 34.5%N - to strip 17; Section 3 only | 556 | kg/ha |
| 12/06/2017 | p | Sprayed Samson Extra - Section 3 only | 750 | ml/ha |
| 12/06/2017 | p | Sprayed Callisto - Section 3 only | 2 | lt/ha |
| 14/09/2017 | a | Harvested Maize for Yield - Section 3 only | - | - |
| 15/09/2017 | a | Cut all remaining maize – Section 3 only | - | - |
| 19/09/2017 | a | Baled and removed maize – Section 3 only | - | - |



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**Wilderness**

20/12/2016 a Topped Broadbalk wilderness

NOTE: Samples of grain and straw were taken for chemical analysis. Unground grain and straw samples from selected treatments were archived.

## YIELDS

**WINTER WHEAT**

Grain Tonnes/Hectare (85% DM)

*Tables of means*

| Section Plot | 5/W1 | 4/W2 | 7/W3 | 6/W40 | 0/W13 | 1/W51 | 9/W59 | 8/W1 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 01 (FYM) N4 | 9.94 | 7.83 | 5.67 | 5.36 | - | - | - | - | 7.20 |
| 21 FYM N3 | 10.49 | 9.51 | 6.43 | 5.78 | 4.48 | 4.61 | 7.12 | 5.00 | 6.68 |
| 22 FYM | 7.10 | 6.40 | 6.37 | 6.48 | 4.34 | 4.63 | 6.37 | 6.18 | 5.98 |
| 03 NIL | 2.27 | 1.00 | 1.26 | 1.54 | 0.74 | 0.68 | 0.44 | 3.26 | 1.40 |
| 05 (P) KMg | 2.00 | 1.20 | 1.78 | 1.38 | 1.13 | 0.96 | 0.97 | 5.44 | 1.86 |
| 06 N1 (P) KMg | 4.29 | 2.77 | 3.02 | 3.28 | 2.11 | 2.13 | 3.43 | 5.40 | 3.30 |
| 07 N2 (P) KMg | 6.53 | 4.12 | 3.55 | 4.25 | 2.67 | 2.57 | 4.03 | 5.05 | 4.09 |
| 08 N3 (P) KMg | 8.09 | 4.75 | 3.76 | 4.76 | 3.85 | 2.98 | 4.96 | 6.42 | 4.95 |
| 09 N4 (P) KMg | 9.06 | 5.88 | 4.04 | 5.88 | 3.20 | 2.69 | 3.96 | 7.82 | 5.32 |
| 10 N4 | 7.35 | 2.04 | 3.00 | 2.95 | 1.81 | 1.35 | 2.48 | 3.15 | 3.02 |
| 11 N4 PMg | 7.67 | 5.46 | 3.01 | 4.44 | 3.34 | 2.37 | 3.07 | 4.39 | 4.22 |
| 12N1+3+1 (P) KMg | 10.38 | 7.85 | 5.39 | 6.39 | 4.18 | 3.72 | 5.46 | 7.04 | 6.30 |
| 13 N4 PK | 9.22 | 4.90 | 3.96 | 5.97 | 3.71 | 2.49 | 4.94 | 5.66 | 5.11 |
| 14 N4 PK* (Mg*) | 8.69 | 5.10 | 4.42 | 6.51 | 4.55 | 4.15 | 5.51 | 6.79 | 5.71 |
| 15 N5 (P) KMg | 9.82 | 4.88 | 4.78 | 6.32 | 3.68 | 3.60 | 4.39 | 5.30 | 5.35 |
| 16 N6 (P) KMg | 10.41 | 7.02 | 4.88 | 6.91 | 4.62 | 4.16 | 4.26 | 4.61 | 5.86 |
| 17 N1+4+1PKMg | 10.64 | 8.23 | 5.12 | 7.12 | 4.90 | 4.42 | 6.03 | 2.53 | 6.13 |
| 18 N1+2+1PKMg | 8.89 | 5.86 | 4.46 | 5.56 | 4.30 | 3.51 | 4.89 | 3.19 | 5.08 |
| 19 N1+1+1KMg | 7.55 | 3.56 | 5.30 | 3.83 | 3.88 | 3.09 | 5.27 | 3.86 | 4.54 |
| 20 N4 KMg | - | - | - | - | 0.81 | 0.37 | - | - | 0.59 |
| Mean | 7.92 | 5.18 | 4.22 | 4.99 | 3.28 | 2.87 | 4.31 | 5.06 | 4.73 |
| Grain Mean DM% | 88.0 | | | | | | | | |



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Results of the Classical and other Long-term Experiments 2017

Straw Tonnes/Hectare

*Tables of means*

| Section<br>Plot | 5/W1 | 4/W2 | 7/W3 | 6/W40 | 0/W13 | 1/W51 | 9/W59 | 8/W1 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 01 (FYM) N4 | 4.05 | - | - | - | - | - | - | - | 4.05 |
| 21 FYM N3 | 5.18 | - | - | - | - | 2.98 | - | 3.23 | 3.80 |
| 22 FYM | 3.21 | - | - | - | - | 2.63 | - | 5.51 | 3.79 |
| 03 NIL | 0.54 | - | - | - | - | 0.50 | - | 2.06 | 1.03 |
| 05 (P) KMg | 0.36 | - | - | - | - | 0.54 | - | 4.04 | 1.65 |
| 06 N1 (P) KMg | 0.92 | - | - | - | - | 0.96 | - | 4.42 | 2.10 |
| 07 N2 (P) KMg | 1.53 | - | - | - | - | 1.43 | - | 4.07 | 2.35 |
| 08 N3 (P) KMg | 2.02 | - | - | - | - | 1.45 | - | 4.87 | 2.78 |
| 09 N4 (P) KMg | 2.38 | - | - | - | - | 1.30 | - | 4.85 | 2.84 |
| 10 N4 | 1.72 | - | - | - | - | 1.01 | - | 2.37 | 1.70 |
| 11 N4 PMg | 1.80 | - | - | - | - | 1.52 | - | 3.79 | 2.37 |
| 12N1+3+1 (P) KMg | 3.50 | - | - | - | - | 2.40 | - | 5.20 | 3.70 |
| 13 N4 PK | 2.42 | - | - | - | - | 1.36 | - | 4.40 | 2.72 |
| 14 N4 PK* (Mg*) | 2.19 | - | - | - | - | 2.03 | - | 4.81 | 3.01 |
| 15 N5 (P) KMg | 3.63 | - | - | - | - | 2.33 | - | 4.46 | 3.47 |
| 16 N6 (P) KMg | 4.60 | - | - | - | - | 2.98 | - | 4.97 | 4.18 |
| 17 N1+4+1PKMg | 5.20 | - | - | - | - | 2.61 | - | 4.78 | 4.20 |
| 18 N1+2+1PKMg | 2.79 | - | - | - | - | 2.07 | - | 5.25 | 3.37 |
| 19 N1+1+1KMg | 2.67 | - | - | - | - | 1.94 | - | 4.68 | 3.10 |
| 20 N4 KMg | - | - | - | - | - | 0.41 | - | - | 0.41 |
| Mean | 2.67 | - | - | - | - | 1.71 | - | 4.32 | 2.87 |
| Straw Mean DM% | 89.50 | | | | | | | | |

**WINTER OAT**

Tonnes/Hectare (85% DM)

*Table of means*

| Plot | Treatment | Grain | Straw |
|---|---|---|---|
| 12 | 01(FYM)[N4] | 6.69 | 4.81 |
| 212 | 21[FYMN3] | 8.08 | 6.91 |
| 222 | 22[FYM] | 8.68 | 7.45 |
| 32 | 03Nil | 2.53 | 1.36 |
| 52 | 05(P)KMg | 3.08 | 1.71 |
| 62 | 06[N1](P)KMg | 3.28 | 1.79 |
| 72 | 07[N2](P)KMg | 4.24 | 1.90 |
| 82 | 08[N3](P)KMg | 4.43 | 2.26 |
| 92 | 09[N4](P)KMg | 3.49 | 1.83 |
| 102 | 10[N4] | 4.52 | 2.02 |
| 112 | 11[N4]PMg | 5.22 | 3.08 |
| 122 | 12[N1+3+1](P)KMg | 4.24 | 2.53 |
| 132 | 13[N4]PK | 3.74 | 2.09 |
| 142 | 14[N4]PK*(Mg*) | 4.19 | 2.00 |



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| | | | |
|---|---|---|---|
| 152 | 15[N5](P)KMg | 5.27 | 2.80 |
| 162 | 16[N6](P)KMg | 5.72 | 3.26 |
| 172 | 17[N1+4+1]PKMg | 5.34 | 3.03 |
| 182 | 18[N1+2+1]PKMg | 2.89 | 1.50 |
| 192 | 19[N1+1+1]KMg | 2.61 | 1.18 |
| | Mean | 4.64 | 2.82 |

Plot Area Harvested 0.00463

MAIZE

TONNES/HECTARE (100% DM)

*Tables of means*

| Plot | Treatment | Whole Crop |
|---|---|---|
| 13 | 01(FYM)N4 | 11.02 |
| 213 | 21FYMN3 | 14.40 |
| 223 | 22FYM | 17.83 |
| 33 | 03Nil | 1.95 |
| 53 | 05(P)KMg | 5.01 |
| 63 | 06N1(P)KMg | 8.70 |
| 73 | 07N2(P)KMg | 10.92 |
| 83 | 08N3(P)KMg | 11.17 |
| 93 | 09N4(P)KMg | 10.98 |
| 103 | 10N4 | 4.22 |
| 113 | 11N4PMg | 6.49 |
| 123 | 12N2+3(P)KMg | 14.21 |
| 133 | 13N4PK | 14.45 |
| 143 | 14N4PK*(Mg*) | 14.08 |
| 153 | 15N5(P)KMg | 12.89 |
| 163 | 16N6(P)KMg | 12.91 |
| 173 | 17N2+4PKMg | 10.79 |
| 183 | 18N2+2PKMg | 12.79 |
| 193 | 19N2+1KMg | 7.20 |
| | MEAN | 10.63 |

Mean DM% 25.7

PLOT AREA HARVESTED 0.00189



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Results of the Classical and other Long-term Experiments 2017

Section 8 Wheat Yields: Clean Grain (2.0-3.5mm), Tonnes/Hectare, after removing weed seed

| **YEAR** | **2017** |
|---|---|
| **SECTION** | **8/W1** |
| **PLOT** | |
| 2.1 FYMN3 | 4.49 |
| 2.2 FYM | 5.69 |
| 03 Nil | 3.13 |
| 05 (P)KMg | 4.97 |
| 06 N1(P)KMg | 4.89 |
| 07 N2(P)KMg | 4.68 |
| 08 N3(P)KMg | 5.91 |
| 09 N4(P)KMg | 7.31 |
| 10 N4 | 2.94 |
| 11 N4PMg | 3.96 |
| 12 N1+3+1(P)K2Mg2 | 6.37 |
| 13 N4PK | 5.23 |
| 14 N4PK*(Mg*) | 6.04 |
| 15 N5(P)KMg | 4.81 |
| 16 N6(P)KMg | 3.80 |
| 17 N1+4+1PKMg | 2.32 |
| 18 N1+2+1PKMg | 2.85 |
| 19 N1+1+1KMg | 3.52 |
| Mean | 4.61 |

Note: All clean grain yields for section 8 are reported for the 2 - 3.5mm grain size fraction, excluding grain <2mm, as was the practice prior to 2012.



*https://doi.org/10.23637/ERADOC-1-251* 

## 17/R/HB/2 HOOS BARLEY (Hoosfield)

**Object**: To study the effects of organic manures and inorganic fertilizers on continuous spring barley. From 1968 to 1978 a rotation of potatoes, beans and spring barley was practised on parts of the experiment. The rotation was discontinued in 1979 and the whole experiment reverted to continuous spring barley. The experiment was modified for 2003. The main plots continue as previously. The Silicate Test plots continue but are not split to test rates of N (basal N is applied). The remaining plots are to be used to study the effect on yield of P residues, (basal N applied).

The 166th year, spring barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and Yield Books for 74-16/R/HB/2.

**Main plots**

**Treatments:**

**Whole plots**

| **MANURE** | | **Fertilizers and Organic Manures:-** | | |
|---|---|---|---|---|
| | Plot | Form of N 1852-1966 | Additional treatments 1852-2002 | Treatments since 2003 |
| --- | 11 | None | - | - |
| -P- | 21 | None | P | (P) |
| --K | 31 | None | K (Na) Mg | K(Mg) |
| -PK | 41 | None | PK (Na) Mg | (P) K (Mg) |
| A-- | 12 | A | - | - |
| AP- | 22 | A | P | (P) |
| A-K | 32 | A | K (Na) Mg | K(Mg) |
| APK | 42 | A | PK (Na) Mg | (P) K (Mg) |
| D1852 | 72 | None | D | D |
| (D) | 71 | None | (D) | (D) |
| (A) | 62 | None | (Ashes) | (Ashes) |
| - | 61 | None | - | - |
| D2001 [a] | 73[a] | - | D | D |
| P2KMg [a] | 63 [a] | - | P2KMg | P2KMg |

[a] Plots 63 and 73 started in 2001

Form of N: A, sulphate of ammonia to supply 48kg N
P: 35 kg P as triple superphosphate in 1974 and from 1988 to 2002, single superphosphate in other years
(P): (none), P application to be reviewed for 2018
P2: 44kg P as triple superphosphate
K: 90 kg K as sulphate of potash
(Na): (none), 16 kg Na as sulphate of soda until 1973
Mg: 35kg Mg as kieserite every third year since 1974 (applied at 30 kg in 1992, 1995 and 1998) (sulphate of magnesia annually until 1973). Annually to new plot 63.
(Mg): (none), Mg application to be reviewed for 2021



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D1852: Farmyard manure at 35t since 1852
D2001: Farmyard manure at 35t since 2001
(D): Farmyard manure 1852 – 1871 only
(Ashes): Weed ash 1852-1916, furnace ash 1917-1932, none since

Sub-Plots

(2) N Nitrogen fertilizer (kg N), as 'Nitro-Chalk', since 1968 (cumulative N applications until 1973, on a cyclic system since 1974):

0
48
96
144

**Silicate Test plots**

**Treatments:**

Whole plots

| **MANURE** | **Plot** | **Fertilizers:-** Additional treatment 1852-1979 | Changes since 1980 | Treatments since 2003 |
|---|---|---|---|---|
| N---- | 131 | - | - | N3 |
| NP--- | 231 | P | - | N3 (P) |
| N-K-- | 331 | K(Na)Mg | - | N3 K(Mg) |
| NPK-- | 431 | PK(Na)Mg | - | N3(P)K(Mg) |
| N—S- | 134 | Si | Si omitted | N3 (Si) |
| NP-S- | 234 | P Si | Si omitted | N3(P) (Si) |
| N-KS- | 334 | K(Na)MgSi | Si omitted | N3 K(Mg)(Si) |
| NPKS- | 434 | PK(Na)MgSi | Si omitted | N3(P)K(Mg)(Si) |
| N---S | 132 | - | Si added | N3 Si |
| NP--S | 232 | P | Si added | N3(P) Si |
| N-K-S | 332 | K(Na)Mg | Si added | N3 K(Mg) Si |
| NPK-S | 432 | PK(Na)Mg | Si added | N3(P)K(Mg) Si |
| N--SS | 133 | Si | - | N3 Si |
| NP-SS | 233 | P Si | - | N3(P) Si |
| N-KSS | 333 | K(Na)MgSi | - | N3 K(Mg) Si |
| NPKSS | 433 | PK(Na)MgSi | - | N3(P)K(Mg) Si |

N: From 1852-1966 whole plots received 48kg N as nitrate of soda. Between 1968-2002 whole plots were split to test 4 rates of N as "Nitro-chalk" (cumulative applications until 1973, on a cyclic system from 1974).
N3: Basal N, 144kg as "Nitro-chalk" since 2003
Si: Silicate of soda at 450kg (Note: S also refers to silicate of soda)
(Si): Silicate of soda omitted since 1980
P, (P), K, Mg, (Mg), (Na): as above



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**Phosphorus Test plots**

**Treatments:**

Since 2003 the remaining plots [ex-Castor meal (plots 14, 24, 34 & 44) and those testing combinations of NPK with and without Mg (plots 55, 56, 57 & 58)] have been used to study the effect of P residues on yield. Previous treatments have resulted in different levels of available P in the soil. Large dressings of K were applied to some plots to increase levels of exchangeable K in the soil such that K should not limit yield; plots 141 and 241 were sacrificed and used as discard areas so that the K application did not encroach on adjacent no K plots on the Silicate Test. Other plots received the normal rate of K. The level of exchangeable Mg in the soil is such that Mg should not limit yield; the need to apply Mg was reviewed for 2017.

**Whole plots**

**Manure**

| Plot | Treatment since 2003 |
|---|---|
| 142 | N3K* |
| 143 | N3K* |
| 144 | N3K* |
| 242 | N3K* |
| 243 | N3K* |
| 244 | N3K* |
| 341 | N3K |
| 342 | N3K |
| 343 | N3K |
| 344 | N3K |
| 441 | N3K |
| 442 | N3K |
| 443 | N3K |
| 444 | N3K |
| 551 | N3K |
| 552 | N3K |
| 561 | N3K |
| 562 | N3K |
| 571 | N3K* |
| 572 | N3K* |
| 581 | N3K* |
| 582 | N3K* |

N3: Basal N, 144kg as “Nitro-chalk”
K: 90kg K as sulphate of potash
K*: 450kg K as sulphate of potash
In 2005 the extra dressings of K (i.e. K*) was stopped and all of the P test plots reverted to K



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## Experimental Diary

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 11/10/2016 | a | Ploughed - thrown South | - | - |
| 15/10/2016 | p | Sprayed Buffalo Elite | 1 | lt/ha |
| 15/10/2016 | p | Sprayed Samurai | 3 | lt/ha |
| 31/10/2016 | f | Applied SOP to Plots 141 - 144, 241 - 244, 311 - 344, 411 - 444, 551 - 582, 631 - 634 | 217 | kg/ha |
| 31/10/2016 | f | Applied Kieserite to Plots 631 - 634 | 233 | kg/ha |
| 31/10/2016 | f | Applied TSP to Plots 631 - 634 | 215 | kg/ha |
| 08/11/2016 | f | Applied Silicate of Soda to Plots 433, 333, 233, 133, 432, 332, 232 and 132 | 450 | kg/ha |
| 10/11/2016 | f | Applied FYM to Plots 721 to 734 | 35 | t/ha |
| 07/03/2017 | p | Sprayed Buffalo Elite | 1 | lt/ha |
| 07/03/2017 | p | Sprayed Samurai | 3 | lt/ha |
| 12/03/2017 | a | Cousin Combi Harrowed | - | - |
| 15/03/2017 | s | Drilled KWS Irina trt With Raxil Star | 350 | seeds/$m^2$ |
| 17/03/2017 | a | Ring Rolled | - | - |
| 12/05/2017 | a | Rotavated Paths | - | - |
| 22/05/2017 | p | Sprayed Hallmark | 50 | ml/ha |
| 23/05/2017 | f | Applied Nitrochalk (27% N) to Plots 113, 124, 211,222, 313, 321, 412, 421, 611, 621, 631, 712, 721, 732 | 48 | kg/ha |
| 23/05/2017 | f | Applied Nitrochalk (27% N) to Plots 112, 123, 212, 223, 314, 324, 414, 422, 613, 624, 634, 711, 722, 731 | 96 | kg/ha |
| 23/05/2017 | f | Applied Nitrochalk (27% N) to Plots 114, 122, 213, 224, 312, 323, 411, 424, 612, 622, 632, 714, 723, 733 | 144 | kg/ha |
| 24/05/2017 | a | Rotavated Paths | - | - |
| 24/05/2017 | f | Applied Nitram to Series AA (except 621 to 624, 721 to 724), C and Strip 5 | 417 | kg/ha |
| 30/05/2017 | p | Sprayed Refine Max | 75 | g/ha |
| 30/05/2017 | p | Sprayed Kingdom | 1.25 | lt/ha |
| 30/05/2017 | p | Sprayed Hurler | 700 | ml/ha |
| 14/07/2017 | a | Cut Paths | - | - |
| 28/07/2017 | a | Pulled 7 Wild Oats from within plots | - | - |
| 29/08/2017 | a | Harvested plots for yield & baled all discard and remaining swaths. | - | - |



*https://doi.org/10.23637/ERADOC-1-251* 

## Yields

**Main Plots**

Grain Yield, tonnes/hectare

*Table of means*

| N | 0 | 48 | 96 | 144 | Mean |
|---|---|---|---|---|---|
| MANURE | | | | | |
| --- | 1.43 | 1.13 | 0.95 | 1.14 | 1.16 |
| -P- | 2.50 | 3.94 | 3.78 | 3.92 | 3.53 |
| --K | 1.45 | 1.45 | 1.76 | 1.49 | 1.54 |
| -PK | 2.41 | 3.47 | 3.80 | 4.81 | 3.62 |
| A-- | 0.95 | 1.36 | 1.10 | 1.08 | 1.12 |
| AP- | 2.86 | 3.94 | 4.44 | 4.13 | 3.84 |
| A-K | 0.95 | 0.97 | 1.26 | 1.12 | 1.07 |
| APK | 2.51 | 3.56 | 4.01 | 4.88 | 3.74 |
| FYM1852onwards | 8.04 | 8.07 | 7.92 | 7.91 | 7.99 |
| FYM1852-1871 | 2.87 | 2.99 | 3.11 | 5.61 | 3.64 |
| (A) | 1.66 | 2.03 | 3.38 | 1.98 | 2.26 |
| - | 1.27 | 1.40 | 1.52 | 1.41 | 1.40 |
| FYM2001onwards | 6.66 | 6.92 | 7.09 | 6.93 | 6.90 |
| P2K | 3.62 | 4.78 | 4.86 | 5.63 | 4.72 |
| Mean | 2.80 | 3.28 | 3.5 | 3.72 | 3.33 |
| Grain mean DM% | 85.9 | | | | |

Straw Yield, tonnes/hectare

*Table of means*

| N | 0 | 48 | 96 | 144 | Mean |
|---|---|---|---|---|---|
| MANURE | | | | | |
| --- | 0.32 | 0.25 | 0.19 | 0.17 | 0.23 |
| -P- | 0.38 | 0.69 | 0.72 | 0.79 | 0.65 |
| --K | 0.25 | 0.25 | 0.29 | 0.28 | 0.27 |
| -PK | 0.39 | 0.73 | 1.00 | 1.30 | 0.86 |
| A-- | 0.20 | 0.22 | 0.24 | 0.21 | 0.22 |
| AP- | 0.61 | 0.84 | 1.05 | 0.95 | 0.86 |
| A-K | 0.16 | 0.18 | 0.19 | 0.20 | 0.18 |
| APK | 0.65 | 0.82 | 1.00 | 1.46 | 0.98 |



*https://doi.org/10.23637/ERADOC-1-251* 

| | | | | | |
|---|---|---|---|---|---|
| FYM1852onwards | 3.86 | 3.35 | 3.81 | 3.16 | 3.54 |
| FYM1852-1871 | 0.64 | 0.70 | 0.63 | 1.73 | 0.92 |
| (A) | 0.26 | 0.41 | 0.61 | 0.13 | 0.35 |
| - | 0.32 | 0.27 | 0.20 | 0.36 | 0.29 |
| FYM2001onwards | 3.30 | 2.98 | 2.90 | 2.69 | 2.97 |
| P2K | 1.21 | 1.52 | 1.42 | 1.76 | 1.48 |
| Mean | 0.90 | 0.94 | 1.02 | 1.08 | 0.99 |

| | |
|---|---|
| Grain mean DM% | 85.8 |

**PHOSPHATE PLOTS**

**Grain Yield, tonnes/hectare**

*Tables of means*

PLOTS

| | |
|---|---|
| 142 | 3.66 |
| 143 | 3.57 |
| 144 | 3.27 |
| 242 | 5.13 |
| 243 | 4.82 |
| 244 | 4.84 |
| 341 | 3.50 |
| 342 | 4.12 |
| 343 | 4.23 |
| 344 | 4.68 |
| 441 | 4.55 |
| 442 | 5.23 |
| 443 | 5.04 |
| 444 | 5.08 |
| 551 | 5.24 |
| 552 | 4.81 |
| 561 | 4.77 |
| 562 | 4.46 |
| 571 | 4.19 |
| 572 | 4.69 |
| 581 | 0.99 |
| 582 | 1.08 |
| Mean | 4.18 |
| Grain Mean DM% | 86.7 |
| Plot area Harvested | 0.00244 |



*https://doi.org/10.23637/ERADOC-1-251* 

**SILICATE PLOTS**

Grain Yield, tonnes/hectare

*Tables of means*

| PK Silicate | N3-- | N3P- | N3-K | N3PK | Mean |
|---|---|---|---|---|---|
| (-)- | 1.34 | 4.26 | 1.24 | 4.99 | 2.96 |
| (Si)- | 1.89 | 4.99 | 2.63 | 5.11 | 3.65 |
| (-)Si | 2.54 | 5.11 | 2.34 | 5.14 | 3.78 |
| (Si)Si | 2.81 | 5.00 | 3.06 | 4.81 | 3.92 |
| Mean | 2.15 | 4.84 | 2.32 | 5.01 | 3.58 |

| | |
|---|---|
| Grain Mean DM% | 86.3 |
| Plot area harvested | 0.00244 |



*https://doi.org/10.23637/ERADOC-1-251* 

## 17/R/WF/3 WHEAT AND FALLOW (Hoosfield)

**Object**: To maintain a low plant available P site – Hoosfield.

**Whole plot dimensions:** 9 x 211

**Treatments:**

Two plots, one sown to winter wheat, one fallow; alternating in successive years. From 2016 this experiment was converted to continuous wheat on both plots, with no yields or samples taken at harvest. For previous years see 'Details' 1967, 1973 and Yield Books for 74-16/R/WF/3.

**Experimental Diary**

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 28/09/2016 | a | Ploughed - thrown North | - | - |
| 02/10/2016 | p | Sprayed Buffalo Elite | 1 | lt/ha |
| 02/10/2016 | p | Sprayed Samurai | 3 | lt/ha |
| 06/10/2016 | a | Cultipressed All Ground | - | - |
| 10/10/2016 | a | Ring Rolled All New Drilling | | |
| 10/10/2016 | s | Drilled Crusoe trt w/Redigo Pro + Deter | 350 | seed/$m^2$ |
| 10/10/2016 | a | Cultipressed -all sites and surrounds | - | - |
| 15/10/2016 | p | Sprayed Liberator | 600 | ml/ha |
| 15/10/2016 | p | Sprayed Defy | 3 | lt/ha |
| 15/10/2016 | p | Sprayed Deploy | 400 | ml/ha |
| 02/12/2016 | p | Sprayed Hallmark | 50 | ml/ha |
| 04/04/2017 | f | Applied Nitram | 145 | kg/ha |
| 05/04/2017 | p | Sprayed Artemis | 1 | lt/ha |
| 05/04/2017 | p | Sprayed Claw 500 | 1 | lt/ha |
| 05/04/2017 | p | Sprayed 3C Chlormequat 750 | 2 | lt/ha |
| 27/04/2017 | p | Sprayed keystone | 600 | ml/ha |
| 27/04/2017 | p | Sprayed epic | 400 | ml/ha |
| 27/04/2017 | p | Sprayed balear 720sc | 700 | ml/ha |
| 19/06/2017 | p | Sprayed Fezan (Tebuconazole) | 750 | ml/ha |
| 24/08/2017 | a | Harvested wheat | - | - |
| 07/09/2017 | a | Straw baled and removed | - | - |



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## 17/R/EX/4 EXHAUSTION LAND (Hoosfield)

**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 spring barley up to 1991, winter wheat since – Hoosfield.

The 162nd year, winter wheat.

For previous years see 'Details' 1977, 1973 and Yield Books for 74-16/R/EX/4

**Treatments:** All combinations of:

Whole plots (P test)

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

Main plot

| | | |
|---|---|---|
| 01 | O | None |
| 03 | D | Farmyard manure at 35 t |
| 05 | N | 96 kg N as ammonium salts |
| 09 | P | 34 kg P as superphosphate |
| 07 | 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. From 2016 onward P was withheld from the P(P1) sub-plots.

1986–1992:

| | 2016-Present | 2009-2015 | 2000-08 | 1986-92 |
|---|---|---|---|---|
| O | None | None | None | None |
| P (P1) | None | 15 kg P | 20 kg P | 44 kg P |
| P (P2) | 15 kg P | 15 kg P | 20 kg P | 87 kg P |
| P (P3) | 15 kg P | 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:

Main Plot

| | | |
|---|---|---|
| 02 | O | None |
| 04 | D | Farmyard manure at 35 t |
| 06 | N* | 96 kg N as nitrate of soda |
| 10 | PK | 34 kg P as superphosphate, 137 kg K as sulphate of potash |
| 08 | 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 (2 sub-plots within each treatment strip) |
| 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 |
|---|---|---|---|---|
| 26/09/2016 | a | Topped all stubble | - | - |
| 26/09/2016 | f | Applied TSP to plots 101-104, 081-084, 061-064, 041-044, 021-024, 091-092, 071-072, 051-052, 031-032 and 011-012 | 75 | kg/ha |
| 26/09/2016 | f | Applied MOP to plots 103, 083, 063,043, 023 | 125 | kg/ha |
| 26/09/2016 | f | Applied MOP onto plots 104-094, 084-074, 064-054, 044-034 and 024-014 | 250 | kg/ha |
| 28/09/2016 | a | Ploughed - thrown North | - | - |
| 06/10/2016 | a | Cultipressed - all ground and immediate surrounds | - | - |
| 10/10/2016 | a | Ring Rolled All New Drilling | - | - |
| 10/10/2016 | s | Drilled Crusoe Treated w/Redigo Pro + Deter | 350 | seeds/$m^2$ |
| 10/10/2016 | a | Cultipressed - all sites and surrounds | - | - |
| 15/10/2016 | p | Sprayed Liberator | 600 | ml/ha |
| 15/10/2016 | p | Sprayed Defy | 3 | lt/ha |
| 15/10/2016 | p | Sprayed Deploy | 400 | ml/ha |
| 02/12/2016 | p | Sprayed Hallmark | 50 | ml/ha |
| 14/03/2017 | f | Applied Sulphate of Ammonia (21%N 60%SO3) to all plots | 238 | kg/ha |



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| | | | | |
|---|---|---|---|---|
| 21/03/2017 | f | Applied Kieserite | 80 | kg/ha |
| 04/04/2017 | f | Applied Nitram | 580 | kg/ha |
| 05/04/2017 | p | Sprayed Artemis | 1 | lt/ha |
| 05/04/2017 | p | Sprayed Claw 500 | 1 | lt/ha |
| 05/04/2017 | p | Sprayed 3C Chlormequat 750 | 2 | lt/ha |
| 27/04/2017 | p | Sprayed keystone | 600 | ml/ha |
| 27/04/2017 | p | Sprayed epic | 400 | ml/ha |
| 27/04/2017 | p | Sprayed balear 720sc | 700 | ml/ha |
| 05/05/2017 | f | Applied Nitram (34.5% N) | 145 | kg/ha |
| 08/06/2017 | a | Cut Paths | - | - |
| 19/06/2017 | p | Sprayed Fezan (Tebuconazole) | 750 | ml/ha |
| 26/06/2017 | a | cut all paths | - | - |
| 27/07/2017 | a | cut all paths | - | - |
| 01/09/2017 | a | Harvested All Plots | - | - |
| 02/09/2017 | a | Completed Straw Samples and Weights | - | - |
| 06/09/2017 | a | harvested leftover wheat of harvested trials and surrounds | - | - |
| 07/09/2017 | a | Baled all remaining commercial swath | - | - |

## Yields

**P TEST**

Grain Yield, tonnes/hectare

*Tables of means*

| P_RES<br>OLD_RES | O | (P1) | (P2) | (P3) | Mean |
|---|---|---|---|---|---|
| O | 1.87 | 4.18 | 5.69 | 6.14 | 4.47 |
| D | 3.49 | 6.23 | 7.49 | 7.68 | 6.22 |
| N | 1.76 | 5.19 | 6.56 | 7.74 | 5.31 |
| P | 2.44 | 5.66 | 7.28 | 7.31 | 5.67 |
| NPKNAMG | 3.22 | 5.86 | 6.47 | 7.12 | 5.67 |
| Mean | 2.56 | 5.43 | 6.70 | 7.20 | 5.47 |

| | |
|---|---|
| Grain mean DM% | 86.4 |



*https://doi.org/10.23637/ERADOC-1-251* 

Results of the Classical and other Long-term Experiments 2017

Straw Yield, tonnes/hectare

*Tables of means*

| P_RES | O | (P1) | (P2) | (P3) | Mean |
|---|---|---|---|---|---|
| OLD_RES | | | | | |
| O | 1.01 | 1.76 | 2.65 | 3.05 | 2.12 |
| D | 1.78 | 2.86 | 3.58 | 3.36 | 2.89 |
| N | 1.23 | 2.81 | 3.66 | 2.78 | 2.62 |
| P | 0.93 | 2.15 | 2.68 | 3.02 | 2.20 |
| NPKNAMG | 1.40 | 2.37 | 2.69 | 3.16 | 2.40 |
| Mean | 1.27 | 2.39 | 3.05 | 3.07 | 2.45 |

Straw mean DM% 96.2

Plot area harvested 0.00512.

**K TEST**

Grain Yield, tonnes/hectare

*Tables of means*

| K_Test | K0 | K1 | K2 | Mean |
|---|---|---|---|---|
| OLD_RES | | | | |
| O | 6.54 | 7.80 | 7.52 | 7.10 |
| D | 7.02 | 8.52 | 8.07 | 7.66 |
| N* | 7.04 | 7.96 | 8.19 | 7.56 |
| PK | 8.37 | 7.86 | 8.23 | 8.21 |
| N*PK | 7.81 | 7.48 | 8.14 | 7.81 |
| Mean | 7.36 | 7.92 | 8.03 | 7.67 |

Grain mean DM% 86.6

Straw Yield, tonnes/hectare

*Tables of means*

| K_Test | K0 | K1 | K2 | Mean |
|---|---|---|---|---|
| OLD_RES | | | | |
| O | 2.31 | 3.65 | 3.68 | 2.99 |
| D | 2.62 | 3.55 | 3.51 | 3.08 |
| N* | 2.65 | 3.73 | 3.77 | 3.2 |
| PK | 3.20 | 3.15 | 3.30 | 3.21 |
| N*PK | 2.99 | 1.99 | 2.95 | 2.73 |
| Mean | 2.76 | 3.21 | 3.44 | 3.04 |

Straw mean DM% 97.0

Plot area harvested 0.00512



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## 17/R/PG/5 PARK GRASS

**Object**: To study the effects of organic manures and inorganic fertilisers and lime on old grass for hay.

The 162nd year, hay.
For previous years see 'Details' 1977 and 1973 and Yield Books for 74-16/R/PG/5.

**Treatments**: Combinations of:

Whole plots

1. **Manure** Fertilizers and organic manures:

| | | |
|---|---|---|
| N1 | Plot 1 | N1 |
| K | Plot 2/1 | K since 1996 (as 2/2 before) |
| None (FYM) | Plot 2/2 | None (FYM until 1863) |
| None | Plot 3 | None |
| P | Plot 4/1 | P |
| N2P | Plot 4/2 | N2 P |
| N1PKNaMg | Plot 6 | N1 P K Na Mg |
| (P)KNaMg | Plot 7/1 | K Na Mg (+P until 2012) |
| PKNaMg | Plot 7/2 | P K Na Mg |
| PNaMg | Plot 8 | P Na Mg |
| PKNaMg(N2) | Plot 9/1 | P K Na Mg (+ N2 until 1989) |
| N2PKNaMg | Plot 9/2 | N2 P K Na Mg |
| N2PNaMg | Plot 10 | N2 P Na Mg |
| N3PKNaMg | Plot 11/1 | N3 P K Na Mg |
| N3PKNaMgSi | Plot 11/2 | N3 P K Na Mg Si |
| None | Plot 12 | None |
| (FYM/F) | Plot 13/1 | None (FYM/F until 1993/1995) |
| FYM/PM | Plot 13/2 | FYM/PM (FYM/F until 1999) |
| PKNaMg (N2*) | Plot 14/1 | P K Na Mg (+ N2* until 1989) |
| N2*PKNaMg | Plot 14/2 | N2* P K Na Mg |
| N3*PKNaMg (N2*) | Plot 15 | N3*P K Na Mg (N2* until 1875; P K Na Mg 1876-2012) |
| N1*PKNaMg | Plot 16 | N1* P K Na Mg |
| N1* | Plot 17 | N1* |
| N2KNaMg | Plot 18 | N2 K Na Mg |
| FYM | Plot 19 | FYM |
| FYM/N*PK | Plot 20 | FYM/N*P K |

| | |
|---|---|
| N1, N2, N3: | 48, 96, 144 kg N as sulphate of ammonia |
| N1*, N2*, N3*: | 48, 96, 144 kg N as nitrate of soda (30 kg N to plot 20 in years with no farmyard manure). In 2013 plot 15 started to receive 144 kg N/ha as nitrate of soda to provide a comparison with plot 11/1, which receives 144 kg N/ha as sulphate of ammonia. |



*https://doi.org/10.23637/ERADOC-1-251* *pp 33*

| | |
|---|---|
| P: | 17 kg P/ha applied as triple superphosphate since 2017, except for plot 20 which receives 15 kg P/ha in years with no farmyard manure. Prior to this, 35 kg P (15 kg P to plot 20 in years with no farmyard manure) was applied as triple superphosphate in 1974 and since 1987, single superphosphate in other years. |
| (P): | In 2013 plot 7 was split into 7/1 & 7/2. P was withheld from plot 7/1 but 7/2 continues to receive P as above. |
| K: | 225 kg K (45 kg K to plot 20 in years with no farmyard manure) as sulphate of potash |
| Na: | 15 kg Na as sulphate of soda |
| Mg: | 10 kg Mg as sulphate of magnesia |
| Si: | Silicate of soda at 450 kg |
| FYM: | Farmyard manure at 35 t every fourth year |
| F: | Fishmeal every fourth year to supply 63 kg N (stopped 1999; replaced by PM) |
| PM | Pelleted poultry manure at 2 t, every fourth year to supply 63 kg N (started 2003) |

Sub-plots

| | | |
|---|---|---|
| 2. | **Lime** | **Liming plots 1-18 (excluding 18/2):** |
| | a | Ground chalk applied as necessary to achieve pH7 |
| | b | Ground chalk applied as necessary to achieve pH6 |
| | c | Ground chalk applied as necessary to achieve pH5 |
| | d | None |

NOTE: A small amount of chalk was applied to all plots during tests in the 1880s and 1890s. A regular test of liming was started in 1903 when most plots were divided in two and 4 t $ha^{-1}$ $CaCO_3$ was applied every four years to the southern half. In 1965, most plots were divided into four: sub-plots “a” and “b” on the previously limed halves and sub-plots “c” and “d” on the unlimed halves. Sub-plots “a”, “b” and “c” now receive different amounts of chalk, when necessary, to achieve and/or maintain soil (0-23cm) at pH 7, 6 and 5, respectively. Sub-plot “d” receives no lime and its pH reflects inputs from the various treatments and the atmosphere. Lime was last applied in 2014-2015; the eighth application in a triennial scheme of soil pH analysis and remedial chalk applications.

[This note was incorrect in earlier Yield book entries.]

NOTE: A separate scheme of liming was introduced on plots 18, 19 & 20 in 1920; subplot /1, /2 and /3 receive no lime, “high” lime and “light” lime respectively every 4 years. Since 1965 plot 18-1 has been split into two for treatments ‘c’ and ’d’ as above and plot 18-3 split into two for treatments ‘a’ and ‘b. Plots 19 and 20 received no further chalk after 1968; plot 18/2 no further chalk after 1972.

[This note was incorrect in earlier Yield book entries. See further details on the e-RA website at http://www.era.rothamsted.ac.uk]



*https://doi.org/10.23637/ERADOC-1-251* *pp 34*

## Experimental Diary

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 17/10/2016 | a | Cut Paths - in and around trial | - | - |
| 20/10/2016 | a | Mowed All Grass | - | - |
| 20/10/2016 | a | Rowed up All Grass | - | - |
| 25/11/2016 | f | Applied TSP - plots 4/1, 4/2, 6, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16 | 73 | kg/ha |
| 28/11/2016 | f | Applied Sulphate of Potash - plots 2/1, 6, 7/1, 7/2, 9/1, 9/2, 11/1, 11/2, 14/1, 14/2, 15, 16, 18 | 542 | kg/ha |
| 28/11/2016 | f | Applied Sulphate of Soda - plots 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16, 18 | 43 | kg/ha |
| 28/11/2016 | f | Applied Sulphate of Magnesia (Epsom Salts) - plots 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16, 18 | 111 | kg/ha |
| 28/11/2016 | f | Applied Silicate of Soda - plot 11/2 | 450 | kg/ha |
| 30/11/2016 | f | Applied FYM - plots 13/2, 19, 20 | 35 | t/ha |
| 18/04/2017 | f | Applied Sulphate of Ammonia (21% N) - plot 1, 6a, 6b | 229 | kg/ha |
| 18/04/2017 | f | Applied Sulphate of Ammonia (21% N) - plots 4/2, 9/2, 10, 18 | 457 | kg/ha |
| 18/04/2017 | f | Applied Sulphate of Ammonia (21% N) - plots 11/1, 11/2 | 686 | kg/ha |
| 19/04/2017 | f | Applied Sodium Nitrate (16% N) - plots 16, 17 | 300 | kg/ha |
| 19/04/2017 | f | Applied Sodium Nitrate (16% N) - plot 14/2 | 600 | kg/ha |
| 19/04/2017 | f | Applied Sodium Nitrate (16% N) - plot 15 | 900 | kg/ha |
| 10/05/2017 | a | Cut All Paths | - | - |
| 23/05/2017 | a | Cut paths | - | - |
| 07/06/2017 | a | Cut Paths | - | - |
| 19/06/2017 | a | Cut Paths and surrounds | - | - |
| 20/06/2017 | a | Started harvesting grass yields - 1st Cut | - | - |



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| | | | | |
|---|---|---|---|---|
| 21/06/2017 | a | Completed grass yield - 1st Cut | - | - |
| 21/06/2017 | a | Mowed all grass | - | - |
| 23/06/2017 | a | Turned all hay | - | - |
| 26/06/2017 | a | Rowed up all grass for baling | - | - |
| 19/10/2017 | a | Cut Paths | - | - |
| 24/10/2017 | a | Started harvesting plot yields - 2nd Cut | - | - |
| 25/10/2017 | a | Completed harvesting yield plots - 2nd Cut | - | - |
| 01/11/2017 | a | Baled leftover grass and removed | - | - |

**NOTE:** Samples of herbage (1st and 2nd Cut) were taken for chemical analysis. Unground herbage samples from all plots were archived.

## Yields

### 1ST CUT (20-21 JUN 2017) DRY MATTER, TONNES/HECTARE

*Tables of means*

Grand mean 3.00

| Manure | Lime | a | b | c | d | Mean |
|---|---|---|---|---|---|---|
| N1 | 1 | 1.42 | 1.10 | 0.83 | 0.31 | 0.91 |
| K | 2/1 | 0.85 | 1.44 | 0.85 | 0.52 | 0.91 |
| None(FYM) | 2/2 | 1.63 | 1.72 | 0.93 | 0.88 | 1.29 |
| None | 3 | 1.44 | 1.64 | 0.83 | 0.82 | 1.18 |
| P | 4/1 | 2.34 | 2.69 | 1.91 | 1.51 | 2.11 |
| N2P | 4/2 | 1.87 | 2.53 | 2.92 | 1.28 | 2.15 |
| N1PKNaMg | 6 | 5.23 | 5.04 | - | - | 5.14 |
| (P)KNaMg | 7/1 | 3.84 | 4.28 | 3.88 | 1.78 | 3.44 |
| PKNaMg | 7/2 | 4.54 | 5.28 | 4.90 | 2.76 | 4.37 |
| PNaMg | 8 | 2.13 | 2.62 | 2.13 | 2.51 | 2.35 |
| PKNaMg(N2) | 9/1 | 4.46 | 3.96 | 3.97 | 0.37 | 3.19 |
| N2PKNaMg | 9/2 | 5.21 | 5.53 | 4.11 | 1.91 | 4.19 |
| N2PNaMg | 10 | 2.40 | 2.86 | 3.09 | 1.27 | 2.40 |
| N3PKNaMg | 11/1 | 4.75 | 4.15 | 4.44 | 2.32 | 3.91 |
| N3PKNaMgSi | 11/2 | 4.96 | 4.49 | 4.21 | 2.49 | 4.04 |
| None | 12 | 1.71 | 1.44 | 1.06 | 1.03 | 1.31 |
| (FYM/F) | 13/1 | 2.16 | 2.45 | 2.26 | 1.88 | 2.19 |
| FYM/PM | 13/2 | 3.81 | 4.71 | 4.50 | 4.63 | 4.41 |
| PKNaMg(N2*) | 14/1 | 5.20 | 6.25 | 5.29 | 5.32 | 5.52 |
| N2*PKNaMg | 14/2 | 4.08 | 4.58 | 4.46 | 4.55 | 4.42 |
| N3*PKNaMg(N2*) | 15 | 5.45 | 4.78 | 3.82 | 3.74 | 4.45 |
| N1*PKNaMg | 16 | 4.91 | 5.35 | 3.90 | 3.74 | 4.48 |
| N1* | 17 | 0.87 | 1.64 | 1.24 | 1.77 | 1.38 |
| N2KNaMg | 18 | 1.33 | 1.97 | 1.69 | 0.08 | 1.27 |



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| | | | |
|---|---|---|---|
| N2KNaMg | 18/2 | | 2.81 |
| FYM | 19/1 | | 4.32 |
| FYM | 19/2 | | 4.75 |
| FYM | 19/3 | | 4.29 |
| FYM/N*PK | 20/1 | | 4.63 |
| FYM/N*PK | 20/2 | | 4.48 |
| FYM/N*PK | 20/3 | | 4.40 |

1st cut mean DM% 30.8

**2ND CUT (24-25 OCT 2017) DRY MATTER, TONNES/HECTARE**

*Tables of means*

Grand mean **2.01**

| **Manure** | Lime | a | b | c | d | Mean |
|---|---|---|---|---|---|---|
| N1 | 1 | 1.67 | 1.56 | 1.74 | 0.61 | 1.39 |
| K | 2/1 | 1.41 | 1.28 | 0.99 | 0.94 | 1.15 |
| None(FYM) | 2/2 | 1.24 | 1.23 | 1.47 | 1.32 | 1.32 |
| None | 3 | 1.03 | 1.27 | 1.40 | 1.31 | 1.25 |
| P | 4/1 | 1.85 | 1.86 | 2.02 | 2.10 | 1.96 |
| N2P | 4/2 | 1.51 | 1.92 | 1.98 | 1.24 | 1.66 |
| N1PKNaMg | 6 | 2.08 | 2.23 | - | - | 2.15 |
| (P)KNaMg | 7/1 | 2.05 | 2.40 | 2.01 | 1.37 | 1.96 |
| PKNaMg | 7/2 | 2.01 | 2.43 | 2.47 | 1.60 | 2.13 |
| PNaMg | 8 | 1.79 | 1.83 | 2.07 | 2.89 | 2.15 |
| PKNaMg(N2) | 9/1 | 2.27 | 2.49 | 2.18 | 0.43 | 1.84 |
| N2PKNaMg | 9/2 | 2.56 | 2.52 | 2.03 | 1.55 | 2.17 |
| N2PNaMg | 10 | 1.74 | 1.86 | 2.61 | 1.12 | 1.83 |
| N3PKNaMg | 11/1 | 2.00 | 2.23 | 2.39 | 2.23 | 2.21 |
| N3PKNaMgSi | 11/2 | 2.90 | 2.48 | 2.15 | 1.85 | 2.35 |
| None | 12 | 1.96 | 1.63 | 1.20 | 1.20 | 1.50 |
| (FYM/F) | 13/1 | 2.48 | 2.69 | 2.10 | 1.73 | 2.25 |
| FYM/PM | 13/2 | 2.32 | 3.11 | 2.72 | 2.80 | 2.74 |
| PKNaMg(N2*) | 14/1 | 2.14 | 2.92 | 3.22 | 3.11 | 2.85 |
| N2*PKNaMg | 14/2 | 1.82 | 2.37 | 2.62 | 2.71 | 2.38 |
| N3*PKNaMg(N2*) | 15 | 2.26 | 2.31 | 2.83 | 2.65 | 2.51 |
| N1*PKNaMg | 16 | 2.37 | 2.90 | 2.64 | 2.24 | 2.54 |
| N1* | 17 | 1.59 | 1.82 | 1.64 | 1.91 | 1.74 |
| N2KNaMg | 18 | 1.48 | 1.34 | 1.27 | 0.46 | 1.14 |
| N2KNaMg | 18/2 | | | | | 1.68 |
| FYM | 19/1 | | | | | 3.04 |
| FYM | 19/2 | | | | | 3.22 |
| FYM | 19/3 | | | | | 2.90 |
| FYM/N*PK | 20/1 | | | | | 2.85 |
| FYM/N*PK | 20/2 | | | | | 2.94 |
| FYM/N*PK | 20/3 | | | | | 2.92 |

2nd cut mean DM% 25.13



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Results of the Classical and other Long-term Experiments 2017

## TOTAL OF 2 CUTS DRY MATTER, TONNES/HECTARE

### *Tables of means*

Grand mean 5.00

| Manure | | Lime | a | b | c | d | Mean |
|---|---|---|---|---|---|---|---|
| N1 | 1 | | 3.09 | 2.65 | 2.56 | 0.92 | 2.31 |
| K | 2/1 | | 2.25 | 2.73 | 1.84 | 1.46 | 2.07 |
| None(FYM) | 2/2 | | 2.88 | 2.95 | 2.40 | 2.20 | 2.61 |
| None | 3 | | 2.48 | 2.91 | 2.23 | 2.13 | 2.44 |
| P | 4/1 | | 4.18 | 4.55 | 3.93 | 3.61 | 4.07 |
| N2P | 4/2 | | 3.38 | 4.45 | 4.91 | 2.52 | 3.81 |
| N1PKNaMg | 6 | | 7.31 | 7.27 | - | - | 7.29 |
| (P)KNaMg | 7/1 | | 5.89 | 6.68 | 5.88 | 3.15 | 5.40 |
| PKNaMg | 7/2 | | 6.55 | 7.72 | 7.37 | 4.36 | 6.50 |
| PNaMg | 8 | | 3.92 | 4.45 | 4.20 | 5.40 | 4.49 |
| PKNaMg(N2) | 9/1 | | 6.73 | 6.45 | 6.15 | 0.80 | 5.03 |
| N2PKNaMg | 9/2 | | 7.77 | 8.05 | 6.14 | 3.47 | 6.36 |
| N2PNaMg | 10 | | 4.14 | 4.73 | 5.70 | 2.38 | 4.24 |
| N3PKNaMg | 11/1 | | 6.74 | 6.38 | 6.83 | 4.55 | 6.13 |
| N3PKNaMgSi | 11/2 | | 7.86 | 6.96 | 6.36 | 4.34 | 6.38 |
| None | 12 | | 3.67 | 3.07 | 2.26 | 2.22 | 2.81 |
| (FYM/F) | 13/1 | | 4.64 | 5.14 | 4.36 | 3.61 | 4.44 |
| FYM/PM | 13/2 | | 6.13 | 7.82 | 7.22 | 7.43 | 7.15 |
| PKNaMg(N2*) | 14/1 | | 7.34 | 9.17 | 8.51 | 8.44 | 8.36 |
| N2*PKNaMg | 14/2 | | 5.90 | 6.95 | 7.08 | 7.26 | 6.80 |
| N3*PKNaMg(N2*) | 15 | | 7.71 | 7.09 | 6.65 | 6.38 | 6.96 |
| N1*PKNaMg | 16 | | 7.28 | 8.25 | 6.54 | 5.99 | 7.01 |
| N1* | 17 | | 2.46 | 3.46 | 2.88 | 3.68 | 3.12 |
| N2KNaMg | 18 | | 2.81 | 3.31 | 2.96 | 0.54 | 2.41 |
| N2KNaMg | 18/2 | | | | | | 4.49 |
| FYM | 19/1 | | | | | | 7.36 |
| FYM | 19/2 | | | | | | 7.97 |
| FYM | 19/3 | | | | | | 7.19 |
| FYM/N*PK | 20/1 | | | | | | 7.48 |
| FYM/N*PK | 20/2 | | | | | | 7.42 |
| FYM/N*PK | 20/3 | | | | | | 7.33 |

TOTAL OF 2 CUTS
Mean DM% 27.98



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## 17/R/GC/8 GARDEN CLOVER (Manor Garden)

**Object:** To study yields and pathogens of red clover grown continuously - Manor Garden.

The 164th year, red clover.

For previous years see `Details' 1967 and 1973, and Yield books for 74-16/R/GC/8.

**Design:** 2 blocks of 2 plots.

**Whole plot dimensions:** 1.00 m x 1.40 m.

**Treatments**:

Residual effects of fungicide to control *Sclerotinia trifoliorum*:

NONE None

Benomyl sprays during previous winters, last applied November 1989.

### Experimental Diary

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 01/12/2016 | f | Applied Epsom Salts | 50 | kg/ha |
| 01/12/2016 | f | Applied TSP | 75 | kg/ha |
| 01/12/2016 | f | Applied Potassium Sulphate | 150 | kg/ha |
| 01/12/2016 | f | Applied Chalk. | 1.25 | t/ha |
| 31/05/2017 | a | First Cut | - | - |
| 04/07/2017 | a | Second Cut | - | - |
| 13/09/2017 | a | Third Cut | - | - |

### Yields

Dry Matter, Tonnes/Hectare

| | | | FUNG_RES | | |
|---|---|---|---|---|---|
| Cut | Date | Grand Mean | NONE | BENOMYL | Mean DM% |
| 1st | 31 MAY 2017 | 4.09 | 4.14 | 4.04 | 20.10 |
| 2nd | 04 JUL 2017 | 3.71 | 3.65 | 3.77 | 23.50 |
| 3rd | 13 SEP 2017 | 3.27 | 3.34 | 3.20 | 24.70 |
| Total of 3 cuts | | 11.06 | 11.12 | 11.00 | 22.80 |



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## 17/W/RN/3 LEY/ARABLE (Stackyard D, Woburn Farm)

**Object:** To compare the effects on soil fertility of rotations with or without leys – Woburn, Stackyard D.

**Sponsors:** A. J. Macdonald

The 80th year, leys, winter beans, winter wheat, winter rye

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-16/W/RN/3.

**Design**: 5 series of 8 plots, split for treatments other than rotations.

**Whole plot dimensions:** 8.53 m x 40.7 m

**Treatments:** All phases of four five-course rotations were originally present:

**ROTATION**

| | | |
|---|---|---|
| LEY | Clover/grass ley: | L, L, L, P, W |
| CLO | All legume ley: | SA, SA, SA, P, W until 1971 then CL, CL, CL, P, WINTER |
| A | Arable with roots: | P, R, C, P, W until 1971 then P, B, B, P, WINTER |
| A H | Arable with hay: | P, R, H, P, W until 1971 then P, B, H, P, WINTER |

P = potatoes, R = winter rye, C = carrots, W= winter wheat, B = spring barley, H = hay, L = clover/grass ley, SA = sainfoin ley, CL = red clover ley.

Rotations themselves followed different cycles:
On four plots in each block the rotations were repeated.
On four plots in each block arable rotations alternated every five years with ley rotations.
From 1976 all the rotations were changed on all phases except for the first and second test crops in 1976:

| | |
|---|---|
| LN 3 | (Previous LEY) LN1, LN2, LN3, W, R |
| LC 3 | (Previous CLO) LC1, LC2, LC3, W, R |
| AF | (Previous A) F, F, BE, W, R |
| AB | (Previous A H) B, B, BE, W, R |
| | From 1988 rotations AF and AB are replaced by AM and ABe respectively. Phased in at the beginning of each treatment crop sequence. |
| AM | R, BE, M, W, R |
| ABe | R, M, BE, W, R |

LN1 to LN3 = three-year grass ley with N, 1st year to 3rd year,
LC= clover/grass ley, no N, BE = beans (spring oats until 1980), F = fallow,
M = forage maize



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Plots hitherto in alternating rotations were changed to test eight-year leys and two test crops:

LLN LLN1, LLN2, LLN3, LLN4, LLN5, LLN6, LLN7, LLN8, W, R
LLC LLC1, LLC2, LLC3, LLC4, LLC5, LLC6, LLC7, LLC8, W, R

LLN1 to LLN8 = eight year grass leys with nitrogen, first year to eighth year, similarly for LLC – clover/grass ley, no nitrogen

The new scheme started by sowing these new leys in spring 1976 on four phases and in spring 1977 on the fifth phase (2nd test crop in 1976).

In 1992 winter rye (R) replaced spring barley (B) as the second test crop. Yields are taken from the leys, arable treatment crops and the test crops.

From 2007 plots previously in the 1st cycle of testing eight-year leys followed by two arable test crops (i.e. those plots which were changed to eight-year ley treatments in 1976 or 1977) changed to a three-year arable rotation followed by two arable test crops. Plots were "phased in" but joined the relevant point in the rotation. From 2008 the second cycle 8-yr grass and grass/clover leys changed to 3-yr grass or grass/clover leys respectively. They were phased in between 2008 and 2012.
LLN/AO (Previously 1st cycle, 8-yr grass ley) R, BE, O, W, R
LLC/ABe (Previously 1st cycle, 8-yr grass/clover ley) R, O, BE, W, R
LLC/LC3 (Previously 2nd cycle, 8-yr grass ley) Lc 1, Lc 2, Lc 3, W, R

LLN/LN3 (Previously 2nd cycle, 8-yr grass/clover ley) Ln 1, Ln 2, Ln 3, W, R

From 2009 W oats (O) replaced forage maize (M) in the AM and ABe rotations on block III and were phased in on blocks V, IV, II and I in subsequent years. The AM treatment was re-named AM/AO.

**Treatments to first test crop winter wheat, all combinations of:**

**Whole plots:**

1. **ROTATION** Rotations before wheat:
   LLN 8

   LN 3

   LLC 8

   LC 3

   LLC/LC3 not yet in phase

   LLN/LN3 not yet in phase

   LLN/AO not yet in phase

   LLC/ABe not yet in phase

   AM/AO

   ABe



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1/ 2 plots:

2. **NSPLIT (FYM res)** Farmyard manure residues, last applied 1960s:
Split N v single N dressing to wheat, tested 2001-5

   Nsplit (noFYM)

   Nsingle (FYM)

1/8 plots:

3. **N** Nitrogen fertilizer as split dressings in spring 2017 (kg N) as 34.5% N:

| | | |
|---|---|---|
| 0 | 0 | |
| 80 | 40 + 40 | ) to be applied |
| 160 | 40 + 120 | ) late-February/early-March |
| 240 | 40+ 200 | ) and mid-April |

**Treatments to second test crop winter rye, all combinations of:**

**Whole plots:**

1. **ROTATION** Rotations before first test crop:
LLN8

   LN 3

   LLC 8

   LC 3

   LLC/LC3 not yet in phase

   LLN/LN3 not yet in phase

   LLN/AO not yet in phase

   LLC/ABe not yet in phase

   AM/AO

   ABe

1/ 2 plots:

2. **NSPLIT (FYM res)** Farmyard manure residues, last applied 1960s:
N split to wheat (no FYM)

   N single to wheat (FYM)

1/8 plots:

3. **N** Nitrogen fertilizer in spring 2017 (kg N) as 34.5%:
0
50
100
150



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Treatments to leys:

**FYM RES** Farmyard manure residues:

NONE
FYM 38 t on each occasion, last applied 1960s.

**NOTE:** Corrective K dressings (kg $K_2O$ $ha^{-1}$) as muriate of potash, applied where necessary to first test crop winter wheat and long-term leys in the wheat block, applied 2016 (see date below).

| Continuous rotations | No FYM | FYM Res |
|---|---|---|
| Before wheat | Half plots | Half plots |
| ABe/Be | 100 | 10 |
| AO/O | 110 | 60 |
| LLn/AO | 20 | 20 |
| LLn/ABe | 0 | 0 |

None to other plots.

## Experimental Diary

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| **ALL** | | | | |
| 26/09/2016 | a | Ploughed - thrown north west - to finish | - | - |
| 27/09/2016 | a | Ploughed - Finished | - | - |
| 20/04/2017 | a | Cut paths | - | - |
| 19/06/2017 | a | Cut paths | - | - |
| 11/08/2017 | a | Topped Surrounds and paths | - | - |
| 29/09/2017 | a | Topped Trial Site | - | - |
| **Grass ley and clover/grass leys (first year leys)** | | | | |
| 14/09/2016 | f | Applied SOP (50% K2O, 45% SO3) | 140.00 | kg/ha |
| 14/09/2016 | f | Applied Nitram (34.5% N) Fertiliser | 145.00 | kg/ha |
| 14/09/2016 | f | Applied TSP | 213.00 | kg/ha |
| 26/10/2016 | s | Drilled Grass and Clover mix - plots 3, 4, 7, 8 | 30.00 | kg/ha |
| 26/10/2016 | s | Drilled Grass only - plots 11, 12, 13, 14 | 30.00 | kg/ha |



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| | | | | |
|---|---|---|---|---|
| 06/04/2017 | f | Applied Nitram (34.5% N) Fertiliser to plots: 11, 12, 13, 14 | 217.00 | kg/ha |
| 07/04/2017 | f | Applied MOP to plots: 11, 12, 13, 14 | 167.00 | kg/ha |
| 27/06/2017 | a | Cut grass plots for yield (1st cut) | - | - |
| 06/07/2017 | a | Mowed all remaining grass on plots | - | - |
| 10/07/2017 | a | Baled and removed all remaining grass | - | - |
| 17/11/2017 | a | Cut grass plots for yield (2nd Cut) | - | - |

**Grass ley and clover/grass leys (2nd and 3rd year leys)**

| | | | | |
|---|---|---|---|---|
| 14/09/2016 | f | Applied SOP (50% K2O, 45% SO3) | 140.00 | kg/ha |
| 14/09/2016 | f | Applied TSP | 213.00 | kg/ha |
| 06/04/2017 | f | Applied Nitram (34.5% N) Fertiliser to plots 25, 26, 31, 32, 57, 58, 61, 62. | 217.00 | kg/ha |
| 07/04/2017 | f | Applied MOP to plots 25, 26, 31, 32, 57, 58, 61, 62. | 167.00 | kg/ha |
| 27/06/2017 | a | Cut grass plots for yield (1st Cut) | - | - |
| 06/07/2017 | a | Mowed all remaining grass on plots | - | - |
| 10/07/2017 | a | Baled and removed all remaining grass | - | - |
| 17/11/2017 | a | Cut grass plots for yield (2nd Cut) | - | - |

**W Beans**

| | | | | |
|---|---|---|---|---|
| 14/09/2016 | f | Applied TSP Fertilizer to all arable plots. | 127.00 | kg/ha |
| 28/10/2016 | s | Drilled Beans - Wizard - plots 19, 20, 27, 28, 49, 50, 53, 54 | 35.00 | seeds/$m^2$ |
| 31/10/2016 | p | Sprayed Nivana in 200 lt/ha | 4.00 | lt/ha |
| 06/04/2017 | p | Sprayed Troy 480 | 3.00 | lt/ha |
| 07/04/2017 | f | Applied SOP (50% K2O, 45% SO3) - to all arable plots | 150.00 | kg/ha |
| 02/05/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 02/05/2017 | p | Sprayed Hallmark in 200 lt/ha water volume | 75.00 | ml/ha |
| 02/05/2017 | p | Sprayed San 703 in 200 lt/ha water volume | 2.00 | lt/ha |
| 15/08/2017 | a | Harvested | - | - |



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**W Wheat**

| | | | | |
|---|---|---|---|---|
| 06/09/2016 | p | Sprayed Samurai | 4.00 | lt/ha |
| 06/09/2016 | p | Sprayed Firebrand | 1.00 | lt/ha |
| 14/09/2016 | f | Applied TSP Fertilizer to all arable plots. | 127.00 | kg/ha |
| 19/09/2016 | f | Applied MOP Fertiliser - to plots 68. By hand. | 10.00 | kg/ha |
| 19/09/2016 | f | Applied MOP Fertiliser - to plots 71, 72. By hand. | 20.00 | kg/ha |
| 19/09/2016 | f | Applied MOP Fertiliser - to plots 74. By hand. | 60.00 | kg/ha |
| 19/09/2016 | f | Applied MOP Fertiliser - to plots 67. By hand. | 100.00 | kg/ha |
| 19/09/2016 | f | Applied MOP Fertiliser - to plots 73. By hand. | 110.00 | kg/ha |
| 27/10/2016 | s | Drilled Wheat - Crusoe - trt Redigo Pro + Deter - Block 5. | 400.00 | seeds/$m^2$ |
| 17/03/2017 | f | Applied Nitro-chalk - Block 5 - Block 5 excluding plots 653, 663, 672, 682, 692, 702, 713, 721, 732, 744, 751, 763, 771, 782, 791, 803 | 148.00 | kg/ha |
| 07/04/2017 | f | Applied SOP (50% K2O, 45% SO3) - to all arable plots | 150.00 | kg/ha |
| 24/04/2017 | f | Applied Nitro-chalk (27.0% N) Block 5 - plots 651, 662, 674, 684, 693, 701, 714, 722, 733, 743, 754, 761, 774, 781, 793, 804 | 148.00 | kg/ha |
| 24/04/2017 | f | Applied Nitro-chalk (27.0% N) Block 5 - plots 654, 661, 671, 683, 691, 703, 712, 723, 734, 741, 752, 764, 773, 784, 794, 801 | 444.00 | kg/ha |
| 24/04/2017 | f | Applied Nitro-chalk (27.0% N) Block 5 - plots 652, 664, 673, 681, 694, 704, 711, 724, 731, 742, 753, 762, 772, 783, 792, 802 | 741.00 | kg/ha |
| 28/04/2017 | p | Sprayed Sprinter | 2.00 | lt/ha |
| 28/04/2017 | p | Sprayed Keystone | 0.80 | lt/ha |
| 28/04/2017 | p | Sprayed Balear 720 | 0.70 | lt/ha |
| 22/05/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |



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| | | | | |
|---|---|---|---|---|
| 22/05/2017 | p | Sprayed Simba SX in 200 lt/ha water volume | 30.00 | g/ha |
| 22/05/2017 | p | Sprayed Hatchet Xtra in 200 lt/ha water volume | 0.50 | lt/ha |
| 22/05/2017 | p | Sprayed Aviator Xpro in 200 lt/ha water volume | 0.56 | lt/ha |
| 22/05/2017 | p | Sprayed Keystone in 200 lt/ha water volume | 0.23 | lt/ha |
| 22/05/2017 | p | Sprayed Cello in 200 lt/ha water volume | 0.17 | lt/ha |
| 25/03/2017 | p | Sprayed Chex | 0.25 | lt/ha |
| 25/03/2017 | p | Sprayed Palio | 0.27 | lt/ha |
| 25/03/2017 | p | Sprayed Eximus | 2.00 | lt/ha |
| 25/03/2017 | p | Sprayed Cogent | 1.00 | lt/ha |
| 06/04/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 06/04/2017 | p | Sprayed Cortez in 200 lt/ha water volume | 0.50 | lt/ha |
| 06/04/2017 | p | Sprayed Chlormequat in 200 lt/ha water volume | 2.00 | lt/ha |
| 06/04/2017 | p | Sprayed Bravo 500 in 200 lt/ha water volume | 1.00 | lt/ha |
| 15/08/2017 | a | Harvested | - | - |
| **W Rye** | | | | |
| 14/09/2016 | f | Applied TSP Fertilizer to all arable plots. | 127.00 | kg/ha |
| 20/09/2016 | f | Applied Chalk to block 3 | 5.00 | t/ha |
| 27/10/2016 | s | Drilled Rye - Mephisto trt Kinto - Block 3 - plots 1, 2, 5, 6, 9, 10, 15, 16 | 350.00 | seeds/$m^2$ |
| 25/03/2017 | p | Sprayed Chex | 0.25 | lt/ha |
| 25/03/2017 | p | Sprayed Palio | 0.27 | lt/ha |
| 25/03/2017 | p | Sprayed Eximus | 2.00 | lt/ha |
| 25/03/2017 | p | Sprayed Cogent | 1.00 | lt/ha |
| 06/04/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 06/04/2017 | p | Sprayed Cortez in 200 lt/ha water volume | 0.50 | lt/ha |
| 06/04/2017 | p | Sprayed Chlormequat in 200 lt/ha water volume | 2.00 | lt/ha |



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| | | | | |
|---|---|---|---|---|
| 06/04/2017 | p | Sprayed Bravo 500 in 200 lt/ha water volume | 1.00 | lt/ha |
| 06/04/2017 | f | Applied Nitram (34.5% N) Fertiliser - to plots 1, 2, 5, 6, 9, 10, 15, 16 | 290.00 | kg/ha |
| 07/04/2017 | f | Applied SOP (50% K2O, 45% SO3) - to all arable plots | 150.00 | kg/ha |
| 21/04/2017 | f | Applied Nitrochalk (27% N) - Block 3 - plots 332, 342, 353, 363, 372, 383, 392, 403, 412, 424, 434, 441, 452, 461, 472, 483 | 185.00 | kg/ha |
| 21/04/2017 | f | Applied Nitrochalk (27% N) - Block 3 - plots 331, 343, 351, 361, 373, 384, 394, 401, 414, 422, 432, 444, 453, 462, 471, 484 | 370.00 | kg/ha |
| 21/04/2017 | f | Applied Nitrochalk (27% N) - Block 3 - plots 334, 341, 354, 364, 374, 381, 393, 404, 411, 423, 431, 443, 454, 463, 474, 482 | 556.00 | kg/ha |
| 02/05/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 02/05/2017 | p | Sprayed Keystone in 200 lt/ha water volume | 0.80 | lt/ha |
| 24/05/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 24/05/2017 | p | Sprayed Cello in 200 lt/ha water volume | 0.75 | lt/ha |
| 15/08/2017 | a | Harvested | - | - |

**W Oats**

| | | | | |
|---|---|---|---|---|
| 14/09/2016 | f | Applied TSP Fertilizer to all arable plots. | 127.00 | kg/ha |
| 27/10/2016 | s | Drilled Oats - Mascani trt Beret Gold - plots 17, 18, 21, 22, 51, 52, 63, 64 | 350.00 | seeds/$m^2$ |
| 06/04/2017 | f | Applied Nitram (34.5% N) Fertiliser - plots 17, 18, 21, 22, 51, 52, 63, 64 | 290.00 | kg/ha |
| 07/04/2017 | f | Applied SOP (50% K2O, 45% SO3) - to all arable plots | 150.00 | kg/ha |
| 22/05/2017 | p | Sprayed Sprinter in 200 lt/ha water volume | 2.00 | lt/ha |
| 22/05/2017 | p | Sprayed Refin Max in 200 lt/ha water volume | 75.00 | g/ha |
| 22/05/2017 | p | Sprayed Cello in 200 lt/ha water volume | 1.00 | lt/ha |
| 22/05/2017 | p | Sprayed Hurler in 200 lt/ha water volume | 0.75 | lt/ha |



*https://doi.org/10.23637/ERADOC-1-251* 

15/08/2017 a Harvested - -

NOTE: Herbage and grain samples were taken for chemical analyses.

## Yields

### LEYS

1ST CUT (27 JUN 2017) DRY MATTER TONNES/HECTARE

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

FYM_RES

| LEY | NONE | FYM | MEAN |
|---|---|---|---|
| LC1 | 3.41 | 2.31 | 2.86 |
| LC2 | 2.72 | 2.29 | 2.50 |
| LC3 | 5.10 | 5.49 | 5.29 |
| LN1 | 2.55 | 4.49 | 3.52 |
| LN2 | 3.83 | 5.85 | 4.84 |
| LN3 | 4.64 | 4.08 | 4.36 |
| (LLC/LC)LC1 | 5.38 | 5.51 | 5.45 |
| (LLC/LC)LC2 | 2.25 | 2.80 | 2.52 |
| (LLC/LC)LC3 | 4.90 | 4.85 | 4.87 |
| (LLN/LN)LN1 | 8.56 | 7.03 | 7.80 |
| (LLN/LN)LN2 | 4.23 | 3.55 | 3.89 |
| (LLN/LN)LN3 | 4.49 | 5.00 | 4.74 |
| MEAN | 4.34 | 4.44 | 0.39 |

1ST CUT MEAN DM% 0.30

2ND CUT (17 NOV 2017) DRY MATTER TONNES/HECTARE

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

FYM_RES

| LEY | NONE | FYM | MEAN |
|---|---|---|---|
| LC1 | 0.35 | 0.68 | 0.51 |
| LC2 | 0.76 | 0.67 | 0.71 |
| LC3 | 1.18 | 1.99 | 1.58 |
| LN1 | 0.74 | 1.10 | 0.92 |
| LN2 | 0.95 | 1.02 | 0.98 |
| LN3 | 4.15 | 1.40 | 2.77 |
| (LLC/LC)LC1 | 1.06 | 1.72 | 1.39 |
| (LLC/LC)LC2 | 0.45 | 0.34 | 0.39 |



*https://doi.org/10.23637/ERADOC-1-251* *pp 48*

| | | | |
|---|---|---|---|
| (LLC/LC)LC3 | 2.20 | 2.93 | 2.56 |
| (LLN/LN)LN1 | 2.84 | 2.28 | 2.56 |
| (LLN/LN)LN2 | 0.95 | 0.91 | 0.93 |
| (LLN/LN)LN3 | 1.24 | 1.16 | 1.20 |
| MEAN | 1.40 | 1.35 | 1.38 |
| 2ND CUT MEAN DM% | 22.80 | | |

Total of 2 CUTS DRY MATTER TONNES/HECTARE

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

| FYM_RES | | | |
|---|---|---|---|
| LEY | NONE | FYM | MEAN |
| LC1 | 3.76 | 2.99 | 3.37 |
| LC2 | 3.48 | 2.95 | 3.22 |
| LC3 | 6.28 | 7.48 | 6.88 |
| LN1 | 3.28 | 5.59 | 4.44 |
| LN2 | 4.77 | 6.86 | 5.82 |
| LN3 | 8.79 | 5.48 | 7.13 |
| (LLC/LC)LC1 | 6.44 | 7.22 | 6.83 |
| (LLC/LC)LC2 | 2.69 | 3.14 | 2.91 |
| (LLC/LC)LC3 | 7.10 | 7.77 | 7.44 |
| (LLN/LN)LN1 | 11.40 | 9.32 | 10.36 |
| (LLN/LN)LN2 | 5.18 | 4.47 | 4.82 |
| (LLN/LN)LN3 | 5.73 | 6.15 | 5.94 |
| MEAN | 5.74 | 5.79 | 5.76 |
| 2ND CUT MEAN DM% | 33.10 | | |

Note: Since 2014 grass-only leys have not been receiving N after the first cut and in some years K has not been applied after the first cut on both grass-only and grass-clover leys.

**ARABLE TREATMENT CROPS**

**WINTER BEANS**



*https://doi.org/10.23637/ERADOC-1-251* *pp 49*

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

| FYMRES ROTATION | NONE | FYM | Mean |
|---|---|---|---|
| (AO)Be | 0.34 | 1.01 | 0.68 |
| (LLn/AO)Be | 0.75 | 1.26 | 1.01 |
| (LLc/ABe)Be | 2.31 | 1.20 | 1.76 |
| (ABe)Be | 1.78 | 2.19 | 1.99 |
| Mean | 1.30 | 1.42 | 1.36 |

| | |
|---|---|
| Grain mean DM% | 85.3 |
| Plot area harvested | 0.00393 |

**RYE (EXTRA)**

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

| FYMRES ROTATION | NONE | FYM | Mean |
|---|---|---|---|
| (AO)Be | 5.91 | 5.18 | 5.54 |
| (LLn/AO)Be | 5.62 | 5.28 | 5.45 |
| (LLc/ABe)Be | 5.07 | 5.84 | 5.46 |
| (ABe)Be | 6.33 | 5.76 | 6.05 |
| Mean | 5.73 | 5.52 | 5.62 |

| | |
|---|---|
| Grain mean DM% | 86.1 |
| Plot area harvested | 0.00393 |

**WINTER WHEAT**

Grain tonnes/hectare



*https://doi.org/10.23637/ERADOC-1-251* *pp 50*

Results of the Classical and other Long-term Experiments 2017

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

| FYMRES | none | FYM | Mean |
|---|---|---|---|
| ROTATION | | | |
| (AO)W | 5.95 | 5.33 | 5.64 |
| (ABe)W | 4.82 | 4.45 | 4.63 |
| (LLn/AO)W | 5.24 | 4.80 | 5.02 |
| (LLc/ABe)W | 6.24 | 7.37 | 6.80 |
| (LN)W | 4.70 | 5.26 | 4.98 |
| (LLN/Ln)W | 5.74 | 5.93 | 5.84 |
| (LC)W | 7.54 | 6.36 | 6.95 |
| (LLc/Lc)W | 7.35 | 6.88 | 7.11 |
| Mean | 5.95 | 5.80 | 5.87 |

| N | 0 | 80 | 160 | 240 | Mean |
|---|---|---|---|---|---|
| ROTATION | | | | | |
| (AO)W | 2.63 | 5.18 | 7.08 | 7.67 | 5.64 |
| (ABe)W | 3.00 | 5.20 | 5.03 | 5.30 | 4.63 |
| (LLn/AO)W | 2.77 | 6.46 | 6.83 | 4.02 | 5.02 |
| (LLc/ABe)W | 5.89 | 7.77 | 7.48 | 6.08 | 6.8 |
| (LN)W | 4.28 | 5.29 | 6.00 | 4.35 | 4.98 |
| (LLN/Ln)W | 3.33 | 6.61 | 6.38 | 7.03 | 5.84 |
| (LC)W | 5.71 | 8.07 | 7.71 | 6.30 | 6.95 |
| (LLc/Lc)W | 5.89 | 7.40 | 7.31 | 7.85 | 7.11 |
| Mean | 4.19 | 6.50 | 6.73 | 6.07 | 5.87 |

| N | 0 | 80 | 160 | 240 | Mean |
|---|---|---|---|---|---|
| FYMRES | | | | | |
| none | 4.06 | 6.50 | 7.12 | 6.10 | 5.95 |
| FYM | 4.31 | 6.49 | 6.34 | 6.04 | 5.80 |
| Mean | 4.19 | 6.50 | 6.73 | 6.07 | 5.87 |

| | N | 0 | 80 | 160 | 240 |
|---|---|---|---|---|---|
| ROTATION | FYMRES | | | | |
| (AO)W | none | 2.71 | 5.6 | 7.77 | 7.71 |
| | FYM | 2.55 | 4.75 | 6.39 | 7.62 |
| (ABe)W | none | 2.42 | 4.63 | 7.17 | 5.04 |
| | FYM | 3.57 | 5.77 | 2.89 | 5.55 |
| (LLn/AO)W | none | 2.59 | 6.79 | 6.64 | 4.95 |
| | FYM | 2.96 | 6.13 | 7.01 | 3.09 |
| (LLc/ABe)W | none | 6.09 | 7.98 | 5.68 | 5.20 |
| | FYM | 5.69 | 7.55 | 9.29 | 6.96 |
| (LN)W | none | 3.75 | 5.05 | 6.39 | 3.61 |
| | FYM | 4.81 | 5.53 | 5.61 | 5.08 |
| (LLN/Ln)W | none | 3.47 | 6.42 | 6.72 | 6.35 |



*https://doi.org/10.23637/ERADOC-1-251* 

| | | | | | |
|---|---|---|---|---|---|
| | FYM | 3.19 | 6.79 | 6.04 | 7.71 |
| (LC)W | none | 5.81 | 7.58 | 8.97 | 7.80 |
| | FYM | 5.62 | 8.56 | 6.46 | 4.79 |
| (LLc/Lc)W | none | 5.67 | 7.92 | 7.62 | 8.18 |
| | FYM | 6.11 | 6.87 | 7.00 | 7.53 |

| | |
|---|---|
| Grain mean DM% | 86.9 |
| Plot area harvested | 0.00183 |

**WINTER RYE**

Grain tonnes/hectare
*Tables of means*

| FYMRES | none | FYM | Mean |
|---|---|---|---|
| ROTATION | | | |
| (AO)R | 5.16 | 6.06 | 5.61 |
| (ABe)R | 6.07 | 7.01 | 6.54 |
| (LLn/AO)R | 5.76 | 6.49 | 6.13 |
| (LLc/ABe)R | 6.81 | 6.96 | 6.89 |
| (Ln)R | 7.16 | 6.59 | 6.87 |
| (LLn/Ln)R | 6.15 | 6.99 | 6.57 |
| (Lc)R | 6.61 | 6.88 | 6.74 |
| (LLc/Lc)R | 7.00 | 7.11 | 7.06 |
| Mean | 6.34 | 6.76 | 6.55 |

| N | 0 | 50 | 100 | 150 | Mean |
|---|---|---|---|---|---|
| ROTATION | | | | | |
| (AO)R | 2.84 | 5.07 | 7.18 | 7.36 | 5.61 |
| (ABe)R | 3.61 | 6.64 | 7.68 | 8.24 | 6.54 |
| (LLn/AO)R | 3.37 | 6.64 | 7.41 | 7.08 | 6.13 |
| (LLc/ABe)R | 4.57 | 6.72 | 7.88 | 8.39 | 6.89 |
| (Ln)R | 5.17 | 6.97 | 7.22 | 8.14 | 6.87 |
| (LLn/Ln)R | 4.75 | 7.02 | 7.30 | 7.22 | 6.57 |
| (Lc)R | 5.48 | 6.25 | 7.47 | 7.78 | 6.74 |
| (LLc/Lc)R | 5.19 | 7.39 | 8.34 | 7.31 | 7.06 |
| Mean | 4.37 | 6.59 | 7.56 | 7.69 | 6.55 |

| N | 0 | 50 | 100 | 150 | Mean |
|---|---|---|---|---|---|
| FYMRES | | | | | |
| none | 4.22 | 6.49 | 7.45 | 7.2 | 6.34 |
| FYM | 4.52 | 6.69 | 7.67 | 8.17 | 6.76 |
| Mean | 4.37 | 6.59 | 7.56 | 7.69 | 6.55 |

| | N | 0 | 50 | 100 | 150 |
|---|---|---|---|---|---|



*https://doi.org/10.23637/ERADOC-1-251* 

| ROTATION | FYMRES | | | | |
|---|---|---|---|---|---|
| (AO)R | none | 2.38 | 4.65 | 7.25 | 6.37 |
| | FYM | 3.30 | 5.50 | 7.11 | 8.35 |
| (ABe)R | none | 3.25 | 6.46 | 6.87 | 7.72 |
| | FYM | 3.97 | 6.82 | 8.49 | 8.76 |
| (LLn/AO)R | none | 2.97 | 6.37 | 7.33 | 6.38 |
| | FYM | 3.78 | 6.91 | 7.49 | 7.78 |
| (LLc/ABe)R | none | 3.73 | 6.83 | 8.48 | 8.21 |
| | FYM | 5.40 | 6.62 | 7.27 | 8.57 |
| (Ln)R | none | 6.32 | 7.15 | 7.17 | 8.02 |
| | FYM | 4.02 | 6.79 | 7.27 | 8.27 |
| (LLn/Ln)R | none | 4.41 | 7.05 | 6.34 | 6.78 |
| | FYM | 5.08 | 6.98 | 8.26 | 7.65 |
| (Lc)R | none | 5.55 | 6.04 | 7.81 | 7.02 |
| | FYM | 5.41 | 6.45 | 7.12 | 8.54 |
| (LLc/Lc)R | none | 5.16 | 7.34 | 8.37 | 7.14 |
| | FYM | 5.23 | 7.43 | 8.31 | 7.48 |

| | |
|---|---|
| Grain mean DM% | 86.73 |
| Plot area harvested | 0.00183 |

**WINTER OATS**

GRAIN (85% DRY MATTER) TONNES/HECTARE

*Tables of means*

| FYMRES | NONE | FYM | Mean |
|---|---|---|---|
| ROTATION | | | |
| ABe | 1.02 | 1.15 | 1.09 |
| AO | 3.81 | 3.36 | 3.59 |
| LLc/ABe | 1.59 | 1.54 | 1.56 |
| LLn/AO | 2.41 | 2.78 | 2.59 |
| Mean | 2.21 | 2.21 | 2.21 |

| | |
|---|---|
| Grain mean DM% | 80.9 |
| Plot area harvested | 0.00393 |



*https://doi.org/10.23637/ERADOC-1-251* *pp 53*

## 17/W/RN/12 ORGANIC MANURING (Stackyard B, Woburn Farm)

**Object:** To study, from crop yields and soil analyses, the effects of a range of types of organic matter – Woburn, Stackyard B.

**Sponsors:** A. J. Macdonald

The 52nd year, Forage Maize.

For previous years see 'Details' 1973 and Yield Books for 74-16/W/RN/12.

**Design**: 4 blocks of 8 plots

**Whole plot dimensions:** 8.0 m x 29.5 m (8.0 m x 26.5 m on Block III).

**Treatments:** From 1966 to 1971 the experiment had a preliminary period designed to build up organic matter from different sources. An arable rotation was started on two blocks on 1972 and the remaining two blocks in 1973. After a period of testing the residues, a further period of accumulation was started; on two blocks (which included ley sown in 1979) in 1981 and on the other two (which included ley sown in 1980) in 1982. A second test phase began when leys on the first pair of blocks were ploughed for the 1st test crop in 1987 and on the second pair for the 1st test crop in 1988. From 1988 two blocks, and 1989 the other two, to 1994, plots were split into 6 sub-plots to test five levels of nitrogen and nil. From 1995 to 1997 residual effects of that nitrogen were measured. In 1998 to 2000 yields were taken from whole plots only. In 2001 plots were split into half-plots to test two rates of N.

For 2003 the experiment was modified to test further inputs of organic matter. An arable rotation (winter rye, spring barley, winter beans, winter wheat, forage maize) was started on seven plots within each block; the eighth was sown to a grass/clover ley.

**Whole plots**

1. **Treatment** (Not necessarily applied each year):

| 1966-1971/2 | 1979/82-1986/7 | Since 2003 |
|---|---|---|
| Fd | Fd | F |
| Ln | Lc6 | F |
| St | St | St |
| Gm | Lc8 | CC |
| Pt | Lc8 | Co |
| Fs | Fs | Dg10 |
| Dg | Dg | Dg25 |
| Lc | Lc6 | Lc |



*https://doi.org/10.23637/ERADOC-1-251* *pp 54*

F: no organic amendment. St: chopped straw at 7.5t/ha. CC: cover crop prior to spring sown crops. Co: compost at 40t/ha. Dg10: FYM at 10t/ha. Dg25: FYM at 25t/ha. Dg: FYM at 50t/ha. Fd: fertilizers equivalent to FYM. Fs: fertilizers equivalent to straw (+P). Lc/Lc6/Lc8: grass/clover leys. Ln: grass ley + N. Gm: green manure. Pt: peat.

Since 2003, all treatments, except Dg25, have also received PKS fertilizers:

20 kg P/ha, 83 kg K/ha, 36 kg S/ha

In addition, in 2003 F and CC treatments received 120 kg N/ha, St received 90 kg N/ha. Dg10 received 60 kg N/ha. No N was applied to Dg25, Co or Lc treatments.

**Nitrogen**

In 2008 all plots, except Lc (permanent grass/clover), split into 6 to test rates of N. For crops receiving nitrogen rates rotate as follows:

N0 > N1 > N2 > N3 > N4 > N5 > N0 etc.

For 2009 spring barley crop nitrogen rates (kg N/ha) were:

0, 35, 70, 105, 140, 175 as nitro-chalk (27% N).

No N was applied to the beans in 2010

For 2011 Winter wheat rates were 0, 50, 100, 150, 200 & 250 kg N/ha as nitro-chalk (27% N).

For 2012 Forage maize rates were 0, 50, 100, 150, 200, 250 & 250 kg N/ha as Nitro-chalk (27% N)

For 2013 Winter rye nitrogen rates were 0, 30, 60, 90, 120 & 150 kg N/ha as Nitro-chalk (27% N)

For 2014 S Barley nitrogen rates were 0, 35, 70, 105, 140 & 175 kg N/ha as Nitro-chalk (27% N)

For 2015 Winter beans – No Nitrogen Applied

For 2016 Winter wheat rates were 0, 50, 100, 150, 200 & 250 kg N/ha as Nitro-Chalk (27% N)

For 2017 Forage maize rates were 0, 50, 100, 150, 200 & 250 kg N/ha as Nitro-Chalk (27% N)



*https://doi.org/10.23637/ERADOC-1-251* *pp 55*

## Experimental Diary

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 09/09/2016 | s | Hand broadcast mustard Zlata - plots 4, 10, 19 and 32 only. Cover Crop plots (CC). | 10.00 | kg/ha |
| 09/09/2016 | a | Power harrowed - Cover crop plots lightly. | - | - |
| 13/04/2017 | p | Sprayed Firebrand - Sprayed off stubble only. | 1.00 | lt/ha |
| 13/04/2017 | p | Sprayed Samurai - Sprayed off stubble only. | 4.00 | lt/ha |
| 20/04/2017 | f | Applied Chalk - all plots | 5.00 | t/ha |
| 21/04/2017 | f | Applied SOP (50% K2O, 45% SO3) - all plots apart from 5, 11, 23, 26. | 200.00 | kg/ha |
| 21/04/2017 | f | Applied MOP - all plots a part from 5,11,23,26. | 97.50 | kg/ha |
| 24/04/2017 | f | Applied compost - plots 7, 12, 21, 27 | 40.00 | t/ha |
| 25/04/2017 | f | Applied straw - plots 3, 15, 17, 31 | 7.50 | t/ha |
| 25/04/2017 | f | Applied FYM - plots 5, 11, 23, 26 | 25.00 | t/ha |
| 25/04/2017 | f | Applied FYM - plots 8, 14, 18, 28 | 10.00 | t/ha |
| 26/04/2017 | a | Topped straw plots | - | - |
| 27/04/2017 | a | Ploughed - thrown south east | - | - |
| 03/05/2017 | a | Power harrowed | - | - |
| 04/05/2017 | a | Rolled prior to drilling | - | - |
| 04/05/2017 | s | Drilled maize Severus tr. Mesurial | 10.10 | s/m^2 |
| 25/05/2017 | f | Applied Nitro-chalk (27% N) by hand - N1 to N5 treatments | 185.00 | kg/ha |
| 19/06/2017 | a | Cut paths | - | - |
| 22/06/2017 | f | Applied Nitro-chalk (27% N) by hand. To plots 0025, 0033, 0044, 0054, 0064, 0076, 0085, 0091, 0102, 0111, 0123, 0142, 0154, 0162, 0176, 0181, 0192, 0201, 0211, 0223, 0236, 0252, 0262, 0273, 0283, 0305, 0312, 0323 - Maize plots only | 185.00 | kg/ha |



*https://doi.org/10.23637/ERADOC-1-251* 

| | | | | |
|---|---|---|---|---|
| 22/06/2017 | f | Applied Nitro-chalk (27% N) by hand. To plots 0023, 0034, 0042, 0051, 0061, 0074, 0086, 0094, 0103, 0114, 0125, 0141, 0152, 0165, 0172, 0183, 0191, 0204, 0216, 0221, 0234, 0254, 0264, 0275, 0281, 0306, 0316, 0321 - Maize plots only | 370.00 | kg/ha |
| 22/06/2017 | f | Applied Nitro-chalk (27% N) by hand. To plots 0026, 0031, 0041, 0052, 0066, 0075, 0081, 0096, 0101, 0115, 0122, 0145, 0151, 0161, 0174, 0184, 0196, 0203, 0213, 0224, 0233, 0251, 0261, 0276, 0285, 0301, 0314, 0322 - Maize plots only | 556.00 | kg/ha |
| 22/06/2017 | f | Applied Nitro-chalk (27% N) by hand. To plots 0024, 0032, 0045, 0053, 0065, 0073, 0084, 0093, 0106, 0116, 0126, 0146, 0155, 0163, 0171, 0185, 0193, 0202, 0215, 0226, 0235, 0256, 0266, 0272, 0282, 0304, 0311, 0325 - Maize plots only | 741.00 | kg/ha |
| 26/06/2017 | p | Sprayed Callisto in 200 lt/ha water volume - maize plots only | 1.50 | lt/ha |
| 26/06/2017 | p | Sprayed Samson Extra in 200 lt/ha water volume | 0.75 | lt/ha |
| 27/06/2017 | a | Cut grass plots for yield (1st Cut) | - | - |
| 06/07/2017 | a | Mowed all remaining grass on plots | - | - |
| 10/07/2017 | a | Baled and removed all remaining grass | - | - |
| 11/08/2017 | a | Topped Surrounds and paths | - | - |
| 20/09/2017 | a | Started Harvesting Maize for Yield | - | - |
| 21/09/2017 | a | Finished Harvesting Maize for Yield | - | - |
| 29/09/2017 | a | Topped Trial Site | - | - |
| 17/11/2017 | a | Cut grass plots for yield (2nd Cut) | - | - |



*https://doi.org/10.23637/ERADOC-1-251* *pp 57*

## Yields

FORAGE MAIZE

GRAIN TONNES/HECTARE (100% DM)

*Tables of means*

| Nitrogen<br>Treatment | 0 | 50 | 100 | 150 | 200 | 250 | Mean |
|---|---|---|---|---|---|---|---|
| F(Fd) | 3.40 | 6.04 | 7.05 | 8.85 | 10.37 | 10.06 | 7.63 |
| F(Ln, Lc6) | 5.31 | 8.27 | 9.57 | 11.87 | 10.62 | 13.05 | 9.78 |
| St(St) | 5.75 | 6.79 | 8.88 | 9.26 | 10.84 | 12.14 | 8.94 |
| CC(Gm, Lc8) | 5.19 | 5.59 | 8.93 | 8.61 | 7.51 | 11.64 | 7.91 |
| Co(Pt, Lc8) | 7.96 | 11.38 | 13.86 | 11.60 | 13.13 | 13.91 | 11.97 |
| Dg10(Fs) | 6.32 | 8.14 | 11.70 | 11.57 | 12.78 | 12.86 | 10.56 |
| Dg25(Dg) | 9.75 | 13.24 | 16.00 | 13.45 | 13.94 | 14.79 | 13.53 |
| Mean | 6.24 | 8.49 | 10.85 | 10.74 | 11.31 | 12.64 | 10.05 |

*Standard errors of differences of means*

| Table | Treatment | Nitrogen | Treatment<br>Nitrogen |
|---|---|---|---|
| s.e.d. | 1.559 | 0.499 | 1.971 |
| Except when comparing means with the same level(s) of Treatment | 1.321 | | |
| d.f. | 105 | | |
| Grain Mean DM (%) | 28.8 | | |
| Plot area harvested (ha) 0.00063 | | | |



*https://doi.org/10.23637/ERADOC-1-251* 

**GRASS/CLOVER**

DRY MATTER TONNES/HECTARE
***** Table of means *****

| Year | 1st Cut | 2nd Cut | Total |
|---|---|---|---|
| 2003 | - | - | - |
| 2004 | 1.82 | - | 1.82 |
| 2005 | 1.86 | 0.13 | 1.99 |
| 2006 | 4.07 | - | 4.07 |
| 2007 | 3.12 | 1.36 | 4.48 |
| 2008 | 5.72 | 1.65 | 7.37 |
| 2009 | 4.77 | - | 4.77 |
| 2010 | 4.41 | - | 4.41 |
| 2011 | 1.46 | 0.39 | 1.85 |
| 2012 | 4.11 | 0.64 | 4.75 |
| 2013 | 4.65 | 0.60 | 5.24 |
| 2014 | 4.09 | 0.91 | 5.01 |
| 2015 | * | 0.36 | - |
| 2016 | 3.97 | 0.56 | 4.54 |
| 2017 | 2.17 | 1.48 | 3.65 |

Cut dry matter t/ha (27 JUN 2017 & 17 NOV 2017)

Note: Whole maize crop and herbage samples were taken for chemical analyses and archiving.



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# 17/R/CS/326 and 17/W/CS/326 AMOUNTS OF STRAW (Gt. Knott III (R) and Far field I (W))

**Object:** To study the effects of different amounts of straw, incorporated into the soil, on winter wheat – Rothamsted (R) Great Knott III, Woburn (W) Far Field I

**Sponsors:** A Macdonald and M. J. Glendining,

The 31st year, winter wheat (no yields taken).

**Notes:** Both experiments will finish in autumn 2017. No yields to be taken in 2016 or 2017. Only farm diary details are shown below. For previous years see Yield Books for 87-17/R & W/CS/326.

**Design:** 4 randomised blocks of 4 plots (R)

3 randomised blocks of 4 plots (W)

**Whole plot dimensions:**

3.0 m x 13.5 m (R) = 0.0040 ha

3.0 m x 14.5 m (W) = 0.0043 ha

**Treatments:**

Amounts of straw incorporated into the seedbed (t/ha), cumulative to previous annual dressings:

| | | R | W |
|---|---|---|---|
| NONE | None | - | - |
| NORMAL | Normal | 4.70 | 3.39 |
| 2 NORMAL | Twice normal | 9.40 | 6.78 |
| 4 NORMAL | Four times normal | 18.80 | 13.56 |

**Experimental Diary**

**Great Knott III (R)**

| Date | | Application | Rate | Units |
|---|---|---|---|---|
| 21/09/2016 | a | Loaded Straw onto Plots 4, 7, 11, 14 | 4.70 | t/ha |
| 21/09/2016 | a | Loaded Straw onto Plots 2, 6, 10, 13 | 9.40 | t/ha |
| 21/09/2016 | a | Loaded Straw onto Plots 3, 5, 9, 16 | 18.80 | t/ha |
| 21/09/2016 | a | Topped Straw before Ploughing | - | - |
| 22/09/2016 | a | Sub-Soiled Tramlines | - | - |
| 23/09/2016 | a | Ploughed - thrown East | - | - |
| 07/10/2016 | a | Ring Rolled - all new drilling | - | - |
| 13/10/2016 | p | Sprayed Liberator | 600.00 | ml/ha |



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| | | | | |
|---|---|---|---|---|
| 13/10/2016 | p | Sprayed Jade | 3.00 | lt/ha |
| 13/10/2016 | p | Sprayed Deploy | 400.00 | ml/ha |
| 08/11/2016 | p | Applied Major Slug Pellets | 5.00 | kg/ha |
| 30/11/2016 | p | Sprayed Hallmark | 50.00 | ml/ha |
| 09/03/2017 | f | Applied Doubletop | 148.00 | kg/ha |
| 27/03/2017 | p | Sprayed Chex - winter wheat only | 250.00 | ml/ha |
| 27/03/2017 | p | Sprayed Pacifica - winter wheat only | 500.00 | 0g/ha |
| 27/03/2017 | p | Sprayed Bio Power - winter wheat only | 1.00 | lt/ha |
| 04/04/2017 | f | Applied Nitram (34.5% N) - winter wheat only | 260.00 | kg/ha |
| 05/04/2017 | p | Sprayed Artemis | 1.00 | lt/ha |
| 05/04/2017 | p | Sprayed Claw 500 | 1.00 | lt/ha |
| 05/04/2017 | p | Sprayed3C Chlormequat 750 | 2.00 | lt/ha |
| 23/04/2017 | p | Sprayed Keystone | 600.00 | ml/ha |
| 23/04/2017 | p | Sprayed Epic | 400.00 | ml/ha |
| 23/04/2017 | p | Sprayed Balear 720 | 700.00 | ml/ha |
| 04/05/2017 | f | Applied Nitram to WW | 260.00 | kg/ha |
| 13/06/2017 | p | Sprayed Fezan (Tebuconazole) | 750.00 | ml/ha |
| 15/08/2017 | a | Harvested as a commercial crop | - | - |

**Far Field I (W)**

| Date | | Application | Rate | Unit |
|---|---|---|---|---|
| 02/09/2016 | a | Straw loaded to plots 18, 24, 26 | 3.40 | t/ha |
| 02/09/2016 | a | Straw loaded to plots 17, 22, 25 | 6.80 | t/ha |
| 02/09/2016 | a | Straw loaded to plots 20, 23, 27 | 13.60 | t/ha |
| 02/09/2016 | a | Topped straw to help ploughing | - | - |
| 05/09/2016 | a | Ploughed - thrown north west | - | - |
| 26/09/2016 | a | Power harrowed | - | - |
| 04/10/2016 | s | Drilled Crusoe tr Redigo Pro + Deter | 375.00 | seeds/$m^2$ |
| 04/10/2016 | a | Rolled | - | - |
| 25/10/2016 | p | Sprayed Hallmark in 200 lt/ha water volume. | 50.00 | ml/ha |



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| | | | | |
|---|---|---|---|---|
| 25/10/2016 | p | Sprayed Movon in 200 lt/ha water volume. | 1.00 | lt/ha |
| 08/03/2017 | f | Applied Double Top Fertilizer | 148.00 | kg/ha |
| 27/03/2017 | a | Sprayed Chex | 0.25 | lt/ha |
| 27/03/2017 | a | Sprayed Pacifica | 0.50 | kg/ha |
| 27/03/2017 | a | Sprayed Cogent | 2.00 | lt/ha |
| 07/04/2017 | a | Sprayed Sprinter in 150 lt/ha water volume | 2.00 | lt/ha |
| 07/04/2017 | a | Sprayed Artemis in 150 lt/ha water volume | 1.00 | lt/ha |
| 07/04/2017 | a | Sprayed Claw 500 in 150 lt/ha water volume | 1.00 | lt/ha |
| 07/04/2017 | a | Sprayed Moddus in 150 lt/ha water volume | 0.10 | lt/ha |
| 07/04/2017 | a | Sprayed Chlormequat in 150 lt/ha water volume | 1.00 | lt/ha |
| 10/04/2017 | f | Applied Nitram (34.5% N) Fertiliser | 203.00 | kg/ha |
| 25/04/2017 | f | Applied Nitram (34.5% N) Fertiliser | 203.00 | kg/ha |
| 28/04/2017 | p | Sprayed Sprinter in 150 lt/ha water volume | 2.00 | lt/ha |
| 28/04/2017 | p | Sprayed Keystone in 150 lt/ha water volume | 0.80 | lt/ha |
| 28/04/2017 | p | Sprayed Balear 720 in 150 lt/ha water volume | 0.70 | lt/ha |
| 24/05/2017 | p | Sprayed Sprinter in 150 lt/ha water volume | 2.00 | t/ha |
| 24/05/2017 | p | Sprayed Vortex in 150 lt/ha water volume | 1.50 | lt/ha |
| 13/08/2017 | a | Harvested as a commercial crop | - | - |



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## Weather Summaries

| Rothamsted Research | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| The Weather : Monthly Summary : 2017 | | | | | | | | | | | | | | | |
| (Departure from the 30 year means (1981 - 2010) in brackets) | | | | | | | | | | | | | | | |
| | Sunshine | | Mean temperatures °C | | | | | | | | Rain | | Rain | Drainage | Wind |
| | | | Maximum | | Minimum | | Dew point | Ground | In ground under grass | | Tipping Bucket | | | 20" | |
| | Hours | ( ) | °C | ( ) | °C | ( ) | °C | frosts* | 30 cm | 100 cm | Total mm | ( ) | days** | mm | km/hr*** |
| **January** | 77.2 | (+15.19) | 6.3 | (-0.38) | -0.2 | (-1.40) | 1.52 | 19 | 4.1 | 6.8 | 70.2 | (+0.21) | 23 | 49.6 | 6.2 |
| **February** | 62.8 | (-17.48) | 8.5 | (+1.59) | 3.2 | (+2.29) | 4.52 | 15 | 5.6 | 6.3 | 38.7 | (-11.40) | 18 | 19.0 | 10.1 |
| **March** | 139.9 | (+24.97) | 12.7 | (+2.76) | 5.0 | (+2.33) | 6.64 | 15 | 8.0 | 7.8 | 40.4 | (-10.42) | 21 | 13.1 | 9.9 |
| **April** | 197.4 | (+36.17) | 13.8 | (+1.20) | 4.2 | (+0.13) | 4.95 | 17 | 10.2 | 9.6 | 10.9 | (-44.19) | 14 | 0.1 | 7.1 |
| **May** | 185.1 | (-9.57) | 17.7 | (+1.65) | 8.7 | (+1.79) | 10.23 | 2 | 12.7 | 11.0 | 70.5 | (+15.82) | 16 | 19.8 | 7.3 |
| **June** | 229.1 | (+30.91) | 21.5 | (+2.38) | 12.0 | (+2.25) | 12.21 | 1 | 16.7 | 14.3 | 39.1 | (-14.12) | 12 | 4.2 | 7.9 |
| **July** | 187.4 | (-17.77) | 21.8 | (+0.00) | 13.2 | (+1.31) | 12.74 | 0 | 17.6 | 15.9 | 72.6 | (+22.69) | 16 | 7.5 | 7.2 |
| **August** | 170.2 | (-26.04) | 20.2 | (-1.39) | 11.8 | (-0.03) | 13.3 | 0 | 16.7 | 15.9 | 66.6 | (+2.89) | 14 | 16.0 | 6.8 |
| **September** | 116.9 | (-26.44) | 17.3 | (-0.94) | 9.8 | (-0.17) | 11.4 | 1 | 15.0 | 15.1 | 86.9 | (+29.29) | 23 | 23.7 | 6.7 |
| **October** | 87.4 | (-24.30) | 15.4 | (+1.37) | 9.1 | (+1.99) | 10.3 | 3 | 13.5 | 13.9 | 31.2 | (-50.51) | 19 | 5.8 | 8.9 |
| **November** | 92.0 | (+21.21) | 9.6 | (-0.09) | 3.5 | (-0.28) | 4.8 | 15 | 9.4 | 11.3 | 53.5 | (-23.09) | 22 | 18.2 | 8.4 |
| **December** | 57.4 | (+3.57) | 7.2 | (+0.35) | 1.8 | (+0.17) | 3.1 | 19 | 6.0 | 8.1 | 110.8 | (+41.25) | 24 | 98.4 | 10.0 |
| **Year** | 1602.7 | (+10.41) | 14.3 | (+0.71) | 6.8 | (+0.86) | 8.0 | 107.0 | 11.3 | 11.3 | 691.4 | (-41.58) | 222.0 | 275.4 | 8.1 |
| * Number of nights grass minimum was below 0.0 °C | | | | | | | | | | | | | | | |
| ** Number of days rain was 0.2 mm or more | | | | | | | | | | | | | | | |
| *** At 2 metres above the ground | | | | | | | | | | | | | | | |



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| Woburn Experimental Farm | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| The Weather : Monthly Summary : 2017 | | | | | | | | | | | | | | |
| (Departure from 30-year means (1981 - 2010) in brackets) | | | | | | | | | | | | | | |
| | Sunshine | | Mean temperatures °C | | | | | | | | Rain | | | Wind |
| | | | Maximum | | Minimum | | Dew | Ground | In ground under grass | | Total mm | | Rain | *** |
| | Hours | ( ) | | ( ) | | ( ) | point | frosts * | 30 cm | 100 cm | Tipping bucket | | days ** | km/hr |
| | | | | | | | | | | | | ( ) | | |
| **January** | 66.7 | (+6.63) | 6.7 | (-0.30) | -0.4 | (-1.62) | 1.6 | 19 | 3.9 | 7.4 | 67.0 | (+12.46) | 20 | 5.7 |
| **February** | 64.7 | (-10.18) | 9.1 | (+1.73) | 3.2 | (+2.32) | 4.8 | 15 | 5.9 | 6.6 | 47.3 | (+5.09) | 19 | 9.7 |
| **March** | 144.6 | (+31.10) | 13.0 | (+2.69) | 4.9 | (+2.22) | 6.8 | 16 | 8.3 | 7.8 | 48.1 | (+2.18) | 18 | 9.5 |
| **April** | 183.8 | (+32.85) | 14.3 | (+1.21) | 3.6 | (-0.20) | 5.3 | 17 | 10.3 | 9.4 | 13.4 | (-38.77) | 14 | 7.0 |
| **May** | 186.3 | (-0.89) | 18.3 | (+1.78) | 8.2 | (+1.65) | 10.3 | 3 | 13.8 | 10.9 | 71.6 | (+18.35) | 14 | 7.2 |
| **June** | 221.3 | (+33.41) | 22.1 | (+2.55) | 11.7 | (+2.31) | 12.4 | 0 | 18.0 | 14.2 | 40.3 | (-9.75) | 12 | 9.1 |
| **July** | 184.6 | (-12.49) | 22.4 | (+0.32) | 12.6 | (+0.96) | 13.1 | 0 | 18.6 | 15.9 | 97.6 | (+47.71) | 17 | 7.7 |
| **August** | 176.5 | (-12.30) | 20.8 | (-1.09) | 11.3 | (-0.27) | 13.2 | 0 | 17.7 | 16.1 | 76.8 | (+18.98) | 15 | 7.0 |
| **September** | 119.7 | (-17.37) | 17.9 | (-0.75) | 9.4 | (-0.20) | 12.9 | 1 | 15.6 | 15.6 | 73.4 | (+16.29) | 25 | 6.8 |
| **October** | 89.7 | (-22.06) | 16.0 | (+1.57) | 9.1 | (+2.19) | 11.5 | 4 | 13.8 | 14.5 | 33.2 | (-37.63) | 14 | 10.0 |
| **November** | 77.1 | (+10.89) | 10.1 | (+0.17) | 3.2 | (-0.59) | 6.0 | 13 | 9.1 | 12.1 | 51.2 | (-11.27) | 18 | 8.5 |
| **December** | 45.9 | (+0.24) | 7.6 | (+0.38) | 1.9 | (+0.44) | 4.0 | 19 | 5.8 | 9.1 | 76.6 | (+20.85) | 21 | 10.2 |
| **Year** | 1560.9 | (+39.83) | 15.0 | (+0.86) | 6.6 | (+0.78) | 8.6 | 107.0 | 11.8 | 11.7 | 696.5 | (+44.48) | 207.0 | 8.3 |
| * Number of nights grass minimum was below 0.0 °C | | | | | | | | | | | | | | |
| ** Number of days rain was 0.2 mm or more | | | | | | | | | | | | | | |
| *** At 2 metres above ground | | | | | | | | | | | | | | |



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