



**ROTHAMSTED  
RESEARCH**

**Results of the  
Classical and other  
Long-Term Experiments  
2021**

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The information and data contained in this Yield Book is correct to the best of our knowledge. Any errors that arise will be corrected in the electronic version. Printed copies of this Yield Book should therefore be checked against the electronic version by checking the version date.

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## 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, respectively.

Anhydrous Sulphate of Soda

Chalk

Compost

Double Top

27% N and 30% SO<sub>3</sub>

FYM

Farmyard manure (from bullocks)

Headland Manganese 500

500 g/l 27.5% w/w MnCO<sub>3</sub>

Kieserite

MgSO<sub>4</sub>H<sub>2</sub>O; 17.7% Mg and 23.3% S

Maize Tops

Magnesium sulphate

MgSO<sub>4</sub> H<sub>2</sub>O; 17.7% Mg and 23.3% S

Manganese sulphate

Mn<sub>2</sub> (SO<sub>4</sub>)<sub>3</sub>; 27% Mn and 24% S

Manganese and Dinitrate ('Sprinter')

14% w/w and 7.2% w/w Nitric Nitrogen

Muriate of potash (MOP)

KCl; 60% K<sub>2</sub>O (49.8% K)

Nitram

34.5% N

Nitraprill

34.5% N

Nitrate of soda

NaNO<sub>3</sub>; 16% N and 27% Na

Nitro-Chalk

Calcium Ammonium Nitrate; 27% N

Silicate of soda

Na<sub>2</sub>SiO<sub>3</sub>; 37% Na and 23% Si

Sodium Sulphate

35% Na

Sulphate of ammonia

(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>; 21% N and 24% S

Sulphate of potash (SOP)

K<sub>2</sub>SO<sub>4</sub>; 50% K<sub>2</sub>O (41.5% K) and 18.4% S

Triple superphosphate (TSP)

47% P<sub>2</sub>O<sub>5</sub>; (20.1% P)

Cereal straw is removed unless otherwise stated.

GS: Growth Stage

tm): Tank mix; two or more products applied together

tr: Seed dressing

**PESTICIDES USED**

The following list of pesticides is based on the HSE Pesticide Product Register (<https://secure.pesticides.gov.uk/pestreg/ProdSearch.asp>) and Adjuvant Product Register (<https://secure.pesticides.gov.uk/adjuvants/Search.aspx>); 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 |

| <b>Trade Name (MAPP or ADJ number)</b> | <b>Function</b>   | <b>Active ingredient</b>   |
|--|-------------------|--|
| Ally Max SX (18768)                    | h                 | 143.000 g/kg metsulfuron-methyl and 143.000 g/kg tribenuron-methyl   |
| Buffalo Elite                          | water conditioner | ammonium sulphate (40 % w/w), water conditioner  |
| Caramba 90 (15524)                     | f                 | 90.000 g/L metconazole   |
| Cello (18290)                          | f                 | 100.000 g/L prothioconazole, 250.000 g/L spiroxamine and 100.000 g/L tebuconazole                                |
| Cogent (A0902)                         | ad                | 32.67 % w/w alkoxyated alcohols and 1.0 % w/w trisiloxane organosilicone copolymers                              |
| Cortez (16280)                         | f                 | 125 g/L (12.1% w/w) epoxiconazole  |
| Cytokin P (?)                          | gr                | No information available   |
| Envoy (16297)                          | f                 | 85 g/L (8.2% w/w) pyraclostrobin plus 62.5 g/L (6% w/w) epoxiconazole  |
| Firestarter (18422)                    | h                 | 100.000 g/L diflufenican and 400.000 g/L flufenacet  |
| Hallmark with Zeon Technology (12629)  | i                 | 100.000 g/L lambda-cyhalothrin   |
| Hurler (17715)                         | h                 | 200.000 g/L fluroxypyr   |
| Laser (17339)                          | h                 | 200.000 g/L cycloxydim   |
| Lentyrna XE (19301)                    | f                 | 66.700 g/L fluxapyroxad and 70.000 g/L Mefentrifluconazole   |
| Mobius (13395)                         | f                 | 175.000 g/L prothioconazole and 150.000 g/L trifloxystrobin  |
| Moddus (15151)                         | gr                | 250.000 g/L trinexapac-ethyl   |
| Ninja 5CS (16417)                      | i                 | 50.000 g/L lambda-cyhalothrin  |
| Plexeo 60 (18281)                      | f, gr             | 60 g/L metconazole   |
| Pontos (17811)                         | h                 | 240.000 g/L flufenacet and 100.000 g/L picolinafen   |
| Presite SX (18776)                     | h                 | 67.000 g/kg metsulfuron-methyl and 333.000 g/kg thifensulfuron-methyl  |
| Retengo 200 (19551)                    | f                 | 200.000 g/L pyraclostrobin   |
| Samurai (16238)                        | h                 | 360.000 g/L glyphosate   |
| Simveris (19619)                       | f                 | 90.000 g/L metconazole   |
| Starane HI-Load HL (16557)             | h                 | 333.000 g/L fluroxypyr   |
| Stefes CCC 720 (17731)                 | gr                | 720.000 g/L chlormequat  |
| Velogy Plus (17866)                    | f                 | 100.000 g/L benzovindiflupyr   |
| Velomax (A0831)                        | ad                | 86.8 % w/w oil (rapeseed fatty acid esters), 5.2 % w/w alkoxyated alcohols, 2.5 % w/w oil (tall oil fatty acids) |
| X-Clude                                | water conditioner |  |
| Zarado (A0516)                         | ad                | 70.0 % w/w oil (rapeseed fatty acid esters)  |

**Machinery Referred to in the Diary Notes**

| <b><u>Cultivators</u></b>                          | <b><u>Manufacturer</u></b> | <b><u>Width</u></b> | <b><u>Description</u></b>   |
|--|----------------------------|---------------------|---|
| Plough   | Kverneland                 | 1.5 m               | 5 Furrow, 25 cm Furrows.  |
| Plough   | Ransome                    | 1 m                 | 3 Furrow, 25 cm Furrows   |
| Plough   | Dowdeswell                 |                     | 5 Furrow, 12 in Furrows (Woburn)  |
| Press  | Philip Watkins             | 4.6 m               | Used to level and consolidate ground after ploughing  |
| Flexitine  | Bomford                    | 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.   |
| <b><u>Drills</u></b>                               | <b><u>Manufacturer</u></b> | <b><u>Width</u></b> | <b><u>Description</u></b>   |
| Accord Combination Drill No. 4                     | Kverneland                 | 3.0 m               | Power-harrow mounted pneumatic drill with Suffolk coulters 12.5 cm apart.   |
| Accord Tyne Drill                                  | Kverneland                 | 4.0 m               | 3-point linkage with Suffolk coulters Plots/Commercial (Woburn)   |
| <b><u>Chemical Applicators</u></b>                 | <b><u>Manufacturer</u></b> | <b><u>Width</u></b> | <b><u>Description</u></b>   |
| Cascade  | Horstine                   | 12 m                | Tractor-mounted pneumatic boom fertiliser spreader  |
| GSA 300  | Nordsten                   | 3 m                 | Tractor-mounted - Fert Applications.  |
| Exactomatic  | Ransome,<br>Nordsten       | 3.8 m               | Tractor-mounted - Fert Applications.  |
| Muck Spreader                                      | International              | 1.5 m               | Trailed - FYM Applications.   |
| Sprayer  | Tecnomat                   | 12 m                | Tractor-mounted boom sprayer - Chemical Application.  |
| Sprayer  | Knight                     | 24 m                | Tractor-mounted boom sprayer - Chemical Application.  |
| Sprayer  | Knight                     | 12 m                | Tractor-mounted boom sprayer - Chemical Application. (Woburn)   |
| <b><u>Harvesters</u></b>                           | <b><u>Manufacturer</u></b> | <b><u>Width</u></b> | <b><u>Description</u></b>   |
| Amazone Groundkeeper Smart Cut<br>- GHS Drive 1500 | Amazone                    |                     | Flail mower collector, specially modified by Trials Equipment UK to cut and weigh grass. This was commissioned for 2021 to replace the Wilder Grass Box Mower previously used for grass yields but which was no longer fit for purpose. |
| Tucano 430   | Claas                      | 6 m                 | Commercial combine used for harvesting discards after plot yields.  |
| Box Mower  | Wilder                     | 1.01 m              | No longer used. Box mower mainly used for yields on PG/5 up until 2020.   |
| Mower  | Unifarm                    | 1.83 m              | Commercial mower used to mow discards on PG/5.  |
| Mower Conditioner                                  | Kuhn                       | 3 m                 | Commercial mower with conditioning.   |
| Plot Combine                                       | Haldrup                    | 2 m Cut             | Cereal plot combine harvester (used from 2017).   |
| <b><u>Other</u></b>                                | <b><u>Manufacturer</u></b> | <b><u>Width</u></b> | <b><u>Description</u></b>   |
| Cambridge Ring Rolls                               | Flexicoil                  | 6 m                 | Ring rolls for covering seed post drilling.   |
| PZ Hay Rake  | Zweegers                   | -                   | Rowing up for baling  |
| Tedder (Fanex 524)                                 | Vicon                      | -                   | Turning and rowing up of grass for hay making (W/RN/3 and 12, R/PG/5).  |

|                        |             |        |   |
|------------------------|-------------|--------|---|
| Topper 9               | McConnell   | 2.72 m | Topper used for topping stubbles and grass areas.                 |
| 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. |
| Grass Box              | Wilder      | -      | Used for grass weights.   |

| <u>Tractors</u> | <u>Manufacturer</u> | <u>Weight</u> | <u>Description</u>        |
|-----------------|---------------------|---------------|---------------------------|
| ISTH4335        | Iseki               | 1.71 t        | Small Machinery Tractor   |
| JD5070          | John Deere          | 5.85 t        | Wide Wheeled Tractor      |
| JD5620          | John Deere          | 5.46 t        | Drilling Tractor          |
| JD6145R         | John Deere          | 11.25 t       | Cultivations Tractor      |
| JD6230          | John Deere          | 6.10 t        | Yard Tractor              |
| JD6620          | John Deere          | 5.2 t         | Tractor (Woburn)          |
| JD6830          | John Deere          | 5.7 t         | Fertiliser Tractor        |
| JD6930          | John Deere          | 5.9 t         | Drilling Tractor          |
| MF3070          | Massey<br>Ferguson  | 4.4 t         | Hedge Cutting Tractor     |
| MF6150          | Massey<br>Ferguson  | 4.6 t         | Spraying Tractor (Woburn) |
| NH T6030        | New Holland         | 5.50 t        | Mounted Sprayer Tractor   |
| NH T7210        | New Holland         | 8.10 t        | Cultivations Tractor      |
| Tym T503        | Tym                 | 3.63 t        | Small Light Tractor       |

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

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

## 21/R/BK/1 BROADBALK WINTER WHEAT

**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. In 2018 (175<sup>th</sup> year) winter beans (Be) replaced maize on the rotational sections and the rotation was changed to wheat, wheat, oats, wheat, beans. The new rotation includes two first wheats each year. Previously, only one first wheat was included in the rotation. This change has resulted in additional harvest sampling and analysis, to include both first wheats, oats and the beans. The experimental diary below also includes the Broadbalk 'Wilderness' (R/BK/1W) – a 0.2 ha area of land at the west end of the field taken out of cultivation in 1882 and which now supports 'wooded', 'mown' and 'stubbed' sections.

2021 was the 178<sup>th</sup> year of the experiment, 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 74-20/R/BK/1.

### Areas harvested <sup>a</sup>:

|        |            |         |
|--------|------------|---------|
| Wheat: | Section    | ha      |
|        | 0          | 0.00305 |
|        | 1          | 0.00561 |
|        | 2, 5, 6, 7 | 0.00463 |
|        | 8, 9       | 0.00488 |
| Oats:  | 3          | 0.00463 |
| Beans: | 4          | 0.00463 |

<sup>a</sup> The new Haldrup combine has a slightly smaller cut width (2.0 m) than the previous Sampo combine (2.1 m). Consequently, from 2017 cereal yields are based on a 2.0 m cut width.

### Treatments:

In 2021 some of the treatments were changed. The treatments are now:

Whole plots

#### PLOT

|                 | Plot | From 2021       |
|-----------------|------|-----------------|
| 01 (FYM) N4     | 01   | (FYM) N4        |
| 2.1 FYM N3      | 2.1  | FYM N3          |
| 2.2 FYM         | 2.2  | FYM             |
| 03 Nil          | 03   | Nil             |
| 05 (P)KMg       | 05   | (P) K Mg        |
| 06 N1(P)KMg     | 06   | N1 (P) K Mg     |
| 07 N2(P)KMg     | 07   | N2 (P) K Mg     |
| 08 N3(P)KMg     | 08   | N3 (P) K Mg     |
| 09 N4(P)KMg     | 09   | N4 (P) K Mg     |
| 10 N4           | 10   | N4              |
| 11 N4PMg        | 11   | N4 (P) Mg       |
| 12 N1+3+1(P)KMg | 12   | N1+3+1 (P) K Mg |
| 13 N4PK         | 13   | N4 (P) K        |
| 14 N4PK*(Mg*)   | 14   | N4 (P) K* (Mg*) |
| 15 N5(P)KMg     | 15   | N5 (P) K Mg     |
| 16 N6(P)KMg     | 16   | N6 (P) K Mg     |

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

## Winter wheat – single N to wheat

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 N plots for wheat.

## – Split N to wheat

N1+1+1, 1+2+1 etc: Rates as above, but in 3 splits. Timings: first two weeks of March, GS31 or mid-April (whichever comes first), and GS37/mid-May.

Winter oats – single N application 24, 48, 72, 96, 120, 144 kg N as 33.5%N; applied at half the rate for wheat in a single application in mid-April; oats received no N from 1996 to 2017.

½ N1, ½ N2, ½ N3, ½ N4, ½ N5, ½ N6:

Winter Beans (Be) No N applied.

All crops P, K, Mg & FYM applications as shown below:-

P: 35 kg P as triple superphosphate

(P): No P since 2001 or 2021 (under review)

K: 90 kg K as potassium sulphate

K\*: 90 kg K as potassium chloride

Mg: 12 kg Mg as kieserite

(Mg\*): No Mg since 2001 (under review)

FYM: Farmyard manure at 35 t (fresh weight) to wheat and oats in autumn; no FYM applied to beans (oats received no FYM from 1996 to 2017)

**Previous treatment:**

## Whole plots

**PLOT**

## Fertilizers and organic manures:-

|           | Plot | Treatments until 1967 | Treatments from 1968 | Treatments from 1985 – 2000    | Treatments from 2001-2020      |
|-----------|------|-----------------------|----------------------|--------------------------------|--------------------------------|
| 01 DN4PK  | 01   | -                     | D N2 P K             | D N4 P K                       | N4                             |
| 2.1 DN2   | 2.1  | D                     | D N2                 | D N2                           | FYM N3 <sup>(1)</sup>          |
| 2.2 D     | 2.2  | D                     | D                    | D                              | FYM                            |
| 03 0      | 03   | Nil                   | Nil                  | Nil                            | Nil                            |
| 05 F      | 05   | P K Na Mg             | P K (Na) Mg          | P K Mg                         | (P) K Mg                       |
| 06 N1F    | 06   | N1 P K Na Mg          | N1 P K (Na) Mg       | N1 P K Mg                      | N1 (P) K Mg                    |
| 07 N2F    | 07   | N2 P K Na Mg          | N2 P K (Na) Mg       | N2 P K Mg                      | N2 (P) K Mg                    |
| 08 N3F    | 08   | N3 P K Na Mg          | N3 P K (Na) Mg       | N3 P K Mg                      | N3 (P) K Mg                    |
| 09 N4F    | 09   | N*1 P K Na Mg         | N4 P K (Na) Mg       | N4 P K Mg                      | N4 (P) K Mg                    |
| 10 N2     | 10   | N2                    | N2                   | N2                             | N4                             |
| 11 N2P    | 11   | N2 P                  | N2 P                 | N2 P                           | N4 P Mg                        |
| 12 N2PNA  | 12   | N2 P Na               | N2 P Na              | N2 P Na                        | N1+3+1 (P) K Mg <sup>(2)</sup> |
| 13 N2PK   | 13   | N2 P K                | N2 P K               | N2 P K                         | N4 P K                         |
| 14 N2PKMG | 14   | N2 P Mg*              | N2 P K Mg*           | N2 P K Mg*                     | N4 P K* (Mg*)                  |
| 15 N5F    | 15   | N2 P K Na Mg          | N3 P K (Na) Mg       | N5 P K Mg                      | N5 (P) K Mg                    |
| 16 N6F    | 16   | N*2 P K Na Mg         | N2 P K (Na) Mg       | N6 P K Mg                      | N6 (P) K Mg                    |
| 17 N1+3FH | 17   | N2 (A)                | N2 ½[P K (Na) Mg]    | N1+3 ½[P K Mg] <sup>(A)+</sup> | N1+4+1 P K Mg                  |
| 18 N0+3FH | 18   | P K Na Mg (A)         | N2 ½[P K (Na) Mg]    | N0+3 ½[P K Mg] <sup>(A)+</sup> | N1+2+1 P K Mg                  |
| 19 (C)    | 19   | C                     | C                    | (C) (since 1989)               | N1+1+1 K Mg                    |
| 20 N2KMG  | 20   | N2 K Na Mg            | N2 K (Na) Mg         | N2 K Mg                        | N4 K Mg                        |

(1) N2 2001-2004

(2) N1+3+1 (P) K2 Mg2 2001-2005

(A) Alternating each year

+ This change since 1980. Treatments shown are those to winter wheat; autumn N alternates. Maize received N3 ½[P K Mg] on both plots 17 and 18. These treatments shown incorrectly in 1999-2002 Yield books.



Winter oats; Nitrogen and dung were not applied, 1996-2017.

- 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
- K2: 180 kg K as potassium sulphate (plus 450 kg K autumn 2000 only)
- Na: 55 kg Na as sulphate of soda
- (Na): 16 kg Na as sulphate of soda until 1973
- Mg: 12 kg Mg from 2001, previously 35 kg Mg every third year 1974-2000 (applied at 30 kg Mg in 1991, 1994, 1997 and 2000 and at 15 kg Mg on half rate treatments), and 11 kg Mg until 1973. Mg\* indicates plot 14 applications of 26 kg Mg 1990 to 2000, previously 30 kg Mg 1974-1989, and 31 kg Mg until 1973.  
All Mg applied as kieserite since 1974, previously as sulphate of magnesia until 1973.
- Mg2: 24 kg Mg as kieserite (plus 60 kg Mg, autumn 2000 only)
- D: Farmyard manure at 35 t (fresh weight)
- (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  |
| 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  |

| Section<br>Year      | 1 | 9 | 0* | 8+ | 6** | 5  | 3 | 7  | 4  | 2  |
|----------------------|---|---|----|----|-----|----|---|----|----|----|
| 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 <sup>†</sup>    | 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 <sup>++</sup>   | 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  |
| 2018                 | W | W | W  | W  | W   | W  | W | Be | O  | W  |
| 2019                 | W | W | W  | W  | W   | O  | W | W  | W  | Be |
| 2020 <sup>++,†</sup> | W | W | W  | W  | W   | W  | O | W  | Be | W  |
| 2021                 | W | W | W  | W  | W   | Be | W | O  | W  | W  |

W = winter wheat, O = winter oats, P = potatoes, BE = spring beans, F = fallow, M = forage maize, Be = Winter Beans

\* Straw incorporated since autumn 1986. \*\* No sprays except herbicides since 1985.

+ No herbicides.

++ Spring Wheat in 2015, 2020

† Spring Oats in 2001, 2020

#### NOTES:

- (1) For a fuller record of treatments see 'Details' etc.
- (2) From autumn 1975 to autumn 1986, chalk was applied at 2.9 t 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 and 2018, see 14/R/BK/1 and 19/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 (22 February 2013) because of the very wet autumn and winter of 2012-2013.
- (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. Spring wheat (var Tybalt) was sown in March 2020 because the wet autumn and winter of 2019-2020 prevented sowing of a winter crop.

- (6) Section 8 was left in bare fallow in 2015 & 2016 and had two in-season cultivations (inversion ploughing) each year to control weeds.
- (7) No Triple Superphosphate applied to Strips 11, 13 and 14: After reviewing amounts of available P in soil it was decided not to apply TSP from 2021 (under review).

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

| Date                |   | Application  | Rate  | Unit  |
|---------------------|---|--|-------|-------|
| <b>All Sections</b> |   |  |       |       |
| 16/09/2020          | p | Sprayed Samurai (16238) using NH T6030, Knight 24m Sprayer   | 3     | L/ha  |
| 16/09/2020          | p | Sprayed Buffalo Elite using NH T6030, Knight 24m Sprayer   | 1     | L/ha  |
| 16/09/2020          | a | Rolled; 6m Flexicoil Cambridge Roll, JD6230  | -     | -     |
| 21/09/2020          | f | Applied Triple Superphosphate (TSP) using Cascade Spreader: Strips 17, 18  | 171   | kg/ha |
| 22/09/2020          | f | Applied Farmyard manure (FYM) using Tym T503, Muck spreader – international: All sections except 5, Strips 2.1, 2.2;.  | 35    | t/ha  |
| 22/09/2020          | f | Applied Muriate of Potash (MOP): Strip 14; Cascade Spreader  | 181   | kg/ha |
| 22/09/2020          | a | Topping plot boundaries using Batwing Topper, JD6230: paths between plots before ploughing due to weed growth.   | -     | -     |
| 23/09/2020          | a | Cultivation: Ploughed Tillage 15 cm; NHT7210, KV Five Furrow Plough: Thrown S  |       |       |
| 01/10/2020          | p | Sprayed using Tym T503, Tecnomat 12m Sprayer: Pontos (17811);  | 1     | L/ha  |
| 01/10/2020          | p | Sprayed using Tym T503, Tecnomat 12m Sprayer: Firestarter (18422)  | 0.3   | L/ha  |
| 01/10/2020          | p | Sprayed using Tym T503, Tecnomat 12m Sprayer: Velomax  | 0.4   | L/ha  |
| 02/12/2020          | p | Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology: Sections 0, 1, 2, 3, 4, 6, 7, 8, 9  | 50    | mL/ha |
| 30/03/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: X-Clude;   | 0.25  | L/ha  |
| 30/03/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Cintac;  | 0.5   | L/ha  |
| 30/03/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Cogent   | 1     | L/ha  |
| 04/04/2021          | a | Ploughed Tillage 0 cm down paths only; Rotavator Howard, Tym T503  |       |       |
| 12/05/2021          | f | Applied Kieserite with Cascade Spreader, JD6830: Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9: Strip 05, 06, 07, 08, 09, 11, 12, 15, 16, 17, 18, 19, 20                | 80    | kg/ha |
| 14/05/2021          | f | Applied Sulphate of Potash (SOP) with Cascade Spreader, JD6830: Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9: Strip 05, 06, 07, 08, 09, 12, 13, 15, 16, 17, 18, 19, 20 | 217   | kg/ha |
| 03/06/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238): Section 0, 1, 2, 3, 4, 5, 6, 7, 9   | 3     | L/ha  |
| 03/06/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite: Section 0, 1, 2, 3, 4, 5, 6, 7, 9   | 1     | L/ha  |
| 26/06/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Caramba 90   | 0.359 | L/ha  |
| 26/06/2021          | p | Sprayed using Knight 24m Sprayer, NH T6030: Simveris   | 0.4   | L/ha  |

## Results of the Classics and other Long-Term Experiments 2021

21/R/BK/1

|                |   |  |      |                      |
|----------------|---|--|------|----------------------|
| 26/06/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Cytokin P  | 1    | L/ha                 |
| 26/06/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Laser  | 0.75 | L/ha                 |
| 26/06/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Zarado   | 1    | L/ha                 |
| 08/07/2021     | a | Wild Oat Count by hand: Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9:<br>Strip 01, 2.1, 2.2, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14,<br>15, 16, 17, 18, 19, 20 | -    | -                    |
| 13/07/2021     | a | Power harrowed Paths   | -    | -                    |
| <b>W Wheat</b> |   |  |      |                      |
| 28/09/2020     | s | Drilled Zyatt with JD6830, Accord Combination Drill No. 4 :<br>Section 0, 1, 2, 3, 4, 6, 8, 9  | 350  | seeds/m <sup>2</sup> |
| 02/03/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 12, 17, 18, 19  | 139  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 06, 19  | 139  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 07, 18  | 278  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Exactomatic, Cascade Spreader,<br>JD6830: Section 0, 1, 2, 3, 4, 6, 8, 9: Strip 08, 12, 2.1  | 417  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 01, 09, 10, 11, 13, 14, 17, 20                                      | 556  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 15  | 696  | kg/ha                |
| 20/04/2021     | F | Applied Nitram with Cascade Spreader, JD6830: Section 0,<br>1, 2, 3, 4, 6, 8, 9: Strip 16  | 835  | kg/ha                |
| 21/04/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Cortez:<br>Sections 0, 1, 2, 3, 4, 8, 9  | 0.5  | L/ha                 |
| 21/04/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Moddus:<br>Sections 0, 1, 2, 3, 4, 8, 9  | 0.1  | L/ha                 |
| 21/04/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Moddus:<br>Section 6: Strip 01, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13,<br>14, 15, 16, 17, 18, 19, 2.1, 2.2    | 0.1  | L/ha                 |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Lentyma<br>XE: Section 0, 1, 2, 3, 4, 8, 9   | 1    | L/ha                 |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Retengo<br>200: Section 0, 1, 2, 3, 4, 8, 9  | 0.4  | L/ha                 |
| 26/05/2021     | f | Applied Nitram: Section 0, 1, 2, 3, 4, 6, 8, 9: Strip 12, 17,<br>18, 19  | 139  | kg/ha                |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Plexeo 60:<br>Section 8  | 1.25 | L/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Velogy<br>Plus: Section 8  | 0.63 | L/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Presite SX:<br>Section 6   | 60   | g/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Hurler:<br>Section 6   | 0.6  | L/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Presite SX:<br>Section 0, 1, 2, 3, 4, 9  | 60   | g/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Plexeo 60:<br>Section 0, 1, 2, 3, 4, 9   | 1.25 | L/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Velogy<br>Plus: Section 0, 1, 2, 3, 4, 9   | 0.63 | L/ha                 |
| 27/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Hurler:<br>Section 0, 1, 2, 3, 4, 9  | 0.6  | L/ha                 |
| 10/06/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Cello:<br>Section 0, 1, 2, 3, 4, 8, 9  | 1    | L/ha                 |
| 27/08/2021     | a | Harvest; Haldrup C-85 2m cut: Section 0, 1, 2, 3, 4, 6, 8, 9   | -    | -                    |

|                |   |   |      |                      |
|----------------|---|---|------|----------------------|
| 02/09/2021     | a | Straw weights – Wheat using Amazone Grass Harvester - Flail Mower Collector, JD5070: Section 1, 3, 4, 8                         | -    | -                    |
| <b>W Oats</b>  |   |   |      |                      |
| 28/09/2020     | s | Drilled Miscani : Section 7   | 350  | seeds/m <sup>2</sup> |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 7: Strip 06   | 70   | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 7: Strip 07   | 139  | kg/ha                |
| 20/04/2021     | f | Applied Nitram: Section 7: Strip 2.1 by hand  | 209  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 7: Strip 08, 19   | 209  | kg/ha                |
| 20/04/2021     |   | Applied Nitram with Cascade Spreader, JD6830: Section 7: Strip 09, 10, 11, 13, 14, 18   | 278  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Cascade Spreader, JD6830: Section 7: Strip 12, 15   | 348  | kg/ha                |
| 20/04/2021     | f | Applied Nitram with Exactomatic, Cascade Spreader, JD6830: Section 7: Strip 16, 17  | 417  | kg/ha                |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Presite SX: Section 7   | 60   | g/ha                 |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Envoy: Section 7  | 1.5  | L/ha                 |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Stefes CCC 720: Section 7   | 1.5  | L/ha                 |
| 12/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Starane HI-Load HL: Section 7   | 0.4  | L/ha                 |
| 08/06/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Cello: Section 7  | 1    | L/ha                 |
| 11/08/2021     | a | Harvest Winter Oats; Haldrup C-85 2m cut: Section 7   | -    | -                    |
| 14/08/2021     | a | Straw weights - Oats: Section 7   | -    | -                    |
| 20/08/2021     | a | Harvest; Haldrup C-85 2m cut: Section 7: Strip 01, 2.1, 2.2, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 | -    | -                    |
| <b>W Beans</b> |   |   |      |                      |
| 08/03/2021     | a | Tines using Bomford Flexitine, JD6145R : Section 5  | -    | -                    |
| 08/03/2021     | a | Rolling using 6m Flexicoil Cambridge Roll, JD6230: Section 5  | -    | -                    |
| 08/03/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai: Section 5  | 3    | L/ha                 |
| 08/03/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite: Section 5  | 1    | L/ha                 |
| 09/03/2021     | s | Drilled Tundra: Section 5   | 35   | seeds/m <sup>2</sup> |
| 20/03/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Nirvana: Section 5  | 4    | L/ha                 |
| 20/03/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Velomax: Section 5  | 0.4  | L/ha                 |
| 29/04/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Ninja 5CS: Section 5  | 0.15 | L/ha                 |
| 28/05/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology: Section 5  | 75   | mL/ha                |
| 27/08/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai: Section 5  | 3    | L/ha                 |
| 27/08/2021     | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite: Section 5  | 1    | L/ha                 |
| 06/09/2021     | a | Harvest; Haldrup C-85 2m cut: Section 5   | -    | -                    |

|                   |   |  |   |   |
|-------------------|---|--|---|---|
| 08/09/2021        | a | Straw weights using Amazone Grass Harvester - Flail Mower Collector, JD5070: Section 5 | - | - |
|                   |   |  | - | - |
| <b>Wilderness</b> |   |  |   |   |
|                   |   |  | - | - |
| 05/01/2021        | a | Topping Stubbed Area; Tym T503, McConnel SE 6 Topper                                   | - | - |
| 19/04/2021        | a | Topping Mown Area; Iseki ISTH4335, Kilworth Topper                                     | - | - |
| 14/05/2021        | a | Topping Mown Area; Iseki ISTH4335, Kilworth Topper                                     | - | - |
| 07/06/2021        | a | Topping Mown Area; Iseki ISTH4335, Kilworth Topper                                     | - | - |
| 26/07/2021        | a | Topping Mown Area; Iseki ISTH4335, Kilworth Topper                                     | - | - |
| 31/08/2021        | a | Topping Mown Area; Iseki ISTH4335, Kilworth Topper                                     | - | - |
| 17/12/2021        | a | Topping Stubbed Area; Iseki ISTH4335, Kilworth Topper                                  | - | - |

NOTE: Samples of grain and straw were taken for chemical analysis. Unground grain and straw samples from selected treatments were placed in the Rothamsted Sample Archive.

## YIELDS

### WINTER WHEAT

Grain Tonnes/Hectare (85% DM)

*Tables of means*

| SECTION<br>PLOT  | 3/W1  | 4/W1 | 2/W2 | 6/W44 | 0/W17 | 1/W55 | 9/W63 | 8/W5 | Mean |
|------------------|-------|------|------|-------|-------|-------|-------|------|------|
| 01 (FYM)N4       | 8.29  | 8.47 | 7.62 | 3.97  | -     | -     | -     | -    | 7.09 |
| 21 FYMN3         | 10.06 | 9.94 | 9.53 | 4.40  | 5.30  | 8.33  | 8.54  | 1.15 | 7.15 |
| 22 FYM           | 6.70  | 7.46 | 6.48 | 5.22  | 5.51  | 6.30  | 6.11  | 3.09 | 5.86 |
| 03 Nil           | 0.07  | 0.14 | 0.21 | 0.05  | 0.21  | 0.30  | 0.19  | 0.55 | 0.21 |
| 05 (P)KMg        | 0.06  | 0.79 | 0.21 | 0.05  | 0.21  | 0.15  | 0.24  | 1.13 | 0.35 |
| 06 N1(P)KMg      | 4.16  | 5.27 | 4.90 | 2.26  | 3.36  | 3.84  | 3.47  | 0.65 | 3.49 |
| 07 N2(P)KMg      | 6.24  | 6.76 | 6.45 | 2.47  | 3.88  | 5.14  | 4.85  | 0.45 | 4.53 |
| 08 N3(P)KMg      | 7.63  | 8.16 | 7.82 | 2.10  | 5.67  | 4.66  | 5.79  | 0.38 | 5.28 |
| 09 N4(P)KMg      | 7.81  | 8.04 | 8.93 | 2.41  | 5.36  | 5.70  | 6.28  | 0.79 | 5.67 |
| 10 N4            | 2.36  | 3.96 | 4.08 | 1.11  | 0.45  | 1.45  | 0.73  | 0.63 | 1.85 |
| 11 N4(P*)Mg      | 4.65  | 6.52 | 6.33 | 1.96  | 6.66  | 5.56  | 4.79  | 0.66 | 4.64 |
| 12 N1+3+1(P)KMg  | 8.17  | 9.63 | 9.54 | 2.83  | 7.18  | 7.94  | 8.08  | 0.74 | 6.76 |
| 13 N4(P*)K       | 7.36  | 8.24 | 8.35 | 2.62  | 6.05  | 6.71  | 6.39  | 0.37 | 5.76 |
| 14 N4(P*)K*(Mg*) | 5.07  | 6.43 | 5.90 | 2.60  | 5.40  | 5.31  | 4.54  | 0.80 | 4.51 |
| 15 N5(P)KMg      | 6.21  | 5.39 | 8.36 | 1.46  | 6.07  | 6.00  | 6.15  | -    | 5.66 |
| 16 N6(P)KMg      | 7.29  | 7.49 | 8.61 | 1.73  | 6.43  | 4.93  | 7.09  | 0.67 | 5.53 |
| 17 N1+4+1PKMg    | 9.27  | 7.73 | 9.36 | 3.18  | 7.15  | 6.99  | 7.30  | 0.73 | 6.46 |
| 18 N1+2+1PKMg    | 8.62  | 8.73 | 9.13 | 3.44  | 7.15  | 6.66  | 7.61  | 0.89 | 6.53 |
| 19 N1+1+1KMg     | 6.60  | 6.04 | 6.98 | 2.03  | 5.32  | 3.88  | 6.17  | 0.51 | 4.69 |
| 20 N4KMg         | -     | -    | -    | -     | 0.91  | 0.15  | -     | -    | 0.53 |
| Mean             | 6.14  | 6.59 | 6.78 | 2.42  | 4.64  | 4.74  | 5.24  | 0.83 | 4.72 |
| Grain Mean DM%   | 84.3  |      |      |       |       |       |       |      |      |

Straw Tonnes/Hectare

*Tables of means*

| SECTION<br>PLOT  | 3/W1 | 4/W1 | 2/W2 | 6/W44 | 0/W17 | 1/W55 | 9/W63 | 8/W5 | Mean |
|------------------|------|------|------|-------|-------|-------|-------|------|------|
| 01 (FYM)N4       | 2.40 | 3.12 | -    | -     | -     | -     | -     | -    | 2.76 |
| 21 FYMN3         | 4.62 | 4.29 | -    | -     | -     | 3.67  | -     | 1.56 | 3.53 |
| 22 FYM           | 2.72 | 3.04 | -    | -     | -     | 3.01  | -     | 3.96 | 3.18 |
| 03 Nil           | 0.61 | 0.07 | -    | -     | -     | 0.05  | -     | 0.60 | 0.33 |
| 05 (P)KMg        | 0.06 | 0.34 | -    | -     | -     | 0.03  | -     | 0.01 | 0.11 |
| 06 N1(P)KMg      | 0.90 | 1.28 | -    | -     | -     | 1.14  | -     | 1.09 | 1.10 |
| 07 N2(P)KMg      | 1.70 | 2.01 | -    | -     | -     | 1.12  | -     | 1.48 | 1.58 |
| 08 N3(P)KMg      | 1.71 | 1.54 | -    | -     | -     | 0.41  | -     | 0.61 | 1.07 |
| 09 N4(P)KMg      | 1.90 | 1.8  | -    | -     | -     | 1.14  | -     | 1.76 | 1.65 |
| 10 N4            | 1.26 | 1.07 | -    | -     | -     | 0.55  | -     | 0.08 | 0.74 |
| 11 N4(P*)Mg      | 0.43 | 0.92 | -    | -     | -     | 1.50  | -     | 0.91 | 0.94 |
| 12 N1+3+1(P)KMg  | 3.06 | 3.69 | -    | -     | -     | 2.61  | -     | 2.68 | 3.01 |
| 13 N4(P*)K       | 0.44 | 1.81 | -    | -     | -     | 1.84  | -     | 0.58 | 1.16 |
| 14 N4(P*)K*(Mg*) | 1.04 | 0.66 | -    | -     | -     | 1.25  | -     | 1.59 | 1.13 |
| 15 N5(P)KMg      | 1.94 | 0.27 | -    | -     | -     | 0.71  | -     | 0.22 | 0.79 |
| 16 N6(P)KMg      | 1.35 | 0.96 | -    | -     | -     | 1.39  | -     | 1.55 | 1.31 |
| 17 N1+4+1PKMg    | 3.02 | 2.73 | -    | -     | -     | 1.97  | -     | 1.33 | 2.26 |
| 18 N1+2+1PKMg    | 3.94 | 3.24 | -    | -     | -     | 2.46  | -     | 2.33 | 2.99 |
| 19 N1+1+1KMg     | 0.64 | 0.76 | -    | -     | -     | 1.35  | -     | 1.35 | 1.02 |
| 20 N4KMg         | -    | -    | -    | -     | -     | 0.11  | -     | -    | 0.11 |
| Mean             | 1.78 | 1.77 | -    | -     | -     | 1.38  | -     | 1.32 | 1.56 |

Straw Mean DM% 86.00

**WINTER OATS**

Tonnes/Hectare (85% DM)

*Table of means*

| Plot | Treatment           | Grain | Straw |
|------|---------------------|-------|-------|
| 017  | 01 (FYM)1/2N4       | 8.24  | 3.17  |
| 217  | 02.1 FYM1/2N3       | 7.76  | 3.88  |
| 227  | 02.2 FYM            | 5.06  | 2.59  |
| 037  | 03 Nil              | 0.58  | 0.08  |
| 057  | 05 (P)KMg           | 1.46  | 0.30  |
| 067  | 06 1/2N1(P)KMg      | 3.20  | 0.70  |
| 077  | 07 1/2N2(P)KMg      | 4.13  | 1.50  |
| 087  | 08 1/2N3(P)KMg      | 5.08  | 1.57  |
| 097  | 09 1/2N4(P)KMg      | 7.34  | 2.78  |
| 107  | 10 1/2N4            | 5.01  | 1.91  |
| 117  | 11 1/2N4(P*)Mg      | 8.08  | 2.66  |
| 127  | 12 1/2N5(P)KMg      | 7.69  | 2.34  |
| 137  | 13 1/2N4(P*)K       | 7.22  | 2.76  |
| 147  | 14 1/2N4(P*)K*(Mg*) | 4.83  | 2.35  |
| 157  | 15 1/2N5(P)KMg      | 5.96  | 3.18  |
| 167  | 16 1/2N6(P)KMg      | 6.94  | 2.97  |
| 177  | 17 1/2N6PKMg        | 7.70  | 3.45  |
| 187  | 18 1/2N4PKMg        | 6.07  | 2.41  |
| 197  | 19 1/2N3KMg         | 4.07  | 1.49  |

|                          |         |       |
|--------------------------|---------|-------|
| Mean                     | 5.60    | 2.22  |
| Mean DM%                 | 83.80   | 81.50 |
| Plot Area Harvested (ha) | 0.00463 |       |

**WINTER BEANS**

TONNES/HECTARE (85% DM)

*Tables of means*

| Plot | Treatment                | Grain   | Straw |
|------|--------------------------|---------|-------|
| 015  | 01 (FYM)[N4]             | 4.69    | 1.63  |
| 215  | 21 [FYMN3]               | 4.77    | 1.64  |
| 225  | 22 [FYM]                 | 4.66    | 2.19  |
| 035  | 03 Nil                   | 0.32    | 1.58  |
| 055  | 05 (P)KMg                | 3.04    | 1.86  |
| 065  | 06 [N1](P)KMg            | 2.59    | 1.51  |
| 075  | 07 [N2](P)KMg            | 3.15    | 1.08  |
| 085  | 08 [N3](P)KMg            | 2.10    | 1.41  |
| 095  | 09 [N4](P)KMg            | 1.89    | 1.43  |
| 105  | 10 [N4]                  | 0.37    | 0.33  |
| 115  | 11 [N4](P*)Mg            | 0.13    | 0.92  |
| 125  | 12 [N1+3+1](P)KMg        | 2.40    | 1.89  |
| 135  | 13 [N4](P*)K             | 2.54    | 2.35  |
| 145  | 14 [N4](P*)K*(Mg*)       | 1.71    | 2.03  |
| 155  | 15 [N5](P)KMg            | 2.07    | 2.16  |
| 165  | 16 [N6](P)KMg            | 2.10    | 2.10  |
| 175  | 17 [N1+4+1]PKMg          | 1.97    | 2.66  |
| 185  | 18 [N1+2+1]PKMg          | 3.11    | 2.50  |
| 195  | 19 [N1+1+1]KMg           | 2.21    | 2.85  |
|      | MEAN                     | 2.41    | 1.79  |
|      | Mean DM%                 | 83.80   | 89.10 |
|      | Plot Area Harvested (ha) | 0.00463 |       |

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

| YEAR              | 2021 |
|-------------------|------|
| SECTION           | 8/W5 |
| PLOT              |      |
| 01 (FYM) N4       |      |
| 2.1 FYMN3         | 1.08 |
| 2.2 FYM           | 2.82 |
| 03 Nil            | 0.52 |
| 05 (P)KMg         | 0.96 |
| 06 N1(P)KMg       | 0.56 |
| 07 N2(P)KMg       | 0.40 |
| 08 N3(P)KMg       | 0.34 |
| 09 N4(P)KMg       | 0.69 |
| 10 N4             | 0.53 |
| 11 N4(P)Mg        | 0.58 |
| 12 N1+3+1(P)K2Mg2 | 0.67 |
| 13 N4(P)K         | 0.31 |
| 14 N4(P)K*(Mg*)   | 0.64 |
| 15 N5(P)KMg       |      |
| 16 N6(P)KMg       | 0.56 |
| 17 N1+4+1PKMg     | 0.63 |



|               |      |
|---------------|------|
| 18 N1+2+1PKMg | 0.77 |
| 19 N1+1+1KMg  | 0.43 |
| 20 N4KMg      |      |
| Mean          | 0.74 |

Note: All clean grain yields for section 8 are reported for the 2.0 - 3.5 mm grain size fraction, excluding grain <2 mm, as was the practice prior to 2012.

## 21/R/HB/2 HOOSFIELD SPRING 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 170<sup>th</sup> year, spring barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and Yield Books for 74-20/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 <sup>(a)</sup> | 73 <sup>(a)</sup>                 | -                   | D                               | D                     |
| P2KMg <sup>(a)</sup> | 63 <sup>(a)</sup>                 | -                   | P2KMg                           | P2KMg                 |

<sup>(a)</sup> Plots 63 and 73 started in 2001

- Form of N: A, sulphate of ammonia to supply 48 kg N  
 P: 35 kg P as triple superphosphate in 1974 and from 1988 to 2002, single superphosphate in other years  
 (P): (none) under review  
 P2: 44 kg P as triple superphosphate since 2001  
 K: 90 kg K as sulphate of potash  
 (Na): (none), 16 kg Na as sulphate of soda until 1973  
 Mg: 35 kg Mg as kieserite every third year since 1974 (applied at 30 kg in 1992, 1995 and 1998) (sulphate of magnesia annually until 1973). Annually at 35 kg Mg to new plot 63.  
 (Mg): (none) under review  
 D1852: Farmyard manure at 35 t (fresh weight) since 1852  
 D2001: Farmyard manure at 35 t (fresh weight) since 2001  
 (D): Farmyard manure at 35 t (fresh weight) 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<br>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 48 kg 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, 144 kg as "Nitro-chalk" since 2003

Si: Silicate of soda at 450 kg (Note: S also refers to silicate of soda)

(Si): Silicate of soda omitted since 1980

P, (P), K, Mg, (Mg), (Na): as above

**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 (Strip 5 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, 144 kg as "Nitro-chalk"

K: 90 kg K as sulphate of potash

K\*: 450 kg 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

## Experimental Diary

| Date       |   | Application  | Rate | Units                |
|------------|---|--|------|----------------------|
| 13/10/2020 | f | Applied Triple Superphosphate (TSP): Plots 631-634 (Series AA); By Hand  | 215  | kg/ha                |
| 13/10/2020 | f | Applied Kieserite: Plots 631-634 (Series AA) ; By Hand   | 233  | kg/ha                |
| 26/10/2020 | f | Applied Sulphate of Potash (SOP); JD830 with Cascade Spreader: Plots 141-144, 241-244, 311-314, 321-324, 331-334, 341-344, 411-414, 421-424, 431-434, 441-444, 551, 552, 561, 562, 571, 572, 581, 582, 631-634 | 217  | kg/ha                |
| 28/10/2020 | f | Applied Silicate of Soda: By hand - plots 433, 333, 233, 133, 432, 332, 232, 132   | 450  | kg/ha                |
| 04/11/2020 | f | Applied Farmyard Manure (FYM); Tym T503 with Muck Spreader - Plots 721-724, 731-734  | 35   | t/ha                 |
| 25/02/2021 | a | Ploughed Tillage 20 cm: Thrown N   | -    | -                    |
| 08/03/2021 | a | Spring Tines; JD6145R with Cousins Spring Tines  | --   |                      |
| 08/03/2021 | s | Drilled Diablo; JD6830 with Accord Combination Drill No.4  | 350  | Seeds/m <sup>2</sup> |
| 09/03/2021 | a | Rolling; JD6230 with 6m Flexicoil Cambridge Roll   | -    | -                    |
| 27/04/2021 | a | Power harrowed Paths; Iseki ISTH4335 with Kilworth Power Harrow 1.3m   | -    | -                    |
| 17/05/2021 | f | Applied Nitro Chalk (27% N); By Hand: Plots 113, 124, 211, 222, 313, 321, 412, 421, 611, 621, 631, 712, 721, 732   | 178  | kg/ha                |
| 17/05/2021 | f | Applied Nitro Chalk (27% N) ); By Hand: Plots 112, 123, 212, 223, 314, 324, 414, 422, 613, 624, 634, 711, 722, 731   | 356  | kg/ha                |
| 17/05/2021 | f | Applied Nitro Chalk (27% N) ); By Hand: Plots 114, 122, 213, 224, 312, 323, 411, 424, 612, 622, 632, 714, 723, 733   | 533  | kg/ha                |
| 27/05/2021 | f | Applied Nitram; JD6830 with Cascade Spreader: Series AA. C strip 5 and O&E only  | 417  | kg/ha                |

|            |   |  |     |      |
|------------|---|--|-----|------|
| 24/06/2021 | p | Sprayed Mobius; NH T6030 with Knight 24m Sprayer                           | 0.4 | L/ha |
| 09/07/2021 | a | Wild Oat Count   | -   | -    |
| 04/09/2021 | a | Harvest plots - grain yields; Haldrup C-85 2m Cut.                         | -   | -    |
| 04/09/2021 | a | Straw weights; JD5070 with Amazone Grass Harvester – Flail Mower Collector | -   | -    |
| 13/09/2021 | a | Operation: Baling ; JD6145R with McHale Fusion 2 Baler                     | -   | -    |

## Yields

### Main Plots

Grain Yield, tonnes/hectare

#### Table of means

|                | N     | 0    | 48   | 96   | 144  | Mean |
|----------------|-------|------|------|------|------|------|
| MANURE         |       |      |      |      |      |      |
| ---            | 0.67  | 0.48 | 0.42 | 0.51 | 0.52 |      |
| -P-            | 1.31  | 3.05 | 2.56 | 2.31 | 2.31 |      |
| --K            | 0.85  | 0.75 | 1.30 | 1.00 | 0.97 |      |
| -PK            | 1.54  | 3.09 | 3.73 | 4.40 | 3.19 |      |
| A--            | 0.35  | 0.70 | 0.65 | 0.48 | 0.54 |      |
| AP-            | 1.58  | 2.36 | 2.37 | 2.67 | 2.25 |      |
| A-K            | 0.56  | 0.79 | 1.10 | 0.91 | 0.84 |      |
| APK            | 1.66  | 3.29 | 3.89 | 4.74 | 3.39 |      |
| FYM1852onwards | 5.08  | 6.21 | 7.15 | 7.26 | 6.43 |      |
| FYM1852-1871   | 1.51  | 1.42 | 1.50 | 4.99 | 2.35 |      |
| (A)            | 1.33  | 2.08 | 2.93 | 2.35 | 2.17 |      |
| -              | 1.00  | 0.81 | 1.30 | 1.07 | 1.05 |      |
| FYM2001onwards | 4.68  | 5.71 | 6.24 | 7.03 | 5.91 |      |
| P2K            | 2.05  | 3.99 | 4.97 | 6.00 | 4.25 |      |
| Mean           | 1.73  | 2.48 | 2.86 | 3.27 | 2.58 |      |
| Grain mean DM% | 81.10 |      |      |      |      |      |

Straw Yield, tonnes/hectare

#### Table of means

|                | N       | 0       | 48   | 96   | 144  | Mean |
|----------------|---------|---------|------|------|------|------|
| MANURE         |         |         |      |      |      |      |
| ---            | 0.45    | 0.32    | 1.42 | 0.37 | 0.64 |      |
| -P-            | 0.24    | 1.29    | 1.50 | 1.68 | 1.18 |      |
| --K            | 0.18    | 0.41    | 0.59 | 0.68 | 0.46 |      |
| -PK            | 0.60    | 1.18    | 1.83 | 2.05 | 1.42 |      |
| A--            | 0.46    | 0.34    | 0.45 | 0.57 | 0.46 |      |
| AP-            | 0.58    | 1.07    | 0.39 | 1.69 | 0.93 |      |
| A-K            | 0.25    | 1.11    | 0.80 | 0.93 | 0.78 |      |
| APK            | 0.77    | 0.60    | 1.71 | 2.35 | 1.36 |      |
| FYM1852onwards | 2.53    | 2.13    | 2.78 | 2.15 | 2.40 |      |
| FYM1852-1871   | 0.97    | 0.93    | 0.33 | 2.06 | 1.07 |      |
| (A)            | 1.10    | 0.39    | 0.60 | 1.08 | 0.79 |      |
| -              | 0.56    | 0.95    | 1.53 | 0.47 | 0.88 |      |
| FYM2001onwards | 1.54    | 3.47    | 1.19 | 2.52 | 2.18 |      |
| P2K            | 2.76    | 2.63    | 2.28 | 4.06 | 2.93 |      |
| Mean           | 0.93    | 1.20    | 1.24 | 1.62 | 1.25 |      |
| Straw mean DM% | 83.70   |         |      |      |      |      |
| Plot Area (ha) | 0.00244 | 0.00183 |      |      |      |      |

**PHOSPHATE PLOTS****Grain Yield, tonnes/hectare***Tables of means*

| PLOT |      |
|------|------|
| 142  | 1.76 |
| 143  | 1.66 |
| 144  | 1.38 |
| 242  | 3.73 |
| 243  | 3.58 |
| 244  | 3.37 |
| 341  | 2.10 |
| 342  | 2.79 |
| 343  | 2.89 |
| 344  | 3.26 |
| 441  | 3.02 |
| 442  | 3.22 |
| 443  | 3.28 |
| 444  | 3.11 |
| 551  | 3.25 |
| 552  | 3.14 |
| 561  | 3.55 |
| 562  | 3.11 |
| 571  | 2.37 |
| 572  | 2.95 |
| 581  | 0.61 |
| 582  | 0.65 |
| Mean | 2.67 |

|                          |         |
|--------------------------|---------|
| Grain Mean DM%           | 83.80   |
| Plot area Harvested (ha) | 0.00244 |

**SILICATE PLOTS****Grain Yield, tonnes/hectare***Tables of means*

|          | PK   | N3-- | N3P- | N3-K | N3PK | Mean |
|----------|------|------|------|------|------|------|
| Silicate |      |      |      |      |      |      |
| (-)-     | 0.81 | 2.40 | 0.76 | 3.07 | 1.76 |      |
| (Si)-    | 0.73 | 2.68 | 1.52 | 3.14 | 2.02 |      |
| (-)Si    | 1.43 | 2.66 | 1.42 | 3.55 | 2.26 |      |
| (Si)Si   | 1.32 | 2.33 | 1.78 | 3.54 | 2.24 |      |
| Mean     | 1.07 | 2.52 | 1.37 | 3.33 | 2.07 |      |

|                          |         |                              |
|--------------------------|---------|------------------------------|
| Grain Mean DM%           | 83.80   |                              |
| Plot area harvested (ha) | 0.00244 | Means exclude missing values |

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

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

**Whole plot dimensions:** 9 m × 211 m

**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. Nevertheless, the experiment is in its 166<sup>th</sup> year. For previous years see 'Details' 1967, 1973 and Yield Books for 74-20/R/WF/3.

**Experimental Diary**

| Date       |   | Application   | Rate | Units                |
|------------|---|---|------|----------------------|
| 21/09/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai                               | 3    | L/ha                 |
| 21/09/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite                         | 1    | L/ha                 |
| 19/10/2020 | a | Ploughed Tillage 20 cm: Thrown N  | -    | -                    |
| 19/10/2020 | s | Drilled KWS Zyatt   | 350  | seeds/m <sup>2</sup> |
| 01/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology (12629) | 50   | mL/ha                |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Pontos                                | 0.5  | L/ha                 |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Firestarter                           | 0.6  | L/ha                 |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Velomax                               | 0.4  | L/ha                 |
| 20/04/2021 | f | Applied Nitram  | 145  | kg/ha                |
| 12/05/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Lentyma XE                            | 1    | L/ha                 |
| 12/05/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Retengo 200                           | 0.4  | L/ha                 |
| 23/06/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Cello                                 | 0.66 | L/ha                 |
| 11/08/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai                               | 3    | L/ha                 |
| 11/08/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite                         | 1    | L/ha                 |
| 19/08/2021 | a | Harvest   | -    | -                    |
| 20/08/2021 | a | Baled   | -    | -                    |

## 21/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 166<sup>th</sup> year, winter wheat.

For previous years see 'Details' 1977, 1973 and Yield Books for 74-20/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 (fresh weight)  |
| 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,<br>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 (fresh weight)                    |
| 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                                       |



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

|    |  |
|----|--|
| O  | None (2 sub-plots within each treatment strip) |
| K1 | 75 kg K <sub>2</sub> O (62.2 kg K)             |
| K2 | 150 kg K <sub>2</sub> O (124.5 kg K)           |

## Whole plots

Nitrogen: 50 kg N as ammonium sulphate (to supply sufficient S) during first two weeks in March, 200 kg N as ammonium nitrate at GS31/mid-April (whichever comes first) and 50 kg N as ammonium nitrate at GS37 (not later than mid-May).

**Experimental Diary**

| Date       |   | Application   | Rate | Unit                 |
|------------|---|---|------|----------------------|
| 21/09/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6830: Plots 011, 012, 021-024, 031, 032, 041-044, 051, 052, 061-064, 071, 072, 081-084, 091, 092, 101-104 | 75   | kg/ha                |
| 21/09/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238)   | 3    | L/ha                 |
| 21/09/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite   | 1    | L/ha                 |
| 22/09/2020 | f | Applied Muriate of Potash (MOP) using Cascade Spreader, JD6830: Plots 103, 083, 063, 043, 023   | 125  | kg/ha                |
| 22/09/2020 | f | Applied Muriate of Potash (MOP) using Cascade Spreader, JD6830: Plots 011-014, 024, 031-034, 044, 051-054, 064, 071-074, 084, 091-094, 104                              | 250  | kg/ha                |
| 07/10/2020 | a | Path cutting using Kilworth Topper, Iseki ISTH4335  | -    | -                    |
| 19/10/2020 | a | Ploughed Tillage 20 cm using NHT7210, KV Five Furrow Plough: Thrown N   | -    | -                    |
| 19/10/2020 | s | Drilled using JD6830, Accord Combination Drill No. 4: KWS Zyatt   | 350  | seeds/m <sup>2</sup> |
| 01/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology   | 50   | mL/ha                |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Pontos  | 0.5  | L/ha                 |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Firestarter   | 0.6  | L/ha                 |
| 02/12/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Velomax   | 0.4  | L/ha                 |
| 04/04/2021 | a | Cultivated Paths only   |      |                      |
| 21/04/2021 | f | Applied Sulphate of Ammonia using Cascade Spreader, JD6830: All Plots   | 238  | kg/ha                |
| 12/05/2021 | f | Applied Kieserite using Cascade Spreader, JD6830: All Plots   | 80   | kg/ha                |
| 12/05/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Lentyma XE  | 1    | L/ha                 |
| 26/05/2021 | f | Applied Nitram using Cascade Spreader, JD6830 : All Plots   | 580  | kg/ha                |
| 09/06/2021 | f | Applied Nitram using Cascade Spreader, JD6830: All Plots  | 145  | kg/ha                |
| 23/06/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Cello   | 0.66 | L/ha                 |

|            |   |   |   |      |
|------------|---|---|---|------|
| 15/07/2021 | a | Power harrowed Paths using Iseki ISTH4335, Kilworth Power Harrow 1.3 m      | - | -    |
| 02/08/2021 | a | Path Cutting using Iseki ISTH4335, Kilworth Topper                          | - | -    |
| 11/08/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai                         | 3 | L/ha |
| 11/08/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite                   | 1 | L/ha |
| 26/08/2021 | A | Harvest Surrounds using Claas Tucano 430                                    | - | -    |
| 26/08/2021 | a | Harvest Plots using Haldrup C-85 2m cut                                     | - | -    |
| 27/08/2021 | a | Straw weights using JD5070, Amazone Grass Harvester - Flail Mower Collector | - | -    |

## Yields

### P TEST

#### Tables of means

#### Grain Yield, tonnes/hectare

| P_RES          | O     | (P1) | (P2) | (P3) | Mean |
|----------------|-------|------|------|------|------|
| OLD_RES        |       |      |      |      |      |
| O              | 2.35  | 4.40 | 6.27 | 6.36 | 4.85 |
| D              | 3.00  | 6.11 | 7.48 | 7.05 | 5.91 |
| N              | 2.05  | 4.30 | 6.40 | 6.93 | 4.92 |
| P              | 2.67  | 5.97 | 7.18 | 6.96 | 5.69 |
| NPKNAMG        | 2.04  | 5.68 | 7.00 | 7.12 | 5.46 |
| Mean           | 2.42  | 5.29 | 6.86 | 6.88 | 5.36 |
| Grain mean DM% | 85.00 |      |      |      |      |

#### Straw Yield, tonnes/hectare

| P_RES          | O     | (P1) | (P2) | (P3) | Mean |
|----------------|-------|------|------|------|------|
| OLD_RES        |       |      |      |      |      |
| O              | 0.49  | 1.42 | 1.09 | 1.35 | 1.09 |
| D              | 0.84  | 2.11 | 2.13 | 2.03 | 1.78 |
| N              | 0.49  | 1.17 | 2.20 | 3.03 | 1.72 |
| P              | 0.87  | 2.34 | 2.79 | 2.31 | 2.08 |
| NPKNAMG        | 1.44  | 1.68 | 1.84 | 2.20 | 1.79 |
| Mean           | 0.83  | 1.74 | 2.01 | 2.18 | 1.69 |
| Straw mean DM% | 85.20 |      |      |      |      |

Plot area harvested 0.00512 ha.

### K TEST

#### Tables of means

#### Grain Yield, tonnes/hectare

| K_Test         | K0    | K1   | K2   | Mean |
|----------------|-------|------|------|------|
| OLD_RES        |       |      |      |      |
| O              | 6.02  | 6.78 | 6.97 | 6.45 |
| D              | 7.36  | 8.25 | 7.26 | 7.56 |
| N*             | 6.82  | 7.40 | 6.85 | 6.97 |
| PK             | 6.64  | 5.88 | 5.95 | 6.28 |
| N*PK           | 7.06  | 7.70 | 7.72 | 7.38 |
| Mean           | 6.78  | 7.20 | 6.95 | 6.93 |
| Grain mean DM% | 85.20 |      |      |      |

## Straw Yield, tonnes/hectare

| K_Test         | K0    | K1   | K2   | Mean |
|----------------|-------|------|------|------|
| OLD_RES        |       |      |      |      |
| O              | 2.78  | 2.87 | 2.69 | 2.78 |
| D              | 2.31  | 2.50 | 2.64 | 2.44 |
| N*             | 2.21  | 2.91 | 1.66 | 2.25 |
| PK             | 2.20  | 3.13 | 2.62 | 2.54 |
| N*PK           | 2.02  | 3.29 | 2.50 | 2.46 |
| Mean           | 2.30  | 2.94 | 2.42 | 2.49 |
| Straw mean DM% | 84.10 |      |      |      |

Plot area harvested 0.00512 ha

## 21/R/PG/5      PARK GRASS

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

The 166<sup>th</sup> year, hay.

For previous years see 'Details' 1977 and 1973 and Yield Books for 74-20/R/PG/5.

**Treatments:** Combinations of:

Whole plots

| 1. <b>Manure</b> | 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 (N*2)     | Plot 14/1  | P K Na Mg (+ N*2 until 1989)                        |
| N*2PKNaMg        | Plot 14/2  | N*2 P K Na Mg                                       |
| N*3PKNaMg (N*2)  | Plot 15  | N*3 P K Na Mg (N*2 until 1875; P K Na Mg 1876-2012) |
| N*1PKNaMg        | Plot 16  | N*1 P K Na Mg                                       |
| N*1              | Plot 17  | N*1   |
| 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  |   |
| N*1, N*2, N*3:   | 48, 96, 144 kg N as nitrate of soda (30 kg N to plot 20 in years with no FYM). In 2013 plot 15 started to receive 144 kg N as nitrate of soda to provide a comparison with plot 11/1, which receives 144 kg N as sulphate of ammonia.  |   |
| P:               | 17 kg P applied as triple superphosphate since 2017, except for plot 20 which receives 15 kg P in years with no FYM. Prior to this, 35 kg P (15 kg P to plot 20 in years with no FYM) 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 FYM) 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 (fresh weight) 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 (fresh weight), 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 CaCO<sub>3</sub> 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 (0-23 cm) 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 2018; the ninth 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>]

## Experimental Diary

| Date       | Application  | Rate | Units |
|------------|--|------|-------|
| 22/03/2021 | f Applied Chalk by hand: Plots 2/1c, 2/2a, 2/2b, 3b, 4/1b, 7/1c, 7/2c, 12/c, 13/1c, 13/2b, 15c | 0.3  | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 3a, 8b, 9/1b, 9/1c, 14/1b, 15b                                  | 0.5  | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 1b, 1c, 2/1b, 4/2c, 7/1b, 7/2b, 10c, 12/b, 13/1b, 18/c          | 0.75 | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plot 4/2b   | 1    | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plot 10b  | 1.25 | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 2/1a, 9/1a, 9/2b, 11/1b, 11/1c, 11/2c, 18/b                     | 1.5  | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 12/a, 13/1a, 17a  | 1.75 | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 1a, 4/1a, 9/2c, 11/2b, 13/2a, 14/1a, 14/2a                      | 2    | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 6b, 7/1a, 7/2a, 8a, 9/2a, 10a, 15a, 16a                         | 2.5  | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 11/2a   | 3    | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plot 6a   | 3.5  | t/ha  |
| 22/03/2021 | f Applied Chalk by hand: Plots 4/2a, 11/1a, 18/a   | 4    | t/ha  |

## Results of the Classics and other Long-Term Experiments 2021

21/R/PG/5

|               |   |  |     |       |
|---------------|---|--|-----|-------|
| 06/04/2021    | f | Applied TSP using Nordsten 3m fertiliser box, JD5070 : Plots 4/1, 4/2, 6, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16; Sub-plots a, b, c, d | 83  | kg/ha |
| 09/04/2021    | f | Applied SOP using Quick Pass, JD5070; Plots 2/1, 6, 7/1, 7/2, 9/1, 9/2, 11/1, 11/2, 14/1,14/2, 15, 16, 18; Sub-plots a, b, c, d                      | 542 | kg/ha |
| 09/04/2021    | f | Applied Silicate of Soda using Quick Pass, JD5070; Plot 11/2; Sub-plots a, b, c, d   | 450 | kg/ha |
| 09/04/2021    | f | Applied Sulphate of Soda using Quick Pass, JD5070; Plots 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1,14/2, 15, 16, 18; Sub-plots a, b, c, d       | 43  | kg/ha |
| 09/04/2021    | f | Applied Sulphate of Magnesia using Quick Pass, JD5070; Plots 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1,14/2, 15, 16, 18; Sub-plots a, b, c, d   | 111 | kg/ha |
| 13/04/2021    | f | Applied Sulphate of Ammonia using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plots 1 (Sub-plots a-d), 6a, 6b                             | 229 | kg/ha |
| 13/04/2021    | f | Applied Sulphate of Ammonia using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plots 4/2, 9/2, 10, 18; Sub-plots a, b, c, d                | 457 | kg/ha |
| 13/04/2021    | f | Applied Sulphate of Ammonia using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plots 11/1, 11/2; Sub-plots a, b, c, d                      | 686 | kg/ha |
| 12/04/2021    | f | Applied Sodium Nitrate using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plot 20  | 188 | kg/ha |
| 13/04/2021    | f | Applied Sodium Nitrate using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plot 16, 17; Sub-plots a, b, c, d                                | 300 | kg/ha |
| 13/04/2021    | f | Applied Sodium Nitrate using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plot 14/2; Sub-plots a, b, c, d                                  | 600 | kg/ha |
| 13/04/2021    | f | Applied Sodium Nitrate using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Plot 15; Sub-plots a, b, c, d                                    | 900 | kg/ha |
| 14/04/2021    | f | Applied FYM using Muck spreader - international, Tym T503: Plots 13/2, 19, 20  | 35  | t/ha  |
| 30/04/2021    | a | Cut Paths using Kilworth Topper, Iseki ISTH4335  | -   | -     |
| 14/06/2021    | a | Cut Paths using Kilworth Topper, Iseki ISTH4335  | -   | -     |
| 14-15/06/2021 | a | Harvesting using Amazone Grass Harvester - Flail Mower Collector, JD5070 : Cut 1   | -   | -     |
| 14/07/2021    | a | Mowing using JD6830, Kuhn Mower Conditioner  | -   | -     |
| 14/07/2021    | a | Turning  | -   | -     |
| 08-09/11/2021 | a | Harvesting using Amazone Grass Harvester - Flail Mower Collector, JD5070: Cut 2  | -   | -     |
| 16/11/2021    | a | Rowing up using PZ Hay Rake, JD5070  | -   | -     |

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

**Yields****1ST CUT (14-15 JUN 2021) DRY MATTER, TONNES/HECTARE***Tables of means*

| <b>Grand mean</b> |      | <b>3.61</b> |      |      |      |       |  |
|-------------------|------|-------------|------|------|------|-------|--|
| Manure            | Lime | a           | b    | c    | d    | Mean  |  |
| N1                | 1    | 2.67        | 2.57 | 2.15 | 1.56 | 2.24  |  |
| K                 | 2/1  | 2.88        | 2.50 | 2.13 | 1.74 | 2.31  |  |
| None(FYM)         | 2/2  | 2.72        | 2.69 | 2.05 | 1.50 | 2.24  |  |
| None              | 3    | 2.96        | 2.93 | 2.00 | 1.53 | 2.35  |  |
| P                 | 4/1  | 2.95        | 3.30 | 2.32 | 2.09 | 2.66  |  |
| N2P               | 4/2  | 3.26        | 2.98 | 2.71 | 1.25 | 2.55  |  |
| N1PKNaMg          | 6    | 5.28        | 4.65 | -    | -    | 4.96  |  |
| (P)KNaMg          | 7/1  | 5.06        | 3.60 | 2.22 | 1.73 | 3.15  |  |
| PKNaMg            | 7/2  | 6.15        | 4.72 | 2.51 | 1.94 | 3.83  |  |
| PNaMg             | 8    | 2.56        | 3.52 | 2.39 | 2.00 | 2.62  |  |
| PKNaMg(N2)        | 9/1  | 5.42        | 4.49 | 3.65 | 1.39 | 3.74  |  |
| N2PKNaMg          | 9/2  | 6.40        | 6.14 | 5.27 | 2.40 | 5.05  |  |
| N2PNaMg           | 10   | 4.26        | 4.15 | 3.58 | 1.53 | 3.38  |  |
| N3PKNaMg          | 11/1 | 6.88        | 4.80 | 6.02 | 3.09 | 5.20  |  |
| N3PKNaMgSi        | 11/2 | 6.35        | 4.98 | 5.66 | 3.81 | 5.20  |  |
| None              | 12   | 2.66        | 2.12 | 2.07 | 2.69 | 2.38  |  |
| (FYM/F)           | 13/1 | 2.60        | 3.19 | 3.06 | 2.71 | 2.89  |  |
| FYM/PM            | 13/2 | 3.91        | 4.38 | 4.71 | 4.19 | 4.30  |  |
| PKNaMg(N*2)       | 14/1 | 4.16        | 4.77 | 2.98 | 2.97 | 3.72  |  |
| N*2PKNaMg         | 14/2 | 5.43        | 6.62 | 5.09 | 5.39 | 5.63  |  |
| N*3PKNaMg(N*2)    | 15   | 7.94        | 6.53 | 5.41 | 4.92 | 6.20  |  |
| N*1PKNaMg         | 16   | 5.21        | 5.38 | 4.51 | 4.26 | 4.84  |  |
| N*1               | 17   | 2.76        | 2.53 | 2.00 | 2.09 | 2.34  |  |
| N2KNaMg           | 18   | 2.87        | 2.46 | 1.93 | 1.74 | 2.25  |  |
| N2KNaMg           | 18/2 | -           | -    | -    | -    | 2.68  |  |
| FYM               | 19/1 | -           | -    | -    | -    | 4.51  |  |
| FYM               | 19/2 | -           | -    | -    | -    | 4.48  |  |
| FYM               | 19/3 | -           | -    | -    | -    | 4.12  |  |
| FYM/N*PK          | 20/1 | -           | -    | -    | -    | 5.16  |  |
| FYM/N*PK          | 20/2 | -           | -    | -    | -    | 4.90  |  |
| FYM/N*PK          | 20/3 | -           | -    | -    | -    | 4.67  |  |
| 1st cut mean DM%  |      |             |      |      |      | 27.30 |  |

**2nd CUT (08-09 NOV 2021) DRY MATTER, TONNES/HECTARE***Tables of means*

| <b>Grand mean</b> |      | <b>2.42</b> |      |      |      |       |
|-------------------|------|-------------|------|------|------|-------|
| Manure            | Lime | a           | b    | c    | d    | Mean  |
| N1                | 1    | 2.10        | 1.82 | 2.04 | 1.13 | 1.77  |
| K                 | 2/1  | 2.59        | 2.09 | 2.35 | 2.08 | 2.28  |
| None(FYM)         | 2/2  | 2.58        | 2.79 | 2.69 | 1.49 | 2.39  |
| None              | 3    | 2.18        | 2.35 | 2.32 | 1.97 | 2.21  |
| P                 | 4/1  | 2.78        | 2.57 | 2.25 | 2.09 | 2.42  |
| N2P               | 4/2  | 1.98        | 1.83 | 2.13 | 1.62 | 1.89  |
| N1PKNaMg          | 6    | 2.09        | 1.75 | -    | -    | 1.92  |
| (P)KNaMg          | 7/1  | 2.64        | 2.47 | 2.25 | 1.95 | 2.33  |
| PKNaMg            | 7/2  | 2.43        | 2.73 | 2.72 | 2.04 | 2.48  |
| PNaMg             | 8    | 2.37        | 2.71 | 2.95 | 2.04 | 2.52  |
| PKNaMg(N2)        | 9/1  | 2.69        | 3.11 | 2.70 | 1.13 | 2.41  |
| N2PKNaMg          | 9/2  | 2.42        | 2.62 | 2.51 | 2.26 | 2.45  |
| N2PNaMg           | 10   | 2.00        | 1.95 | 2.91 | 2.11 | 2.24  |
| N3PKNaMg          | 11/1 | 2.98        | 2.82 | 2.46 | 3.65 | 2.98  |
| N3PKNaMgSi        | 11/2 | 3.57        | 3.04 | 2.26 | 3.12 | 3.00  |
| None              | 12   | 2.32        | 1.97 | 2.73 | 2.43 | 2.36  |
| (FYM/F)           | 13/1 | 2.65        | 3.17 | 2.82 | 2.61 | 2.81  |
| FYM/PM            | 13/2 | 2.08        | 3.19 | 3.11 | 2.99 | 2.85  |
| PKNaMg(N2*)       | 14/1 | 2.50        | 2.80 | 2.25 | 2.34 | 2.47  |
| N*2PKNaMg         | 14/2 | 2.55        | 3.11 | 2.60 | 2.36 | 2.65  |
| N*3PKNaMg(N*2)    | 15   | 2.19        | 3.04 | 3.07 | 2.31 | 2.65  |
| N*1PKNaMg         | 16   | 2.19        | 2.97 | 2.68 | 1.78 | 2.40  |
| N*1               | 17   | 2.35        | 1.86 | 2.52 | 1.71 | 2.11  |
| N2KNaMg           | 18   | 2.45        | 2.26 | 1.81 | 1.16 | 1.92  |
| N2KNaMg           | 18/2 | -           | -    | -    | -    | 2.25  |
| FYM               | 19/1 | -           | -    | -    | -    | 2.79  |
| FYM               | 19/2 | -           | -    | -    | -    | 3.27  |
| FYM               | 19/3 | -           | -    | -    | -    | 2.85  |
| FYM/N*PK          | 20/1 | -           | -    | -    | -    | 2.00  |
| FYM/N*PK          | 20/2 | -           | -    | -    | -    | 3.03  |
| FYM/N*PK          | 20/3 | -           | -    | -    | -    | 2.40  |
| 1st cut mean DM%  |      |             |      |      |      | 28.08 |



**TOTAL OF 2 CUTS DRY MATTER, TONNES/HECTARE***Tables of means*

| <b>Grand mean</b> |      | <b>6.02</b> |      |      |      |       |
|-------------------|------|-------------|------|------|------|-------|
| Manure            | Lime | a           | b    | c    | d    | Mean  |
| N1                | 1    | 4.77        | 4.39 | 4.19 | 2.69 | 4.01  |
| K                 | 2/1  | 5.47        | 4.59 | 4.48 | 3.81 | 4.59  |
| None(FYM)         | 2/2  | 5.30        | 5.48 | 4.74 | 2.99 | 4.62  |
| None              | 3    | 5.14        | 5.28 | 4.32 | 3.50 | 4.56  |
| P                 | 4/1  | 5.72        | 5.87 | 4.57 | 4.18 | 5.09  |
| N2P               | 4/2  | 5.23        | 4.81 | 4.84 | 2.87 | 4.44  |
| N1PKNaMg          | 6    | 7.37        | 6.40 | -    | -    | 6.89  |
| (P)KNaMg          | 7/1  | 7.70        | 6.07 | 4.47 | 3.68 | 5.48  |
| PKNaMg            | 7/2  | 8.59        | 7.45 | 5.23 | 3.98 | 6.31  |
| PNaMg             | 8    | 4.93        | 6.23 | 5.33 | 4.04 | 5.13  |
| PKNaMg(N2)        | 9/1  | 8.11        | 7.60 | 6.34 | 2.52 | 6.14  |
| N2PKNaMg          | 9/2  | 8.82        | 8.75 | 7.78 | 4.66 | 7.50  |
| N2PNaMg           | 10   | 6.26        | 6.10 | 6.49 | 3.64 | 5.62  |
| N3PKNaMg          | 11/1 | 9.86        | 7.63 | 8.48 | 6.74 | 8.18  |
| N3PKNaMgSi        | 11/2 | 9.93        | 8.02 | 7.91 | 6.93 | 8.20  |
| None              | 12   | 4.99        | 4.09 | 4.79 | 5.12 | 4.75  |
| (FYM/F)           | 13/1 | 5.26        | 6.36 | 5.88 | 5.32 | 5.70  |
| FYM/PM            | 13/2 | 5.99        | 7.57 | 7.83 | 7.18 | 7.14  |
| PKNaMg(N*2)       | 14/1 | 6.66        | 7.56 | 5.23 | 5.32 | 6.19  |
| N*2PKNaMg         | 14/2 | 7.98        | 9.72 | 7.69 | 7.75 | 8.28  |
| N*3PKNaMg(N*2)    | 15   | 10.14       | 9.57 | 8.48 | 7.23 | 8.85  |
| N*1PKNaMg         | 16   | 7.39        | 8.35 | 7.19 | 6.04 | 7.24  |
| N*1               | 17   | 5.10        | 4.39 | 4.53 | 3.80 | 4.45  |
| N2KNaMg           | 18   | 5.32        | 4.72 | 3.74 | 2.90 | 4.17  |
| N2KNaMg           | 18/2 | -           | -    | -    | -    | 4.93  |
| FYM               | 19/1 | -           | -    | -    | -    | 7.30  |
| FYM               | 19/2 | -           | -    | -    | -    | 7.75  |
| FYM               | 19/3 | -           | -    | -    | -    | 6.97  |
| FYM/N*PK          | 20/1 | -           | -    | -    | -    | 7.16  |
| FYM/N*PK          | 20/2 | -           | -    | -    | -    | 7.93  |
| FYM/N*PK          | 20/3 | -           | -    | -    | -    | 7.07  |
| 1st cut mean DM%  |      |             |      |      |      | 27.69 |

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

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

The 168<sup>th</sup> year, red clover.

For previous years see 'Details' 1967 and 1973, and Yield books for 74-20/R/GC/8.

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

**Whole plot dimensions:** 1.00 m × 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 | Unit  |
|------------|---|--|------|-------|
| 13/11/2020 | f | Applied Triple Superphosphate (TSP): By Hand | 75   | kg/ha |
| 13/11/2020 | f | Applied Epsom Salts: By Hand                 | 50   | kg/ha |
| 13/11/2020 | f | Applied Sulphate of Magnesia: By Hand        | 150  | kg/ha |
| 13/11/2020 | f | Applied Chalk: By Hand                       | 1.25 | kg/ha |
| 01/06/2021 | a | Harvest by hand: 1st Cut                     | -    | -     |
| 14/07/2021 | a | Harvest by hand: 2nd Cut                     | -    | -     |
| 23/09/2021 | a | Harvest by hand: 3rd Cut                     | -    | -     |

**Yields**

Dry Matter, Tonnes/Hectare

| Cut             | Date              | Grand Mean | FUNG_RES |         | Mean DM% |
|-----------------|-------------------|------------|----------|---------|----------|
|                 |                   |            | NONE     | BENOMYL |          |
| 1st             | 01 June 2021      | 3.68       | 3.54     | 3.82    | 12.7     |
| 2nd             | 14 July 2021      | 2.62       | 2.80     | 2.44    | 17.6     |
| 3rd             | 23 September 2021 | 1.21       | 1.21     | 1.20    | 19.9     |
| Total of 3 cuts |                   | 7.50       | 7.55     | 7.46    | 16.7     |

## 21/W/RN/3 WOBURN LEY-ARABLE (Stackyard D, Woburn Farm)

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

The 84<sup>th</sup> year, leys, winter beans, winter wheat, winter rye

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-20/W/RN/3.

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

**Whole plot dimensions:** 8.53 m × 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:

|     |                                    |
|-----|------------------------------------|
| Ln3 | (Previous LEY) LN1, LN2, LN3, W, R |
| Lc3 | (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, 1<sup>st</sup> year to 3<sup>rd</sup> year,  
Lc = clover/grass ley, no N, Be = beans (spring oats until 1980), F = fallow,  
M = forage maize

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 N, first year to eighth year, similarly for LLc – clover/grass ley, no N

The new scheme started by sowing these new leys in spring 1976 on four phases and in spring 1977 on the fifth phase (2<sup>nd</sup> 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 1<sup>st</sup> 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 1<sup>st</sup> cycle, 8-yr grass ley) R, Be, O, W, R  
 LLc/ABe (Previously 1<sup>st</sup> cycle, 8-yr grass/clover ley) R, O, Be, W, R  
 LLc/Lc3 (Previously 2<sup>nd</sup> cycle, 8-yr grass ley) Lc 1, Lc 2, Lc 3, W, R  
 LLn/Ln3 (Previously 2<sup>nd</sup> 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 AO. The new rotations were fully in phase by 2016.

For 2021, a further change was made to replace winter beans (which had occasionally failed on the experiment) with winter barley (WB), and to synchronise all arable rotations. As a result, treatments ABe, AO, LLc/ABe and LLn/AO all follow the same rotation: R, WB, O, W, R.

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

#### Whole plots:

- ROTATION** Rotations before wheat:
  - Ln 3
  - Lc 3
  - LLc/Lc3
  - LLn/Ln3
  - LLn/AO
  - LLc/ABe
  - AO
  - ABe

1/ 2 plots:
- 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:
- N** N fertilizer as split dressings in spring  
 (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:  
Ln 3  
Lc 3  
LLc/Lc3  
LLn/Ln3  
LLn/AO  
LLc/ABe  
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**                                  N fertilizer in spring (kg N) as 34.5%:  
0  
50  
100  
150

**Treatments to leys:**

**FYM RES**                              Farmyard manure residues:  
NONE  
FYM 38 t (fresh weight) on each occasion, last applied 1960s.

**NOTE:**                              Corrective K dressings (kg K<sub>2</sub>O) as muriate of potash, applied where necessary to first test crop winter wheat, applied 2020 (see date below). Note that for 2021, applications were based on rounded means calculated from 2016-2020 data in the absence of current data due to the COVID-19 pandemic.

| Continuous rotations<br>Before wheat | No FYM<br>Half plots | FYM Res<br>Half plots |
|--------------------------------------|----------------------|-----------------------|
| Lc3                                  | Plot 34: 0           | Plot 33: 0            |
| LLn/AO                               | Plot 36: 160         | Plot 35: 160          |
| LLn/Ln3                              | Plot 37: 10          | Plot 38: 10           |
| AO                                   | Plot 40: 250         | Plot 39: 250          |
| LLc/Lc3                              | Plot 41: 0           | Plot 42: 0            |
| Ln3                                  | Plot 43: 30          | Plot 44: 30           |
| ABe                                  | Plot 45: 220         | Plot 46: 220          |
| LLc/ABe                              | Plot 47: 120         | Plot 48: 120          |

**Experimental Diary**

| Date   |   | Application   | Rate | Units |
|--|---|---|------|-------|
| <b>ALL</b>   |   |   |      |       |
| 25/10/2020   | P | Sprayed using WES 12m Knight Sprayer, WES MF6150: Samurai (16238):  | 2.5  | L/ha  |
| 26/10/2020   | a | Topping; Topper 9, JD6620   |      |       |
| 04/11/2020   | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Samurai (16238): Block 3 - Grass only   | 2.5  | L/ha  |
| 05/11/2020   | a | Topping; Topper 9, JD6620   |      |       |
| 11/11/2020   | a | Ploughed Tillage 20 cm in Stackyard Woburn; WES Dowdeswell 100 Series Five Furrow Plough, JD6620                                    |      |       |
| 13/11/2020   | a | Power Harrow; WES Power Harrow, JD6620.   |      |       |
| 24/02/2021   | a | Topping; Topper 9, JD6620   | -    | -     |
| 24/02/2021   | a | Topping; Topper 9, JD6620   | -    | -     |
| 02/09/2021   | a | Topping; Topper 9, JD6620   | -    | -     |
| 08/09/2021   | a | Topping paths; Kilworth Topper, Iseki ISTH4335  | -    | -     |
| 05/10/2021   | a | Applied Muriate of Potash (MOP) by hand: Block 2 - Plots 23, 24, 25, 26, 29, 30, 31, 32   | 0    |       |
| 25/11/2021   | a | Topping; Topper 9, JD6620   |      |       |
| <b>Grass ley and clover/grass leys (1st year leys)</b>         |   |   |      |       |
| 26/10/2020   | a | Topping using Topper 9, JD6620  |      |       |
| 09/11/2020   | f | Applied Triple Superphosphate (TSP): Block 2 - Plots 23, 24, 25, 26, 29, 30, 31, 32   | 213  | kg/ha |
| 09/11/2020   | f | Applied Sulphate of Potash (SOP): Block 2 - Plots 23, 24, 25, 26, 29, 30, 31, 32  | 140  | kg/ha |
| 22/04/2021   | f | Applied Nitram: Block 2 - Plots 25, 26, 31, 32  | 217  | kg/ha |
| 22/04/2021   | f | Applied Muriate of Potash (MOP): Block 2 - Plots 23, 24, 25, 26, 29, 30, 31, 32   | 167  | kg/ha |
| 22/11/2021   | a | Harvest using Amazone Grass Harvester - Flail Mower Collector, JD5070: 2nd Cut  | -    | -     |
| <b>Grass ley and clover/grass leys (2nd and 3rd year leys)</b> |   |   |      |       |
| 09/11/2020   | F | Applied Muriate of Potash (MOP): Block 4 - Plots 55, 56, 57, 58, 59, 60, 61, 62; Block 5 - Plots 65, 66, 69, 70, 77, 78, 79, 80     | 0    | kg/ha |
| 09/11/2020   | f | Applied Triple Superphosphate (TSP): Block 4 - Plots 55, 56, 57, 58, 59, 60, 61, 62; Block 5 - Plots 65, 66, 69, 70, 77, 78, 79, 80 | 213  | kg/ha |
| 09/11/2020   | f | Applied Sulphate of Potash (SOP): Block 4 - Plots 55, 56, 57, 58, 59, 60, 61, 62; Block 5 - Plots 65, 66, 69, 70, 77, 78, 79, 80    | 140  | kg/ha |
| 22/04/2021   | f | Applied Nitram: Block 4 - Plots 57, 58, 61, 62; Block 5 - 65, 66, 69, 70  | 217  | kg/ha |
| 22/04/2021   | f | Applied Muriate of Potash (MOP): Block 4 - Plots 55, 56, 57, 58, 59, 60, 61, 62; Block 5 - Plots 65, 66, 69, 70, 77 to 80           | 167  | kg/ha |
| 23/06/2021   | a | Harvest using Amazone Grass Harvester - Flail Mower Collector<br>JD5070: 1 <sup>st</sup> Cut  | -    | -     |
| 30/06/2021   | a | Mowing using JD6620, Mower-Unifarm CM166  | -    | -     |
| 30/06/2021   | a | Baling Grass using Claas Baler, JD6620  | -    | -     |
| 22/11/2021   | a | Harvest using Amazone Grass Harvester - Flail Mower Collector, JD5070: 2 <sup>nd</sup> Cut  | -    | -     |
| 25/11/2021   | a | Baling using Claas Baler, JD6620  | -    | -     |

**W Wheat (test crop 1)**

|            |   |  |     |                      |
|------------|---|--|-----|----------------------|
| 09/11/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6930 : Block 3 - All Plots                                   | 127 | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 37, 38  | 10  | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 43, 44  | 30  | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 47, 48  | 120 | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 35, 36  | 160 | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 45, 46  | 220 | kg/ha                |
| 09/11/2020 |   | Applied MOP as corrective K: Plots 39, 40  | 250 | kg/ha                |
| 11/11/2020 | a | Ploughed Tillage 20 cm in Stackyard Woburn using WES Dowdeswell 100 Series Five Furrow Plough, JD6620                      |     |                      |
| 13/11/2020 | a | Minimum Tillage 10 cm in Stackyard Woburn using WES Power Harrow, JD6620   |     |                      |
| 24/11/2020 | s | Drilled using WES Accord 4m Tyne Drill JD6620: KWS Zyatt - Wheat   | 400 | seeds/m <sup>2</sup> |
| 20/04/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Sprinter - ????  | 3   | L/ha                 |
| 20/04/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Ally Max SX (18768)  | 42  | g/ha                 |
| 20/04/2021 | p | Sprayed using Knight 24m Sprayer, NH T6030: Starane HI-Load HL (16557)   | 0.6 | L/ha                 |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP): Block 3 - All Plots  | 150 | kg/ha                |
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 3 - Plots 331, 351, 361, 343, 373, 384, 394, 401, 414, 422, 432, 444, 453, 462, 471, 484 | 148 | kg/ha                |
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 3 - Plots 334, 341, 354, 364, 381, 374, 393, 404, 411, 423, 431, 443, 454, 463, 474, 482 | 444 | kg/ha                |
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 3 - Plots 333, 344, 352, 362, 371, 382, 391, 402, 413, 421, 433, 442, 451, 481, 464, 473 | 741 | kg/ha                |
| 14/05/2021 | P | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 2   | L/ha                 |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Lentyma XE (19301),  | 1   | L/ha                 |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Retengo 200 (19551)  | 0.4 | L/ha                 |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Stefes CCC 720 (17731)   | 1.5 | L/ha                 |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut   | -   | -                    |
| 02/09/2021 | a | Baling using Claas Baler   | -   | -                    |

**W Rye (test crop 2)**

|            |   |   |     |                      |
|------------|---|---|-----|----------------------|
| 09/11/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6930: Block 1 - All Plots | 127 | kg/ha                |
| 10/11/2020 | f | Applied Chalk: Block 1 – all plots  | 5   | t/ha                 |
| 02/12/2020 | s | Drilled using WES Accord 4m Tyne Drill, JD6620: Miscani - Oats                          | 400 | seeds/m <sup>2</sup> |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????                       | 3   | L/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)                   | 42  | g/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)            | 0.6 | L/ha                 |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader, JD6930: Block 1 - All Plots    | 150 | kg/ha                |

## Results of the Classics and other Long-Term Experiments 2021

21/W/RN/3

|            |   |  |     |       |
|------------|---|--|-----|-------|
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 1 - Plots 014, 021, 034, 043, 054, 061, 074, 084, 094, 102, 113, 123, 134, 143, 152, 163 | 185 | kg/ha |
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 1 - Plots 011, 023, 031, 042, 051, 063, 072, 081, 091, 103, 111, 121, 132, 142, 153, 162 | 370 | kg/ha |
| 06/05/2021 | f | Applied Nitrochalk (27% N): Block 1 - Plots 013, 022, 033, 044, 053, 062, 073, 083, 093, 101, 114, 124, 133, 144, 151, 164 | 556 | kg/ha |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 3   | L/ha  |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)  | 42  | g/ha  |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)   | 0.6 | L/ha  |
| 14/05/2021 | P | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 2   | L/ha  |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Cello (18290)  | 1   | L/ha  |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Stefes CCC 720 (17731)   | 1.5 | L/ha  |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut   | -   | -     |
| 02/09/2021 | a | Baling using Claas Baler   | -   | -     |

**Rye (treatment crop)**

|            |   |  |     |                      |
|------------|---|--|-----|----------------------|
| 09/11/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6930: Block 2 - Plots 17, 18, 19, 20, 21, 22, 27, 28 | 127 | kg/ha                |
| 02/12/2020 | s | Drilled using WES Accord 4m Tyne Drill   | 400 | seeds/m <sup>2</sup> |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader, JD6930: Block 2 - Plots 17, 18, 19, 20, 21, 22, 27, 28    | 150 | kg/ha                |
| 22/04/2022 | f | Applied Nitram (34.5% N) using Cascade Spreader, JD6930: Block 2 – Plots 17, 18, 19, 20, 21, 22, 27, 28            | 290 | kg/ha                |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 3   | L/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)  | 42  | g/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)                                       | 0.6 | L/ha                 |
| 14/05/2021 | P | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 2   | L/ha                 |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Cello (18290)  | 1   | L/ha                 |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Stefes CCC 720 (17731)   | 1.5 | L/ha                 |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut   | -   | -                    |
| 02/09/2021 | a | Baling using Claas Baler   | -   | -                    |

**W Oats**

|            |   |  |     |                      |
|------------|---|--|-----|----------------------|
| 09/11/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6930: Block 5 - Plots 67, 68, 71, 72, 73, 74, 75, 76 | 127 | kg/ha                |
| 24/11/2020 | s | Drilled using WES Accord 4m Tyne Drill<br>JD6620: Mephisto - RYE   | 350 | seeds/m <sup>2</sup> |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????  | 3   | L/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)  | 42  | g/ha                 |
| 20/04/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)                                       | 0.6 | L/ha                 |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader, JD6930: Block 5 - 67, 68, 71, 72, 73, 74, 75, 76          | 150 | kg/ha                |



|            |   |  |     |       |
|------------|---|--|-----|-------|
| 22/04/2021 | f | Applied Nitram (34.5% N) using Cascade Spreader, JD6930:<br>Plots 67, 68, 71, 72, 73, 74, 75, 76 | 290 | kg/ha |
| 14/05/2021 | P | Sprayed using WES 12m Knight Sprayer, WES MF6150:<br>Sprinter - ????                             | 2   | L/ha  |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Cello<br>(18290)                               | 1   | L/ha  |
| 14/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Stefes<br>CCC 720 (17731)                      | 1.5 | L/ha  |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut   | -   | -     |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut   | -   | -     |
| 02/09/2021 | a | Baling using Claas Baler   | -   | -     |

**W Barley**

|            |   |   |     |                      |
|------------|---|---|-----|----------------------|
| 09/11/2020 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader,<br>JD6930: Block 4 - Plots 49, 50, 51, 52, 53, 54, 63, 64 | 127 | kg/ha                |
| 24/11/2020 | s | Drilled Libra - Barley  | 400 | seeds/m <sup>2</sup> |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader,<br>JD6930: Block 4 - Plots 49, 50, 51, 52, 53, 54, 63, 64    | 150 | kg/ha                |
| 22/04/2021 | f | Applied Nitram (34.5% N) using Cascade Spreader, JD6930:<br>Plots 49, 50, 51, 52, 53, 54, 63, 64                      | 290 | kg/ha                |
| 24/11/2020 | s | Drilled using WES Accord 4m Tyne Drill<br>JD6620: Libra - Barley  | 400 | seeds/m <sup>2</sup> |
| 21/04/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader,<br>JD6930: Block 4 - Plots 49, 50, 51, 52, 53, 54, 63, 64    | 150 | kg/ha                |
| 25/08/2021 | a | Harvesting using Haldrup C-85 2m cut  | -   | -                    |
| 02/09/2021 | a | Baling using Claas Baler  | -   | -                    |

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

**Yield Error Note:** It was found that the FYM notation (dr) for some plots on Block 5 was incorrect in the 2020 field plan, and for several previous years (2003-2006, 2009). Consequently, the yield and plans for 2020 were corrected, but earlier printed yield books contain an error in some of the mean yields for FYM and NONE treatments.

**GRASS TREATMENT CROP****LEYS**

1ST CUT (30 JUN 2020) DRY MATTER TONNES/HECTARE

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

| FYM_RES  | LEY | NONE | FYM  | MEAN |
|----------|-----|------|------|------|
|          | Lc1 | 0.00 | 0.00 | 0.00 |
|          | Lc2 | 4.33 | 3.69 | 4.01 |
|          | Lc3 | 5.39 | 5.29 | 5.34 |
|          | Ln1 | 0.00 | 0.00 | 0.00 |
|          | Ln2 | 7.75 | 7.05 | 7.40 |
|          | Ln3 | 7.77 | 6.67 | 7.22 |
| (LLc/Lc) | Lc1 | 0.00 | 0.00 | 0.00 |
| (LLc/Lc) | Lc2 | 3.61 | 3.80 | 3.70 |
| (LLc/Lc) | Lc3 | 4.45 | 4.11 | 4.28 |
| (LLn/Ln) | Ln1 | 0.00 | 0.00 | 0.00 |

|                  |       |      |      |
|------------------|-------|------|------|
| (LLn/Ln)Ln2      | 7.15  | 6.74 | 6.95 |
| (LLn/Ln)Ln3      | 6.82  | 7.14 | 6.98 |
| MEAN             | 3.94  | 3.71 | 3.82 |
| 1ST CUT MEAN DM% | 21.80 |      |      |

## 2ND CUT (30 JUN 2020) DRY MATTER TONNES/HECTARE

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

| FYM_RES          | LEY         | NONE | FYM  | MEAN |
|------------------|-------------|------|------|------|
|                  | Lc1         | 0.51 | 1.18 | 0.85 |
|                  | Lc2         | 1.11 | 1.18 | 1.15 |
|                  | Lc3         | 0.00 | 0.00 | 0.00 |
|                  | Ln1         | 2.55 | 2.91 | 2.73 |
|                  | Ln2         | 1.04 | 1.53 | 1.29 |
|                  | Ln3         | 0.00 | 0.00 | 0.00 |
|                  | (LLc/Lc)Lc1 | 1.75 | 1.86 | 1.81 |
|                  | (LLc/Lc)Lc2 | 1.20 | 0.93 | 1.07 |
|                  | (LLc/Lc)Lc3 | 0.00 | 0.00 | 0.00 |
|                  | (LLn/Ln)Ln1 | 1.62 | 1.78 | 1.70 |
|                  | (LLn/Ln)Ln2 | 1.21 | 1.19 | 1.20 |
|                  | (LLn/Ln)Ln3 | 0.00 | 0.00 | 0.00 |
|                  | MEAN        | 0.92 | 1.05 | 0.98 |
| 2ND CUT MEAN DM% | 32.90       |      |      |      |

## TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

| FYM_RES            | LEY         | NONE | FYM  | MEAN |
|--------------------|-------------|------|------|------|
|                    | Lc1         | 0.51 | 1.18 | 0.85 |
|                    | Lc2         | 5.44 | 4.87 | 5.16 |
|                    | Lc3         | 5.39 | 5.29 | 5.34 |
|                    | Ln1         | 2.55 | 2.91 | 2.73 |
|                    | Ln2         | 8.79 | 8.57 | 8.68 |
|                    | Ln3         | 7.77 | 6.67 | 7.22 |
|                    | (LLc/Lc)Lc1 | 1.75 | 1.86 | 1.81 |
|                    | (LLc/Lc)Lc2 | 4.81 | 4.73 | 4.77 |
|                    | (LLc/Lc)Lc3 | 4.45 | 4.11 | 4.28 |
|                    | (LLn/Ln)Ln1 | 1.62 | 1.78 | 1.70 |
|                    | (LLn/Ln)Ln2 | 8.36 | 7.93 | 8.15 |
|                    | (LLn/Ln)Ln3 | 6.82 | 7.14 | 6.98 |
|                    | MEAN        | 4.86 | 4.75 | 4.80 |
| TOTAL CUT MEAN DM% | 26.20       |      |      |      |

**Note 2:** 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****RYE**

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

|                          | FYMRES | NONE    | FYM  | Mean |
|--------------------------|--------|---------|------|------|
| ROTATION                 |        |         |      |      |
| (ABe)R                   |        | 4.41    | 5.28 | 4.85 |
| (AO)R                    |        | 5.72    | 5.23 | 5.48 |
| (LLn/AO)R                |        | 5.54    | 5.63 | 5.58 |
| (LLc/ABe)R               |        | 3.88    | 4.53 | 4.21 |
| Mean                     |        | 4.89    | 5.17 | 5.03 |
| Grain mean DM%           |        | 79.90   |      |      |
| Plot area harvested (ha) |        | 0.00393 |      |      |

**WINTER BARLEY**

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

|                          | FYMRES | NONE    | FYM  | Mean |
|--------------------------|--------|---------|------|------|
| ROTATION                 |        |         |      |      |
| (ABe)WB                  |        | 2.50    | 2.46 | 2.48 |
| (AO)WB                   |        | 2.16    | 2.19 | 2.18 |
| (LLn/AO)WB               |        | 2.43    | 2.19 | 2.31 |
| (LLc/ABe)WB              |        | 1.86    | 2.35 | 2.11 |
| Mean                     |        | 2.24    | 2.30 | 2.27 |
| Grain mean DM%           |        | 81.90   |      |      |
| Plot area harvested (ha) |        | 0.00393 |      |      |

**WINTER OATS**

GRAIN (85% DRY MATTER) TONNES/HECTARE

*Tables of means*

|                          | FYMRES | NONE    | FYM  | Mean |
|--------------------------|--------|---------|------|------|
| ROTATION                 |        |         |      |      |
| ABe                      |        | 2.84    | 3.25 | 3.04 |
| AO                       |        | 3.44    | 3.19 | 3.32 |
| LLc/ABe                  |        | 3.00    | 3.75 | 3.38 |
| LLn/AO                   |        | 3.32    | 2.83 | 3.07 |
| Mean                     |        | 3.15    | 3.26 | 3.20 |
| Grain mean DM%           |        | 81.30   |      |      |
| Plot area harvested (ha) |        | 0.00393 |      |      |

**ARABLE TEST CROPS****WINTER WHEAT**

Grain tonnes/hectare

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

|                          |         |      |      |      |      |
|--------------------------|---------|------|------|------|------|
| FYMRES                   | none    | FYM  | Mean |      |      |
| ROTATION                 |         |      |      |      |      |
| (AO)W                    | 2.36    | 4.36 | 3.36 |      |      |
| (ABe)W                   | 3.50    | 4.19 | 3.84 |      |      |
| (LLn/AO)W                | 2.19    | 3.51 | 2.85 |      |      |
| (LLc/ABe)W               | 4.60    | 2.55 | 3.57 |      |      |
| (Ln)W                    | 4.50    | 3.06 | 3.78 |      |      |
| (LLn/Ln)W                | 4.58    | 5.33 | 4.95 |      |      |
| (Lc)W                    | 3.85    | 3.36 | 3.61 |      |      |
| (LLc/Lc)W                | 4.36    | 5.22 | 4.79 |      |      |
| Mean                     | 3.74    | 3.95 | 3.84 |      |      |
| N                        | 0       | 80   | 160  | 240  | Mean |
| ROTATION                 |         |      |      |      |      |
| (AO)W                    | 1.45    | 3.20 | 4.11 | 4.65 | 3.36 |
| ((ABe)W                  | 1.99    | 3.30 | 5.39 | 4.69 | 3.84 |
| (LLn/AO)W                | 1.89    | 3.02 | 3.89 | 2.59 | 2.85 |
| (LLc/ABe)W               | 1.86    | 3.23 | 4.17 | 5.03 | 3.57 |
| (Ln)W                    | 3.45    | 3.05 | 4.08 | 4.54 | 3.78 |
| (LLn/Ln)W                | 3.54    | 4.54 | 6.26 | 5.48 | 4.95 |
| (Lc)W                    | 1.95    | 3.57 | 4.64 | 4.28 | 3.61 |
| (LLc/Lc)W                | 2.93    | 4.62 | 5.50 | 6.11 | 4.79 |
| Mean                     | 2.38    | 3.57 | 4.76 | 4.67 | 3.84 |
| N                        | 0       | 80   | 160  | 240  | Mean |
| FYMRES                   |         |      |      |      |      |
| none                     | 2.18    | 3.66 | 4.57 | 4.56 | 3.74 |
| FYM                      | 2.58    | 3.48 | 4.94 | 4.78 | 3.95 |
| Mean                     | 2.38    | 3.57 | 4.76 | 4.67 | 3.84 |
| N                        |         | 0    | 80   | 160  | 240  |
| ROTATION                 | FYMRES  |      |      |      |      |
| (AO)W                    | none    | 1.34 | 2.85 | 2.16 | 3.07 |
|                          | FYM     | 1.56 | 3.56 | 6.06 | 6.24 |
| (ABe)W                   | none    | 1.83 | 3.06 | 5.45 | 3.66 |
|                          | FYM     | 2.14 | 3.53 | 5.34 | 5.73 |
| (LLn/AO)W                | none    | 1.46 | 2.56 | 2.59 | 2.15 |
|                          | FYM     | 2.33 | 3.49 | 5.19 | 3.02 |
| (LLc/ABe)W               | none    | 2.29 | 4.62 | 5.45 | 6.04 |
|                          | FYM     | 1.42 | 1.85 | 2.90 | 4.03 |
| (Ln)W                    | none    | 2.71 | 3.85 | 5.61 | 5.82 |
|                          | FYM     | 4.19 | 2.24 | 2.54 | 3.26 |
| (LLn/Ln)W                | none    | 3.10 | 3.77 | 6.12 | 5.32 |
|                          | FYM     | 3.98 | 5.30 | 6.40 | 5.64 |
| (Lc)W                    | none    | 1.88 | 4.23 | 4.53 | 4.78 |
|                          | FYM     | 2.02 | 2.91 | 4.75 | 3.77 |
| (LLc/Lc)W                | none    | 2.84 | 4.33 | 4.63 | 5.64 |
|                          | FYM     | 3.02 | 4.92 | 6.38 | 6.57 |
| Mean                     |         | 2.38 | 3.57 | 4.76 | 4.67 |
| Grain mean DM%           | 79.20   |      |      |      |      |
| Plot area harvested (ha) | 0.00183 |      |      |      |      |

**WINTER RYE**

Grain tonnes/hectare

*Tables of means*

| FYMRES                   | none    | FYM  | Mean  |      |      |
|--------------------------|---------|------|-------|------|------|
| ROTATION                 |         |      |       |      |      |
| (AO)R                    | 4.91    | 4.81 | 4.86  |      |      |
| (ABe)R                   | 4.95    | 4.65 | 4.80  |      |      |
| (LLn/AO)R                | 4.75    | 5.95 | 5.35  |      |      |
| (LLc/ABe)R               | 5.48    | 4.70 | 5.09  |      |      |
| (Ln)R                    | 6.32    | 6.13 | 6.24  |      |      |
| (LLn/Ln)R                | 7.83    | 5.72 | 6.78  |      |      |
| (Lc)R                    | 6.05    | 4.86 | 5.46  |      |      |
| (LLc/Lc)R                | 6.51    | 5.52 | 6.01  |      |      |
| Mean                     | 5.85    | 5.27 | 5.56  |      |      |
| N                        | 0       | 50   | 100   | 150  | Mean |
| ROTATION                 |         |      |       |      |      |
| (AO)R                    | 2.56    | 4.74 | 5.44  | 6.70 | 4.86 |
| (ABe)R                   | 2.53    | 4.69 | 5.53  | 6.46 | 4.80 |
| (LLn/AO)R                | 4.81    | 5.89 | 5.90  | 4.82 | 5.35 |
| (LLc/ABe)R               | 3.14    | 5.34 | 5.69  | 6.18 | 5.09 |
| (Ln)R                    | 5.38    | 6.29 | 7.23  | 6.56 | 6.24 |
| (LLn/Ln)R                | 4.28    | 8.65 | 7.46  | 6.71 | 6.78 |
| (Lc)R                    | 3.50    | 5.41 | 6.13  | 6.78 | 5.46 |
| (LLc/Lc)R                | 3.68    | 5.93 | 7.00  | 7.44 | 6.01 |
| Mean                     | 3.74    | 5.87 | 6.23  | 6.45 | 5.56 |
| N                        | 0       | 50   | 100   | 150  | Mean |
| FYMRES                   |         |      |       |      |      |
| none                     | 3.35    | 6.62 | 6.62  | 6.81 | 5.85 |
| FYM                      | 4.12    | 5.11 | 5.80  | 6.10 | 5.27 |
| Mean                     | 3.74    | 5.87 | 6.23  | 6.45 | 5.56 |
| ROTATION FYMRES/N        |         |      |       |      |      |
| (AO)R                    | none    | 2.69 | 4.54  | 5.35 | 7.06 |
|                          | FYM     | 2.44 | 4.94  | 5.53 | 6.33 |
| (ABe)R                   | none    | 2.43 | 4.66  | 5.71 | 7.00 |
|                          | FYM     | 2.63 | 4.71  | 5.34 | 5.92 |
| (LLn/AO)R                | none    | 3.08 | 6.22  | 6.45 | 3.26 |
|                          | FYM     | 6.53 | 5.56  | 5.34 | 6.38 |
| (LLc/ABe)R               | none    | 3.06 | 5.17  | 6.40 | 7.29 |
|                          | FYM     | 3.23 | 5.52  | 4.98 | 5.07 |
| (Ln)R                    | none    | 3.97 | 6.42  | 7.23 | 7.66 |
|                          | FYM     | 6.78 | 6.16  | -    | 5.46 |
| (LLn/Ln)R                | none    | 3.93 | 13.84 | 7.18 | 6.35 |
|                          | FYM     | 4.64 | 3.45  | 7.73 | 7.08 |
| (Lc)R                    | none    | 3.72 | 5.53  | 7.24 | 7.70 |
|                          | FYM     | 3.27 | 5.30  | 5.02 | 5.87 |
| (LLc/Lc)R                | none    | 3.92 | 6.60  | 7.37 | 8.15 |
|                          | FYM     | 3.45 | 5.27  | 6.63 | 6.73 |
|                          | Mean    | 3.74 | 5.87  | 6.23 | 6.45 |
| Grain mean DM%           | 79.44   |      |       |      |      |
| Plot area harvested (ha) | 0.00183 |      |       |      |      |

Plot 132 [(Ln)R, FYM, 100 kg N] lost due to combine driver error.

Plots 021-024 [(ABe)R, none] received the same mis-applied N rates as in 2020 (1 3 2 0, rather than 2 0 3 1 that they should have been).

## 21/W/RN/12 WOBURN 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.

The 57<sup>th</sup> year, Winter Beans.

For previous years see 'Details' 1973 and Yield Books for 74-20/W/RN/12.

**Design:** 4 blocks of 8 plots

**Whole plot dimensions:** 8.0 m × 29.5 m (8.0 m × 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 in 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 1<sup>st</sup> test crop in 1987 and on the second pair for the 1<sup>st</sup> 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 N and nil. From 1995 to 1997 residual effects of that N 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         |

F: no organic amendment. St: chopped straw at 7.5 t/ha. CC: cover crop (white mustard) prior to spring sown crops. Co: compost at 40 t/ha. Dg10: FYM at 10 t/ha. Dg25: FYM at 25 t/ha. Dg: FYM at 50 t/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. All application rates of organics are on a fresh weight basis.

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, except for when under winter beans (when no N is applied). For crops receiving N rates rotate as follows:

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

The N0-N5 application rate (per hectare, all applied as Nitro-Chalk 27%N) for each crop are, respectively:

|                             |                                |
|-----------------------------|--------------------------------|
| winter rye                  | 0, 30, 60, 90, 120, 150 kg N   |
| spring barley               | 0, 35, 70, 105, 140, 175 kg N  |
| winter wheat / forage maize | 0, 50, 100, 150, 200, 250 kg N |

### Experimental Diary

| Date       |   | Application  | Rate | Units                |
|------------|---|--|------|----------------------|
| 25/10/2020 | p | Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238)  | 2.5  | L/ha                 |
| 26/10/2020 | a | Topping; Topper 9, JD6620  | -    | -                    |
| 28/10/2020 | f | Applied Farmyard Manure (FYM) by hand: Plots 005, 011, 023, 026  | 25   | t/ha                 |
| 28/10/2020 | f | Applied Farmyard Manure (FYM) by hand: Plots 008, 014, 018, 028  | 10   | t/ha                 |
| 29/10/2020 | f | Applied Straw by hand: Plots 003, 015, 017, 031  | 7.5  | t/ha                 |
| 29/10/2020 | f | Applied Compost by hand: Plots 007, 012, 021, 027  | 40   | t/ha                 |
| 04/11/2020 | a | Topping; WES Topper 9, WES 3m Front Topper, JD6620: Straw Plots  | -    | -                    |
| 04/11/2020 | a | Ploughed Tillage 20 cm using WES Dowdeswell 100 Series Five Furrow Plough<br>JD6620: Thrown E  | -    | -                    |
| 13/11/2020 | a | Power Harrow using WES Power Harrow, JD6620  | -    | -                    |
| 24/11/2020 | s | Drilled using WES Accord 4m Tyne Drill, JD6620: KWS Zyatt  | 400  | seeds/m <sup>2</sup> |
| 24/02/2021 | a | Topping using Topper 9, JD6620: Grass Plots  | -    | -                    |
| 28/04/2021 | a | Minimum Tillage 5 cm using Kilworth Power Harrow 1.3 m, Iseki ISTH4335: Marking paths  | -    | -                    |
| 05/05/2021 | f | Applied Nitrochalk; All Plots except Plots 001, 013, 024, 029  | 185  | kg/ha                |
| 05/05/2021 | f | Applied Nitrochalk; Sub Plots 024, 032, 045, 053, 065, 073, 084, 093, 106, 116, 126, 146, 155, 163, 171, 185, 193, 202, 215, 226, 235, 256, 266, 272, 282, 304, 311, 325 | 185  | kg/ha                |
| 05/05/2021 | f | Applied Nitrochalk; Sub Plots 021, 036, 046, 055, 063, 072, 083, 092, 104, 113, 124, 143, 153, 166, 173, 186, 195, 206, 212, 222, 232, 253, 265, 274, 286, 303, 313, 324 | 370  | kg/ha                |
| 05/05/2021 | f | Applied Nitrochalk; Sub Plots 022, 035, 043, 056, 062, 071, 082, 095, 105, 112, 121, 144, 156, 164, 175, 182, 194, 205, 214, 225, 231, 255, 263, 271, 284, 302, 315, 326 | 556  | kg/ha                |
| 05/05/2021 | f | Applied Nitrochalk; Sub Plots 025, 033, 044, 054, 064, 076, 085, 091, 102, 111, 123, 142, 154, 162, 176, 181, 192, 201, 211, 223, 236, 252, 262, 273, 283, 305, 312, 323 | 741  | kg/ha                |
| 07/05/2021 | f | Applied Sulphate of Potash (SOP) using Cascade Spreader, JD6620; All plots except 005, 011, 023, 026   | 200  | kg/ha                |

|            |   |   |      |       |
|------------|---|---|------|-------|
| 07/05/2021 | f | Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6620; All plots except 005, 011, 023, 026 | 97.5 | kg/ha |
| 18/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????                                       | 2    | L/ha  |
| 18/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)                                   | 42   | g/ha  |
| 18/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Lentyma XE (19301)                                    | 1    | L/ha  |
| 18/05/2021 | p | Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)                            | 0.4  | L/ha  |
| 23/06/2021 | a | Harvest: 1st Cut Grass Plots  | -    | -     |
| 30/06/2021 | a | Mowing grass plots using Mower-Unifarm CM166, JD6620  | -    | -     |
| 30/06/2021 | a | Topping using WES Topper 9, JD6620  | -    | -     |
| 30/06/2021 | a | Baling Grass  | -    | -     |
| 09/08/2021 | a | Topping using WES Topper 9, JD6620  | -    | -     |
| 20/08/2021 | a | Harvest using Haldrup C-85 2m cut   | -    | -     |
| 24/08/2021 | a | Harvested discard areas using Haldrup C-85 2m cut   | -    | -     |
| 02/09/2021 | a | Baling using Claas Baler, JD6620  | -    | -     |
| 02/09/2021 | a | Topping using WES Topper 9, JD6620  | -    | -     |
| 22/11/2021 | a | Harvest: Second Cut Grass Plots   | -    | -     |
| 25/11/2021 | a | Topping using WES Topper 9, JD6620  | -    | -     |
| 25/11/2021 | a | Baling  | -    | -     |

## Yields

### WINTER WHEAT

|                | N     | 0    | 50   | 100  | 150  | 200  | 250  | Mean |
|----------------|-------|------|------|------|------|------|------|------|
| ROTATION       |       |      |      |      |      |      |      |      |
| F(Fd)          | 0.61  | 2.39 | 2.73 | 2.33 | 2.51 | 2.45 | 2.17 |      |
| F(Ln,Lc6)      | 0.76  | 2.25 | 2.13 | 1.31 | 1.72 | 2.03 | 1.70 |      |
| St(St)         | 0.63  | 1.76 | 2.17 | 2.33 | 2.13 | 1.79 | 1.80 |      |
| CC(Gm,Lc8)     | 0.67  | 1.99 | 2.83 | 2.63 | 2.68 | 2.52 | 2.22 |      |
| Co(Pt,Lc8)     | 1.71  | 3.14 | 3.16 | 3.09 | 2.93 | 3.34 | 2.89 |      |
| Dg10(Fs)       | 0.87  | 2.51 | 2.29 | 2.08 | 2.44 | 2.69 | 2.15 |      |
| Dg25(Dg)       | 1.24  | 3.33 | 2.91 | 2.96 | 3.33 | 2.59 | 2.73 |      |
| Mean           | 0.93  | 2.48 | 2.60 | 2.39 | 2.53 | 2.49 | 2.24 |      |
| Grain mean DM% | 83.80 |      |      |      |      |      |      |      |

### GRASS/CLOVER

#### DRY MATTER TONNES/HECTARE

\*\*\*\*\* Table of means \*\*\*\*\*

| Year | 1 <sup>st</sup> Cut | 2 <sup>nd</sup> 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  |



## Results of the Classics and other Long-Term Experiments 2021

21/W/RN/12

|      |      |      |      |
|------|------|------|------|
| 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 |
| 2018 | 2.98 | 0.93 | 3.91 |
| 2019 | 2.34 | 0.39 | 2.73 |
| 2020 | 1.01 | -    | -    |
| 2021 | 3.33 | 1.29 | 4.63 |

Cut dry matter t/ha (23 JUNE 2021 AND 22 NOVEMBER 2021).

Note: Herbage samples were taken for chemical analyses and archiving.

## Weather Summaries

## Rothamsted Research

## The Weather : Monthly Summary : 2021

(Departure from the 30 year means (1991 - 2020) in brackets)

|             | Sunshine      |                  | Mean Temperatures °C |                |            |                |            |              |                       | Rain        |                |                 | Drainage     | Wind ***     |            |
|-------------|---------------|------------------|----------------------|----------------|------------|----------------|------------|--------------|-----------------------|-------------|----------------|-----------------|--------------|--------------|------------|
|             | Hours         | (hours)          | Maximum              |                | Minimum    |                | Dew point  | Ground       | In ground under grass |             | Tipping Bucket |                 | 20"          | km/hr        |            |
|             |               |                  | °C                   | (°C)           | °C         | (°C)           | °C         | #            | 30 cm                 | 100 cm      | Total          |                 | Total        |              |            |
|             |               |                  |                      |                |            |                |            |              |                       |             | mm             | (mm )           |              |              | #          |
|             |               |                  |                      |                |            |                | frosts*    |              |                       | days**      |                |                 |              |              |            |
| January     | 52.0          | (-11.91)         | 5.8                  | (-1.20)        | 0.4        | (-1.22)        | 1.9        | 18           | 5.0                   | 7.2         | 113.6          | (+39.48)        | 23           | 88.7         | 8.6        |
| February    | 80.8          | (-5.38)          | 8.1                  | (+0.56)        | 2.2        | (+0.73)        | 3.1        | 14           | 5.2                   | 6.4         | 45.8           | (-11.15)        | 15           | 34.0         | 9.3        |
| March       | 112.0         | (-16.36)         | 10.7                 | (+0.42)        | 3.5        | (+0.62)        | 4.0        | 18           | 6.9                   | 7.2         | 27.6           | (-19.47)        | 13           | 3.1          | 9.8        |
| April       | 215.8         | (+43.79)         | 11.5                 | (-1.84)        | 1.1        | (-3.36)        | 1.2        | 22           | 8.0                   | 8.1         | 1.6            | (-52.40)        | 4            | 0.0          | 7.9        |
| May         | 150.4         | (-52.92)         | 14.7                 | (-1.78)        | 6.2        | (-1.10)        | 7.1        | 10           | 10.7                  | 9.5         | 94.4           | (+41.14)        | 24           | 21.4         | 8.4        |
| June        | 184.7         | (-21.09)         | 20.3                 | (+0.77)        | 11.8       | (+1.62)        | 12.7       | 0            | 15.9                  | 12.9        | 77.6           | (+22.78)        | 11           | 7.8          | 6.3        |
| July        | 195.6         | (-11.18)         | 22.3                 | (+0.29)        | 13.4       | (+1.04)        | 14.4       | 0            | 17.7                  | 15.0        | 51.0           | (-4.46)         | 17           | 5.4          | 5.9        |
| August      | 114.2         | (-75.21)         | 19.9                 | (-1.69)        | 12.3       | (+0.02)        | 13.3       | 0            | 16.9                  | 15.7        | 37.0           | (-34.99)        | 13           | 0.1          | 6.8        |
| September   | 136.2         | (-14.46)         | 20.6                 | (+2.08)        | 11.5       | (+1.32)        | 13.1       | 0            | 16.0                  | 15.5        | 54.1           | (-3.60)         | 11           | 13.5         | 5.9        |
| October     | 95.1          | (-17.97)         | 15.2                 | (+0.94)        | 8.6        | (+1.01)        | 9.7        | 4            | 13.2                  | 14.0        | 104.8          | (+23.51)        | 17           | 55.5         | 7.1        |
| November    | 82.1          | (+9.89)          | 10.0                 | (-0.07)        | 3.9        | (-0.37)        | 5.0        | 13           | 9.8                   | 11.8        | 19.2           | (-62.02)        | 16           | 6.3          | 7.6        |
| December    | 23.5          | (-37.31)         | 8.6                  | (+1.16)        | 3.9        | (+1.94)        | 4.7        | 9            | 7.5                   | 9.3         | 76.2           | (+0.58)         | 24           | 44.2         | 8.7        |
| <b>Year</b> | <b>1442.4</b> | <b>(-210.13)</b> | <b>14.0</b>          | <b>(-0.03)</b> | <b>6.6</b> | <b>(+0.19)</b> | <b>7.5</b> | <b>108.0</b> | <b>11.1</b>           | <b>11.1</b> | <b>702.9</b>   | <b>(-60.59)</b> | <b>188.0</b> | <b>280.1</b> | <b>7.7</b> |

\* 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

**Woburn Experimental Farm**  
**The Weather : Monthly Summary : 2021**  
 (Departure from 30-year means (1991 - 2020) in brackets)

|                  | Sunshine |           | Mean Temperatures |         |         |         |           |          |                       | Rain   |                |          | Wind *** |         |       |
|------------------|----------|-----------|-------------------|---------|---------|---------|-----------|----------|-----------------------|--------|----------------|----------|----------|---------|-------|
|                  | Hours    | (hours)   | Maximum           |         | Minimum |         | Dew Point | Ground   | In ground under grass |        | Tipping bucket |          | days **  | km/hr   |       |
|                  |          |           | °C                | (°C)    | °C      | (°C)    | °C        | #        | 30 cm                 | 100 cm | Total          | mm       |          |         | (mm ) |
|                  |          |           |                   |         |         |         |           | frosts * |                       |        |                |          |          |         |       |
| <b>January</b>   | 44.3     | (-15.63)  | 5.5               | (-1.82) | 0.5     | (-1.04) | 1.4       | 20       | 4.7                   | 7.6    | 111.9          | (+54.46) | 25       | 8.2     |       |
| <b>February</b>  | 81.8     | (-1.07)   | 8.4               | (+0.40) | 1.4     | (-0.02) | 2.4       | 17       | 5.2                   | 6.8    | 42.6           | (-3.75)  | 17       | 8.1     |       |
| <b>March</b>     | 104.7    | (-21.96)  | 10.8              | (+0.13) | 3.1     | (+0.45) | 3.7       | 13       | 6.9                   | 7.3    | 29.5           | (-12.22) | 14       | 9.5     |       |
| <b>April</b>     | 214.9    | (+47.57)  | 11.8              | (-2.07) | -0.5    | (-4.54) | 0.9       | 25       | 8.2                   | 8.3    | 6.9            | (-43.42) | 6        | 6.5     |       |
| <b>May</b>       | 167.6    | (-32.90)  | 15.3              | (-1.74) | 5.6     | (-1.21) | 6.5       | 12       | 11.6                  | 9.8    | 120.6          | (+66.75) | 21       | 8.2     |       |
| <b>June</b>      | 181.4    | (-17.20)  | 20.5              | (+0.51) | 10.9    | (+1.24) | 12.2      | 1        | 17.2                  | 13.5   | 70.9           | (+19.06) | 11       | 6.2     |       |
| <b>July</b>      | 218.7    | (+21.05)  | 23.1              | (+0.71) | 12.6    | (+0.71) | 14.2      | 0        | 19.2                  | 15.8   | 75.8           | (+24.91) | 17       | 5.9     |       |
| <b>August</b>    | 128.7    | (-60.99)  | 20.6              | (-1.54) | 12.1    | (+0.13) | 12.9      | 0        | 18.0                  | 16.8   | 24.2           | (-37.97) | 11       | 7.5     |       |
| <b>September</b> | 152.3    | (+9.02)   | 21.2              | (+2.20) | 10.9    | (+1.21) | 13.0      | 0        | 16.7                  | 16.4   | 48.4           | (-8.37)  | 10       | 6.1     |       |
| <b>October</b>   | 95.3     | (-15.24)  | 15.9              | (+1.19) | 8.8     | (+1.63) | 9.6       | 2        | 13.4                  | 14.8   | 83.4           | (+9.40)  | 17       | missing |       |
| <b>November</b>  | 68.8     | (-0.39)   | 10.5              | (+0.19) | 3.4     | (-0.65) | 5.0       | 8        | 9.4                   | 12.4   | 16.1           | (-50.56) | 18       | missing |       |
| <b>December</b>  | 19.3     | (-35.11)  | 8.8               | (+1.16) | 3.9     | (+2.15) | 4.6       | 4        | 7.2                   | 9.7    | 73.1           | (+13.91) | 25       | 8.8     |       |
| <b>Year</b>      | 1477.9   | (-122.86) | 14.4              | (-0.09) | 6.1     | (-0.02) | 7.2       | 102.0    | 11.5                  | 11.6   | 703.4          | (+32.20) | 192.0    | 7.6     |       |

\* 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