ROTHAMSTED RESEARCH

Results of the Classical and Other Long-term Experiments 2022

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Contents

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_3
FYM	Farmyard manure (from bullocks)
Headland Manganese 500	500 g/L 27.5% w/w $MnCO_3$
Kieserite	$MgSO_4H_2O$; 17.7% Mg and 23.3% S
Maize tops	
Magnesium sulphate	$MgSO_4$ H_2O; 17.7% Mg and 23.3% S
Manganese sulphate	Mn_2 $(SO_4)_3$; 27% Mn and 24% S
Manganese and Dinitrate	14% w/w and 7.2% w/w Nitric Nitrogen
Muriate of potash (MOP)	KCl; 60% K_2O (49.8% K)
Nitram	34.5% N
Nitraprill	34.5% N
Nitrate of soda	$NaNO_3$; 16% N and 27% Na
Nitro-Chalk	Calcium Ammonium Nitrate; 27% N
Silicate of soda	Na_2SiO_3; 37% Na and 23% Si
Sodium sulphate	35% Na
Sulphate of ammonia	$(NH_4)_2SO_4$; 21% N and 24% S
Sulphate of potash (SOP)	K_2SO_4; 50% K_2O (41.5% K) and 18.4% S
Triple superphosphate (TSP)	47% P_2O_5; (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

Trade Name (MAPP or ADJ number)	Function	Active ingredient
Ally Max SX (18768)	h	143 g/kg metsulfuron-methyl and 143 g/kg tribenuron-methyl
Aphox (17401)	i	500 g/kg pirimicarb
Axial Pro (10910)	h	55 g/L pinoxaden; Not listed
Azoxystar (17407)	f	250 g/L azoxystrobin
Bugle (17821)	f	59.4 g/L fluxapyroxad
Buffalo Elite	water conditioner	ammonium sulphate (40 % w/w), water conditioner
Caramba 90 (15524)	f	90 g/L metconazole
Cello (18290)	f	100 g/L prothioconazole, 250 g/L spiroxamine and 100 g/L tebuconazole
Cintac (18222)	h	10 g/kg iodosulfuron-methyl-sodium and 30 g/kg mesosulfuron-methyl
Clayton Prius (18946)	f	267 g/L prochloraz and 133 g/L tebuconazole
Clayton Tebucon 250 EW (17823)	f	250 g/L tebuconazole
Cogent (A0902)	ad	32.67 % w/w alkoxylated alcohols and 1.0 % w/w trisiloxane organosilicone copolymers
Cortez (16280)	f	125 g/L (12.1% w/w) epoxiconazole
Firestarter (18422)	h	100 g/L diflufenican and 400 g/L flufenacet
Hallmark with Zeon Technology (12629)	i	100 g/L lambda-cyhalothrin
Laser (17339)	h	200 g/L cycloxydim
Lentyma XE (19301)	f	66.7 g/L fluxapyroxad and 70 g/L Mefentrifluconazole
Mobius (13395)	f	175 g/L prothioconazole and 150 g/L trifloxystrobin
Moddus (15151)	gr	250 g/L trinexapac-ethyl
Moraine (19608)	h	200 g/L fluroxypyr
Nirvana (14256)	h	16.7 g/L imazamox and 250 g/L pendimethalin
Plexeo 60 (18281)	f, gr	60 g/L metconazole
Pontos (17811)	h	240 g/L flufenacet and 100 g/L picolinafen
Presite SX (18776)	h	67 g/kg metsulfuron-methyl and 333 g/kg thifensulfuron-methyl
Retengo 200 (19551)	f	200 g/L pyraclostrobin
Samurai (16238)	h	360 g/L glyphosate
Simveris (19619)	f	90 g/L metconazole
Solitaire (15792)	h	400 g/L propyzamide
Sprinter	f	Water soluble manganese (Mn) 14.0 w/w and Nitric Nitrogen (N) 7.2% w/w in 10 L of product.
Starane HI-Load HL (16557)	h	333 g/L fluroxypyr
Stefes CCC 720 (17731)	gr	720 g/L chlormequat
Thor (15239)	h	A soluble granule formulation containing 500 g/kg tribenuron methyl, a sulfonylurea.
Velogy Plus (17866)	f	100 g/L benzovindiflupyr
Velomax (A0831)	ad	86.8 % w/w oil (rapeseed fatty acid esters), 5.2 % w/w alkoxylated 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

Cultivators	Manufacturer	Width	Description
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

Drills	Manufacturer	Width	Description
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)

Chemical Applicators	Manufacturer	Width	Description
Cascade	Horstine	12 m	Tractor-mounted pneumatic boom fertiliser spreader
GSA 300	Nordsten	3 m	Tractor-mounted - Fert Applications
Exactomatic	Ransome, Nordsten	3.8 m	Tractor-mounted - Fert Applications
Muck Spreader	International	1.5 m	Trailed - FYM Applications
Sprayer	Tecnoma	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)

Harvesters	Manufacturer	Width	Description
Amazone Groundkeeper Smart Cut - GHS Drive 1500	Amazone	1.5 m cut	Flail mower collector, specially modified by Trials Equipment UK to cut and weigh grass (used from 2021)
Tucano 430	Claas	6 m	Commercial combine used for harvesting discards after plot yields
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)

Other	Manufacturer	Width	Description
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

Tractors	Manufacturer	Weight	Description
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 Ferguson	4.4 t	Hedge Cutting Tractor
MF6150	Massey 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 s: seed

22/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 (175th 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 and the beans.

2022 was the 179th 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 74-21/R/BK/1

Areas harvested [a]:

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

[a] The current Haldrup combine has a 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:

From 2021 crop, some of the treatments were changed. The treatments are now:

PLOT	TREATMENT
01	N4
2.1	FYM N3
2.2	FYM
03	None
05	(P) K Mg
06	N1 (P) K Mg
07	N2 (P) K Mg
08	N3 (P) K Mg
09	N4 (P) K Mg
10	N4
11	N4 (P) Mg
12	N1+3+1 (P) K Mg
13	N4 (P) K
14	N4 (P) K* (Mg*)
15	N5 (P) K Mg
16	N6 (P) K Mg
17	N1+4+1 P K Mg
18	N1+2+1 P K Mg
19	N1+1+1 K Mg
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 34.5% 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

½ N1, ½ N2, ½ N3, ½ N4, ½ N5, ½ N6: 24, 48, 72, 96, 120, 144 kg N as 34.5%N; applied at half the rate for wheat in a single application in mid-April. Oats received no N or FYM from 1996 to 2017.

Winter Beans (Be) NO N APPLIED.

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

P: 35 kg P as triple superphosphate

(P): none since 2001 or 2020 (under review)

K: 90 kg K as potassium sulphate

K*: 90 kg K as potassium chloride

Mg: 12 kg Mg as kieserite

(Mg*): none since 2001 (under review)

FYM: Farmyard manure at 35 t (fresh weight); NO FYM APPLIED TO W. BEANS

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	21	D	D N2	D N2	FYM N3 (1)
2.2 D	22	D	D	D	FYM
03 0	03	None	None	None	None
05 F	05	P K Na Mg	P K (Na) Mg	PK 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 (2)
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] (A)+	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] (A)+	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[PK Mg] on both plots 17 and 18. These treatments shown incorrectly in 1999-2002 Yield books.

Winter oats: N and FYM 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:	30 kg Mg annually to Plot 14 (applied at 26 kg 1990 to 2000), 35 kg Mg every third year to other plots since 1974 (applied at 30 kg in 1991, 1994, 1997 and 2000 and at 15 kg on half rate treatments). All as kieserite since 1974, previously as sulphate of magnesia annually.
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 was grown continuously on the experiment, with bare fallowing (1 year in 5) from the 1920s. 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
1994	W	W	W	F	W	W	W	P	F	W
1995	W	W	W	W	W	F	W	W	P	W

Section Year	1	9	0*	8+	6**	5	3	7	4	2
1996	W	W	W	W	W	P	O	W	W	W
1997	W	W	W	W	W	W	M	W	W	O
1998	W	W	W	W	W	W	W	O	W	M
1999	W	W	W	W	W	W	W	M	O	W
2000	W	W	W	W	W	O	W	W	M	W
2001†	W	W	W	F	W	M	O	W	W	W
2002	W	W	W	W	W	W	M	W	W	O
2003	W	W	F	W	W	W	W	O	W	M
2004	W	W	F	W	W	W	W	M	O	W
2005	W	W	W	W	W	O	W	W	M	W
2006	W	W	W	W	W	M	O	W	W	W
2007	W	W	W	W	W	W	M	W	W	O
2008	W	W	W	F	W	W	W	O	W	M
2009	W	W	W	W	W	W	W	M	O	W
2010	W	W	W	W	W	O	W	W	M	W
2011	W	W	W	W	W	M	O	W	W	W
2012	W	W	W	W	W	W	M	W	W	O
2013	W	W	W	W	W	W	W	O	W	M
2014	W	W	W	W	W	W	W	M	O	W
2015++	W	W	W	F	W	O	W	W	M	W
2016	W	W	W	F	W	M	O	W	W	W
2017	W	W	W	W	W	W	M	W	W	O
2018	W	W	W	W	W	W	W	Be	O	W
2019	W	W	W	W	W	O	W	W	W	Be
2020++,†	W	W	W	W	W	W	O	W	Be	W
2021	W	W	W	W	W	Be	W	O	W	W
2022	W	W	W	F	W	W	Be	W	W	O

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/ha 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 crop onwards (under review).

22/R/BK/1 Experimental Diary:

Date		Application	Rate	Unit
All Sections				
09/09/2021	f	Applied: Triple Superphosphate (TSP) using Cascade Spreader, JD6830; Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9; Strips 17, 18 only	171	kg/ha
09/09/2021	f	Applied: Muriate of Potash (MOP) using Cascade Spreader, JD6830; Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9; Strip 14 only	181	kg/ha
15/09/2021	f	Applied: Farmyard Manure (FYM) using Muck spreader - international, Tym T503; Section 0, 1, 2, 4, 5, 6, 7, 8, 9; Strips 2.1, 2.2 only	35	t/ha
16/09/2021	a	Plough 20 cm using KV Five Furrow Plough, JD6145R Premium; Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9; soil thrown N	-	-
21/09/2021	a	Cultivate/level 10 cm using Philip Watkins Press, JD6830; Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	-	-
23/09/2021	a	Rolling using 6m Flexicoil Cambridge Roll, JD6230; Section 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	-	-
23/10/2021	p	Sprayed: Solitaire (15792) using Knight 24m Sprayer, NH T6030;	2.1	L/ha
23/10/2021	p	Sprayed: Nirvana (14256) using Knight 24m Sprayer, NH T6030;	4	L/ha
23/10/2021	p	Sprayed: Velomax (A0831) using Knight 24m Sprayer, NH T6030;	0.4	L/ha
20/04/2022	f	Applied: SOP fertiliser using Cascade Spreader, JD6830; Strips 5, 6, 7, 8, 9, 12, 13, 15, 16, 17, 18, 19, 20; all Sections	217	kg/ha
20/04/2022	f	Applied: Kieserite fertiliser using Cascade Spreader, JD6830; Strips 5, 6, 7, 8, 9, 11, 12, 15, 16, 17, 18, 19, 20; all Sections	80	kg/ha
07/06/2022	p	Sprayed: Samurai (16238) using Micron shrouded plot end sprayer, JD5620; Section 0, 1, 2, 3, 4, 5, 6, 7, 9	3	L/ha
07/06/2022	p	Sprayed: Buffalo Elite using Micron shrouded plot end sprayer, JD5620; Section 0, 1, 2, 3, 4, 5, 6, 7, 9	1	L/ha
13/07/2022		Wild oat count	-	-
05/08/2022	a	Baling using McHale Fusion 2 Baler, JD6145R Premium; Sections 1, 2, 3, 4, 5, 6, 7, 9	-	-
W Wheat				
22/09/2021	s	Drilling: Winter Wheat (KWS Zyatt) dr. Beret Gold (16430) using Accord Combination Drill No. 4, JD6830	350	seeds/m2
28/09/2021	p	Sprayed: Pontos (17811) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 8, 9	1	L/ha
28/09/2021	p	Sprayed: Firestarter (18422) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 8, 9	0.3	L/ha
28/09/2021	p	Sprayed: Velomax (A0831) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 8, 9	0.4	L/ha
23/10/2021	p	Sprayed: Hallmark with Zeon Technology (12629) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 8, 9	50	mL/ha
05/11/2021	p	Sprayed: Thor (15239) using Knight 24m Sprayer, NH T6030; Section 5	10	g/ha
21/03/2022	f	Applied: Nitram using Cascade Spreader, JD6830; Strips 12, 17, 18, 19 ; Sections 0, 1, 4, 5, 6, 7, 9	139	kg/ha
28/03/2022	p	Sprayed: Stefes CCC 720 (17731) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 9	1	L/ha

28/03/2022	p	Sprayed: Moddus (15151) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 9	0.1	L/ha
28/03/2022	p	Sprayed: Clayton Prius (18946) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 7, 9	1	L/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 06, 19; Sections 0, 1, 4, 5, 6, 7, 9	139	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 07, 18; Sections 0, 1, 4, 5, 6, 7, 9	278	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 2.1, 08, 12; Sections 0, 1, 4, 5, 6, 7, 9	417	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 01, 09, 10, 11, 13, 14, 17, 20; Sections 0, 1, 4, 5, 6, 7, 9	556	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 15; Sections 0, 1, 4, 5, 6, 7, 9	696	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 16; Sections 0, 1, 4, 5, 6, 7, 9	835	kg/ha
03/05/2022	p	Sprayed: Presite SX (18776) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 6, 7, 9	60	g/ha
03/05/2022	p	Sprayed: Bugle (17821) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 7, 9	0.8	L/ha
03/05/2022	p	Sprayed: Cello (18290) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 7, 9	0.7	L/ha
16/05/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 12, 17, 18, 19; Sections 0, 1, 4, 5, 6, 7, 9	139	kg/ha
17/05/2022	p	Sprayed: Lentyma XE (19301) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 7, 9	1	L/ha
07/06/2022	p	Sprayed: Cello (18290) using Knight 24m Sprayer, NH T6030; Section 0, 1, 4, 5, 7, 9	0.8	L/ha
01/07/2022	a	Power harrow using Kuhn Powerharrow 3m, JD6230; Section 8 (fallow, no fungicides)	-	-
27/07/2022	a	Harvest (Combine)using Haldrup C-85 2m cut; Sections 0, 1, 4, 5, 6, 7, 9	-	-
02/08/2022	a	Straw Weights - Harvest (Trailer and Bale Weights) using Amazone Grass Harvester - Flail Mower Collector, JD5070; Sections 1, 5, 7	-	-
04/08/2022	a	Power harrow using Kuhn Powerharrow 3m, JD6230; Section 8 (fallow, no fungicides)	-	-
W Oats				
22/09/2021	s	Drilling: Winter Oats (Mascani) dr. Redigo Pro (15145) using Accord Combination Drill No. 4, JD6830	350	seeds/m2
26/10/2021	p	Sprayed: Hallmark with Zeon Technology (12629) using Knight 24m Sprayer, NH T6030	50	mL/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 06	70	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 07	139	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 2.1, 08, 19	209	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 01, 09, 10, 11, 13, 14, 18	278	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 12, 15	348	kg/ha
28/04/2022	f	Applied: Nitram using JD6830, Cascade Spreader; Strip 16, 17	417	kg/ha
12/05/2022	p	Sprayed: Presite SX (18776) using Knight 24m Sprayer, NH T6030	60	g/ha
12/05/2022	p	Sprayed: Cello (18290) using Knight 24m Sprayer, NH T6030	0.7	L/ha

12/05/2022	p	Sprayed: Stefes CCC 720 (17731) using Knight 24m Sprayer, NH T6030	2	L/ha
12/05/2022	p	Sprayed: Hurler (17715) using Knight 24m Sprayer, NH T6030	0.6	L/ha
07/06/2022	p	Sprayed: Cello (18290) using Tecnoma 12m Sprayer, Tym T503	0.8	L/ha
13/07/2022		Hand weeding on plot 092	-	-
23/07/2022	a	Harvest (Combine) using Haldrup C-85 2m cut	-	-
23/07/2022	a	Straw Weights - Harvest (Trailer and Bale Weights) using Amazone Grass Harvester - Flail Mower Collector, JD5070	-	-
W Beans				
14/10/2021	s	Drilling: Winter Beans (Tundra) using Accord Combination Drill No. 4, JD6830	25	seeds/m2
05/05/2022	p	Sprayed: Tacanza Era (19217) using Knight 24m Sprayer, NH T6030	0.5	L/ha
01/06/2022	p	Sprayed: Aphox (17401) using Knight 24m Sprayer, NH T6030	0.28	kg/ha
01/06/2022	p	Sprayed: Clayton Tebucon 250 EW (17823) using Knight 24m Sprayer, NH T6030	0.5	L/ha
01/06/2022	p	Sprayed: Azoxystar (17407) using Knight 24m Sprayer, NH T6030	0.5	L/ha
29/07/2022	a	Harvest (Combine) using Haldrup C-85 2m cut	-	-
02/08/2022	a	Straw Weights - Harvest (Trailer and Bale Weights) using Amazone Grass Harvester - Flail Mower Collector, JD5070	-	-
WILDERNESS				
17/12/2021	a	Topped 'Stubbed' area using Kilworth Topper; Iseki ISTH4335	-	-
28/04/2022	a	Mowed 'Mown' area using Kilworth Topper; Iseki ISTH4335	-	-

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

YIELDS

WINTER WHEAT

Grain Tonnes/Hectare (85% DM)

Tables of means

SECTION PLOT	5/W1	7/W1	4/W2	6/W45	0/W18	1/W56	9/W64	Mean
01(FYM)N4	10.91	8.64	10.07	5.11	-	-	-	**8.68**
2.1FYMN3	12.16	11.20	12.22	6.95	8.35	9.18	8.45	**9.79**
2.2FYM	10.10	7.60	8.32	7.15	6.44	7.44	7.15	**7.74**
03Nil	3.53	0.79	1.51	1.14	1.05	1.02	0.63	**1.38**
05(P)KMg	4.67	2.12	2.09	1.10	1.71	1.58	1.48	**2.11**
06N1(P)KMg	8.02	4.49	5.39	3.06	3.30	3.27	3.43	**4.42**
07N2(P)KMg	9.26	5.86	7.43	4.10	4.11	5.31	4.41	**5.78**
08N3(P)KMg	10.13	6.67	7.37	4.46	4.61	5.71	5.14	**6.30**
09N4(P)KMg	10.36	6.12	8.04	4.38	6.38	5.50	5.99	**6.68**
10N4	7.24	3.31	2.25	1.21	2.06	1.61	1.66	**2.76**
11N4(P)Mg	8.28	5.44	7.35	3.58	6.04	6.31	6.93	**6.27**
12N1+3+1(P)KMg	11.26	8.98	8.51	4.62	7.60	7.51	8.51	**8.14**
13N4(P)K	10.53	6.50	6.74	4.68	5.65	5.61	6.72	**6.63**
14N4(P)K-(Mg-)	8.99	6.48	6.12	5.64	5.04	3.95	6.88	**6.16**
15N5(P)KMg	11.08	7.40	10.72	4.92	7.39	7.20	7.73	**8.06**
16N6(P)KMg	10.81	8.88	9.74	5.21	6.78	8.25	8.94	**8.37**
17N1+4+1PKMg	11.32	10.36	11.44	5.05	8.82	6.78	10.05	**9.12**
18N1+2+1PKMg	11.68	9.72	10.52	5.74	7.74	6.40	8.86	**8.67**
19N1+1+1KMg	9.44	8.85	6.98	4.99	6.25	5.33	8.25	**7.16**
20N4KMg	-	-	-	-	2.18	0.88	-	**1.53**
Mean	**9.46**	**6.81**	**7.52**	**4.37**	**5.34**	**5.20**	**6.18**	**6.41**

Grain Mean DM% 88.6

Notes

Section 8 was in Bare Fallow for 2022 (**NO YIELDS**)

Results of the Classicals and other Long-Term Experiments 2022 22/R/BK/1

Straw Tonnes/Hectare

Tables of means

SECTION PLOT	5/W1	7/W1	4/W2	6/W45	0/W18	1/W56	9/W64	Mean
01(FYM)N4	3.82	3.07	-	-	-	-	-	**3.44**
2.1FYMN3	5.77	4.54	-	-	-	3.64	-	**4.65**
2.2FYM	4.70	4.90	-	-	-	3.34	-	**4.31**
03Nil	0.52	1.12	-	-	-	0.23	-	**0.63**
05(P)KMg	2.49	1.51	-	-	-	0.97	-	**1.66**
06N1(P)KMg	3.07	1.03	-	-	-	2.05	-	**2.05**
07N2(P)KMg	1.84	2.53	-	-	-	1.44	-	**1.94**
08N3(P)KMg	2.79	1.31	-	-	-	0.81	-	**1.64**
09N4(P)KMg	2.00	2.63	-	-	-	0.67	-	**1.76**
10N4	2.15	0.46	-	-	-	1.04	-	**1.22**
11N4(P)Mg	1.55	2.32	-	-	-	1.49	-	**1.78**
12N1+3+1(P)KMg	3.18	2.85	-	-	-	2.75	-	**2.93**
13N4(P)K	3.16	1.92	-	-	-	1.74	-	**2.27**
14N4(P)K-(Mg-)	3.45	0.97	-	-	-	2.39	-	**2.27**
15N5(P)KMg	3.28	2.92	-	-	-	2.44	-	**2.88**
16N6(P)KMg	3.55	1.93	-	-	-	2.58	-	**2.68**
17N1+4+1PKMg	4.29	3.92	-	-	-	2.95	-	**3.72**
18N1+2+1PKMg	4.59	3.02	-	-	-	2.31	-	**3.30**
19N1+1+1KMg	3.46	2.72	-	-	-	2.82	-	**3.00**
20N4KMg	-	-	-	-	-	0.35	-	**0.35**
Mean	**3.14**	**2.4**	**-**	**-**	**-**	**1.89**	**-**	**2.48**

Straw Mean DM% 89.6

Notes

Section 8 was in Bare Fallow for 2022 (**NO YIELDS**)

WINTER OATS

Tonnes/Hectare (85% DM)

Table of means

Plot	Treatment	Grain	Straw
012	01 (FYM)1/2N4	8.21	1.64
212	2.1 FYM1/2N3	9.26	3.54
222	2.2 FYM	6.97	2.08
032	03 Nil	1.32	0.02
052	05 (P)KMg	1.44	0.94
062	06 1/2N1(P)KMg	4.38	0.11
072	07 1/2N2(P)KMg	6.31	1.26
082	08 1/2N3(P)KMg	8.14	2.01
092	09 1/2N4(P)KMg	8.19	0.84
102	10 1/2N4	4.03	1.15
112	11 1/2N4(P*)Mg	9.88	3.06
122	12 1/2N5(P)KMg	8.78	1.88
132	13 1/2N4(P*)K	8.66	3.17
142	14 1/2N4(P*)K*(Mg*)	4.64	1.39
152	15 1/2N5(P)KMg	9.09	3.09
162	16 1/2N6(P)KMg	9.90	2.76
172	17 1/2N6PKMg	9.93	1.96
182	18 1/2N4PKMg	8.20	1.54
192	19 1/2N3KMg	6.58	1.48
	Mean	**7.05**	**1.79**
Mean DM%		87.5	73.9
Plot Area Harvested (ha)	0.00463		

WINTER BEANS

TONNES/HECTARE (85% DM)

Tables of means

Plot	Treatment	Grain	Straw
013	01 (FYM) [N4]	5.74	1.60
213	2.1 [FYMN3]	6.15	1.93
223	2.2 [FYM]	6.36	3.57
033	03 Nil	1.41	0.35
053	05 (P)KMg	4.58	1.16
063	06 [N1](P)KMg	5.38	0.74
073	07 [N2](P)KMg	5.38	2.19
083	08 [N3](P)KMg	5.62	2.27
093	09 [N4](P)KMg	5.34	0.58
103	10 [N4]	1.22	1.15
113	11 [N4](P*)Mg	0.24	0.22
123	12 [N1+3+1](P)KMg	5.20	2.57
133	13 [N4](P*)K	5.52	1.25
143	14 [N4](P*)K*(Mg*)	4.61	0.89
153	15 [N5](P)KMg	5.41	1.64
163	16 [N6](P)KMg	5.64	1.93
173	17 [N1+4+1]PKMg	5.70	1.30
183	18 [N1+2+1]PKMg	5.64	2.62
193	19 [N1+1+1]KMg	4.58	0.24
	MEAN	**4.72**	**1.48**
Mean DM%		89.80	89.70
PLOT AREA HARVESTED (ha)		0.00463	

22/R/HB/2 HOOSFIELD SPRING BARLEY

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 171st year, spring barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and Yield Books for 74-21/R/HB/2.

Treatments:

Whole plots

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

[a] Plots 63 and 73 started in 2001

A: 48 kg N as sulphate of ammonia
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

N Nitrogen fertilizer (kg N), as "Nitro-Chalk" (calcium ammonium nitrate), since 1968 (cumulative N applications until 1973, on a cyclic system since 1974): 0, 48, 96, 144 kg N/ha

Silicate Test plots

Treatments:

Whole plots

MANURE	Plot	Fertilizers: Additional treatment 1852-1979	Changes since 1980	Treatments since 2003
N----	131	-	-	N3
NP---	231	P	-	N3 (P)
N-K--	331	K(Na)Mg	-	N3 K(Mg)
NPK--	431	PK(Na)Mg	-	N3 (P)K(Mg)
N---S	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—S-	134	Si	no Si	N3 (Si)
NP-S-	234	P Si	no Si	N3 (P)(Si)
N-KS-	334	K(Na)MgSi	no Si	N3 K(Mg)(Si)
NPKS-	434	PK(Na)MgSi	no Si	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" (calcium ammonium nitrate) (cumulative applications until 1973, on a cyclic system from 1974).
N3: Basal N, 144 kg N as "Nitro-chalk" (calcium ammonium nitrate) 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

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

N3: Basal N, 144 kg as "Nitro-chalk" (calcium ammonium nitrate)
K: 90 kg K as sulphate of potash
K*: 450 kg K as sulphate of potash 2003-2004; 90 kg K since

Experimental Diary

Date		Application	Rate	Units
06/10/2021	f	Applied using Cascade Spreader, JD6830; Sulphate of Potash (SOP) using Cascade Spreader, JD6830; Plots 141-144, 241-244, 311-314, 321-324, 331-334, 341-344, 411-414, 421-424, 431-434, 441-344, 551,552,561,562, 571, 572, 581, 582, 631-634	217	kg/ha
06/10/2021	f	Applied; Triple Superphosphate (TSP); Plots 631-634	215	kg/ha
06/10/2021	f	Applied; Kieserite; Plots 631-634	233	kg/ha
08/10/2021	f	Applied; Farmyard Manure (FYM); Plots 721-724, 731-734	35	t/ha
02/11/2021	p	Sprayed using Knight 24m Sprayer, NH T6030; Samurai (16238)	2	L/ha
02/11/2021	p	Sprayed using Knight 24m Sprayer, NH T6030; Buffalo Elite	1	L/ha
03/11/2021	f	Applied using Cascade Spreader, JD6830; Silicate of Soda using Cascade Spreader, JD6830; 132, 133, 232, 233, 332, 333, 432, 433	450	kg/ha
09/11/2021	a	Topped using McConnel SR620 Batwing Topper, JD6230	-	-
22/11/2021	a	Plough 20 cm using KV Five Furrow Plough, JD6145R Premium; direction E; soil thrown S	-	-
23/03/2022	a	Cultivate/level using Cousins Spring Tines, JD6830	-	-
23/03/2023	s	Drilled using Accord Combination Drill No. 4, JD6830; Spring Barley (Diablo), trt Rancona i-Mix (19847)	-	-
24/03/2022	a	Rolled using 6m Flexicoil Cambridge Roll, JD6230	-	-
29/04/2022	p	Sprayed using Micron shrouded plot end sprayer, JD5620; Samurai (16238)	3	lt/ha
29/04/2022	p	Sprayed using Micron shrouded plot end sprayer, JD5620; Buffalo Elite	1	lt/ha
09/05/2022	a	Power harrow cutting paths Kilworth Power Harrow 1.3 m Iseki ISTH4335	-	-
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 112, 123, 212, 223, 314, 324, 414, 422, 613, 624, 634, 711, 722, 731	177	kg/ha
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 114, 122, 213, 224, 312, 323, 411, 424, 612, 622, 632, 714, 723, 733	355	kg/ha
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 111, 121, 214, 221, 311, 322, 413, 423, 614, 623, 633, 713, 724, 734	532	kg/ha
09/05/2022	f	Applied Nitram (34.5%) using Cascade Spreader, JD6830; Old Strip 5 (551, 552, 561,562, 571, 572, 581, 582), Series C (141 to 144, 241 to 244, 341 to 344, 441 to 444) and Series AA (131 to 134, 231 to 234, 331 to 334, 431 to 434)	417	kg/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Presite X (18776)	75	g/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Hallmark with Zeon Technology (12629)	50	mL/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Cello (18290)	0.6	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Bugle (17821)	0.7	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Axial Pro (10910)	0.6	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Moraine (19608)	0.6	L/ha
19/06/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Mobius (13395)	0.4	L/ha
09/08/2022	a	Harvest (Combine) using Claas Tucano 430; Surrounds	-	-
11/08/2022	a	Harvest (Combine) using Claas Tucano 430; Odds and Ends	-	-
11/08/2022	a	Harvest (Combine using Haldrup C-85 2m cut	-	-

Yields

Main Plots

Grain Yield, tonnes/hectare

Table of means

N	0	48	96	144	Mean
MANURE					
---	0.68	0.88	0.93	1.13	**0.91**
-P-	2.15	2.90	3.08	3.20	**2.83**
--K	1.59	2.09	2.18	2.14	**2.00**
-PK	1.65	3.12	3.69	4.59	**3.26**
A--	1.00	0.91	0.74	0.71	**0.84**
AP-	2.29	3.40	3.75	3.45	**3.22**
A-K	1.32	1.41	1.30	1.57	**1.40**
APK	1.73	2.90	3.87	4.74	**3.31**
FYM1852onwards	7.05	8.06	8.05	7.89	**7.76**
FYM1852-1871	0.69	*0.81	4.63	2.39	**2.13**
(A)	1.46	2.87	2.49	2.47	**2.32**
-	1.40	1.87	1.69	1.84	**1.70**
FYM2001onwards	6.12	7.22	7.07	7.44	**6.96**
P2KMg	2.66	3.16	4.49	5.05	**3.84**
Mean	**2.27**	**2.97**	**3.42**	**3.47**	**3.04**
Grain mean DM%	92.4				

Straw Yield, tonnes/hectare

Table of means

N	0	48	96	144	Mean
MANURE					
---	2.88	2.70	2.55	2.75	**2.72**
-P-	0.79	2.79	0.82	3.03	**1.86**
--K	0.46	3.19	2.92	0.87	**1.86**
-PK	3.06	3.80	1.70	4.42	**3.25**
A--	0.78	2.82	0.99	**	**1.53**
AP-	2.85	0.98	1.92	0.75	**1.62**
A-K	0.42	0.98	0.96	0.67	**0.76**
APK	0.53	1.47	1.84	2.16	**1.50**
FYM1852onwards	5.03	3.54	3.01	3.96	**3.88**
FYM1852-1871	2.47	*2.62	2.21	1.28	**2.14**
(A)	0.45	1.43	1.04	1.38	**1.07**
-	3.07	2.28	0.73	4.41	**2.62**
FYM2001onwards	2.54	2.65	2.16	3.60	**2.74**
P2KMg	**	3.97	1.87	3.17	**3.00**
Mean	**1.95**	**2.51**	**1.76**	**2.50**	**2.18**

Straw mean DM%	89.1	
Plot Area (ha)	0.00244	0.00183

Notes

* On 6 May 2022 there was a leak in the irrigation main the previous week, and the southeast corner of Hoosfield had a lot of water discharged. Plot 711 (FYM1852-1871;N1) was observed to have received a lot of water.

** There were incorrect straw dry matters for Plot 121 (A--;N3) and Plot 631 (P2KMg;N0), and so there are corresponding missing straw yields.

PHOSPHATE PLOTS

Grain Yield, tonnes/hectare

Tables of means

PLOTS	
142	2.92
143	2.87
144	2.36
242	5.22
243	5.10
244	4.66
341	3.28
342	3.77
343	4.15
344	4.55
441	4.26
442	5.11
443	4.74
444	5.07
551	5.26
552	4.89
561	4.77
562	4.51
571	3.53
572	4.10
581	0.89
582	0.90
Mean	**3.95**

Grain Mean DM%	89.8
Plot area Harvested (ha)	0.00244

SILICATE PLOTS

Grain Yield, tonnes/hectare

Tables of means

PK	N3--	N3P-	N3-K	N3PK	Mean
Silicate					
(-)-	1.23	3.64	1.47	4.85	2.80
(Si)-	1.60	4.25	2.88	5.38	3.53
(-)Si	2.32	3.74	2.82	4.88	3.44
(Si)Si	2.11	3.78	3.20	5.21	3.58
Mean	**1.82**	**3.85**	**2.59**	**5.08**	**3.34**
Grain Mean DM%	89.3				
Plot area harvested (ha)	0.00244				

22/R/WF/3 WHEAT AND FALLOW (Hoosfield)

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

Whole plot dimensions: 9 m × 221 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 166th year. For previous years see 'Details' 1967, 1973 and Yield Books for 74-21/R/WF/3.

Experimental Diary

Date		Application	Rate	Units
09/09/2021	a	Plough 20 cm using KV Five Furrow Plough, JD6145R Premium		
16/09/2021	s	Drilled using Accord Combination Drill No. 4, JD6830: KWS Zyatt	350	seeds/m2
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Pontos (17811)	1	L/ha
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Firestarter (18422)	0.3	L/ha
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Velomax (A0831)	0.4	L/ha
11/10/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology (12629)	50	mL/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Stefes CCC 720 (17731)	1	L/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Moddus (15151)	0.1	L/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Clayton Prius (18946)	1	L/ha
25/04/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Bugle (17821)	0.8	L/ha
25/04/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Cello (18290)	0.7	L/ha
27/04/2022	f	Applied Nitram (34.5%) using Cascade Spreader, JD6830	145	kg/ha
07/06/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Cello (18290)	0.8	L/ha
26/07/2022	a	Harvest using Claas Tucano 430 (Combine)		
31/08/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238)	3	L/ha
31/08/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite	1	L/ha

22/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 167th year, winter wheat.

For previous years see 'Details' 1977, 1973 and Yield Books for 74-21/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, 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:

	1986-1992	2000-2008	2009-2015	2016-
O	None	None	None	None
P (P1)	44 kg P	20 kg P	15 kg P	None
P (P2)	87 kg P	20 kg P	15 kg P	15 kg P
P (P3)	131 kg P	20 kg P	15 kg P	15 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_2O (62.2 kg K)
K2	150 kg K_2O (124.5 kg K)

Whole plots

Nitrogen: 50 kg N as ammonium sulphate (21% N, 24% S; to supply sufficient S) during first two weeks in March, 200 kg N as ammonium nitrate (34.5% N) at GS31/mid-April (whichever comes first) and 50 kg N as ammonium nitrate (34.5% N) at GS37 (not later than mid-May).

Experimental Diary

Date		Application	Rate	Unit
08/09/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP); Plots 021-024, 041-044, 061-064, 081-084, 101-104, 011-012, 031-032, 051-052, 071-072, 091-092.	75	kg/ha
09/09/2021	f	Applied using Cascade Spreader, JD6830: Muriate of Potash (MOP); Plots 023, 043, 063, 083, 103	125	kg/ha
09/09/2021	f	Applied using Cascade Spreader, JD6830: Muriate of Potash (MOP); Plots 011-014, 031-034, 051-054, 071-074, 091-094, 024, 044, 064, 084, 104	250	kg/ha
09/09/2021	a	Ploughed using KV Five Furrow Plough, JD6145R Premium	-	-
16/09/2021	a	Ploughed using KV Five Furrow Plough, JD6145R Premium	-	-
16/09/2021	s	Drilled using Accord Combination Drill No. 4, JD6830: KWS Zyatt	350	seeds/m2
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Pontos (17811)	1	L/ha
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Firestarter (18422)	0.3	L/ha
18/09/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Velomax (A0831)	0.4	L/ha
11/10/2021	p	Sprayed using Knight 24m Sprayer, NH T6030: Hallmark with Zeon Technology (12629)	50	mL/ha
22/03/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Ammonia; All Plots	238	kg/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Stefes CCC 720 (17731)	1	L/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Moddus (15151)	0.1	L/ha
29/03/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Clayton Prius (18946)	1	L/ha
20/04/2022	f	Applied using Cascade Spreader, JD6830: Kieserite; All Plots	80	kg/ha
25/04/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Bugle (17821)	0.8	L/ha
25/04/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Cello (18290)	0.7	L/ha
27/04/2022	f	Applied using Cascade Spreader, JD6830: Nitram	580	kg/ha
16/05/2022	f	Applied using Cascade Spreader, JD6830: Nitram	145	kg/ha
07/06/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Cello (18290)	0.8	L/ha
28/07/2022	a	Harvest plots using Haldrup C-85 2m cut	-	-
29/07/2022	a	Topped using Kilworth Topper, Iseki ISTH4335	-	-
30/07/2022	a	Bailed discards using McHale Fusion 2 Baler, JD6145R Premium	-	-
04/08/2022	a	Bailed using McHale Fusion 2 Baler, JD6145R Premium	-	-
31/08/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238)	3	L/ha
31/08/2022	p	Sprayed using Knight 24m Sprayer, NH T6030: Buffalo Elite (16238)	1	L/ha

Yields

P TEST

Grain Yield, tonnes/hectare

Tables of means

P_RES current OLD_RES	O P0	(P1) P0	(P2) P	(P3) P	Mean
O	0.97	2.28	5.77	7.37	4.10
D	1.19	5.06	9.41	9.34	6.25
N	0.45	2.09	6.60	7.78	4.23
P	1.12	4.57	9.44	9.23	6.09
NPKNAMG	0.80	4.49	9.10	9.30	5.92
Mean	**0.91**	**3.70**	**8.06**	**8.60**	**5.32**
Grain mean DM%	88.9				

Straw Yield, tonnes/hectare

Tables of means

P_RES current OLD_RES	O P0	(P1) P0	(P2) P	(P3) P	Mean
O	0.44	0.56	3.27	4.51	2.20
D	0.36	2.75	4.03	3.54	2.67
N	0.04	1.10	1.59	3.39	1.53
P	1.61	1.80	3.39	3.57	2.59
NPKNAMG	1.18	2.68	3.14	3.44	2.61
Mean	**0.72**	**1.78**	**3.08**	**3.69**	**2.32**
Straw mean DM%	85.9				

Plot area harvested 0.00512 ha.

K TEST

Grain Yield, tonnes/hectare

Tables of means

K_Test OLD_RES	K0	K1	K2	Mean
O	7.22	9.16	9.16	8.19
D	7.83	10.65	9.77	9.02
N*	7.79	8.19	7.77	7.88
PK	9.18	9.59	9.81	9.44
N*PK	8.28	9.17	9.61	8.83
Mean	**8.06**	**9.35**	**9.23**	**8.67**
Grain mean DM%	89.3			

Straw Yield, tonnes/hectare

Tables of means

K_Test OLD_RES	K0	K1	K2	Mean
O	3.20	4.81	3.53	3.69
D	2.82	4.40	3.68	3.43
N*	3.27	3.28	2.61	3.11
PK	4.27	3.72	5.49	4.44
N*PK	4.10	3.50	4.76	4.12
Mean	**3.53**	**3.94**	**4.01**	**3.75**
Straw mean DM%	86.4			

Plot area harvested 0.00512 ha

22/R/PG/5 PARK GRASS

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

The 167th year, hay.
For previous years see 'Details' 1977 and 1973 and Yield Books for 74-21/R/PG/5.

Treatments: Combinations of:

Whole plots

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

N1	Plot 1	N1
K	Plot 2/1	K since 1996 (as 2/2 before)
None (FYM)	Plot 2/2	None (FYM until 1863)
None	Plot 3	None
P	Plot 4/1	P
N2P	Plot 4/2	N2 P
N1PKNaMg	Plot 6	N1 P K Na Mg
(P)KNaMg	Plot 7/1	K Na Mg (+P until 2012)
PKNaMg	Plot 7/2	P K Na Mg
PNaMg	Plot 8	P Na Mg
PKNaMg(N2)	Plot 9/1	P K Na Mg (+ N2 until 1989)
N2PKNaMg	Plot 9/2	N2 P K Na Mg
N2PNaMg	Plot 10	N2 P Na Mg
N3PKNaMg	Plot 11/1	N3 P K Na Mg
N3PKNaMgSi	Plot 11/2	N3 P K Na Mg Si
None	Plot 12	None
(FYM/F)	Plot 13/1	None (FYM/F until 1993/1995)
FYM/PM	Plot 13/2	FYM/PM (FYM/F until 1999)
PKNaMg (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*P*K*	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 (Epsom Salts)
Si:	Silicate of soda at 450 kg
FYM:	Farmyard manure at 35 t (fresh weight) every fourth year; last applied 2021
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); last applied 2019

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 $CaCO_3$ was applied every four years to the southern half. In 1965, most plots were divided into four: sub-plots "a" and "b" on the previously limed halves and sub-plots "c" and "d" on the unlimed halves. Sub-plots "a", "b" and "c" now receive different amounts of chalk, when necessary, to achieve and/or maintain soil (0-23 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 2021; the tenth 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
23/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Sulphate of Potash (SOP): All K Plots except 20	542	kg/ha
23/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Sulphate of Potash (SOP): Plot 20 only	108	kg/ha
23/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: sulphate of magnesia (Epsom Salts)	111	kg/ha
23/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Sulphate of Soda	43	kg/ha
23/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Silicate of Soda	450	kg/ha
25/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Triple Super Phosphate (TSP): All P plots except 20	83	kg/ha
25/11/2021	f	Applied using Ransomes Nordsten Lift o-matic Fertiliser Box, JD5070: Triple Super Phosphate (TSP): Plot 20 only	73	kg/ha
23/05/2022	f	Applied using Nordsten 3m fertiliser box, JD5070: Sulphate of Ammonia: Plots 1, 6 (a + b only)	229	kg/ha
23/05/2022	f	Applied using Nordsten 3m fertiliser box, JD5070: Sulphate of Ammonia: Plots 4/2, 9/2, 10, 18	457	kg/ha
23/05/2022	f	Applied using Nordsten 3m fertiliser box, JD5070: Sulphate of Ammonia: Plots 11/1, 11/2	686	kg/ha
23/05/2022	f	Applied using by Hand, JD5070: Sodium Nitrate: Plots 20	188	kg/ha
23/05/2022	f	Applied using by Hand, JD5070: Sodium Nitrate: Plots 16, 17	300	kg/ha
23/05/2022	f	Applied using by Hand, JD5070: Sodium Nitrate: Plots 14/2	600	kg/ha
23/05/2022	f	Applied using by Hand, JD5070: Sodium Nitrate: Plots 15	900	kg/ha
14/06/2022 to 15/06/2022	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, JD5070: Mowing - 1st Cut Started	-	-
31/10/2022	a	Topped using Kilworth Topper, Iseki ISTH4335:Paths and Surrounds	-	-
05/12/2022	a	Harvest using Amazone Grass Harvester - Flail Mower Collector: Park Grass 2nd Cut 2022	-	-
05/12/2022	a	Mowed using McHale Pro Glide R3100, JD6145R Premium: Extras and surrounds	-	-
06/12/2022	a	Rowed up using Claas Windrower, JD6145R Premium	-	-
07/12/2022	a	Baled using McHale Fusion 2 Baler, JD6145R Premium	-	-

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

Yields

1st CUT (14-15 JUN 2022) DRY MATTER, TONNES/HECTARE

Tables of means

Grand mean		**3.36**					
Manure		**Lime**	**a**	**b**	**c**	**d**	**Mean**
N1	1		2.46	1.87	1.26	[a] 2.98	**2.14**
K	2/1		1.32	2.21	1.65	1.66	**1.71**
None(FYM)	2/2		2.60	2.54	2.11	1.52	**2.19**
None	3		3.37	2.45	2.00	1.76	**2.39**
P	4/1		3.51	3.50	2.72	1.91	**2.91**
N2P	4/2		2.80	2.37	2.56	1.91	**2.41**
N1PKNaMg	6		4.45	4.81	-	-	**4.63**
(P)KNaMg	7/1		5.87	4.40	1.57	1.44	**3.32**
PKNaMg	7/2		4.78	3.92	1.77	1.33	**2.95**
PNaMg	8		2.95	3.19	1.61	1.93	**2.42**
PKNaMg(N2)	9/1		3.73	4.87	3.90	1.34	**3.46**
N2PKNaMg	9/2		4.65	3.00	3.16	3.21	**3.51**
N2PNaMg	10		2.92	2.84	3.45	2.21	**2.85**
N3PKNaMg	11/1		5.68	6.50	4.93	3.52	**5.16**
N3PKNaMgSi	11/2		6.38	5.32	5.85	2.44	**5.00**
None	12		2.53	2.16	2.12	1.96	**2.19**
(FYM/F)	13/1		3.09	3.51	2.86	2.90	**3.09**
FYM/PM	13/2		4.08	4.74	5.01	4.02	**4.46**
PKNaMg(N2*)	14/1		5.77	5.56	2.11	3.13	**4.14**
N2*PKNaMg	14/2		4.88	5.66	5.68	4.14	**5.09**
N3*PKNaMg(N2*)	15		6.39	5.70	6.53	4.98	**5.90**
N1*PKNaMg	16		4.23	4.71	3.38	2.33	**3.66**
N1*	17		2.49	2.32	2.12	2.08	**2.25**
N2KNaMg	18		2.14	1.88	1.40	1.47	**1.72**
N2KNaMg	18/2		-	-	-	-	**2.09**
FYM	19/1		-	-	-	-	**5.28**
FYM	19/2		-	-	-	-	**4.74**
FYM	19/3		-	-	-	-	**4.61**
FYM/N*PK	20/1		-	-	-	-	**5.06**
FYM/N*PK	20/2		-	-	-	-	**4.90**
FYM/N*PK	20/3		-	-	-	-	**4.37**
1st cut mean DM%		31.9					

Notes

[a] There is some uncertainty to whether the yield given for subplot 1d is correct as it is unusually high compared to other plot 1 subplots, which are usually higher due to liming treatment.

2nd CUT (02, 05, 06 DEC 2022) DRY MATTER, TONNES/HECTARE

Tables of means

Grand mean		**1.33**					
Manure	**Lime**	**a**	**b**	**c**	**d**	**Mean**
N1	1	0.84	0.47	0.68	0.28	**0.57**
K	2/1	1.23	0.61	0.57	0.42	**0.71**
None(FYM)	2/2	1.11	0.38	0.61	0.81	**0.73**
None	3	0.89	0.63	0.84	0.71	**0.77**
P	4/1	[a] 1.17	0.91	1.12	1.40	**1.15**
N2P	4/2	1.69	1.95	1.04	1.07	**1.44**
N1PKNaMg	6	1.66	1.75	-	-	**1.71**
(P)KNaMg	7/1	2.27	1.89	1.23	0.73	**1.53**
PKNaMg	7/2	2.11	1.77	1.41	0.84	**1.54**
PNaMg	8	0.85	1.03	1.17	1.13	**1.05**
PKNaMg(N2)	9/1	1.44	1.31	0.80	0.30	**0.96**
N2PKNaMg	9/2	1.99	1.90	1.14	0.98	**1.50**
N2PNaMg	10	[a] 0.97	0.95	0.91	1.04	**0.97**
N3PKNaMg	11/1	1.06	[a] 1.89	[a] 2.07	2.15	**1.79**
N3PKNaMgSi	11/2	0.69	1.21	1.51	1.66	**1.27**
None	12	0.87	0.61	0.51	0.80	**0.70**
(FYM/F)	13/1	[a] 1.65	[a] 1.32	1.28	0.99	**1.31**
FYM/PM	13/2	1.69	1.97	1.70	1.43	**1.70**
PKNaMg(N2*)	14/1	1.86	1.54	1.29	*	**1.56**
N2*PKNaMg	14/2	1.61	2.16	2.51	2.11	**2.09**
N3*PKNaMg(N2*)	15	2.12	1.78	2.19	1.43	**1.88**
N1*PKNaMg	16	2.12	2.20	[a] 1.46	[a] 1.56	**1.84**
N1*	17	[a] 0.92	1.31	1.42	0.84	**1.12**
N2KNaMg	18	[a] 1.95	[a] 1.06	0.68	0.46	**1.04**
N2KNaMg	18/2	-	-	-	-	**0.67**
FYM	19/1	-	-	-	-	[a] **2.30**
FYM	19/2	-	-	-	-	**2.24**
FYM	19/3	-	-	-	-	**2.52**
FYM/N*PK	20/1	-	-	-	-	**2.06**
FYM/N*PK	20/2	-	-	-	-	**2.34**
FYM/N*PK	20/3	-	-	-	-	**2.26**

2nd cut mean DM% 17.85

Notes

[a] The 2nd cut yields for 12 subplots (4/1a, 10a, 11/1b, 11/1c, 13/1a, 13/1b, 16c, 16d, 17a, 18a, 18b, 19/1) are based on one within-plot cut strip only, rather than the usual two, due to the harvest machine jamming a number of times, likely due to the wet conditions. This has been accounted for in calculating the conversion factor from kg to tonnes/hectare (i.e., harvest area halved).

* Missing 2nd cut yields for plot 14/1d as this subplot has only one within-plot cut strip ordinarily.

TOTAL OF 2 CUTS DRY MATTER, TONNES/HECTARE

Tables of means

Grand mean		**4.70**					
Manure		**Lime**	**a**	**b**	**c**	**d**	**Mean**
N1	1		3.30	2.34	1.94	3.26	**2.71**
K	2/1		2.55	2.81	2.22	2.08	**2.42**
None(FYM)	2/2		3.72	2.92	2.72	2.33	**2.92**
None	3		4.26	3.08	2.84	2.47	**3.16**
P	4/1		[a] 4.67	4.41	3.84	3.31	**4.06**
N2P	4/2		4.48	4.32	3.60	2.98	**3.84**
N1PKNaMg	6		6.12	6.57	-	-	**6.34**
(P)KNaMg	7/1		8.14	6.30	2.79	2.16	**4.85**
PKNaMg	7/2		6.89	5.70	3.18	2.18	**4.49**
PNaMg	8		3.80	4.22	2.78	3.06	**3.47**
PKNaMg(N2)	9/1		5.18	6.18	4.70	1.65	**4.43**
N2PKNaMg	9/2		6.64	4.90	4.30	4.19	**5.00**
N2PNaMg	10		[a] 3.90	3.79	4.36	3.24	**3.82**
N3PKNaMg	11/1		6.74	[a] 8.39	[a] 7.00	5.67	**6.95**
N3PKNaMgSi	11/2		7.07	6.53	7.36	4.10	**6.26**
None	12		3.40	2.77	2.62	2.76	**2.89**
(FYM/F)	13/1		[a] 4.74	[a] 4.83	4.14	3.89	**4.40**
FYM/PM	13/2		5.76	6.71	6.71	5.45	**6.16**
PKNaMg(N2*)	14/1		7.63	7.11	3.39	*	**6.04**
N2*PKNaMg	14/2		6.48	7.81	8.19	6.25	**7.18**
N3*PKNaMg(N2*)	15		8.51	7.49	8.72	6.41	**7.78**
N1*PKNaMg	16		6.36	6.91	[a] 4.83	[a] 3.90	**5.50**
N1*	17		[a] 3.41	3.63	3.54	2.92	**3.37**
N2KNaMg	18		[a] 4.09	[a] 2.94	2.07	1.92	**2.76**
N2KNaMg	18/2		-	-	-	-	**2.77**
FYM	19/1		-	-	-	-	[a] **7.57**
FYM	19/2		-	-	-	-	**6.98**
FYM	19/3		-	-	-	-	**7.13**
FYM/N*PK	20/1		-	-	-	-	**7.12**
FYM/N*PK	20/2		-	-	-	-	**7.24**
FYM/N*PK	20/3		-	-	-	-	**6.62**
Total of 2 cuts mean DM%		**24.89**					

Notes

[a] Combined 2 cuts yield for 12 subplots (4/1a, 10a, 11/1b, 11/1c, 13/1a, 13/1b, 16c, 16d, 17a, 18a, 18b, 19/1) are based on three within-plot cut strips only, rather than the usual four, due to issues with the 2nd cut (see 2nd cut notes above). This has been accounted for in calculating the conversion factor from kg to tonnes/hectare.

* Missing combined 2 cuts yield for plot 14/1d as 2nd cut yield was missing (see 2nd cut notes above).

22/R/GC/8 GARDEN CLOVER (Manor Garden)

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

The 169th year, red clover.

For previous years see `Details' 1967 and 1973, and Yield books for 74-21/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
09/12/2021	f	Applied using By Hand: Sulphate of Potash (SOP)	300	kg/ha
09/12/2021	f	Applied using By Hand: Triple superphosphate (TSP)	158	kg/ha
09/12/2021	f	Applied using By Hand: Sulphate of magnesia (Epsom Salts)	520	kg/ha
09/12/2021	f	Applied using By Hand: Chalk	1250	kg/ha
08/06/2022	a	Harvest: 1st Cut	-	-
22/07/2022	a	Harvest: 2nd Cut	-	-

Yields

Dry Matter, Tonnes/Hectare

			FUNG_RES		
Cut	**Date**	**Grand Mean**	**NONE**	**BENOMYL**	**Mean DM%**
1st	10/06/2022	**4.30**	3.99	4.60	16.0
2nd	22/07/2022	**0.99**	0.96	1.02	26.4
Total of 2 cuts		**5.29**	4.95	5.62	21.2

Notes
Two cuts were completed in 2022.

22/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 85th year, leys, winter barley, winter oats, winter wheat, winter rye

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-21/W/RN/3. For a comprehensive guide to the treatments and cropping sequences from 1938, please see https://doi.org/10.23637/wrn3-cropping1938-2020-02

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

L	Clover/grass ley:	L, L, L, P, W until 1971 then L, L, L, W, B (became **Ln3**)
Lu	All legume ley:	SA, SA, SA, P, W until 1971 then CL, CL, CL, W, B (became **Lc3**)
Ar	Arable with roots:	P, R, C, P, W until 1971 then P, B, B, W, B (became **AF**)
Ah	Arable with hay:	P, R, H, P, W until 1971 then P, B, H, W, B (became **AB**)

P = potatoes, C = carrots, W= winter wheat, B = spring barley, H = hay, L = clover/grass ley, SA = sainfoin ley (previously lucerne, Lu), 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 1973 all the rotations were changed on all phases except for the first and second test crops in 1976:

Ln3	(replaced **L**) Ln1, Ln2, Ln3, W, R (this subsequently became **LLn8** or remained **Ln3**)
Lc3	(replaced **Lu**) Lc1, Lc2, Lc3, W, R (this subsequently became **LLc8** or remained **Lc3**)
AF	(replaced **Ar**) F, F, BE, W, R (this subsequently became **AM**)
AB	(replaced **Ah**) B, B, BE, W, R (this subsequently became **ABe**)
	From 1998 rotations **AF** and **AB** are replaced by **AM** and **ABe** respectively. Phased in at the beginning of each treatment crop sequence.
AM	(replaced **AF**) R, BE, M, W, R (this subsequently became **AO**)
ABe	(replaced **AB**) R, M, BE, W, R

Ln1 to **Ln3** = three-year grass ley with N, 1st year to 3rd year,
Lc = clover/grass ley, no N, BE = beans (spring oats until 1980), R = winter rye, F = fallow,
M = forage maize

	Plots hitherto in alternating rotations were changed to test eight-year leys and two test crops:
LLn8	(replaced part of **Ln3**) LLn1, LLn2, LLn3, LLn4, LLn5, LLn6, LLn7, LLn8, W, R (this subsequently became **Ln** or **AO**)
LLc8	(replaced part of **Lc3**) LLc1, LLc2, LLc3, LLc4, LLc5, LLc6, LLc7, LLc8, W, R (this subsequently became **Lc** or **ABe**)

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 (2nd test crop in 1976).

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

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

LLn/AO	(Previously 1st cycle, 8-yr grass ley)	R, Be, O, W, R
LLc/ABe	(Previously 1st cycle, 8-yr grass/clover ley)	R, O, Be, W, R
LLc/Lc3	(Previously 2nd cycle, 8-yr grass ley)	Lc1, Lc2, Lc3, W, R
LLn/Ln3	(Previously 2nd cycle, 8-yr grass/clover ley)	Ln1, Ln2, Ln3, W, R

From 2009 winter 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:

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

2. **NSPLIT (FYM res)** Farmyard manure residues, last applied 1960s (1/2 plots):
   Split N v single N dressing to wheat, tested 2001-5

   Nsplit (noFYM; -)
   Nsingle (FYM; dr)

3. **N** N fertilizer as split dressings in spring (kg N) as 27% N (Nitrochalk) (1/4 plots):

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

2. **NSPLIT (FYM res)** Farmyard manure residues, last applied 1960s (1/2 plots):
   N split to wheat (no FYM)
   N single to wheat (FYM)

3. **N** N fertilizer in spring (kg N) as 27% N (Nitrochalk) (1/4 plots):
   0
   50
   100
   150

Treatments to leys:

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

NOTE: Corrective K dressings (kg K_2O / ha) as muriate of potash, applied where necessary to first test crop winter wheat, applied 2021 (see date below). Note that for 2022, applications were based on rounded means calculated from 2016-2020 data in the absence of more recent data due to the COVID-19 pandemic.

Continuous rotations before wheat	**No FYM (-); half plots**	**FYM Res (dr); half plots**
Lc3	Plot 79: 0	Plot 80: 0
LLn/AO	Plot 71: 160	Plot 72: 160
LLn/Ln3	Plot 69: 10	Plot 70: 10
AO	Plot 74: 250	Plot 73: 250
LLc/Lc3	Plot 78: 0	Plot 77: 0
Ln3	Plot 65: 30	Plot 66: 30
ABe	Plot 68: 220	Plot 67: 220
LLc/ABe	Plot 76: 120	Plot 75: 120

None to other plots.

Experimental Diary

Date		Application	Rate	Units
W Rye (1st year treatment)				
10/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
25/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Block 1, Plots: 1, 2, 5, 6, 9, 10, 15, 16	127	kg/ha
08/10/2021	a	Plough 20 cm, WES Dowdeswell 100 Series Five Furrow Plough, JD6620	-	-
18/10/2021	s	Drilled using WES Accord 4m Tyne Drill, JD6620: Hybrid	350	seeds/m2
31/03/2022	f	Applied using Cascade Spreader, JD6830: Nitram: Block 1, Plots 1, 2, 5, 6, 9, 10, 15, 16	290	kg/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	3	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Clayton Prius (18946)	0.7	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Stefes CCC 720 (17731)	1.5	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Moddus (15151)	0.15	L/ha
05/04/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP)	150	kg/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Bugle (17821)	0.7	L/ha
13/08/2022	a	Harvest using None, Haldrup C-85 2m cut (Combine)	-	-
W Barley (2nd year treatment)				
10/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
25/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Blocks 2, Plots: 17-22, 27, 28	127	kg/ha
08/10/2021	a	Plough 20 cm, WES Dowdeswell 100 Series Five Furrow Plough, JD6620	-	-
18/10/2021	s	Drilled using WES Accord 4m Tyne Drill, JD6620: Libra	300	seeds/m2
31/03/2022	f	Applied using Cascade Spreader, JD6830: Nitram	290	kg/ha
05/04/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP)	150	kg/ha
11/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	3	L/ha
11/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Stefes CCC 720 (17731)	1	L/ha
11/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Moddus (15151)	0.1	L/ha
11/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Mobius (13395)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Bugle (17821)	0.7	L/ha

26/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	1	L/ha
26/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Lentyma XE	1	L/ha
13/08/2022	a	Harvest using None, Haldrup C-85 2m cut (Combine)	-	-

W Oats (3rd year treatment)

10/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
25/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Blocks 4, Plots: 49-54, 63, 64	127	kg/ha
08/10/2021	a	Plough 20 cm, WES Dowdeswell 100 Series Five Furrow Plough, JD6620	-	-
18/10/2021	s	Drilled using Accord Combination Drill No. 4: Miscani	350	seeds/m2
31/03/2022	f	Applied using Cascade Spreader, JD6830: Nitram	290	kg/ha
05/04/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP)	150	kg/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Presite SX (12291)	60	g/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Hurler (17715)	0.6	L/ha
13/08/2022	a	Harvest using None, Haldrup C-85 2m cut (Combine)		

Grass ley and clover/grass leys (1st year treatment)

04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Block 1, Plots: 3,4,7,8,11,12,13,14	213	kg/ha
04/10/2021	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP) : Block 1, Plots: 3,4,7,8, 11,12,13,14.	140	kg/ha
25/11/2021		Mowing, JD6620	-	-
05/04/2022	f	Applied using Cascade Spreader, JD6830: Muriate of Potash (MOP) : Block 1, Plots: 3,4,7,8, 11,12,13,14.	167	kg/ha
06/04/2022	f	Applied using Cascade Spreader, JD6830: Nitram; Grass only Plots 11-12, 13-14	217	kg/ha
13/04/2022	a	Power harrow, Kuhn Powerharrow 3m, JD6620	-	-
13/04/2022	s	Drilled by hand: grass seed	30	kg/ha
13/04/2022	a	Flat roll, WES 6m Rolls JD6620	-	-
24/06/2022	a	First Cut Grass Plots using Amazone Grass Harvester - Flail Mower Collector, JD5070	-	-
28/06/2022	a	Mowed using Amazone Grass Harvester - Flail Mower Collector, JD5070 - Cleared	-	-
29/06/2022	f	Applied using Cascade Spreader, JD6830: Nitram: Plots 11-12, 13-14	217	kg/ha

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

04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Blocks 2 and 4, Plots: 23,24,25,26,29,30,31,32,55-62.	213	kg/ha
04/10/2021	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP) : Block 2 & 4, 2-3 Leys Plots: 23,24,25,26,29,30,31,32, 55-62.	140	kg/ha
25/11/2021		Mowing, JD6620	-	-
05/04/2022	f	Applied using Cascade Spreader, JD6830: Muriate of Potash (MOP) Block 2 & 4, 2-3 Leys Plots: 23,24,25,26,29,30,31,32, 55-62	167	kg/ha

06/04/2022	f	Applied using Cascade Spreader, JD6830: Nitram; Grass only Plots 25-26, 31-32, 57-58, 61-62	217	kg/ha
24/06/2022	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, JD5070 - 1st Cut	-	-
28/06/2022	a	Mowed using Amazone Grass Harvester - Flail Mower Collector, JD5070 - Cleared	-	-
29/06/2022	f	Applied using Cascade Spreader, JD6830: Nitram: Plots 25-26, 31-32, 57-58, 61-62	217	kg/ha
05/01/2023	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, JD5070 - 2nd Cut (2nd year only; plots 23, 24, 25, 26, 29, 30, 31, 32)	-	-

W Wheat (1st year test)

10/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
25/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Blocks 5, Plots: 65-80	127	kg/ha
05/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 69, 70	10	kg/ha
05/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 65, 66	30	kg/ha
05/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 71, 72	160	kg/ha
05/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 67, 68	220	kg/ha
05/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 73, 74	250	kg/ha
06/10/2021	f	Applied using By Hand: Muriate of Potash (MOP): Plots 75, 76	120	kg/ha
08/10/2021	a	Plough 20 cm, WES Dowdeswell 100 Series Five Furrow Plough, JD6620	-	-
08/10/2021	a	Topped using WES Batwing Topper, JD6620; Block 5	-	-
18/10/2021	s	Drilled using WES Accord 4m Tyne Drill: KWS Zyatt	350	seeds/m2
25/02/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	3	L/ha
25/02/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Lentyma XE	0.88	L/ha
04/04/2022	f	Applied using By Hand , Pedestrian Operated: Nitrochalk (Block 5, all plots EXCEPT 651, 662, 674, 684, 693, 701, 714, 722, 733, 743, 754, 761, 774, 781, 793, 804)	148	kg/ha
05/04/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP)	150	kg/ha
08/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	3	L/ha
08/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Clayton Prius (18946)	0.7	L/ha
08/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Stefes CCC 720 (17731)	1	L/ha
08/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Moddus (15151)	0.1	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Bugle (17821)	0.7	L/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 654, 661, 671, 683, 691, 703, 712, 723, 734, 741, 752, 764, 773, 784, 794, 801	148	kg/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 652, 664, 673, 681, 694, 704, 711, 724, 731, 742, 753, 762, 772, 783, 792, 802	444	kg/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 653, 663, 672, 682, 692, 702, 713, 721, 732, 744, 751, 763, 771, 782, 791, 803	741	kg/ha

20/06/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
20/06/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.66	L/ha
13/08/2022	a	Harvest using None, Haldrup C-85 2m cut (Combine); Block 5	-	-

W Rye (2nd year test)

10/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
25/09/2021	a	Power harrow 10 cm, WES Power Harrow JD6620	-	-
04/10/2021	f	Applied using JD6620: Chalk ; Block 3	5	t/ha
04/10/2021	f	Applied using Cascade Spreader, JD6830: Triple Superphosphate (TSP) : Block 3, Plots 33-48	127	kg/ha
08/10/2021	a	Plough 20 cm, WES Dowdeswell 100 Series Five Furrow Plough, JD6620	-	-
18/10/2021	s	Drilled using WES Accord 4m Tyne Drill, JD6620: Hybrid	350	seeds/m2
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	3	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Clayton Prius (18946)	0.7	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Stefes CCC 720 (17731)	1.5	L/ha
05/04/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Moddus (15151)	0.15	L/ha
05/04/2022	f	Applied using Cascade Spreader, JD6830: Sulphate of Potash (SOP)	150	kg/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Sprinter	2	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Cello (18290)	0.6	L/ha
04/05/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Bugle (17821)	0.7	L/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 331, 343, 351, 361, 373, 384, 394, 401, 414, 422, 432, 444, 453, 462, 471, 484	185	kg/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 334, 341, 354, 364, 374, 381, 393, 404, 411, 423, 431, 443, 454, 463, 474, 482	370	kg/ha
16/05/2023	f	Applied using By Hand: Nitrochalk: Plots 333, 344, 352, 362, 371, 382, 391, 402, 413, 421, 433, 442, 451, 464, 473, 481	556	kg/ha
13/08/2022	a	Harvest using None, Haldrup C-85 2m cut (Combine)	-	-

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

GRASS TREATMENT CROPS

LEYS

DRY MATTER TONNES/HECTARE

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

	1st Cut (24/06/2022)			2nd Cut (05/01/2023)			Total of 2 cuts		
FYM_RES	NONE	FYM	MEAN	NONE	FYM	MEAN	NONE	FYM	MEAN
LEY									
Lc1	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0
Lc2	2.23	2.40	2.31	c 0.01	c 0.01	c 0.01	c 2.24	c 2.41	c 2.33
Lc3	2.59	2.73	2.66	b *	b *	b *	b *	b *	b *
Ln1	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0
Ln2	3.73	3.18	3.46	c 0.01	c 0.03	c 0.02	c 3.74	c 3.21	c 3.48
Ln3	2.12	2.23	2.18	b *	b *	b *	b *	b *	b *
(LLc/Lc)Lc1	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0
(LLc/Lc)Lc2	2.00	1.95	1.98	c 0.02	c 0.01	c 0.02	c 2.02	c 1.97	c 1.99
(LLc/Lc)Lc3	3.17	2.90	3.04	b *	b *	b *	b *	b *	b *
(LLn/Ln)Ln1	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0	a 0
(LLn/Ln)Ln2	2.41	2.62	2.52	c 0.03	c 0.04	c 0.04	c 2.44	c 2.67	c 2.55
(LLn/Ln)Ln3	1.57	2.24	1.90	b *	b *	b *	b *	b *	b *
MEAN	**1.65**	**1.69**	**1.67**	**0.01**	**0.01**	**0.01**	**1.31**	**1.28**	**1.29**
MEAN DM%	40.3			34.3			38.1		

Notes

* Missing yield.

a No 1st or 2nd cut yields from 1st year ley (Block 1) (and no total of 2 cuts consequently) due to crop failure.

b No 2nd cut yields from 3rd year ley (Block 4) (and no total of 2 cuts consequently) due to leys having been ploughed in prior to cut.

c 2nd year yields were unable to be recovered from the Farm. It was suspected that files were accidently overwritten with an empty file of the same name. There was only a very small amount of grass harvested in the 2nd cut (in January 2023) from the 2nd year leys. This was not likely to have been much more than the samples provided for dry matters. We therefore report total 2nd cut yields from the total samples sent for dry matters, with the note that these will be an underestimate of the actual 2nd cut yields (and an underestimate of the total of 2 cuts consequently).

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

ARABLE TREATMENT CROPS

WINTER RYE (1ST YEAR)

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
(ABe)R	7.62	7.98	7.80
(AO)R	7.39	7.97	7.68
(LLn/AO)R	8.38	8.02	8.20
(LLc/ABe)R	9.57	7.89	8.73
Mean	**8.24**	**7.97**	**8.10**
Grain mean DM%	91.4		
Plot area harvested (ha)	0.00393		

WINTER BARLEY (2ND YEAR)

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
(ABe)WB	4.14	4.20	4.17
(AO)WB	5.84	5.61	5.72
(LLn/AO)WB	7.44	7.14	7.29
(LLc/ABe)WB	5.16	5.02	5.09
Mean	**5.65**	**5.49**	**5.57**
Grain mean DM%	92.1		
Plot area harvested (ha)	0.00393		

WINTER OATS (3RD YEAR)

GRAIN (85% DRY MATTER) TONNES/HECTARE

Tables of means

FYMRES ROTATION	NONE	FYM	Mean
(ABe)O	5.73	5.95	5.84
(AO)O	4.62	5.10	4.86
(LLc/ABe)O	6.78	6.61	6.70
(LLn/AO)O	6.82	5.89	6.35
Mean	**5.99**	**5.89**	**5.94**
Grain mean DM%	92.2		
Plot area harvested (ha)	0.00393		

ARABLE TEST CROPS

WINTER WHEAT (1ST YEAR)

Grain tonnes/hectare

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

ROTATION / FYMRES	none	FYM	Mean
(AO)W	4.22	3.81	**4.02**
(ABe)W	1.28	4.01	**2.65**
(LLn/AO)W	4.57	2.94	**3.75**
(LLc/ABe)W	1.60	5.56	**3.58**
(Ln)W	5.66	6.82	**6.24**
(LLn/Ln)W	6.58	7.34	**6.96**
(Lc)W	7.95	2.98	**5.46**
(LLc/Lc)W	8.02	8.30	**8.16**
Mean	**4.98**	**5.22**	**5.10**

ROTATION / N	0	80	160	240	Mean
(AO)W	2.59	4.95	4.79	3.74	**4.02**
(ABe)W	1.68	4.09	3.08	1.75	**2.65**
(LLn/AO)W	2.04	5.54	3.28	4.16	**3.75**
(LLc/ABe)W	2.65	3.55	4.53	3.59	**3.58**
(Ln)W	5.63	6.73	6.94	5.66	**6.24**
(LLn/Ln)W	5.43	6.63	8.44	7.33	**6.96**
(Lc)W	4.47	5.17	4.31	7.90	**5.46**
(LLc/Lc)W	7.75	8.11	7.99	8.78	**8.16**
Mean	**4.03**	**5.60**	**5.42**	**5.36**	**5.10**

FYMRES / N	0	80	160	240	Mean
none	4.41	5.38	5.32	4.83	**4.98**
FYM	3.65	5.81	5.52	5.90	**5.22**
Mean	**4.03**	**5.60**	**5.42**	**5.36**	**5.10**

ROTATION	FYMRES / N	0	80	160	240
(AO)W	none	2.66	4.98	†5.00	†4.24
	FYM	2.51	4.91	†4.58	†3.24
(ABe)W	none	†1.02	3.65	†0.27	†0.20
	FYM	†2.33	4.53	5.89	†3.29
(LLn/AO)W	none	3.05	5.24	5.20	†4.77
	FYM	†1.02	5.83	†1.35	†3.55
(LLc/ABe)W	none	†2.50	†1.61	†1.89	†0.40
	FYM	2.79	5.48	7.18	6.77
(Ln)W	none	4.52	6.49	7.04	4.57
	FYM	6.74	6.96	6.84	6.75
(LLn/Ln)W	none	5.32	6.21	8.00	6.80
	FYM	5.54	7.05	8.89	7.87
(Lc)W	none	8.22	6.87	7.72	8.98
	FYM	†0.71	†3.48	†0.89	†6.82
(LLc/Lc)W	none	7.94	7.98	7.44	8.70
	FYM	7.56	8.24	8.55	8.86
Mean		**4.03**	**5.60**	**5.42**	**5.36**

Grain mean DM%	92.07
Plot area harvested (ha)	0.00183

Notes

† Block 5, Plots 672, 674, 681, 682, 683, 684, 713, 721, 722, 724, 731, 732, 742, 744, 761, 762, 763, 764, 801, 802, 803, 804 - all heavily damaged by deer.

WINTER RYE (2ND YEAR)

Grain tonnes/hectare
Tables of means

ROTATION / FYMRES	none	FYM	Mean
(AO)R	4.38	5.39	**4.89**
(ABe)R	5.31	6.34	**5.83**
(LLn/AO)R	6.04	6.89	**6.46**
(LLc/ABe)R	6.45	5.39	**5.92**
(Ln)R	7.36	6.08	**6.72**
(LLn/Ln)R	7.46	7.61	**7.53**
(Lc)R	7.50	6.80	**7.15**
(LLc/Lc)R	7.48	8.03	**7.76**
Mean	**6.50**	**6.57**	**6.53**

ROTATION / N	0	50	100	150	Mean
(AO)R	4.30	4.91	5.10	5.24	**4.89**
(ABe)R	4.65	5.97	5.96	6.73	**5.83**
(LLn/AO)R	5.11	6.73	6.61	7.40	**6.46**
(LLc/ABe)R	5.23	5.65	5.68	7.11	**5.92**
(Ln)R	6.21	6.36	7.73	6.58	**6.72**
(LLn/Ln)R	6.98	8.18	7.68	7.29	**7.53**
(Lc)R	7.11	7.01	7.15	7.33	**7.15**
(LLc/Lc)R	7.46	8.48	7.52	7.57	**7.76**
Mean	**5.88**	**6.66**	**6.68**	**6.91**	**6.53**

FYMRES / N	0	50	100	150	Mean
None	5.93	6.78	6.48	6.79	**6.50**
FYM	5.83	6.54	6.88	7.02	**6.57**
Mean	**5.88**	**6.66**	**6.68**	**6.91**	**6.53**

ROTATION	FYMRES / N	0	50	100	150
(AO)R	none	3.74	4.54	4.69	4.56
	FYM	4.85	5.28	5.51	5.91
(ABe)R	none	4.58	5.34	5.57	5.76
	FYM	4.71	6.61	6.35	7.70
(LLn/AO)R	none	4.62	7.27	5.57	6.68
	FYM	5.60	6.18	7.65	8.11
(LLc/ABe)R	none	5.63	7.00	5.99	7.16
	FYM	4.84	4.31	5.36	7.05
(Ln)R	none	6.86	7.34	7.55	7.69
	FYM	5.57	5.38	7.91	5.47
(LLn/Ln)R	none	7.26	7.70	7.80	7.07
	FYM	6.71	8.66	7.55	7.51
(Lc)R	none	7.79	6.86	7.58	7.79
	FYM	6.43	7.17	6.72	6.87
(LLc/Lc)R	none	6.95	8.24	7.09	7.63
	FYM	7.96	8.72	7.96	7.50
	Mean	**5.88**	**6.66**	**6.68**	**6.91**

Grain mean DM%	91.56
Plot area harvested (ha)	0.00183

22/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 58th year, Forage Maize.

For previous years see 'Details' 1973 and Yield Books for 74-21/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 1st test crop in 1987 and on the second pair for the 1st test crop in 1988. From 1988 two blocks, and 1989 the other two, to 1994, plots were split into 6 sub-plots to test five levels of 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 (number indicates years). 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

For winter wheat, N application is split: 50 kg is applied in February/March and the remainder is applied in mid-April.

For forage maize, N application is split: 50 kg is applied to the seedbank and the remainder is applied post-emergence.

Experimental Diary

Date		Application	Rate	Units
25/09/2021	a	Power harrow 10 cm using WES Power Harrow, JD6620		
28/10/2021	s	Drilled using WES Accord 4m Tyne Drill, JD6620: Zlata (White Mustard): Plots 04, 10, 19, 32	10	kg/ha
25/11/2021	a	Mowed using JD6620n 2022/R/RN/12		
07/03/2022	f	Applied using By Hand: Farmyard Manure (FYM): Plots 08, 14, 18, 28	10	t/ha
08/03/2022	f	Applied using By Hand: Farmyard Manure (FYM): Plots 05, 11, 23, 26	25	t/ha
08/03/2022	f	Applied using By Hand: Compost: Plots 07, 12, 21, 27	40	t/ha
14/03/2022	f	Applied using By Hand: Straw into Stackyard Woburn: Plots 03, 15, 17, 31	7.5	t/ha
15/03/2022	a	Topped using WES Topper 9, JD6620		
15/03/2022	a	Plough using WES Dowdeswell 100 Series Five Furrow Plough, JD683020 cm; thrown NW		
12/05/2022	s	Drilled using WES Accord 4m Tyne Drill, JD6830: Maize (Augustus) with seed dressing Redigo Pro	9	seeds/m2
16/05/2022	f	Applied using: Nitro-Chalk (Basal) to all N1-N5 subplots	185	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N2 subplots	185	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N3 subplots	370	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N4 subplots	556	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N5 subplots	741	kg/ha
20/06/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Callisto (12323)	1.5	L/ha
20/06/2022	p	Applied using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor (440 g/L P, 75 g/L K_2O, 46 g/L Zn, 66 g/L MgO): Maize Boost	5	L/ha
24/06/2022	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, Iseki ISTH4335 - 1st Cut; Plots 01, 13, 24, 29		
28/06/2022	a	Mowed - using Amazone Grass Harvester - Flail Mower Collector, JD5070; Cleared		
20/10/2022	a	Harvest: Maize		
05/01/2023	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, Iseki ISTH4335 – 2nd Cut; Plots 01, 13, 24, 29		

Yields

FORAGE MAIZE

DRY MATTER TONNES/HECTARE

N	0	50	100	150	200	250	Mean
ROTATION							
F(Fd)	4.58	5.92	5.23	4.85	5.22	5.67	**5.25**
F(Ln,Lc6)	6.67	7.02	7.94	6.60	6.90	9.16	**7.38**
St(St)	6.71	7.12	8.41	7.99	8.59	7.90	**7.79**
CC(Gm,Lc8)	5.81	8.02	7.73	7.39	5.74	5.24	**6.65**
Co(Pt,Lc8)	6.95	8.30	6.57	7.96	6.40	6.93	**7.18**
Dg10(Fs)	8.70	9.24	9.01	11.52	10.38	10.67	**9.92**
Dg25(Dg)	8.29	9.62	7.64	8.40	8.90	8.87	**8.62**
Mean	**6.82**	**7.89**	**7.50**	**7.82**	**7.45**	**7.78**	**7.54**
Grain mean DM%	39.20						

GRASS/CLOVER

DRY MATTER TONNES/HECTARE

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

Year	1st Cut	2nd Cut	Total of 2 cuts
2003	-	-	-
2004	1.82	-	1.82
2005	1.86	0.13	1.99
2006	4.07	-	4.07
2007	3.12	1.36	4.48
2008	5.72	1.65	7.37
2009	4.77	-	4.77
2010	4.41	-	4.41
2011	1.46	0.39	1.85
2012	4.11	0.64	4.75
2013	4.65	0.60	5.24
2014	4.09	0.91	5.01
2015	-	0.36	-
2016	3.97	0.56	4.54
2017	2.17	1.48	3.65
2018	2.98	0.93	3.91
2019	2.34	0.39	2.73
2020	1.01	-	-
2021	3.33	1.29	4.63
2022	**2.11**	**0.09**	**2.19**

Cut dry matter t/ha (24/06/2022 and 05/01/2023).

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

Weather Summaries

Rothamsted Research

The Weather : Monthly Summary : 2022

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

	Sunshine		Mean Temperatures °C								Rain			Drainage	Wind ***
			Maximum		Minimum		Dew point	Ground	In ground under grass		Tipping Bucket			20"	
								frosts*	30 cm	100 cm	Total		days**	Total	
	Hours	(hours)	°C	(°C)	°C	(°C)	°C	#	°C	°C	mm	(mm)	#	mm	km/hr
January	86.3	(+22.40)	7.6	(+0.53)	0.8	(-0.74)	1.9	19	6.2	8.2	23.4	(-50.69)	16	13.8	7.4
February	90.0	(+3.82)	9.9	(+2.36)	3.0	(+1.50)	3.7	14	6.6	7.6	79.0	(+22.04)	19	21.0	12.8
March	167.0	(+38.58)	11.8	(+1.50)	3.4	(+0.58)	4.4	16	7.6	7.9	34.1	(-12.93)	13	6.9	7.8
April	197.5	(+25.44)	14.2	(+0.78)	4.1	(-0.41)	5.1	15	9.5	9.2	20.8	(-33.19)	8	0.1	8.8
May	195.1	(-8.24)	17.9	(+1.42)	8.4	(+1.06)	9.1	4	13.0	11.4	33.9	(-19.33)	14	0.1	6.6
June	253.6	(+47.85)	20.8	(+1.29)	10.0	(-0.20)	9.8	2	15.2	13.5	43.8	(-10.99)	13	1.7	6.4
July	254.5	(+47.68)	24.9	(+2.93)	13.1	(+0.79)	11.8	0	17.4	15.4	11.7	(-43.74)	5	0.1	6.4
August	245.6	(+56.19)	25.2	(+3.55)	13.9	(+1.62)	13.1	0	18.3	17.0	41.4	(-30.58)	5	0.1	6.2
September	127.0	(-23.73)	18.5	(-0.05)	10.6	(+0.42)	11.1	4	16.2	16.4	77.9	(+20.14)	16	21.6	5.2
October	147.6	(+34.59)	16.8	(+2.51)	9.2	(+1.62)	10.8	5	13.2	14.0	101.0	(+19.68)	18	58.2	6.6
November	77.0	(+4.77)	11.8	(+1.69)	6.5	(+2.24)	7.6	9	11.0	12.3	131.7	(+50.46)	24	75.0	7.5
December	71.4	(+10.58)	6.4	(-0.97)	0.1	(-1.90)	1.6	21	6.5	8.8	67.9	(-7.70)	16	46.6	7.6
Year	1912.5	(+259.93)	15.5	(+1.44)	6.9	(+0.53)	7.5	109.0	11.7	11.8	666.7	(-96.83)	167.0	20.4	7.5

* 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 : 2022

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

	Sunshine		Mean Temperatures								Rain			Wind ***
			Maximum		Minimum		Dew Point	Ground frosts *	In ground under grass 30 cm	In ground under grass 100 cm	Tipping bucket Total		days **	
	Hours	(hours)	°C	(°C)	°C	(°C)	°C	#	°C	°C	mm	(mm)	#	km/hr
January	69.3	(+9.41)	8.2	(+0.84)	0.4	(-1.10)	1.6	19	5.6	8.4	16.4	(-41.10)	14	7.9
February	92.1	(+9.14)	10.5	(+2.50)	3.3	(+1.92)	3.7	14	6.6	7.7	73.1	(+26.69)	20	13.4
March	167.8	(+41.11)	12.3	(+1.63)	2.5	(-0.07)	4.5	19	7.7	8.0	36.4	(-5.28)	16	6.4
April	193.4	(+26.14)	14.8	(+0.97)	3.2	(-0.82)	5.1	16	9.7	9.0	11.4	(-38.90)	7	8.1
May	201.8	(+1.27)	18.8	(+1.81)	8.4	(+1.60)	9.0	4	14.0	11.5	33.7	(-20.10)	16	7.9
June	245.8	(+47.17)	21.2	(+1.27)	9.5	(-0.17)	9.8	1	16.7	13.9	45.1	(-6.71)	13	7.2
July	237.0	(+39.38)	25.5	(+3.10)	12.4	(+0.53)	11.7	0	19.2	16.0	6.8	(-44.01)	5	6.9
August	249.6	(+59.86)	25.5	(+3.41)	12.4	(+0.49)	13.0	0	19.8	17.5	35.4	(-26.82)	4	6.5
September	121.4	(-21.85)	19.5	(+0.46)	9.9	(+0.16)	11.0	7	16.3	16.9	43.0	(-13.81)	19	5.6
October	136.2	(+25.72)	17.5	(+2.83)	9.1	(+1.89)	10.7	5	12.8	14.5	77.5	(+3.50)	21	7.7
November	58.9	(-10.32)	12.4	(+2.02)	6.8	(+2.79)	7.4	6	10.4	12.9	82.6	(+15.92)	22	8.5
December	40.3	(-14.14)	6.7	(-0.94)	-0.3	(-2.06)	1.0	20	5.4	9.6	58.1	(-1.02)	19	7.6
Year	1813.6	(+212.89)	16.1	(+1.63)	6.5	(+0.40)	7.4	111.0	12.0	12.2	519.6	(-151.64)	176.0	7.8

* 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